GUIDE TO VOLUME VIII

Volume VIII of the Proposed Powder River Basin Expansion Project Draft EIS contains the following items:

- Guide to Volume VIII
- Appendix I, Memorandum of Agreement
- Appendix J, Programmatic Agreement and Identification Plan
- Appendix K, Biological Assessment
- Appendix L, Resource Technical Report and Impact Assessment for the Proposed Dakota, Minnesota & Eastern Railroad, Forest Plan Amendments: Proposed Amendment 8 and Proposed Amendment 20
- Appendix M, Economic Impacts in Minnesota, South Dakota, and Wyoming of the Dakota, Minnesota & Eastern Railroad Corporation Powder River Basin Project
- Appendix N, Historical Structures Report

  Section 106 Evaluation - Architectural and Structural Resources - The Existing Rail Line of the Dakota, Minnesota & Eastern Railroad Powder River Basin Expansion Project in Minnesota

  Section 106 Evaluation - Architectural and Structural Resources - The Existing Rail Line of the Dakota, Minnesota & Eastern Railroad Powder River Basin Expansion Project in South Dakota

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APPENDIX I

Memorandum of Agreement

Tribal Consultation Summary

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Memorandum

of

Agreement

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FINAL DRAFT

MEMORANDUM OF AGREEMENT

Between

[Individual Signatory Tribe]

and

The Surface Transportation Board

and

The Dakota, Eastern & Minnesota Railroad Company

Regarding

The Environmental Impact Statement

For

THE POWDER RIVER BASIN EXPANSION PROJECT

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INTRODUCTION

This Memorandum of Agreement (MOA) has been developed at the request of and with the assistance of representatives of consulting tribes and indian organizations. The intent of this MOA is to ensure tribal participation under the NEPA process in certain specific areas of particular concern to tribes, and sets forth in writing the commitment of the DM&E Railroad and the STB to address issues of concern that were raised by tribal representatives during consultation. This MOA is to be made part of the Environmental Impact Statement (EIS) for this project under the National Environmental Policy Act (NEPA) process. This document does not restrict tribal interest or involvement in any other areas addressed by the NEPA process in the EIS.

Consultation with tribes and tribal organizations identified as potentially affected by this project commenced in February of 1999. 34 federally recognized tribes and 4 Indian Organizations were contacted by letter and telephone and individual meetings, as requested, were held throughout the spring and summer of 1999 to provide information and discuss issues of concern to Indian people and how they would be addressed in the EIS process. To date 13 Tribes and 4 Indian Organizations continue to be actively involved in the process. Attachment 1 provides an overview of these consultation efforts.

An inter-tribal consultation meeting was held in May of 1999 in Williston, ND to review a draft Programmatic Agreement (PA) addressing Section 106 of the National Historic Preservation Act. The tribes in attendance at this meeting felt there were a variety of issues of concern to Indian people and Tribes and requested that an MOA be developed and included in the EIS which would be an umbrella document that would address concerns that could not be covered in the PA. A rough draft MOA was written at this time, a working group was selected to work on the content, and a second working group was selected to assist in providing input on the draft PA. A second meeting later in the summer was agreed upon.

The second inter-tribal meeting was held in Rapid City in July of 1999 to review both revised drafts of the MOA and the PA. At the close of this meeting it was decided that more work on the documents by the working groups was needed and that drafts would then be reviewed/circulated. The final drafts of these documents would be sent out to Tribes, Indian Organizations and Federal Agencies for comment.

A final draft of the MOA was sent out for comment in January of 2000. At a consultation meeting in February of 2000, to review the South Dakota archeological findings (as agreed in the draft MOA and draft PA) discussion of the draft MOA resulted in the request for an Introduction to the MOA which would explain what it's purpose was and how it was created.

The following tribes and tribal organizations were in attendance at one or more of the inter-tribal meetings: Rosebud Sioux, No. Cheyenne, Ft. Peck Tribes, Lower Brule Sioux, Three Affiliated Tribes, Standing Rock Sioux, Crow Creek Sioux, Santee Sioux, Oglala Sioux, Cheyenne River Sioux, Yankton Sioux, Upper Sioux Community, the Kiowa Tribe, Medicine Wheel Coalition, Gray Eagle Society, Minnesota Indian Affairs Council and the Black Hills Sioux Nation Treaty Council. The federal agencies present at one or more of these meetings include: the Army Corps of Engineers (Omaha), the Forest Service, the Surface Transportation Board and the Advisory Council on Historic Preservation (DC and Denver).

The DM&E Railroad was also present at these meetings.

WHEREAS, the Surface Transportation Board (STB), the lead Federal agency, has received an application for the construction and operation of a rail line by the Dakota, Minnesota and Eastern Railroad Corporation (DM&E), extending its existing system into the Powder River Basin of Wyoming as defined in its decision of December 10, 1998; and,

WHEREAS, the STB has determined that the proposed project is an undertaking and may have an effect upon natural and cultural resources of American Indian people and pursuant to the National Environmental Policy Act (NEPA) is conducting an Environmental Impact Statement (EIS) with United States Forest Service Region 2 (USFS), the United States Department of the Interior - Bureau of Land Management Montana State Office and United States Department of the Interior – Bureau of Land Management Wyoming State Office (collectively referred to as BLM), the United States Army Corps of Engineers Omaha District and United States Army Corps of Engineers St. Paul District (collectively referred to as COE), the United States Department of Interior - Bureau of Reclamation (BOR), and the United States Coast Guard (USCG),as cooperating agencies. All of the above are signatories to this Agreement (Signatories); and,

WHEREAS, the STB is in consultation with the Cheyenne and Arapaho Tribes of Oklahoma, Cheyenne River Sioux Tribe, Comanche Nation of Oklahoma, Crow Tribe, Crow Creek Sioux Tribe, Eastern Shoshone Tribe, Flandreau Santee Sioux Tribe, Fort Peck Tribes, Ho-Chunk Nation, Kiowa Tribe, Lower Brule Sioux Tribe, Lower Sioux Community, Menominee Indian Tribe, Northern Arapaho Tribe, Northern Cheyenne Tribe, Oglala Sioux Tribe, Omaha Tribe, Pawnee Nation of Oklahoma, Ponca Tribe, Prairie Island Sioux Community, Rosebud Sioux Tribe, Sac & Fox Nation, Santee Sioux Tribe, Shakopee Mdewakanton Sioux, Sisseton-Wahpeton Sioux Tribe, Spirit Lake Tribe, Standing Rock Sioux Tribe, Three Affiliated Tribes, Turtle Mountain Band of Chippewa Tribe, Upper Sioux Community, West River Cheyenne, Winnebago Tribe, Yankton Sioux Tribe (collectively referred to as Signatory Tribes). All of the above may be signatories to this Agreement. Signatories to this Agreement will be the duly recognized Chairman or authorized representative by Tribal Resolution; and,

WHEREAS, the Medicine Wheel Coalition for Sacred Sites of North America, the Minnesota Indian Affairs Council, The Medicine Wheel Alliance and the Gray Eagle Society and the Black Hills Sioux Nation Council (collectively referred to as Indian Organizations) are also invited to be signatories to this Agreement; and,

WHEREAS, the United States Government has a trust relationship with American Indian Tribes, as evidenced by Treaty and in provisions in numerous laws including, but not limited to the National Historic Preservation Act of 1966 (NHPA), the American Indian Religious Freedom Act (AIRFA), the Native American Graves Protection and Repatriation Act (NAGPRA), the National Park Service Bulletin 38, the Archaeological Resources Protection Act (ARPA) and [reaffirmed in] President Clinton's Memorandum for Heads of Executive Departments and Agencies of April 1994, Executive Order 13084 on Government to Government Consultation, Executive Order 13007 on Indian Sacred Sites. The Federal Agencies and DM&E recognize the need to consult, to the greatest extent practicable and to the extent permitted by law, with the signatory tribal governments prior to taking actions that affect these native governments or their members; and,

WHEREAS the Federal Agencies and DM&E, in consideration of the trust responsibilities between the U.S. Government and American Indian Tribes, are committed to supporting the policy of Public Law 95-341 (the American Indian Religious Freedom Act of 1978), which states that "...it shall be the policy of the United States to protect and preserve for American

Indians their inherent right of freedom to believe, express and exercise the traditional religions of the American Indian, including, but not limited to, access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites"; and,

WHEREAS the Signatory Tribes recognize that cultural and natural resources, and traditional cultural properties potentially affected by this project are invaluable in the preservation of endangered tribal resources critical to the preservation of their cultural heritage and the pursuit of traditional lifeways for present and future generations; and,

WHEREAS, the DM&E Railroad has proposed a rail line to transport coal from the Powder River Basin Coal fields in Wyoming to Winona, MN, transecting aboriginal tribal homelands identified on the map in the US Indian Claims Commission Final Report, 1978. (Attachment 1) These boundaries indicated on this map represent the results of cases before the US Indian Claims Commission of the US Court of Claims, in which American Indian Tribes proved aboriginal occupancy of a tract within the continental United States; and

WHEREAS, to promote and support government-to-government relationships with federally recognized sovereign nations as defined and required by the President's Executive Memorandum of April 1994, and Executive Orders 13007 and 13084, the Federal Agencies, are undertaking, through consultation, to work in partnership with the Signatory Tribes and concurring Indian Organizations to address and find solutions for the issues of concern on the Powder River Basin Expansion Project; and,

WHEREAS, the DM&E wishes to cooperate with the Federal Agencies who desire to fulfill their responsibilities to establish and maintain relationships with federally recognized sovereign nations for the purpose of building stable, long-term working relationships which result in positive, mutually understood and beneficial solutions to common situations; and,

WHEREAS, this MOA reflects the agreements of a formalized consultation process begun by the Federal Agencies and DM&E in January 1999, with the Signatory Tribes and concurring Indian Organizations in addressing the proposed Powder River Basin Expansion Project; and,

WHEREAS, the Federal Agencies and DM&E are committed to addressing concerns identified by signatory tribal governments regarding natural and cultural resource issues and other socio economic issues within their areas of responsibility, and to outline steps necessary and desired in resolving issues;

NOW THEREFORE, be it resolved that the Federal Agencies, the DM&E, and the signatory Tribes, and the concurring Tribal Organization (the Signatory Parties) agree that, to ensure the meaningful participation of the Signatory Tribes and concurring Tribal Organizations, the following stipulations/conditions be agreed upon:

STIPULATIONS/(CONDITIONS)

1. The provisions of this MOA that expressly address the rights, duties and obligations of and to Signatory Tribes shall not be binding upon nor enforceable by an entity not a Party to this Agreement.

2. It is mutually advantageous for all signatory and concurring parties to cooperate in this opportunity to increase the knowledge and understanding of the historical significance of the American Indian people, and their resources.

3. This MOA will be made part of the Environmental Impact Statement (EIS), currently being prepared by the Federal Agencies.

4. The Signatory Tribes will be provided an invitation to fully participate in the development of the Programmatic Agreement (PA) being developed under the National Historic Preservation Act (NHPA), Section 106 and 110.

5. The signatory Tribes will be participants in the Identification, Planning and Treatment of other cultural areas (to include but not be limited to) Traditional Cultural Properties (TCPs), and Sacred Sites using the procedures and process agreed upon in the PA, as identified in the treatment plan.

6. NAGPRA regulations and procedures under federal, state and local laws will be identified and defined, and to the extent possible a unified process will be defined within the PA and the Identification Plan and Treatment Plan being developed for this project.

7. In the event DM&E obtains authority to construct a rail line, the Monitoring Program in use during the archeological survey work will be expanded to include a training component. This program will be utilized and implemented during all phases of the project (to include archeological work) and specifically in the event construction should occur if the project is approved. This plan should include opportunity for all Signatory Tribes to identify potential and qualified monitors, and to participate in the training of monitors in a uniform process for conducting the monitoring and relevant statutory compliance issues.

8. In the event DM&E obtains authority to construct a rail line, the Signatory Tribes and concurring Indian Organizations will have the opportunity to participate in a timely manner, the procedure and process of the development of any studies that may be performed of plants/ethnobotany, animals/aquatic plants and animals of the area of the proposed route.

9. In the event DM&E obtains authority to construct a rail line, the Parties will work together in the development of an ethno-historic record/report of the proposed rail road corridor.

10. The Signatory Tribes will participate in an examination of intellectual property rights in the control of data, in the confidentiality of information [on cultural areas] as determined by numbers 2, 3, 6 and 7 above, and any writing incorporating intellectual properties contributed by Native Americans in the course of this project.

11. The Endangered Species Act will be complied with.

12. The DM&E and the Signatory Tribes will work together to develop an active recruitment and training program for the employment of Indian people of the Signatory Tribes outside the monitoring program in carrying out construction activities in the building of the railroad in the event the appropriate agencies permit a route to be constructed. In the event DM&E obtains authority to construct a rail line, the DM&E will identify and recruit qualified personnel from the Signatory Tribes for long term employment and contract opportunities for qualified American Indian contractors.

13. In the event DM&E obtains authority to construct a rail line, the terms of this MOA will be rolled over into a Management Plan to ensure compliance with this MOA.

14. The Management Plan will include a notification procedure developed by the DM&E and Signatory Tribes. This procedure will ensure notification of Signatory Tribes in the event of unanticipated discoveries of human remains or artifacts during the life of the railroad.

15. The Signatory Tribes will establish a tribal mediation component (group, task force) for consensus building. This component would be included in the Management Plan and would provide oversight (both short and long term), and would be a long-term on-going liaison between the tribes and the project, responsible for inter-tribal conflict resolution and internal tribal disagreements as they pertain to the project.

16. Should a dispute or objection arise between the Signatory Parties regarding any aspect of this MOA, the parties agree to consult with each other in good faith to resolve the dispute or objection. If the dispute or objection cannot be resolved, the disputing parties agree to meet with a mutually acceptable mediator to attempt to resolve the dispute. All parties agree not to seek judicial relief to resolve the dispute or objection, or to otherwise sue to enforce this MOA, until the consultation and mediation attempts have been exhausted.

17. Amendments, supplements or revisions to this MOA may be proposed by any party to this agreement and shall become effective upon formal approval as set forth in 18.

18. The Signatory Parties recognize the logistical difficulty in obtaining simultaneous signatures to this MOA. Therefore, the Signatory Parties agree that this MOA will take effect upon the signature of the Federal agencies, the DM&E and any Signatory Tribes, but its provisions will not affect any party, until and unless that party signs the MOA on or before March 1, 2000.

FEDERAL AGENCIES

The Surface Transportation Board	Date
The U.S. Army Corps of Engineers, Omaha District	Date
The U.S. Army Corps of Engineers, St. Paul District	Date
The U.S.D.A. Forest Service Region 2	Date
The U.S.D.I. Bureau of Land Management Montana State Office	Date
The U.S.D.I. Bureau of Land Management Wyoming State Office	Date
The U.S.D.I. Bureau of Reclamation	Date
The U.S. Coast Guard	Date

APPLICANT

President, Dakota, Minnesota & Eastern Railroad Corporation	Date

SIGNATORY TRIBES

Chairman, Northern Arapaho Tribe	Date
Chairman, Eastern Shoshone Tribe	Date
Chairman, Northern Cheyenne Tribe	Date
Chairman, Ft. Peck Tribes	Date
Chairman, Crow Tribe	Date

Chairman, Oglala Sioux Tribe	Date
Chairman, Rosebud Sioux Tribe	Date
Chairman, Standing Rock Sioux Tribe	Date
Chairman, Spirit Lake	Date
Chairman, Turtle Mountain Band of Chippewa	Date
Chairman, Three Affiliated Tribes	Date
Chairman, Santee Sioux Tribe	Date
Chairman, Omaha Nation	Date
Chairman, Winnebago Tribe	Date
Chairman, Ponca Tribe	Date
Chairman, Upper Sioux Community	Date
Chairman, Lower Sioux Community	Date
Chairman, Prairie Island Sioux Community	Date
Chairman, Shakopee Mdewakanton Sioux	Date
Chairman, Kiowa Nation	Date
Chairman, Comanche Nation	Date
Chairman, Cheyenne-Arapaho Tribes of Oklahoma	Date

Chairman, Pawnee Nation	Date
Chairman, Sac & Fox Nation of Oklahoma	Date
Chairman, Sac & Fox Nation in Iowa	Date
Chairman, Menominee Indian Tribe	Date
Chairman, Ho-Chunk Nation	Date
Chairman, Cheyenne River Sioux	Date
Chairman, Crow Creek Sioux	Date
Chairman, Yankton Sioux	Date
Chairman, Lower Brule Sioux	Date
Chairman, Sisseton-Wahpeton Sioux	Date
Chairman, Flandreau Santee Sioux	Date

CONCURRING PARTIES

President, Medicine Wheel Alliance	Date
President, Medicine Wheel Coalition for Sacred Sites	Date
Chairman, Minnesota Indian Affairs Council	Date
President, Gray Eagle Society	Date
President, Black Hills Sioux Nation Council	Date

GLOSSARY OF TERMS/ACRONYMS

Concurring Party	Those Indian Organizations concurring with the MOA.
Cultural Resource	A cultural resource is any prehistoric or historic district, site, building, structure or object in American history, architecture, engineering, archeology, or culture. This term includes artifacts, records, and remains that are related to and located within such properties. The term also includes properties of traditional religious and cultural importance to an Indian Tribe that may meet the National Register criteria, or criteria as defined in National Park Service Bulletin 38, and in Executive Order 13007 on Indian Sacred Sites.
Federal Agencies	Any Federal entity with a statutory obligation to fulfill the requirements of NEPA, NHPA and Executive Orders 13084 on Government to Government Consultation and 13007 on Indian Sacred Sites
Ground Disturbance Area	The [surface] area that will be impacted by construction
Human Remains	The physical remains of a human body.
Identification Plan	A proposal for the identification of properties eligible for inclusion to the National Register of Historic Places under Section 106 of the National Historic Preservation Act.
Monitoring Program	A program developed to ensure the presence of a Native American during archeological exploration and construction activities.
MOA	Memorandum of Agreement
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
P A	Programmatic Agreement as defined by Section 106 of the National Historic Preservation Act.
STB	Surface Transportation Board
Signatory Tribe	Federally recognized tribes who are signatories to the MOA.
TCP	Traditional Cultural Property as defined in NPS Bulletin No. 38.

THPO	Tribal Historic Preservation Officer appointed or designated in accordance with the Act is the official representative of an Indian tribe for the purposes of Section 106.
Treatment Plan	A proposal for the mitigation of effects upon any historic property that a project would effect. It can include data recovery, documentation, restoration or other measures.
Unassociated funerary objects	Those funerary objects for which the human remains with which they were placed intentionally are not in the possession or control of a museum or Federal agency.
Undertaking	An undertaking is a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; those requiring a Federal permit; license or approval; and those subject to state or local regulation administered pursuant to a delegation or approval by a Federal agency.

Tribal Consultation Summary

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Tribal Consultation Summary
Powder River Basin Expansion Project
Attachment 1

While none of the proposed Powder River Basin Expansion Project route alternatives cross any existing American Indian Reservations, Native American occupation of the area of the proposed route has been well documented, and extends from historic times to the present. In view of potential Native American concerns associated with the project, government-to-government consultation with potentially interested, federally recognized American Indian Tribes was initiated.

The Surface Transportation Board (STB), Section of Environmental Analysis (SEA), with the assistance of the cooperating Federal agencies, State Historic Preservation Office's (SHPO's) in WY, SD and MN, and recommendations from tribes, identified 32 federally recognized tribes having historic, aboriginal or current ties to the project area. Consultation was initiated with these tribes. It is the intent of consultation that each tribe be provided a reasonable opportunity to participate with the Federal government in addressing the potential impacts of the proposed project.

In September of 1998, and in February 1999, letters were sent to the Chairman (and any know cultural resource contact) for each of the 31 tribes outlining the proposed project and requesting their participation in consultation. (An additional tribe was added by request, bringing the total number of tribes to 32.) Only two responses were received. In February and March of 1999, contact was made by telephone with each tribal government to explain the request for consultation and the project. Each tribe was asked to appoint traditional and or cultural representatives to represent the tribe in the consultation efforts. Out of respect for cultural differences, the wisdom of elders and the historically unresolved issue of treaties, several tribal groups/organizations were invited to participate in consultation meetings.

The consultations to date have consisted of 1) two inter-tribal meetings to address tribal participation in the National Historic Preservation Act (NHPA), Section 106 process and to jointly develop a Memorandum of Agreement (MOA) between the tribes, the Federal agencies and the Dakota, Minnesota & Eastern Railroad Corporation (DM&E); 2) an inter-tribal meeting to review archeological findings in South Dakota; 3) several smaller meetings with tribal representatives; 4) personal appearances before tribal culture committees, elder groups, council chairman and individual council members; and, 5) treaty commissions. Throughout the process tribal representatives have been frequently consulted by phone.

The substantive participation of tribal representatives has resulted in a Memorandum of Agreement developed jointly between the tribes, SEA and DM&E. Tribal representatives have also participated with SEA, the Cooperating Federal Agencies, and SHPO's to develop a draft Programmatic Agreement providing tribes the opportunity for substantive participation in the decision making process under Section 106.

Continuing consultations will include: 1) an opportunity for an on-site review of the proposed new construction area and an opportunity to discuss the archeological survey work and offer

recommendations; 2) an inter-tribal meeting after release of the Draft EIS to discuss any areas of concern and offer recommendations on the draft; 3) individual or small group meetings on an as needed or as requested basis.

The following provides a summary of SEA's consultation efforts:

1. Sept 1998 and February 1999 – letters to all Tribal Chairman and known cultural contacts requesting consultation and providing information on the proposed project.

2. Feb 1999 and March 1999 – phone contact to each tribal Chair/tribal government office to notify as above and to request authorized contact person to represent tribe. This process had several purposes: 1) to make sure everyone received the initial correspondence letters and 2) to identify appropriate contact within the tribal structure and 3) to attempt to ascertain the tribal interest in participating in the consultation. (All tribes were contacted.[1])

The tribes contacted and the results of those contacts are provided below.

Northern Arapaho –	Nelson White and Patrick Moss, Councilmen – William C'Hair was determined to be the tribal contact
Eastern Shoshone –	Del Clair and Hamen Wise, Cultural Resource Contacts (also sit on the Medicine Wheel Alliance)
Northern Cheyenne –	Mark Wandering Medicine, Chair of Cultural Committee, official contact of record, with Jenny Parker, Culture committee member as contact.
Crow Tribe –	Burton Pretty on Top, Cultural Resources contact
Oglala Sioux –	President Salway referred to Shawn Perkins as initial contact. Mike Graham upon appointment as 5th Member is appropriate contact (Ron Zephier, Assistant) is unresponsive; Wilbur Between Lodges, Vice Chair is alternate contact
Rosebud Sioux –	Norman Wilson, President referred Terry Gray as contact
Crow Creek Sioux –	Harold Miller's office referred Torin Crowe as cultural contact
Yankton Sioux –	Stephen Cournoyer, Chair – his office was unresponsive
Lower Brule Sioux –	Michael Jandreau, Chairman referred Scott Jones, cultural coordinator
Cheyenne River Sioux –	Greg Bourland's office referred to Bronco Lebau, Tribal Historic Preservation Office (THPO) as contact.
Sisseton-Wahpeton Sioux –	Andrew Grey, Chair's office referred to Jerry Flute, who sits on Medicine Wheel Coalition as contact
Flandreau Santee Sioux –	Thomas Ranfranz, Chair office was unresponsive
Standing Rock Sioux –	Tim Mentz, THPO is contact
Spirit Lake –	Myra Pearson, Chair – office unresponsive
Chippewa –	Richard LaFromboist, Chair – office unresponsive

[1] Two phone calls were made. Unresponsive means that messages were not returned.

Three Affiliated Tribes –	Tex Hall, Chair - referred to Glenda Embry as primary contact along with Gail Baker, Sr.
Santee Sioux –	Arthur Denny, Chairs office referred Jim White, NAGPRA representative as contact
Omaha –	Gary Lasley, Chair – his office did not refer contact, said they would like to receive correspondence only
Winnebago –	Kenneth Mallory, Chair, referred to D. Smith as contact
Ponca –	Fred Leroy, Chair - office did not refer contact, said they would like to receive correspondence only
Upper Sioux Community –	Dallas Ross, Chair (also serves on Medicine Wheel Coalition)
Lower Sioux Community –	Roger Prescott, Chair – office referred Ernie Wabashaw NAGPRA representative as contact
Prairie Island Sioux –	Audrey Kohen, Chair – unresponsive
Shakopee Mdewakanton Sioux –	Stanley Crooks, Chair – unresponsive
Kiowa –	George Daingkau, Chair, Museum Committee
Comanche Tribe –	Chair's office referred Phyllis Attocknie as primary contact – Jimmy Arterberry as additional
Cheyenne Arapaho –	Chairs office referred Gordon Yellowman as contact. Gordon referred Robert Taylor as contact on the Arapaho side.
Pawnee –	William Howell, Tribal Council, NAGPRA rep
Sac & Fox - OK –	Don Abney – unresponsive
Sac & Fox (Iowa) –	David Old Bear, unresponsive
Menominee –	Chairs office unresponsive
Ho-Chunk –	Chairs office unresponsive
Ft. Peck Tribes –	Curly Youpee, Cultural Office is designated contact

Tribal Groups/organizations:

Medicine Wheel Alliance –	John Hill, Chair, Jo Smith is contact
Medicine Wheel Coalition –	Francis Brown, Chair, is contact
Minnesota Indian Affairs Council –	Joe Day, Executive Director, and Jim Jones are contacts
Gray Eagle Society –	Elaine Quiver, Coordinator, is contact

3. Tribal meetings[2]:

November 1998 – Medicine Wheel Alliance
This was an informational meeting initiating consultation. Attending were Crow, Shoshone and No. Cheyenne representatives – Group asked to continue to be informed.

December 1998 –Medicine Wheel Coalition
This was an informational meeting initiating consultation. The group asked to be a part of the process (especially the Section 106 process)

[2] If initial response was unresponsive, tribes were re-contacted about meetings in their area.

1999 February 27 - Medicine Wheel Coalition / Minnesota Indian Affairs Council
This joint meeting was an attempt to initiate consultation with Minnesota tribes and provide a further information update to the Medicine Wheel Coalition (Coalition). Concerns raised included: Why the consulting tribes were not signing the Programmatic Agreement? and, would the consultation meetings address other issues/studies in the discussions? An additional meeting with the Coalition was asked for and set for April 1999. With the exception of the Minnesota Indian Affairs Council staff, Upper Sioux was the only tribe represented from MN. It was decided to plan another meeting for tribes within the MN area (NB, MN and eastern SD) Attending this meeting were Francis Brown, Dallas Ross, Jerry Flute, George Sutton, Joe Day and Jim Jones.

March 2 - Northern Cheyenne Tribe, Cultural Resources Committee
This was an informational meeting. Ian Ritchie and Clair Green met with Mark Wandering Medicine, Chair, Jenny Parker, Hugh Clubfoot, Butch Sootkis and two others. The DME project was presented and discussed, and copies of the initial Surface Transportation Board letter to tribal chairmen were passed out. Of particular discussion was the time frame, other tribes being consulted with, and the need for substantive tribal input into the Programmatic Agreement (PA)and its accompanying Identification Plan (ID). A second meeting was set up to go over the PA/ID plan. The meeting was set for March 9 with alternate date of March 16.

March 4 - Great Sioux Nations Treaty Council
Attending were Ian Ritchie, Dan Shinn Clair Green and Kevin Schieffer. Dan Shinn gave an informational overview of the project after brief remarks by Kevin. There was a lot of discussion about treaty infringements, and the lack of consultation to date. The result of the meeting was the passing of a Treaty Council Resolution which called for the STB to consult with the governments of members of the council and that the Treaty Council reserved decision on the matter until consultations were completed.

March 17 - Follow up meeting - Northern Cheyenne Culture Committee
This meeting was two hours late in starting and due to lack of attendance the PA was only briefly reviewed. – no substantive input.

March 22 - Grey Eagle Society, Pine Ridge Reservation
Clair Green, Dan Shinn and Brian Molyneaux met with Elaine Quiver, President of The Gray Eagle Society and about 15 of the member elders. This was an informational meeting, which reviewed the project and talked about DM&E hauling how the cultural issues were to be handled and discussed the monitor program. The group was concerned about contaminated waste. The group requested that Ben Rhodd be included as a monitor, and that they be kept informed as the process moved along.

March 23 - Rosebud Sioux Tribe
At the request of the Chairman, Clair Green met with Terry Gray, Marcella Banks, Freemont Fallis, and Roland Blackbull, the Chairman's representative. This was an informational meeting to explain the project, the current status of the process, and to solicit input on the PA/ID plans. Terry requested specific input into the PA. An interest in economic development and how the proposed project could help was expressed. This issue was deferred to a later (unspecified time)

meeting at a more appropriate stage in the process. The accelerated time frame of the project was talked about and tribal comment on the PA urged.

March 24 - Standing Rock Sioux Tribe
Clair Green met with Tim Mentz, Tribal Historic Preservation Officer, Bill Kurtz, his assistant, and members of the Cultural Resources Protection Consortium. This meeting was to discuss the project, review the route and express specific tribal concerns. The primary concerns expressed were tribal participation in the process and the protection of cultural resources. Unresolved treaty issues were also brought up.

March 25- Cheyenne River Sioux Tribe (THPO Office)
Clair Green met with Bronco LeBeau (THPO). The meeting was brief, reviewed the project in general and the map of the alternative routes. Bronco requested to be kept advised as the process progressed.

March 25 - Lower Brule Sioux Tribe
Clair Green met with Scott Jones (and later Chairman Jandreau). The project and alternatives were reviewed. Participation in the process was brought up as the most important issue, particularly as the project impacts not only cultural resources but economic development opportunities. The Chairman has already had some discussions with Kevin Schieffer regarding potential economic development issues. Although the Tribe see the project a difficult one, the tribe realizes the projects potential for development.

April 10 - Medicine Wheel Coalition Meeting
This was a follow-up meeting to address the PA and other issues. The Coalition would like to see a "meaningful relationship" for participation in discussions, not just compliance. The Coalition would like to see equal partnership with the tribes on the cultural issues, i.e. a collaborative effort with tribes on Treatment Plans discussed in the PA. The Coalition would like to see a noxious week policy. The Coalition would also like to see an analysis of why existing routes don't work, and a survey of ceremonial and medicinal plants for inclusion in the DEIS. The Coalition wants to see another draft of the PA with Tribes inserted.

April 30 - OK Tribal Reps - Boulder, CO
Four tribes were represented as they were attending another meeting in Colorado – the Comanche (Phyllis Attocknie), the Pawnee (Bill Howell), the Kiowa (George Daingkau) and the Cheyenne & Arapaho (Gordon Yellowman). An informational overview of the project and route was presented by Clair Green. Again, cultural resource protection was voiced as the main concern. Although these Tribes are further from the route than many others, they maintain a historical interest and would like to attend any other meetings in their area and be kept in the loop with any correspondence. Note: Ron Zephier from Oglala Sioux was expected to be in attendance and did not attend, although he was present at the other Boulder meeting.

May 6 and 7 - Northern Arapaho Tribe

Dan Shinn and Clair Green met with members of the Arapaho Economic Development Committee and interested members of both Arapaho and Shoshone tribes in an open meeting for tribal members. An informational overview of the project was provided, with maps and discussion of the process to date. There was little comment.

May 20 and 21 - Inter-tribal Meeting - Williston, ND

This meeting was set up to coincide with the annual meeting of the Keepers of the Treasurers. Tribal attendance at this meeting included Ft. Peck (Curly Youpee), Lower Brule, (Scott Jones), Medicine Wheel Coalition (George Sutton), Rosebud (Terry Gray), Santee Sioux (James White), MN Indian Affairs Council (Jim Jones), Three Affiliated Tribes (Glenda Embry and Gail Baker), Standing Rock (Tim Mentz), also respective Federal Agencies, SHPO's (SD and WY) and Advisory Council on Historic Preservation (ACHP) and Burns & McDonnell personnel. Tribes invited who were not in attendance included Crow Creek, Northern Cheyenne, Oglala Sioux, and Cheyenne River Sioux. The purpose of the meeting was to re-draft the Programmatic Agreement to include more tribal input. It was decided that in addition to the PA, a Memorandum of Agreement (MOA) be drafted as a part of the National Environmental Policy Act (NEPA) process to be included in the Environmental Impact Statement (EIS). This MOA would reflect tribal concerns above and beyond the Programmatic Agreement. It was also decided that the PA would be rewritten to include more input from tribes (and address requests that they be signators on the document), and, that the ID Plan and Treatment Plan issues would be rewritten with assistance from tribes. There would be a follow-up meeting to review these drafts.

June 17 - Crow Tribe

Clair Green met with Burton Pretty on Top, Cultural Office of the tribe. This was an informational meeting providing an overview of project and process to date. Clair requested that the Crow Tribe clarify their interest in participation. Burton said he was unsure of the tribal interest, would take the matter to his elders and let the STB know.

June 18 - Oglala Sioux Tribe

Clair Green met with Wilbur Between Lodges (Vice Chairman) and Teresa Two Bulls (Fifth Members Office). Also in attendance were Elaine Quiver, Gray Eagles, Oliver Red Cloud, Treaty Council, and Bernadine TallMan from the Bombing Range. The purpose of this meeting was to discuss how to continue consultation with the Tribe, as the Fifth Members office was unresponsive and the Tribal Council has passed a resolution in 1998 against the project. Clair expressed the importance of the EIS process for tribal input and said that participation in the process did not indicate support of the project. The various documents (MOA, PA, ID plan) were discussed. Cultural resource preservation and noise pollution were discussed as major areas of concern. Clair pointed to participation in the development of the aforementioned documents as important to the tribe. Economic development/job opportunities were also brought up. Clair pressed for resolution as to how the tribe should be consulted and Wilbur said he would take the issue up with the Executive Committee.

July 14 - Minnesota Indian Affairs Council

This was the third attempt to reach interested Minnesota tribes and those tribes in Nebraska, and eastern South Dakota to discuss the project. A total of 10 tribes were invited by letter. The letter was followed up by several phone calls to each tribe explaining the purpose of the meeting and urging them to attend. Letters were sent to the Chairmen and contacts at – Ponca Tribe, Winnebago Tribe, Omaha Tribe, Santee Sioux, Flandreau Santee Sioux, Sisseton Wahapeton, Lower Sioux, Upper Sioux, Prairie Island, Shakopee Mdewakanton. The only tribes represented at the meeting were Upper Sioux (Dallas Ross) and Lower Sioux (Ernie Wabashow), the Minnesota Indian Affairs Council (Joe Day and Jim Jones), and Sisseton Wahapeton (Charlene Miller). Clair Green and Dan Shinn provided an overview of the project and an update as to where we were in the process.

July 16 - Update to Lower Brule Tribe

Clair Green met with Scott Jones to work on the content of the MOA and, as the Tribal Council was in session, Clair provided a brief overview of the process of the project to date, including the MOA and PA. Preliminary draft copies of these documents were provided at Council request.

July 19 - Inter Tribal Meeting - Rapid City

The purpose of this meeting was a follow up to the meeting on May 20/21 to review drafts of the MOA and PA. The first day of the meeting was taken up with discussions of treaty issues and monitoring issues brought up by the groups in attendance. The draft of the PA was reviewed by SHPO's and Federal agencies and the draft of the MOA was reviewed and edited by tribes on Day 2 of the meeting. (Those items not finished were concluded by conference call). Ft. Peck (Curly Youpee), Lower Brule, (Scott Jones), Medicine Wheel Coalition (George Sutton), Rosebud (Terry Gray), MN Indian Affairs Council (Jim Jones), Three Affiliated Tribes (Glenda Embry and Gail Baker), Standing Rock (Tim Mentz), Crow Creek (Torin Crowe), No Cheyenne (Jenny Parker), and Oglala Sioux (Teresa Two Bulls/Fifth Members Office) were in attendance. Santee Sioux (James White) was unable to attend. Others in attendance included Sioux Nation Treaty Council representatives, Gray Eagle Society, and Medicine Wheel Coalition representatives. Other attendees included the US Forest Service, the Army Corp of Engineers, the Surface Transportation Board, and SHPO's (WY and SD). The DM&E railroad was also present.

2000 - February 29th - March 2nd - Inter-tribal Meeting, Lower Brule, South Dakota

The purpose of this meeting was to review archeological findings to date in the South Dakota area of the project per agreement at earlier inter-tribal meetings and as agreed in the draft MOA. Attendees at this meeting included Grey Eagle Society/Oglala Sioux, Rosebud Sioux, Cheyenne River Sioux, Upper Sioux Community, Lower Brule Sioux, Standing Rock Sioux, Crow Creek Sioux, Yankton Sioux, and Kiowa Tribe, Northern Cheyenne. Cheyenne and No. Arapaho were unable to attend due to weather.

4. Inter-Tribal Meetings – The inter-tribal meeting of February 29, 2000 was to address the initial archeological work completed in SD. The inter-tribal meetings on May 20 and 21st and July 19, 1999 were to develop and put in final draft form, a draft Memorandum of Agreement (MOA)[3] for the Environmental Impact Statement (EIS) which addresses areas of tribal concerns and a Programmatic Agreement (PA) which addresses tribal participation and input into the Section 106 process. These meetings are addressed above in #3.

5. Further consultation – Additional planned consultation will offer tribal representatives opportunity to review the archeological findings (on site visit) and, to the extent possible, view areas of concern in the proposed new construction areas. An inter-tribal meeting (for tribal chairmen) after the release of the Draft EIS to solicit their comments and recommendations on all aspects of the project and the DEIS is also anticipated.

* * * * *

[3] The draft MOA addresses issues other than and in addition to cultural resource issues, which are being coordinated between the tribes and DM&E (i.e. job training and opportunities, the monitor program as it applies to the rail line construction, etc.).

APPENDIX J

Programmatic Agreement Identification Plan

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SEPTEMBER, 2000

DRAFT

PROGRAMMATIC AGREEMENT

AMONG

ADVISORY COUNCIL ON HISTORIC PRESERVATION

SURFACE TRANSPORTATION BOARD

WYOMING STATE HISTORIC PRESERVATION OFFICER

SOUTH DAKOTA STATE HISTORIC PRESERVATION OFFICER

MINNESOTA STATE HISTORIC PRESERVATION OFFICER

U.S.D.I. BUREAU OF LAND

MANAGEMENT, MONTANA STATE OFFICE

U.S.D.I. BUREAU OF LAND

MANAGEMENT, WYOMING STATE OFFICE

THE U.S.D.A. FOREST SERVICE, REGION 2

U.S. ARMY, CORPS OF ENGINEERS, OMAHA DISTRICT

U.S. ARMY, CORPS OF ENGINEERS, ST. PAUL DISTRICT

U.S.D.I. BUREAU OF RECLAMATION

AND

DAKOTA, MINNESOTA, & EASTERN RAILROAD CORPORATION

REGARDING THE

POWDER RIVER BASIN EXPANSION PROJECT

Finance Docket No. 33407

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WHEREAS, the Surface Transportation Board (STB)[1], the lead Federal agency, has received an application for the construction and operation of a rail line by the Dakota, Minnesota, & Eastern Railroad Corporation (DM&E), extending their existing system into the Powder River Basin of Wyoming (undertaking) as defined in its decision of December 10, 1998; and,

WHEREAS, the STB has determined that the proposed project is an undertaking which may have an effect upon historic properties included on or eligible for inclusion on the National Register of Historic Places (NRHP), and is in consultation with the Advisory Council on Historic Preservation (Council); the United States Department of Agriculture, Forest Service Region 2 (USFS); the United States Department of the Interior - Bureau of Land Management Montana State Office and Bureau of Land Management Wyoming State Office (collectively referred to as BLM), the United States Army Corps of Engineers, Omaha District and the United States Army Corps of Engineers, St. Paul District (collectively referred to as COE), the United States Department of Interior - Bureau of Reclamation (BOR), the State Historic Preservation Officers of Wyoming, South Dakota, and Minnesota (collectively referred to as SHPOs), and the DM&E, pursuant to Section 800.14 of the regulations (36 CFR Part 800) implementing Section 106 of the National Historic Preservation Act, 16 U.S.C. 470f (NHPA). And all of the above are signatories to this Agreement (Signatories); and,

WHEREAS, the STB has invited the Cheyenne and Arapaho Tribes of Oklahoma, Cheyenne River Sioux Tribe, Comanche Nation of Oklahoma, Crow Tribe, Crow Creek Sioux Tribe, Eastern Shoshone Tribe, Flandreau Santee Sioux Tribe, Fort Peck Tribes, Ho-Chunk Nation, Kiowa Tribe, Lower Brule Sioux Tribe, Lower Sioux Community, Menominee Indian Tribe, Northern Arapaho Tribe, Northern Cheyenne Tribe, Oglala Sioux Tribe, Omaha Tribe, Pawnee Nation of Oklahoma, Ponca Tribe, Prairie Island Sioux Community, Rosebud Sioux Tribe, Sac & Fox Nation of Oklahoma, Sac & Fox Nation in Iowa, Santee Sioux Tribe, Shakopee Mdewakanton Sioux, Sisseton-Wahpeton Sioux Tribe, Spirit Lake Tribe, Standing Rock Sioux Tribe, Three Affiliated Tribes, Turtle Mountain Band of Chippewa Tribe, Upper Sioux Community, Winnebago Tribe, and the Yankton Sioux Tribe (collectively referred to as "invited signatories or Tribes") to sign this agreement; and,

WHEREAS, the Medicine Wheel Coalition for Sacred Sites of North America, the Minnesota Indian Affairs Council, The Medicine Wheel Alliance, the Gray Eagle Society and the Black Hills Sioux Nation Council (collectively referred to as Indian Organizations) are also invited to sign this agreement; and,

WHEREAS, the STB, in consultation with the Signatories, has developed an Identification plan (ID Plan) for inventory of cultural resources prior to construction; and,

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[1] The Surface Transportation Board (STB) was created with the passage of the Interstate Commerce Commission Termination Act of 1995 (Pub. L. No. 104-88). STB, an independent body within the U.S. Department of Transportation, is responsible for administering rail, pipeline, and certain adjudicatory function involving motor and water carriers. These responsibilities are similar to those duties formerly administered by the Interstate Commerce Commission. The STB is the lead agency under NEPA for the Power River Basin Expansion Project.

WHEREAS, the applicable requirements of the NHPA, the American Indian Religious Freedom Act, 42 U.S.C. 1996 et. seq. (AIRFA), and the Native American Graves Protection and Repatriation Act, 25 U.S.C. 3001 et. seq. and 43 CFR 10 (NAGPRA), have been considered in the development of the ID plan and this agreement does not waive the responsibilities of the Signatories under these regulations; and,

WHEREAS, the lead federal agency (STB) in cooperation with the USFS, BLM, BOR, and COE is preparing an Environmental Impact Statement (EIS) in accordance with the requirements of the National Environmental Policy Act (NEPA) to address the potential impacts of the undertaking on a variety of human and natural resources; and,

WHEREAS, the STB may use an independent third party contractor, working under its supervision, direction, and control, to assist in meeting the STB's responsibilities defined in the stipulations below; and,

NOW, THEREFORE, the Signatories to this agreement consent that the proposed undertaking shall be implemented in accordance with the following stipulations in order to consider the effect of the undertaking on historic properties and to satisfy all Section 106 NHPA responsibilities for all aspects of the project.

STIPULATIONS

The STB has a statutory obligation as the lead Federal agency to fulfill the requirements of Section 106 (36 CFR 800), therefore the STB shall ensure that the measures in the following parts are carried out.

A. IDENTIFICATION PLAN

The portions to be surveyed on the existing rail line and new construction will be determined through consultation with State Historic Preservation Officer(s) (SHPO), Tribal Historic Preservation Officer(s) (THPO)/cultural resource representative(s) designated by the Tribe(s), and Federal agencies. The Identification Plan (ID Plan) describes the APE, the methodology for the location, inventory, identification, recording, and evaluation of all cultural resources that have surface and exposed profile indications along the alternative alignment(s) proposed for construction. The Identification Plan also describes APE, the methodology for location, inventory, identification, recording, and evaluation of all cultural resources in portions of the existing rail line. The Identification Plan generally consists of a literature review to identify previously recorded sites along the proposed alignment, for both new construction and the existing rail line, an intensive survey for identification and evaluation of cultural resources, and preparation of reports of these investigations.

1. IDENTIFICATION

The parties to this Agreement consent that historic properties will be identified in accordance with the ID Plan (Attachment A) which was developed for this project, in coordination with the agencies, SHPO(s)'s, and consulting tribes.

2. SURVEY REPORTS

STB shall prepare intensive survey and cultural resource NRHP evaluation recommendations (Reports), and findings of effect for those areas surveyed as outlined in the Identification Plan. Separate reports will be prepared for each of the states of Wyoming and Minnesota. Two reports will be prepared for South Dakota with one covering the existing system and one covering the new construction. Reports will include the results of literature review, intensive and reconnaissance surveys (to the extent that access from landowners is available), and the evaluation recommendations regarding cultural resources. Surveys of any additional ancillary facilities or reroutes, or non-accessible areas on either the new construction or the reconstruction portions found to be necessary after submittal of these reports will be addressed in addendum reports and submitted to the reviewing parties that reviewed the original reports.

3. SURVEY REPORT REVIEW

STB shall provide Reports on the surveys conducted in accordance with the Identification Plan to the USFS, BLM, BOR, COE (collectively the reviewing agencies), and appropriate THPO(s)/cultural resources representative(s) designated by the Tribe(s). The reviewing agencies and appropriate THPO(s)/cultural resources representative(s) designated by the Tribe(s)shall have 30 days to review the Reports and comment upon them to the STB. These comments will address the adequacy of the intensive survey results, the eligibility of cultural resources identified during the intensive survey for inclusion on the NRHP and the effects of the project on any cultural resources considered to be historic properties.

3.1 The reviewing agencies and appropriate THPO(s)/cultural resources representative(s) designated by the Tribe(s), participating in this Agreement will provide their recommendations for determinations of site eligibility based upon NRHP criteria (36 CFR 60.4) and their comment on STB's application of the criteria at 36 CFR 800.5(1) to the STB. Based on the comments received, the Report(s) may be revised or additional intensive survey(s) conducted, or both. Any revised Report(s) will be submitted by the STB to the same reviewing agencies and appropriate THPO(s)/cultural resources representative(s) designated by the Tribe(s) that received the preliminary Report(s) for a second 15 work-day review. If any reviewing agency or appropriate THPO(s)/cultural resources representative designated by the Tribe(s) has an objection to the Report(s), they shall notify STB within the 15 work-day review period in accordance with Stipulation M.

3.2 Intensive surveys of any additional ancillary facilities or reroutes on either the new construction or the reconstruction portions found to be necessary after submittal of these Report(s), will be prepared as addendum to the original Report(s) and will be submitted to the same reviewing agencies that received the Reports and the appropriate THPO(s)/cultural resource representative(s) designated by the Tribe(s). Addendum reports will be commented on as outlined above. STB shall provide the Report(s) to the SHPO(s) for reviewing adequacy of the surveys and for consensus determinations of eligibility and effect for all

properties identified in the APE which is described in the Identification Plan. SHPO(s) shall be provided 60 days for this review and comment.

4. **ELIGIBILITY DISAGREEMENTS**
If consensus on the eligibility of any cultural resource cannot be reached, the STB shall forward objections or comments on determinations of eligibility to the Keeper of the National Register (Keeper) for resolution.

5. **NO CONSENSUS**
If a consensus of project effect upon a historic property cannot be reached, the STB will seek the Council's finding. Council's determination in matters pertaining to findings of effect are final (36CFR800.5(c)(3).

6. **CONSTRUCTION AREAS WITH NO HISTORIC PROPERTIES**
(Phased Approval)
If after full review by the agencies and other consulting parties, the construction area or portions of the construction area have been determined by STB to be negative for historic properties, and Report(s) have been accepted by the STB (BLM, USFS, BOR, and COE if appropriate), the appropriate SHPO(s), THPO(s)/cultural resource representative(s) designated by the Tribe(s), then construction of project facilities in these areas may be allowed by STB, upon concurrence by the SHPO(s), THPO(s)/cultural resource representative designated by the Tribe(s), subject to DM&E obtaining permits or approvals as required.

B. TREATMENT PLANS FOR HISTORIC PROPERTIES

1. **FORMAT**
Upon completion of Stipulation A, the STB will develop a Treatment Plan for each site, group of closely related sites, or category of sites determined to constitute a historic property. Each Treatment Plan will be developed in consultation with the appropriate reviewing agency(s), the appropriate SHPO(s), THPO(s)/cultural resource representative(s) designated by Tribe(s), and the Council. Each Treatment Plan will address the historic property adversely affected and set forth means to mitigate the undertaking's effects where the STB, in consultation with the agencies, SHPO(s), and THPO(s)/cultural resource representative(s) designated by Tribe(s), determines it is not feasible or prudent to avoid effects by project relocation. The Treatment Plans will conform to the principles of the Council's "*Treatment of Archaeological Properties: A Handbook", Parts I and II*, the *"Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation*" (Federal Register, Vol. 48 No. 190, September 29, 1983, pp. 44716-44742) and appropriate SHPO guidelines. The STB will ensure the measures to be implemented will be responsive to the concerns of the consulting parties.

2. CONTENT

The Treatment Plans for the undertaking will include, but not be limited to:

a. Historic Properties

Specification of all historic properties to be affected by the project, including a description of the nature of the effects.

b. Treatment

A detailed description of the treatments proposed for historic properties or portions of historic properties eligible for the NRHP under 36 CFR Part 60.4 criteria (a), (b), (c) and/or (d), with an explanation or rationale provided for the choice of the proposed treatments. These treatments will take into account the setting, including, but not limited to, visual, auditory, and atmospheric elements, as appropriate, and be responsive to the qualities that contribute to the significance of the affected properties.

c. Research Design

An archaeological research design for adversely affected properties eligible for the NRHP under 36 CFR Part 60.4 criteria (d) will be developed. The research design will specify and explain the following:

- where data recovery is determined by the STB to be appropriate mitigation response. Research questions to be explored through the data recovery efforts (taking into consideration that data recovery is an adverse effect)
- justification of the appropriateness of the chosen research questions
- data needed to explore the questions posed
- sites and portions of those sites to be further investigated
- methods used to collect data needed to explore the research questions posed, where the adverse effect of data recovery is deemed the appropriate treatment
- laboratory methods used in the examination of the physical material that is recovered
- proposed disposition of the recovered materials and records
- the timing for the preparation and distribution of reports

d. Human Remains

The procedures for consulting about the treatment and disposition of Native American human remains and associated grave goods, if encountered, in accordance with the Identification Plan and Stipulations H and J.

e. Monitoring

A description and rationale for selection of the areas proposed for construction monitoring (a qualified archaeologist as defined in the Secretary of Interiors' Professional Qualifications and Standards 48 FR 22716 September, 1983 and qualified Tribally recognized American Indian Monitors present to observe ground surfaces exposed during the actual construction activities) and construction inspection

conducted by a qualified archaeologist of areas of ground disturbance after specific phases of construction are completed.

f. Distribution of Information

The Treatment Plan must contain provisions for the creation of a popular account for disseminating the results of the Treatment Plans to the general public. These popular accounts will be consistent with the Archaeological Resources Protection Act (ARPA), Executive Order on Sacred Sites 13007 FR 61-104 dated May 24, 1996, Native American Graves Protection and Repatriation Act (NAGPRA), the Freedom of Information Act (FOIA), and Section 304 of the NHPA (16U.S.C. 4702-3).

C. TREATMENT PLANS – REVIEW

1. DEVELOPMENT AND REVIEW

The STB will develop, in cooperation with the reviewing agencies, appropriate SHPO(s), and appropriate THPO(s)/cultural resource representative(s) designated by the Tribe(s), each Treatment Plan to ensure that it addresses the concerns of the reviewing agencies, appropriate SHPO(s), and appropriate THPO(s)/cultural resource representative(s) designated by the Tribe(s) in accordance with Stipulation B 2 (b). Each Treatment Plan shall be submitted to the appropriate reviewing agencies, appropriate SHPO(s), and appropriate THPO(s)/cultural resource representative(s) designated by the Tribe(s) for their review. The reviewing parties shall have 30 days to comment on the Treatment Plan. If any party to this Agreement fails to comment within the review period, the STB shall assume that party's concurrence. Based upon comments received, revised Treatment Plan(s) will be prepared and submitted to all parties.

2. SHPO AND ADVISORY COUNCIL REVIEW

The resultant revised Treatment Plan(s) will be submitted to the appropriate SHPO(s), and the Council for a final 30-day comment period. The revised Treatment Plan(s) will also be provided to the reviewing agencies, THPO(s)/cultural resource representative(s) designated by the Tribe(s) for a final 30-day comment period. If any party has an objection to the final Treatment Plan(s) they shall notify STB within the 30-day comment period in accordance with subsection D. below. Disputes will be resolved in accordance with Stipulation M.

D. TREATMENT PLANS - IMPLEMENTATION

1. CONSTRUCTION PLAN

Upon SHPO concurrence, each Treatment Plan will be incorporated by DM&E into their Construction and Use Plan required for the project rights-of-way on Federal Lands, and the STB and/or the appropriate Federal or State agency shall provide authorization to proceed with the implementation of the Treatment Plan on lands under their jurisdiction. DM&E or its authorized representative will obtain Archaeological Resources Protection Act (ARPA) excavation and removal permits for Federal lands and/or required State permits. Termination of the project after initiation of the Treatment Plan(s) will require

completion of any work in progress, and amendment of each Treatment Plan as described below.

2. AMENDMENTS

Amendments to the Treatment Plans will be incorporated by written agreement among the STB, the appropriate SHPO(s), THPO(s)/cultural resource representative(s) designated by the Tribe(s), DM&E, and the Council (BLM, COE, BOR, and USFS will be party to the written agreement if their managed lands are involved). Amendments to the appropriate ARPA permits will be submitted as part of the approval of the amendments.

2.1 DM&E or its authorized representative shall prepare a progress report(s) to the STB, SHPO(s), and THPO(s)/cultural resource representative(s) designated by the Tribe(s) every two weeks documenting progress in the implementation of each Treatment Plan (BLM, COE, BOR, and USFS to be provided with a report every two weeks if their managed lands are involved or if requested). These progress reports will include:

- dates of mitigation work included in the progress reporting period
- historic properties where treatment was conducted
- type and amount of treatment performed
- a brief summary of the treatment results during the period covered by the report.
- concerns or comments of the principal investigator for plan implementation.

E. CHANGES IN ANCILLARY AREAS/CONSTRUCTION RIGHT-OF-WAY

The STB will notify the reviewing agencies and appropriate SHPO(s), THPO(s)/cultural resource representatives(s) designated by the Tribe(s) of changes in the size or location of ancillary areas or the construction right-of-way that may become necessary during actual construction. If any changes result in the use of unsurveyed areas, the STB will ensure that these areas are subject to intensive survey in order to locate any potentially significant cultural resources and that those resources are evaluated for NRHP eligibility. The Reports addressing these areas will be reviewed in accordance with Stipulation A and Treatment Plans will be developed and implemented for those sites determined to be Historic Properties.

F. CONSTRUCTION AREAS WITH HISTORIC PROPERTIES

In those areas where historic properties are present, the STB will be notified and will provide the results of the completed Treatment Plan to the appropriate SHPO(s) when implementation of the Treatment Plan is completed. Within 45 days of this notification of Treatment Plan completion, the STB, the SHPO(s), THPO(s)/cultural resource representative(s) designated by the tribes, (BLM, USFS, BOR, and COE, if lands under their administration are involved), will be invited to inspect the site of the historic property to concur that Treatment Plan implementation is complete. Upon concurrence of complete Treatment Plan implementation, STB may authorize construction along that portion of the project addressed by the completed Treatment Plan. If concurrence of complete Treatment

Plan implementation cannot be reached the dispute will be resolved in accordance with Stipulation M.

G. DOCUMENTATION OF TREATMENT

The STB will prepare a report documenting the implementation and results of the Treatment Plan(s). This report will be the Draft Final Cultural Resource Report for the project. The report will contain a detailed account of the information gained during implementation of the Treatment Plan(s), and the effectiveness of the work measures implemented to mitigate the adverse effects of construction. A review copy of the report will be distributed to the reviewing agencies, cultural resource representative(s) designated by the Tribe(s), SHPO(s)/THPO(s), and the Council. There will be a 30 calendar-day period to review and comment on the report. The Final Cultural Resource Report will be prepared based on comments received and distributed to the reviewing agencies, SHPO(s), THPO(s)/cultural resource representative(s) designated by the Tribe(s), and the Council within 120 calendar-days of receipt of the comments.

H. DISCOVERY

If a previously undiscovered archaeological, historical, or cultural property is encountered during construction, or previously known properties will be affected in an unanticipated manner, all activity will cease within 300 feet of the property to avoid or minimize harm to the property until the STB, the appropriate SHPO(s), THPO(s)/cultural resource representatives(s) designated by the Tribe(s), and, if on federal land, the agency responsible for administering the land, can evaluate and, if necessary, authorize steps to mitigate impacts to the new discovery. Evaluation and mitigation will be carried out in consultation with the reviewing agencies, the appropriate SHPO(s), THPO(s)/cultural resource representative(s) designated by the Tribe(s), and Council as expeditiously as possible in accordance with 36 CFR 800.13(b).

I. CONFIDENTIALITY

All parties shall ensure that shared data, including data concerning the precise location and nature of historic properties and properties of religious and cultural significance are protected from public disclosure to the greatest extent permitted by law, including conformance to Section 304 of the National Historic Preservation Act, as amended (the Act) and Section 9 of the Archeological Resources Protection Act and Executive Order on Sacred Sites 13007 FR 61-104 dated May 24, 1996.

J. HUMAN REMAINS

1. NOTIFICATION AND TREATMENT

If human remains are encountered on Federal lands, the STB shall notify the appropriate Federal land management agency, other consulting agencies if requested, appropriate SHPO(s), and designated Native American NAGPRA tribal contact. Treatment and disposition of remains and associated grave goods will be consistent with measures outlined in the Identification Plan, H, and applicable Federal and State laws. If human remains are encountered on State or Private lands, the STB will notify and consult with the State SHPO(s), THPO(s)/cultural resource representative(s) designated by the

Tribe(s). Treatment and disposition of remains and associated grave goods will be consistent with measures outlined in the Identification Plan and applicable Federal, Local and State laws.

2. **REINTERMENT**
STB will insure that every effort is taken to avoid disturbing known human burial sites. Where avoidance is not possible, and in consultation with appropriate [tribal] parties, burials will be removed prior to construction and reinterred in accordance with reburial procedures outlined in the Identification Plan and any applicable Federal and State laws.

3. **DISCOVERY**
If human remains are inadvertently discovered during construction activities, all construction will cease within 300 feet in all directions of the human remains and the STB will immediately notify the appropriate parties in accordance with the Identification Plan. Human remains and grave goods will be treated in accordance with the Identification Plan.

K. CURATION

1. **FEDERAL LANDS**
STB shall ensure curation of all records and other items (archaeologic and paleontologic) resulting from identification and data recovery efforts is completed in accordance with 36 CFR Part 79, and the provisions of 43 CFR 10 (NAGPRA). STB shall ensure that documentation of the curation of these materials is prepared and provided to the signatory and concurring parties to this Agreement within 10 days of receiving it. All archaeological materials recovered from Federal lands shall be curated in accordance with the Identification Plan.

2. **PRIVATE LANDS**
Private landowners will be encouraged to curate materials (archaeologic and paleontologic) recovered from their lands in accordance with the Identification Plan. Materials from private lands to be returned to the private landowners shall be maintained in accordance with 36 CFR Part 79 until all necessary analysis has been completed. STB shall document the return of materials to private landowners and submit copies of this documentation to the signatory parties to this Agreement.

3. **STATE LANDS**
STB will ensure that all cultural and paleontologic materials discovered on State lands will be curated in accordance with the Identification Plan.

L. AUTHORITIES

Compliance with the provisions of this programmatic agreement does not relieve the STB or other federal agencies of their responsibilities to comply with other legal requirements, including those imposed by the Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. Section 3001 and 43 CFR 10), the Archeological Resources

Protection Act (ARPA) (16 U.S.C. Section 470aa-470ll), and the National Environmental Policy Act (NEPA) (42 U.S.C. Section 4321-4347), and applicable Executive orders.

M. DISPUTE RESOLUTION

Should any party to this Agreement provide notice, within 30 calendar-days of becoming aware of an action, to the STB of their objection to an action under this Agreement, the STB shall consult with the objecting party to resolve the objection unless otherwise specified in this document. If the STB determines that the objection cannot be resolved, the STB shall forward all documentation relevant to the dispute to the Council. Within 30 calendar-days after receipt of all pertinent documentation, the Council shall either; provide STB with recommendations, which STB shall take into account in reaching a final decision regarding the dispute; or notify STB that it will comment in accordance with 36 CFR Part 800 Subpart B. Any Council comment provided in response to such a request will be taken into account by STB in accordance with 36 CFR Part 800 Subpart B with reference to the subject of the dispute.

Any recommendation or comment provided by the Council will be understood to pertain only to the subject of the dispute; the STB's responsibility to carry out all actions under this Agreement that are not subject to dispute will remain unchanged.

N. AMENDMENT

Signatories to this Agreement may request that it be amended, whereupon the parties will consult in accordance with 36 CFR 800.14 to consider such amendment.

O. TERMINATION

1. PARTICIPATION

Any party to this Agreement may terminate their participation by providing 30 calendar-days written notice to the other parties. The parties shall consult during the period prior to termination of participation to seek agreement on amendments or other actions that would avoid termination. The Council will be afforded an opportunity to comment during this period as well.

2. AGREEMENT

The STB, SHPO(s), or DM&E may terminate this Agreement by providing 30 calendar-days written notice to the other parties; the parties shall consult during the period prior to the termination to seek agreement on amendments or other actions that would avoid termination. The Council will be afforded an opportunity to comment during this period as well. In the event of termination, the STB, SHPO(s), and DM&E will comply with 36 CFR 800 subpart B.

3. TERM

The term of this agreement shall be five (5) years from the date of execution unless otherwise terminated or amended by the signatory parties.

P. FAILURE TO CARRY OUT THE TERMS OF THE AGREEMENT

In the event that the terms of this Agreement are not carried out, the STB and all other agencies shall comply with 36 CFR 800 subpart B with regard to individual actions covered by this Agreement.

Q. EXECUTION AND IMPLEMENTATION

This Programmatic Agreement shall take effect when executed by the Council, the Agency Official and the appropriate SHPO(s). Execution and implementation of this Agreement evidences that the STB, BLM, COE, BOR, USFS and the Council have satisfied their National Historic Preservation Act Section 106 responsibilities for all individual actions of the Dakota, Minnesota & Eastern Railroad Corporation's Powder River Basin Expansion Project.

Attachment A – Identification Plan(s)
Attachment B – MOA

FEDERAL AGENCIES

_____	_____
The Surface Transportation Board	Date
_____	_____
The U.S. Army Corps of Engineers, Omaha District	Date
_____	_____
The U.S. Army Corps of Engineers, St. Paul District	Date
_____	_____
The U.S.D.A. Forest Service, Region 2	Date
_____	_____
The U.S.D.I. Bureau of Land Management, Montana State Office	Date
_____	_____
The U.S.D.I. Bureau of Land Management, Wyoming State Office	Date
_____	_____
The U.S.D.I. Bureau of Reclamation	Date

SIGNATORY TRIBES

_____	_____
Chairman, Northern Arapaho Tribe	Date
_____	_____
Chairman, Eastern Shoshone Tribe	Date
_____	_____
Chairman, Northern Cheyenne Tribe	Date
_____	_____
Chairman, Ft. Peck Tribes	Date
_____	_____
Chairman, Crow Tribe	Date
_____	_____
Chairman, Oglala Sioux Tribe	Date

Chairman, Rosebud Sioux Tribe	Date
Chairman, Standing Rock Sioux Tribe	Date
Chairman, Spirit Lake	Date
Chairman, Turtle Mountain Band of Chippewa	Date
Chairman, Three Affiliated Tribes	Date
Chairman, Santee Sioux Tribe	Date
Chairman, Omaha Nation	Date
Chairman, Winnebago Tribe	Date
Chairman, Ponca Tribe	Date
Chairman, Upper Sioux Community	Date
Chairman, Lower Sioux Community	Date
Chairman, Prairie Island Sioux Community	Date
Chairman, Shakopee Mdewakanton Sioux	Date
Chairman, Kiowa Nation	Date
Chairman, Comanche Nation	Date

Chairman, Cheyenne-Arapaho Tribes of Oklahoma	Date
Chairman, Pawnee Nation	Date
Chairman, Sac & Fox Nation of Oklahoma	Date
Chairman, Sac & Fox Nation in Iowa	Date
Chairman, Menominee Indian Tribe	Date
Chairman, Ho-Chunk Nation	Date
Chairman, Cheyenne River Sioux	Date
Chairman, Crow Creek Sioux	Date
Chairman, Yankton Sioux	Date
Chairman, Lower Brule Sioux	Date
Chairman, Sisseton-Wahpeton Sioux	Date
Chairman, Flandreau Santee Sioux	Date

SIGNATORY TRIBAL ORGANIZATIONS

President, Medicine Wheel Alliance	Date
President, Medicine Wheel Coalition for Sacred Sites	Date

_____	_____
Chairman, Minnesota Indian Affairs Council	Date
_____	_____
President, Gray Eagle Society	Date
_____	_____
President, Black Hills Sioux Nation Council	Date

APPLICANT

_____	_____
President, Dakota, Minnesota & Eastern Railroad Corporation	Date

Glossary of Terms/Acronyms

Adverse Effect	When an undertaking may alter, directly or indirectly, the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.
APE	The Area of Potential Effect (APE) is the geographic area within which the project may cause physical, visual or audible effects to the character or use of historic properties. It includes all areas of construction, such as rights-of-way (ROW), staging areas, extra-work spaces, yards, access roads, borrow areas, and other ancillary facilities. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking.
Ancillary Areas	A general term that covers any additional areas that may be effected by the undertaking.
Area of Potential Effect	See APE
Associated Funerary Objects	Objects for which the human remains with which they were placed intentionally are also in the possession or control of a museum or Federal Agency. The term includes those funerary objects and cultural properties that were made for burial purposes or to contain human remains and those cultural properties that are a part of a burial site.
Borrow Area(s)	An excavated area where material has been or will be dug for use as fill at another location.
Consulting Parties	Consulting parties include SHPO/THPO, Indian tribes, representatives of local governments, applicants for Federal assistance, permits, licenses and other approvals, certain individuals and organizations with a demonstrated interest in the undertaking, and the public.

Cultural Resource	A cultural resource is any prehistoric or historic district, site, building, structure or object in American history, architecture, engineering, archeology, or culture. This term includes artifacts, records, and remains that are related to and located within such properties. The term also includes properties of traditional religious and cultural importance to an Indian Tribe that may meet the National Register criteria.
Cultural Resource Management Group	A professional archaeological firm that performs cultural resource investigations for a fee.
Curation	The preservation of material remains that are excavated or removed during a survey, excavation, or other study of a prehistoric or historic resource, and associated records that are prepared or assembled in connection with the survey, excavation or other study.
Eligible for the National Register of Historic Places	The term eligible for the National Register includes both properties formally determined as such in accordance with regulation of the Secretary of the Interior and all other properties that meet the National Register criteria.
Evaluation testing	Archaeological investigation of a prehistoric or historic site with a purpose of evaluating the site against National Register of Historic Places criteria contained in 36 CFR 60.4.
Exposed Profile	Any area where the soils are exposed such as stream cut banks, road cut banks, erosion gullies etc.
Federal Agency(s)	Any federal entity with a statutory obligation to fulfill the requirements of Section 106 who has jurisdiction over an undertaking and takes legal and financial responsibility for section 106 compliance in accordance with subpart B 36 CFR 800. The Federal Agency(s) has approval authority for the undertaking and can commit the Federal agency to take appropriate action for a specific undertaking as a result of Section 106 compliance.
Ground Disturbance Area	The surface area that will be impacted by construction.
Haul Roads (New)	Roads constructed where none previously existed to facilitate hauling of construction materials.
Haul Roads (Upgraded)	Roads or trails that require upgrading to accommodate hauling construction materials.

High Probability Area(s)	An area suspected to have a better than average chance of containing cultural resources (e.g. water crossings, paralleling watercourses, historically prominent areas etc.).
Historic Property	Any prehistoric or historic district, site, building structure, or object included in or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian Tribe that meet the National Register criteria.
Human Remains	The physical remains of a human body.
ID Plan	Identification Plan
Indian Tribe	An Indian Tribe, band, nation, or other organized group or community, including a Native Village, Regional Corporation or Village Corporation, as those terms are defined in Section 3 of the Alaska Native Claims Settlement Act (43 U. S. C 1602) which is recognized eligible for the special programs and serviced provided by the United States to Indians because of their status as Indians.
Intensive Survey	An intensive survey is a systematic, detailed examination of an area designed to gather information about cultural resources sufficient to evaluate them against NRHP eligibility criteria of significance within specific historic contexts.
Keeper of the National Register	The Keeper is the individual who has been delegated the authority by the National Park Service (NPS) to list properties and determine their eligibility for the National Register. The Keeper may further delegate this authority as he or she deems appropriate.
Lateral Area	Any subsequent branch from the main line that may as yet not be identified but is a part of the undertaking.
NAGPRA	Native American Graves Protection and Repatriation Act
National Register	The National Register lists properties formally determined eligible for the NRHP.
National Register Criteria	National register criteria are criteria established by the Secretary of the Interior for use in evaluating the eligibility of properties for the National Register (36 CFR 60). The NRHP criteria are listed below:

The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship and feeling and:

a. that are associated with the events that have made a significant contribution to the broad patterns of our history; or

b. that are associated with the lives of persons significant in our past; or

c. that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic value, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

d. that yielded, or may be likely to yield, information on prehistory or history.

Criteria considerations: ordinarily cemeteries, birthplaces, or graves of historical figures; properties owned by religious institutions or used for religious purposes; structures that have been moved from their original locations, commemorative in nature; and properties that have achieved their significance within the past 50 years shall not be considered eligible for the National Register of Historic Places (36 CFR 60.4).

NRHP	National Register of Historic Places
OSHA	Occupational Safety & Health Administration.
PA	Programmatic Agreement
Popular Account	A popular account is a comprehensive discussion of the information contained in professional report(s) on archaeological investigations that is written for the general public. A popular account will not contain any sensitive material, removes the technical language, yet can serve as an informational and educational tool.
Reconnaissance Survey	A reconnaissance survey is an examination of all or part of an area accomplished in sufficient detail to make generalizations about the types and distributions of historic properties that may be present.
SADI's	Scale Accurate Digital Image photographs with depictions of the construction right-of-way superimposed and geo-referenced.
SHPO	State Historic Preservation Officer

Shovel Test	A small circular test excavation, approximately 40 centimeters in diameter that is dug to a sufficient depth to reach culturally undisturbed soils.
Site	Defined by Willey and Phillips (1958:18), as any reasonably definable spatial unit that contains features or is fairly continuously covered with artifacts that are indicative of an occupation fifty years or older. A site may be defined as "a spatial cluster of cultural features, or items, or both" (Binford 1972:46). These definitions apply to both prehistoric and historic sites. Archaeological context may be defined by the inclusion of any of the following: soil staining, associated fire-cracked rock, ceramics, features, or a concentration of materials within a reasonably defined spatial boundary.
Staging Area(s)	Those areas outside the construction disturbance area used for storage of supplies and equipment used for construction.
STB	Surface Transportation Board
Testing	(See Evaluation testing)
THPO	Tribal Historic Preservation Officer appointed or designated in accordance with the Act is the official representative of an Indian tribe for the purposes of Section 106.
Traditional Cultural Properties	A traditional Cultural Property can be defined generally as one that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that communities history, and (b) are important in maintaining the continuing cultural identity of the community.
Treatment Plan	A proposal for the mitigation of effects upon any historic property that a project would effect. It can include data recovery, documentation, restoration or other measures.
Unassociated funerary Objects	Those funerary objects for which the human remains with which they were placed intentionally are not in the possession or control of a museum or Federal agency. Objects that were displayed with individual human remains as part of a death rite or ceremony of a culture and subsequently returned or distributed according to traditional custom to living descendants or other individuals are not considered unassociated funerary objects.

Undertaking An undertaking is a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; those requiring a Federal permit; license or approval; and those subject to state or local regulation administered pursuant to a delegation or approval by a Federal agency.

USGS United States Geological Survey

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Identification Plan

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September, 2000
DRAFT
Identification Plan
for the Dakota Minnesota and Eastern Railroad Corporation's Proposed
Powder River Basin Expansion Project

A. PURPOSE

The development of this plan is required by the Programmatic Agreement (PA) to ensure the successful completion of the National Historic Preservation Act (NHPA) Section 106 process for this project. The purpose of this Identification Plan (ID Plan) is to ensure that the identification and evaluation of cultural resources is conducted in accordance with the Secretary of Interior's Standards *and Guidelines for Archeology and Historic Preservation* (48 FR 44716-44742) and 36 CFR 800.4. The Identification Plan and the Treatment Plan(s), developed for the identified historic properties, are integral parts of the Programmatic Agreement. While the Standards and Guidelines are not regulatory and do not set or interpret agency policy, they do provide technical advice about archeological and historic preservation activities and methods.

Identification of Historic properties 36 CFR 800.4 is regulatory in nature. The historic properties that should be identified include, any prehistoric or historic district site, building, structure, or object included in or eligible for inclusion in the National Register of Historic places maintained by the *Secretary of the Interior*. The term historic properties includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian Tribe or Native Hawaiian organization and that meet the National Register Criteria. The term eligible for inclusion in the National Register includes both properties formally determined as such in accordance with regulations of the *Secretary of the Interior* and all other properties that meet the National Register criteria. The level of identification needed varies depending on the nature of the property or property type, the nature of the agency's management authority, and the nature of the agency's possible effects on the property.

This Identification Plan describes three key elements: the Area of Potential Effect (APE), minimum standards and qualifications required for the cultural resource investigations, and American Indian and consulting party involvement.

B. SAFETY

All contractors and sub-contractors shall adhere to Occupational, Safety, and Health Administration (OSHA) standards while conducting activities related activities covered in the PA and ID Plan. Additionally, Corps of Engineers, U.S. Forest Service, Bureau of Land Management (BLM) and DM&E Railroad safety rules shall be adhered to when conducting activities on lands under the management or jurisdiction of these parties.

C. AREA OF POTENTIAL EFFECT (APE)

The Area of Potential Effect (APE) and the methods of identification and evaluation will be in accordance with the Secretary of the Interior's Standards and Guidelines for Identification. The project has two distinct parts generally described as; (1) the portion of the proposed project that will involve reconstruction of existing rail lines, and (2) the portion of the proposed project that will involve new construction where rail lines currently do not exist.

1. APE for Reconstruction

The APE for that portion of the project involving reconstruction, from Winona, Minnesota to Wall, South Dakota, and new construction in Minnesota will include:

1. The existing DM&E right-of-way.
2. Any newly acquired right-of-way needed for cut and fill.
3. Any newly acquired right-of-way for a proposed new connecting track near Owatonna, Minnesota.
4. Existing rail corridor and any newly acquired right-of-way required for new DM&E rail line through Mankato, Minnesota.
5. All lateral areas, borrow areas, haul roads (new or upgraded), staging areas and other ancillary areas related to the undertaking.
6. Any newly acquired right-of-way for proposed yards or sidings.
7. That area outside the existing right-of-way or outside any newly acquired right-of-way where there is the potential for the undertaking to have an adverse effect on historic properties as defined in 36 CFR 800.5. Identification of these areas will include consultation with the State Historic Preservation Officer (SHPO), Tribal Historic Preservation Officer (THPO)/cultural resource representatives designated by the tribes, other identified consulting parties and Federal agencies.

2. Reconstruction Identification and Evaluation

Identification and evaluation for the reconstruction will include:

1. Identification of known cultural resources through records search and literature review and through consultation with the SHPO, THPO/cultural resource representatives designated by the tribes, other identified consulting parties, and Federal agencies in accordance with 36 CFR 800.4.
2. Field identification and Section 106 evaluation of all structures within the APE by a qualified architectural historian.
3. Intensive Survey of the known cultural resources and other areas identified by the SHPO, THPO/cultural resource representatives designated by the tribes, other identified consulting parties, and Federal agencies in accordance with 36 CFR 800.4.
4. If the cultural resource is in the APE, necessary information to evaluate the cultural resource against NRHP eligibility criterion (36 CFR 60.4) shall be obtained. The guidance in the National Park Service Bulletin 38 and E. O. 13007 shall also be considered when evaluating sites for NRHP eligibility. If, in the opinion of the

investigator and the cultural resource representatives designated by the tribes, the cultural resource is recommended NRHP eligible sufficient information to formulate Treatment Plan(s) shall be obtained. (The Cultural Resource Representative designated by the Tribes will only make recommendations on cultural Resources having a prehistoric or historic Native American Component). No backhoe or block excavations shall be undertaken without a written plan and SHPO consultation and approval.

5. Intensive Survey to identify all cultural resources in other designated areas within the APE which have been identified by the SHPO, THPO/cultural resource representatives designated by the tribes, other identified consulting parties, and Federal agencies. (All Minnesota investigations shall be in accordance with approved research design).
6. The intensive survey shall gather information from American Indian tribes and elders to assist in identifying properties of religious and cultural significance to them and identifying properties that may be eligible for the NRHP.
7. A reconnaissance level survey of those areas outside the ground disturbance area where there is the potential for the undertaking to have an adverse effect, as defined in 36 CFR 800.5 on historic properties. Identification of these areas will include consultation with the SHPO, THPO/cultural resource representatives designated by the tribes, other identified consulting parties, and Federal agencies.

3. APE for New Construction

The APE for the new construction portion of the project in South Dakota and Wyoming will include:

1. The construction right-of-way to include a twenty-foot buffer on either side of the fenced construction right-of-way along the entire new construction route (ground disturbance area).
2. All lateral areas, borrow areas, haul roads (new or upgraded), staging areas, and other ancillary areas related to the undertaking.
3. That area outside the construction or ground disturbance right-of-way where there is the potential for the undertaking to have an adverse effect on historic properties, as defined in 36 CFR 800.5. Identification of these areas will include consultation with the SHPO, THPO/cultural resource representatives designated by the tribes, other identified consulting parties, and Federal agencies.

4. Construction Identification and Evaluation

Identification and evaluation for the new construction will include:

1. Identification of known cultural resources through records search and literature review and through consultation with the SHPO, THPO/cultural resource representatives designated by the tribes, other identified consulting parties, and Federal agencies in accordance with 36 CFR 800.4.

2. An intensive survey of the construction right-of-way plus 20 feet either side of the fenced construction right-of-way
3. An intensive survey of all lateral areas, borrow areas, haul roads (new and upgraded), staging areas, and other ancillary areas related to the undertaking.
4. An intensive survey of the construction right-of-way to identify all cultural resources. Testing will be done to evaluate the cultural resources against NRHP eligibility criterion (36 CFR 60.4). The guidance in the National Park Service Bulletin 38 and E. O. 13007 shall also be considered when evaluating sites for NRHP eligibility. If, in the opinion of the investigator and the cultural resource representative designated by the tribes, the cultural resource is to be recommended as a historic property, sufficient information to formulate Treatment Plan(s) shall be obtained. (The Cultural Resource Representative designated by the Tribes will only make recommendations on cultural resources having a prehistoric or historic Native American component). No backhoe or block excavations shall be undertaken without a written plan and SHPO consultation and approval.
5. A geomorphological survey of the construction right-of-way will be conducted to identify areas where buried cultural resources may exist and where deep testing may be necessary to identify cultural resources. The geomorphologist will also recommend construction monitoring areas and assist in evaluation of cultural resources against NRHP eligibility criteria (36 CFR 60.4) by providing identification of the soil(s), soil characteristics, soil dating, and analysis of the probability of the soils to contain cultural material.
6. A reconnaissance level survey of those areas outside the ground disturbance area where there is the potential for the undertaking to have an adverse effect, as defined in 36 CPR 800.5, on historic properties. Identification of these areas will include consultation with the SHPO, THPO/cultural resource representatives designated by the tribes, other identified consulting parties, and Federal agencies.

Any areas not originally identified within the APE but potentially affected by the undertaking must be identified by the SHPO, THPO/cultural resource representatives designated by the tribes, other identified consulting parties, and Federal agencies. The Surface Transportation Board (STB) will consult with the SHPO, THPO/cultural resource representatives designated by the tribes, other identified consulting parties (as defined in 36 CFR 800.2(c)), and Federal agencies to address their concerns.

D. STANDARDS AND QUALIFICATIONS

The intensive survey and NRHP eligibility recommendations will be consistent with the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation,* (48 FR 44716-44742), the Secretary of the Interior's *Professional Qualifications and Standards* 48 FR 22716 September 1983, 36 CFR 800, 36 CFR 60.4, National Park Service Bulletin 38, and E. O. 13007.

If there are unanticipated discoveries of cultural resources during implementation of the undertaking, the Agency Official (STB) shall satisfy the requirements of Section 106 in accordance with 36 CFR 800.13. Prior to conducting any work for which a permit is required,

the Cultural Resource Management group(s) (Contractor(s) who meet the *Secretary of the Interior's Professional Qualifications and Standards* 48FR 22716) shall obtain any necessary Federal, State or local permits/license.

E. REPORTS

All reports for the Identification Plan will be submitted in two parts designed to be one report when combined. Each report will be modified from the outline below to address the specific requirements of the *state* where the survey was conducted. The first part of the report will include a comprehensive records search and literature review. The second part will include the results of field investigations, including NRHP evaluations of all cultural resources that are known to be within the APE.

The combined report should provide information for future research and justifiable and defendable NRHP recommendations for those historic properties identified as NRHP eligible. The report must also provide justifiable and defendable explanations of potential effects on historic properties and must comply with 36 CFR 800.5.

The reporting of results and discussions of the cultural resources investigated shall be organized in a logical sequence. (The Wyoming report will be sequenced by site number). In tables, site numbers shall be organized in sequence. A detailed outline of the required elements for the report is contained in the following:

PART 1

Cover

Must include Report Title, Date of Report, Project No(s), Authors, Organization or who prepared the report.

Cover page

Must include Authors, Report Title, Date of the Report, Lead Agency, Preparer's Organization, Type of Report (Identification Plan/Class III, Phase I & II), Survey Methods (transects in meters), County(s), USGS quad(s), Land Owner(s), Legal Description (reference to project maps may be appropriate), Acreage (Federal, Non-Federal, Block and Linear with a total), File Search Date(s), Field work Date(s), Field Personnel, and a site summary table.

Abstract

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Appendix(s)

1. Introduction
    - Project Description (Include appropriate permit and agency file #'s)
    - Personnel (Their roles and duties on the project)
    - Report Format (What is in each chapter of the report and who wrote or contributed to the chapter).
2. Environmental Overview
    - Topography
    - Geology
    - Drainages
    - Flora
    - Fauna
    - Climate
    - Paleoenvironment
3. Culture History
    - Paleoindian (Include a discussion of pre-Clovis)
    - Archaic etc. (Varies widely along the project),
    - Woodland and Plains Village (Plains Indian)
    - Contact period (Protohistoric)
    - Historic
4. Research Design and Methods
    - Archaeological Site Definition
    - Prehistoric Archaeological Research Orientation
    - Prehistoric Archaeological Research Questions
    - Historic Archaeological Research Orientation
    - Historic Archaeological Research Questions
    - Inventory and Research Methods
        - Record Search and Literature Review
            - Known Sites
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        - Field Survey
            - Methods
            - Expected site types/locations
        - Field and Site Records
            - Methods
    - Laboratory Analysis
        - Prehistoric Artifact Collection and Analysis
            - Methods
        - Chipped-stone Technological and Functional Analysis
            - Methods
        - Historic Artifact Collection and Analysis
            - Methods

Curation
Methods
Facilities/Disposition
References
Appendix(s)
(Geomorphology Report)
Detailed Project Location Maps
and
Ethnographic Reports for all TCP's recommended eligible for the NRHP (If required to justify the recommendation)

PART 2

Update and Revise Part 1 by Chapter and Section if additional information is needed.

5. Results of Investigation
(A detailed discussion of each site that will include, as a minimum, the following information)

Site Type, Component, USGS 7.5 minute Quadrangle, Site Area, Topography, elevation, Soil Type, Nearest Water, Survey Method, Site Condition, Site Description, Artifact Descriptions and Disposition, Interpretation, and Recommendation.

Site and UTM locations will be confidential and only included in a removable appendix.

6. Research Findings (Answer research questions presented in Chapter 4)
Prehistoric Context
Site Distribution Relative to Environmental Variables Potential for Unanticipated Discovery
Site Density
Site Function
Temporal and Cultural Affiliation
Historic Context
Site Distribution Relative to Environmental Variables Potential for Unanticipated Discovery
Site Density
Site Function
Temporal and Cultural Affiliation

7. Conclusions and Recommendations (Appropriate text but also include tables to explain the recommendations)

Conclusions
- Prehistoric Sites
- Historic Sites

Recommendations (Eligibility recommendations)
- Prehistoric Sites
- Site Specific/Avoidance/Mitigation/other Historic Sites
- Site Specific/Avoidance/Mitigation/other

8. References

9. Appendix(s)

(Geomorphology Report)
(Ethnographic)
(Site Forms)
(Maps)
(Correspondence)
(American Indian Coordination and Consultation Documentation and Description)
(American Indian Monitor Reports)
(Other ancillary studies for example: Radiocarbon, AMS, Faunal analysis, Phytolith analysis, pollen analysis etc.)

F. FIELDWORK -- Project Requirements

1. Survey Methods

- Shovel Testing

Shovel testing will be required if the surface visibility is less than 50% in the opinion of the project archaeologist/principle investigator, or if the terrain warrants the shovel tests. The shovel tests will be approximately 30 X 30 centimeters to a minimum depth of 50 centimeters or until sterile subsoil, or bedrock, or water are encountered. The shovel test will be spaced no further than 30 meters apart or closer if required by the state. Shovel tests will not be done if, in the project archaeologist's justifiable judgement (such as steep terrain or rocky or other etc.) they are unnecessary.

Regardless of surface visibility, a shovel test will be conducted and documented on each identified site or isolated find site. If a shovel test is not conducted, justification for not conducting a shovel test will be noted in the field notes, site form and report. Deviation from the above policies on shovel testing must be justified.

- Collection

  All subsurface artifacts will be collected and properly labeled in the field. Surface collection of sites not within the ground disturbance area is not required. All obsidian artifacts shall be collected.

- Curation

  Curation of all records and other items resulting from intensive survey, NRHP evaluation and mitigation efforts shall be completed in accordance with 36 CFR Part 79, and the provisions of the Native American Graves Protection and Repatriation Act: Final Rule (43 CFR 10) (NAGPRA). Documentation of the curation of these materials shall be provided to the STB, SHPO/THPO, cultural resource representatives designated by the tribes, and where appropriate, other signatories to the Programmatic Agreement within 30 calendar-days of acceptance of the Final Cultural Resource Report for the Project.
  Private land owners will be encouraged to curate collections from their lands in an appropriate facility. Materials from private lands to be returned to the private landowners shall be maintained in accordance with 36 CFR Part 79 until any specified analysis is complete. Documentation of the return of these materials to the private land owner shall be provided to the STB, the appropriate SHPO/THPO, cultural resource representatives designated by the tribes, and where appropriate other signatories to the Programmatic Agreement within 30 calendar-days of acceptance of the Final Cultural Resource Reports for the Project.

  Materials from State lands in Wyoming, South Dakota, and Minnesota will be provided to a State approved facility for curation. These materials shall be maintained in accordance with 36 CFR Part 79 until any specified analysis is complete. Documentation of the return of these materials to the State approved curation facility shall be provided to the STB and the appropriate SHPO/THPO or cultural resource representatives designated by the tribes within 30 calendar-days of acceptance of the Final Cultural Resources Reports for the project.

  Materials from Federal lands will be maintained in accordance with 36 CFR Part 79 until specified analysis is complete. These materials will be curated in a Federally approved curation facility or repository in their state of discovery but shall remain the property of the Federal government. Materials from Native American sites shall be curated in their approved curation facility if these exist within the state of discovery but shall, as with the state curation facilities, remain the property of the Federal government. Documentation of the curation of these materials will be provided to the STB, the appropriate SHPO/THPO, or cultural resource representatives designated by the tribes within 30 calendar-days of acceptance of the Final Cultural Resources Reports for the project.

  Materials from Native American sites may be curated in an Indian owned federally approved curation facility if these exist within the state of discovery, but the materials shall remain the property of the state, or if on Federal land, the property of the Federal government.

- Human Remains

General field rules if human remains or associated funerary objects or unassociated funerary objects are encountered :

1. If human remains are discovered, they shall be subjected to review under the discovery clause of the PA.
2. Immediately cease work within 300 feet of the remains.
3. DM&E will provide security for a 300 foot perimeter in all directions around the site.
   a. The construction contractor (as per DM&E contract) will immediately notify the American Indian monitor on site, the appropriate law enforcement officer, and county coroner.
   b. If on Federal land the first notification will be to the Federal agency followed by the American Indian monitor on site, the appropriate law enforcement officer, and the county coroner.
4. The construction contractor will immediately notify the SHPO/State Archaeologist and STB.
5. The construction contractor and the American Indian monitor will notify the NAGPRA representatives of each tribe from a list provided to the contractor and each monitor by DM&E.
6. STB shall notify the cooperating agencies, and if on Federal lands follow provisions of 43 CFR 10.
7. Notification of an inadvertent discovery will be made in two ways:
   a. By phone immediately
   b. By letter of notification to the STB and if on Federal lands or lands under Federal permit, to the controlling agency within 24 hours.
8. Do not resume construction within the 300 foot perimeter until the SHPO and STB have authorized it in writing, and, if on Federal lands or land under Federal permit, an authorization in writing from the controlling agency.
9. If on Federal land, refer to 43 CFR 10 and PL 101-601 25 USC (NAGPRA) procedures.

The STB shall ensure that any human remains encountered during the course of this undertaking shall be accorded equal treatment and respect for human dignity without reference to their ethnic origins, cultural backgrounds, or religious affiliations. All human remains shall be handled in accordance with the procedures in the PA, this ID Plan, and in consultation with the Council in accordance with Section 800.13. All unidentified remains or burials found outside of platted, recorded or identified cemeteries and in contexts which indicate antiquity greater than 50 years shall be dealt with as follows:

10. Minnesota

Minnesota Statute § 307.08, § 307.082, and Minnesota Session Laws 1997, Chapter 215, Sec. 42

If such burials are not Indian or their ethnic identity cannot be ascertained, they shall be dealt with in accordance with provisions established by the State Archaeologist.

If such burials are Indian, efforts shall be made by the state archaeologist, THPO/cultural resource representatives designated by the tribes, and the project archaeologist to ascertain their tribal identity.

If their probable tribal identity can be determined, such remains shall at the discretion of the state archaeologist and the THPO/cultural resource representatives designated by the tribes be turned over to the Indian Tribe(s) (43 CFR 10 Sec. 10.4 and PL 101-601 25 U.S.C. Sec 3 Ownership).

If tribal identity cannot be determined, the Indian remains must be dealt with in accordance with provisions established by the state archaeologist and the THPO/cultural resource representatives designated by the tribes and 43 CFR 10 Sec. 10.4 and PL 101-601 25 U.S.C. Sec 3 Ownership.

No authenticated and identified Indian burial ground may be relocated unless the request to relocate is approved by the THPO/cultural resource representatives designated by the tribes.

11. South Dakota

Code § 34-25-24, § 34-25-38, § 34-25-38.1, and SD 34-25-21

Shall be the same as Minnesota per agreement with the South Dakota Research Center and South Dakota SHPO.

12. Wyoming

W.S. § 6-4-501, W. S. § 35-1-420

The procedures outlined in the General Field rules listed in this section shall apply. (Note: There is no Wyoming statute requiring anyone to report the discovery of a dead body to the county sheriff, county coroner, etc.,)

If human remains are encountered on Federal lands, STB and the managing Federal agency shall consult with the Native American tribe or other ethnic

groups related to the human remains identified to determine the treatment and disposition measures consistent with the applicable Federal laws (e.g. NAGPRA), regulations, and policies.

If human remains are encountered on State or private lands, STB shall ensure, in consultation with the appropriate SHPO and the Native American tribe or other ethnic groups related to the human remains, that they are treated according to the provisions of the applicable Federal and State laws, regulations, or policies.

STB will ensure that unanticipated discovery of human remains, and associated or unassociated burial objects, found during implementation of the undertaking shall satisfy the requirements of the appropriate State and Federal Laws, regulations, policies, and Section 106 in accordance with 36 CFR 800.13.

- Evaluation Testing

Sufficient subsurface testing, as determined by the project archaeologist/principle investigator, SHPO, federal agency managing the land, and the Native American Monitor on those sites suspected to be NRHP eligible, will be conducted to allow the Cultural Resource Management groups to develop Treatment Plans or other alternatives to address any adverse effects.

- Minimum Field Recordation Standard

1. Prehistoric and Historic Sites

The appropriate site forms for each state will be completed while on the site (if possible). A sketch map and field notes (field notes should be kept by each crew member), and photographs of the site will be required. A description of the artifacts and features observed on each site shall be included in the field notes. The site will be noted on a 7.5 minute USGS quad.

All photographs will be keyed to the corresponding roll and frame number and identified as such on a photo log. The photo log will also include the site number or temporary site number, time of day, weather conditions at the time of the photograph, what was photographed, and the direction the photographer was facing. The ASA setting and the type of film (color or B&W) shall also be noted (Once the film is developed this information will be on the individual photograph along with the state assigned site number). Upon completion of the project and acceptance of the Final Cultural Resources Report all photographs and negatives shall be shipped to the appropriate curation facility.

2. Standing Structures (includes buildings, bridges and other structures)

The appropriate site forms for each state will be completed while on the site. The field notes will include the address or location, the present condition and integrity of the property; a description of the prominent architectural/engineering features with emphasis on the primary facade; a documented or estimated date of original construction; identification of obvious alterations/additions; and a designation of style or vernacular type, when applicable. A 3 ½" x 5" black and white photograph of each property will be taken using 35mm format. Each photograph will be keyed with the corresponding roll and frame number and identified as such on the individual photographs (See photo log above). Original negatives and contact sheets will be included with the final report (Structures should be evaluated in the field by a qualified architectural historian). Upon completion of the project and acceptance of the Final Cultural Resources Report all photographs and negatives shall be shipped to the appropriate curation facility.

G. CONFIDENTIALITY

Maintaining the confidentiality of information provided by tribes and traditional practitioners will be one of the most important issues to be addressed in the consultation process.

Confidentiality of the information received from Native American monitors or other Native Americans shall be maintained and only released to reviewing individuals or agencies identified in the Programmatic Agreement.

Glossary of Terms/ Acronyms

Adverse Effect	When an undertaking may alter, directly or indirectly, the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.
APE	The Area of Potential Effect (APE) is the geographic area within which the project may cause physical, visual or audible effects to the character or use of historic properties. It includes all areas of construction, such as rights-of-way (ROW), staging areas, extra-work spaces, yards, access roads, borrow areas, and other ancillary facilities. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking.
Ancillary Areas	A general term that covers any additional areas that may be effected by the undertaking.
Area of Potential Effect	See APE
Associated Funerary and Objects	Objects for which the human remains with which they were placed intentionally are also in the possession or control of a museum or Federal Agency. The term includes those funerary objects and cultural properties that were made for burial purposes or to contain human remains and those cultural properties that are a part of a burial site.
Borrow Area(s)	An excavated area where material has been or will be dug for use as fill at another location.
Consulting Parties	Consulting parties are those individuals and groups identified in 36 CFR 800.2 (c).

Cultural Resource	A cultural resource is any prehistoric or historic district, site, building, structure or object in American history, architecture, engineering, archeology, or culture. This term includes artifacts, records, and remains that are related to and located within such properties. The term also includes properties of traditional religious and cultural importance to an Indian Tribe that may meet the National Register criteria.
Cultural Resource Management Group	A professional archaeological firm that performs cultural resource investigations for a fee.
Curation	The preservation of material remains that are excavated or removed during a survey, excavation, or other study of a prehistoric or historic resource, and associated records that are prepared or assembled in connection with the survey, excavation or other study.
Eligible for the National Register of Historic Places	The term eligible for the National Register includes both properties formally determined as such in accordance with regulation of the Secretary of the Interior and all other properties that meet the National Register criteria.
Evaluation Testing	Archaeological investigation of a prehistoric or historic site with a purpose of evaluating the site against National Register of Historic Places criteria contained in 36 CFR 60.4.
Federal Agency(s)	Any Federal entity with a statutory obligation to fulfill the requirements of Section 106 who has jurisdiction over an undertaking and takes legal and financial responsibility for section 106 compliance in accordance with subpart B 36 CFR 800. The Federal Agency(s) has approval authority for the undertaking and can commit the Federal Agency to take appropriate action for a specific undertaking as a result of Section 106 compliance.
Ground Disturbance Area	The surface area that will be impacted by construction
Haul Roads (New)	Roads constructed where none previously existed to facilitate hauling of construction materials.
Haul Roads (Upgraded)	Roads or trails that require upgrading to accommodate hauling construction materials.

High Probability Area(s)	An area suspected to have a better than average chance of containing cultural resources (e.g. water crossings, paralleling water courses, historically prominent areas etc.).
Historic Property	Any prehistoric or historic district, site, building structure, or object included in or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian Tribe that meet the National Register criteria.
Human Remains	Any physical remains of a human body.
ID Plan	Identifcation Plan
Intensive Survey	An intensive survey is a systematic, detailed examination of an area designed to gather information about cultural resources sufficient to evaluate them against NRHP eligibility criteria of significance within specific historic contexts.
Lateral Area	Any subsequent branch from the main line that may as yet not be identified but is a part of the undertaking.
NAGPRA	Native American Graves Protection and Repatriation Act
National Register	The National Register lists properties formally determined eligible for the NRHP
NRHP	National Register of Historic Places
OSHA	Occupational Safety & Health Administration
PA	Programmatic Agreement
Reconnaissance Survey	A reconnaissance survey is an examination of all or part of an area accomplished in sufficient detail to make generalizations about the types and distributions of historic properties that may be present
SADI's	Scale Accurate Digital Image photographs with depictions of the construction right-of-way superimposed and geo-referenced.
SHPO	State Historic Preservation Officer

Shovel Test	A small circular test excavation, approximately 40 centimeters in diameter, excavating sufficient depth to reach culturally sterile soils.
Site	Site definition is different for each state but is generally defined by Willey and Phillips *(1958:18),* as any reasonably definable spatial unit that contains features or is fairly continuously covered with artifacts that are indicative of an occupation 50 years or older. A site may be defined as "a spatial cluster of cultural features, or items, or both" (Binford 1972:46). These definitions apply to both prehistoric and historic sites. Archaeological context may be defined by the inclusion of any of the following: soil staining, associated fire-cracked rock, ceramics, features, or a concentration of materials within a reasonably defined spatial boundary.
Staging Area(s)	Those areas outside the construction disturbance area used for equipment and material storage.
STB	Surface Transportation Board
Testing	(See Evaluation testing)
THPO	Tribal Historic Preservation Officer
Treatment Plan	A proposal for the mitigation of effects upon any historic property that a project would effect. It can include data recovery, documentation, restoration or other measures.
Unassociated Funerary Objects	Those funerary objects for which the human remains with which the human remains with which they were placed intentionally are not in the possession or control of a museum or Federal agency. Objects that were displayed with individual human remains as part of a death rite or ceremony of a culture and subsequently returned or distributed according to traditional custom to living descendants or other individuals are not considered unassociated funerary objects.
USGS	United States Geological Survey

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APPENDIX K

Biological Assessment

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PART 1
INTRODUCTION

1.1 PROPOSED PROJECT DESCRIPTION

The current Dakota, Minnesota & Eastern Railroad Corporation (DM&E) system includes approximately 700 miles of east-west mainline track across southern and central South Dakota and southern Minnesota, extending westward from the Mississippi River at Winona, Minnesota, through Rochester, Owatonna, Waseca, and Mankato and into South Dakota. The mainline passes through Brookings, Huron, Pierre, and Rapid City, South Dakota before turning northwest through Sturgis and Belle Fourche, Minnesota and South Dakota on to Colony, Wyoming. The system also consists of several hundred miles of secondary track extending off the mainline into northwestern Nebraska, northern Iowa, and other portions of South Dakota and (Figure 1-1). DM&E currently operates four to eight trains per day over various sections of its system, transporting a wide variety of commodities including grain and other agricultural products, bentonite and kaolin clays, cement, and wood products.

DM&E is seeking authority to construct and operate new rail line facilities in south-central Minnesota, southwest South Dakota and east-central Wyoming. This construction and operation would extend DM&E's existing system westward into the Powder River Basin region of Wyoming, allowing DM&E to connect to coal producing mines. Construction and operation of this project would provide an additional rail carrier access to the region and facilitate transport of coal eastward from the mines over DM&E's existing system.

The Powder River Basin Expansion Project (PRB Expansion Project) involves approximately 300 miles of new rail line construction. Additionally, as part of the proposed project, DM&E would rebuild approximately 600 miles of its existing rail line along its current system to standards acceptable for operation of unit coal trains.

New rail construction would include approximately 300 miles of rail line extending off DM&E's existing system near Wall, South Dakota, extending generally southwesterly to Edgemont, South Dakota, and then westerly into Wyoming to connect with existing coal mines located south of Gillette, Wyoming. New rail construction would also include approximately 14 miles or less of rail line at Mankato, Minnesota, within Blue Earth County. DM&E currently has trackage on both sides of Mankato, accessed by trackage rights on rail line operated by Union Pacific Railroad Company (UP). The proposed Mankato construction would provide DM&E direct access between its existing lines and avoid operational conflicts with UP.

The final proposed segment of new rail construction would involve a connection between the existing rail systems of DM&E and I&M Rail Link (I&M). The connection would include construction and operation of approximately three miles or less of new rail line near Owatonna, Minnesota, within Steele County. The connection would allow interchange of rail traffic between the two carriers.

In order to transport coal over the existing system, DM&E proposes to rebuild approximately 600 miles of its existing rail line. The majority of this, approximately 580 miles, would be along DM&E's mainline between Wall, South Dakota, and Winona, Minnesota. Approximately 5 miles of existing rail line near Smithwick, South Dakota, would also be rebuilt. Rail line rebuilding would include rail, tie, and ballast replacement, additional sidings, signals, grade crossing improvements, and other systems.

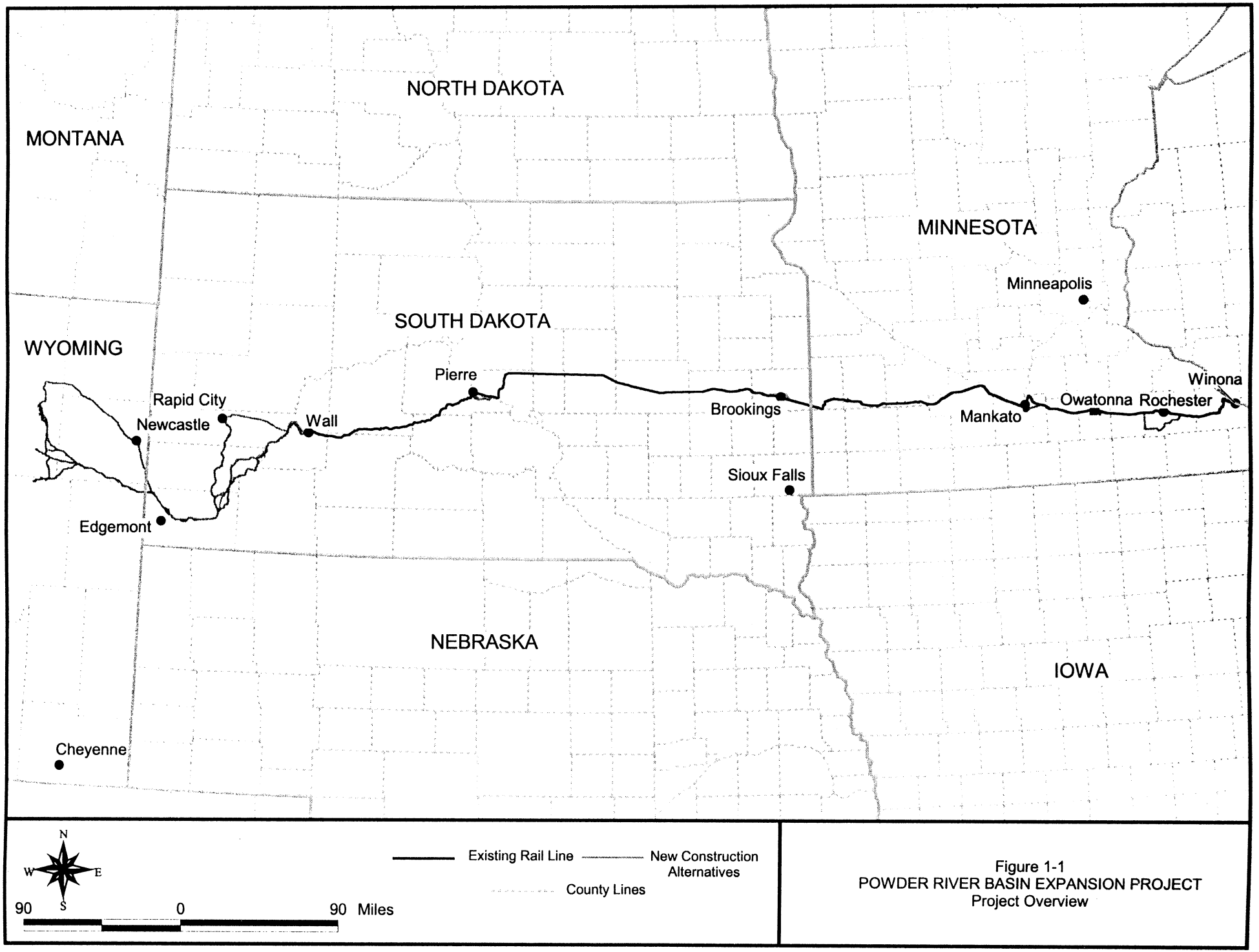


Figure 1-1
POWDER RIVER BASIN EXPANSION PROJECT
Project Overview

1.2 MINNESOTA AND SOUTH DAKOTA REBUILD

1.2.1 Minnesota

DM&E's existing line crosses the counties of Winona, Olmsted, Dodge, Steele, Waseca, Blue Earth, Brown, Redwood, Lyon, and Lincoln. DM&E's existing line originates at Winona, Minnesota and closely parallels U.S. Highway 14 west across much of the state (Fig. 1-2).

1.2.2 South Dakota

The rebuild of the existing DM&E rail line continues in eastern Brookings County, southeast of Elkton at the South Dakota/Minnesota state line (Fig. 1-3). The proposed project area is located primarily in rural areas in the following counties: Brookings, Kingsbury, Beadle, Hand, Hyde, Hughes, Stanley, Jones, Haakon, Jackson, and Pennington. The line closely parallels U.S. Highway 14 west across South Dakota. The rebuild portion of the project terminates at Wall, South Dakota (Pennington County).

1.3 MINNESOTA NEW CONSTRUCTION

1.3.1 Mankato

1.3.1.1 M-1 (No Action)

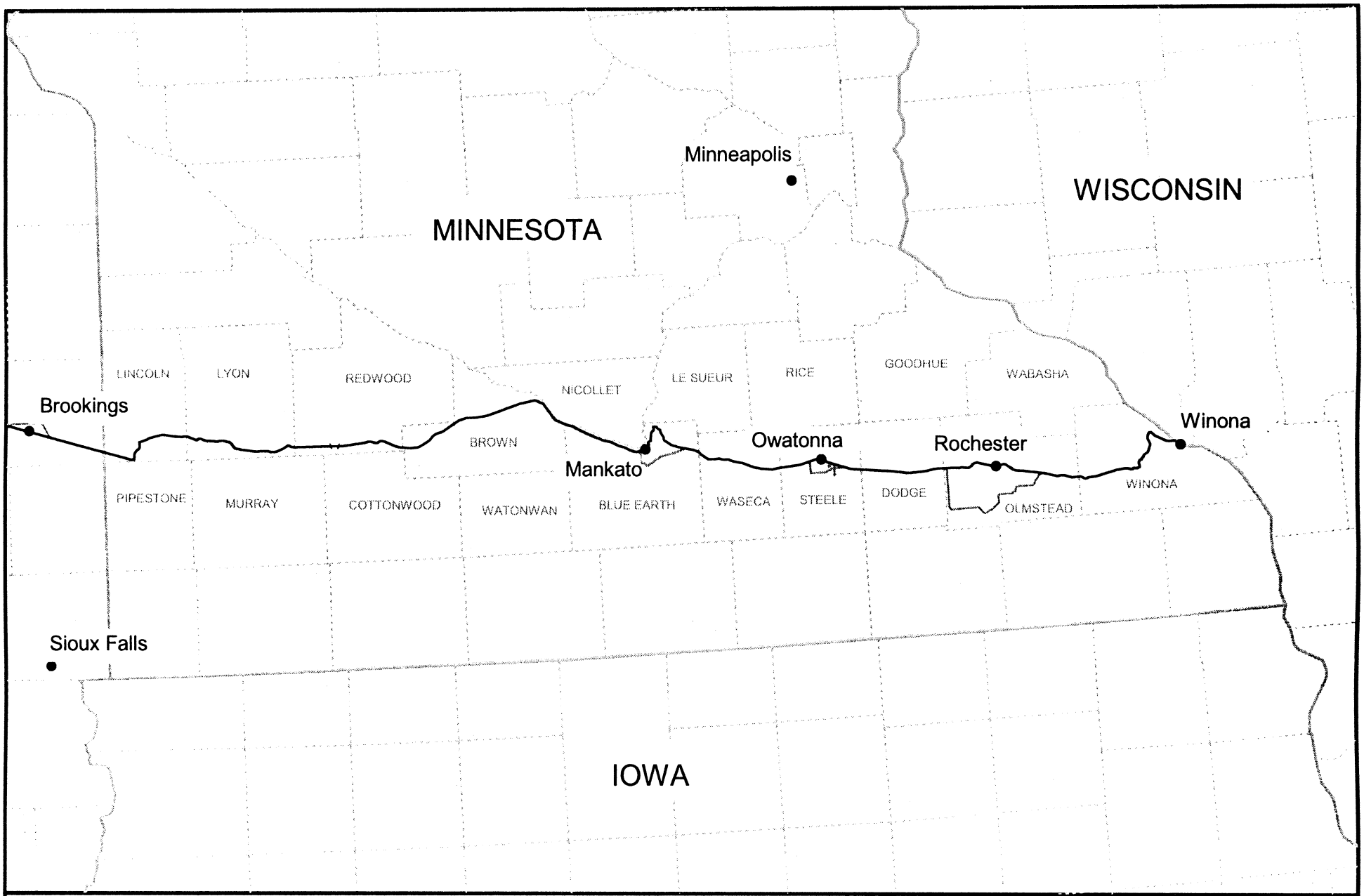
The no-action alternative, M-1, is project denial.

1.3.1.2 M-2 (Proposed Action or Southern Alternative)

This alternative involves construction of a new rail line in a loop south of Mankato to connect DM&E trackage on the west and east sides of the city (Fig. 1-4). The new rail line would extend from DM&E's existing line approximately 1.25 miles east of Eagle Lake. This alternative would join with the existing DM&E rail line approximately 0.6 miles west of where the existing DM&E and UP rail lines merge. M-2 would result in approximately 13.3 miles of new construction and would require construction of bridges across the Blue Earth River.

1.3.1.3 M-3 (Existing Corridor or Middle Alternative)

This alternative would bypass the UP track through Mankato by using the existing DM&E rail line to the point where it merges with the UP rail line and then constructing new rail line within the existing UP rail corridor. It would connect to the existing DM&E rail line where it currently merges with the UP rail line on the east side of Mankato. This alternative would require construction of bridges across the Blue Earth River, the rebuilding of approximately 10.1 miles of existing DM&E track and approximately 5.5 miles of new construction adjacent to the UP rail line (Fig.1-4).



N
W E
S

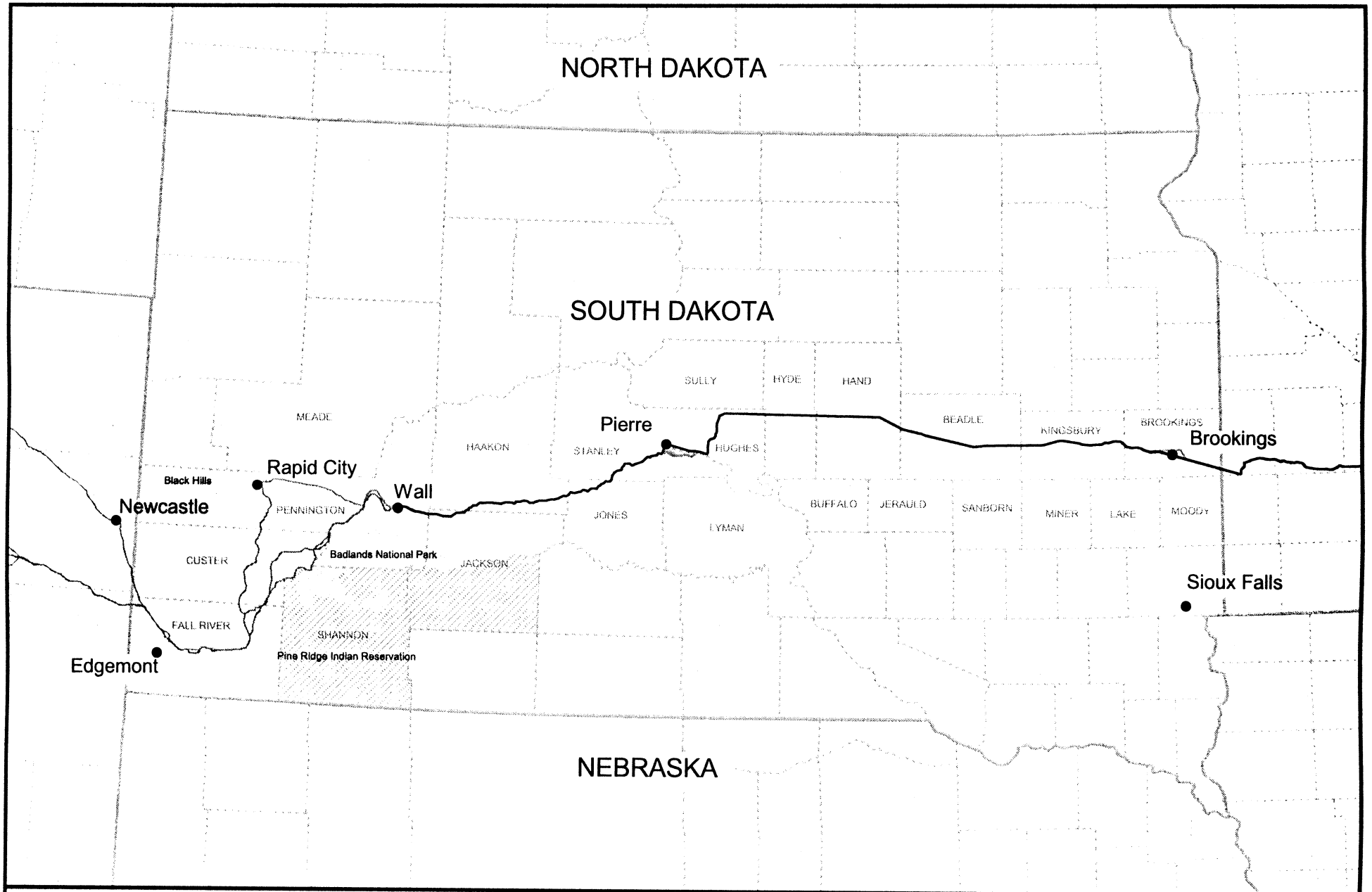
40 0 40 Miles

Existing Rail Line

New Construction Alternatives

County Lines

Figure 1-2
POWDER RIVER BASIN EXPANSION PROJECT
Minnesota Overview



N
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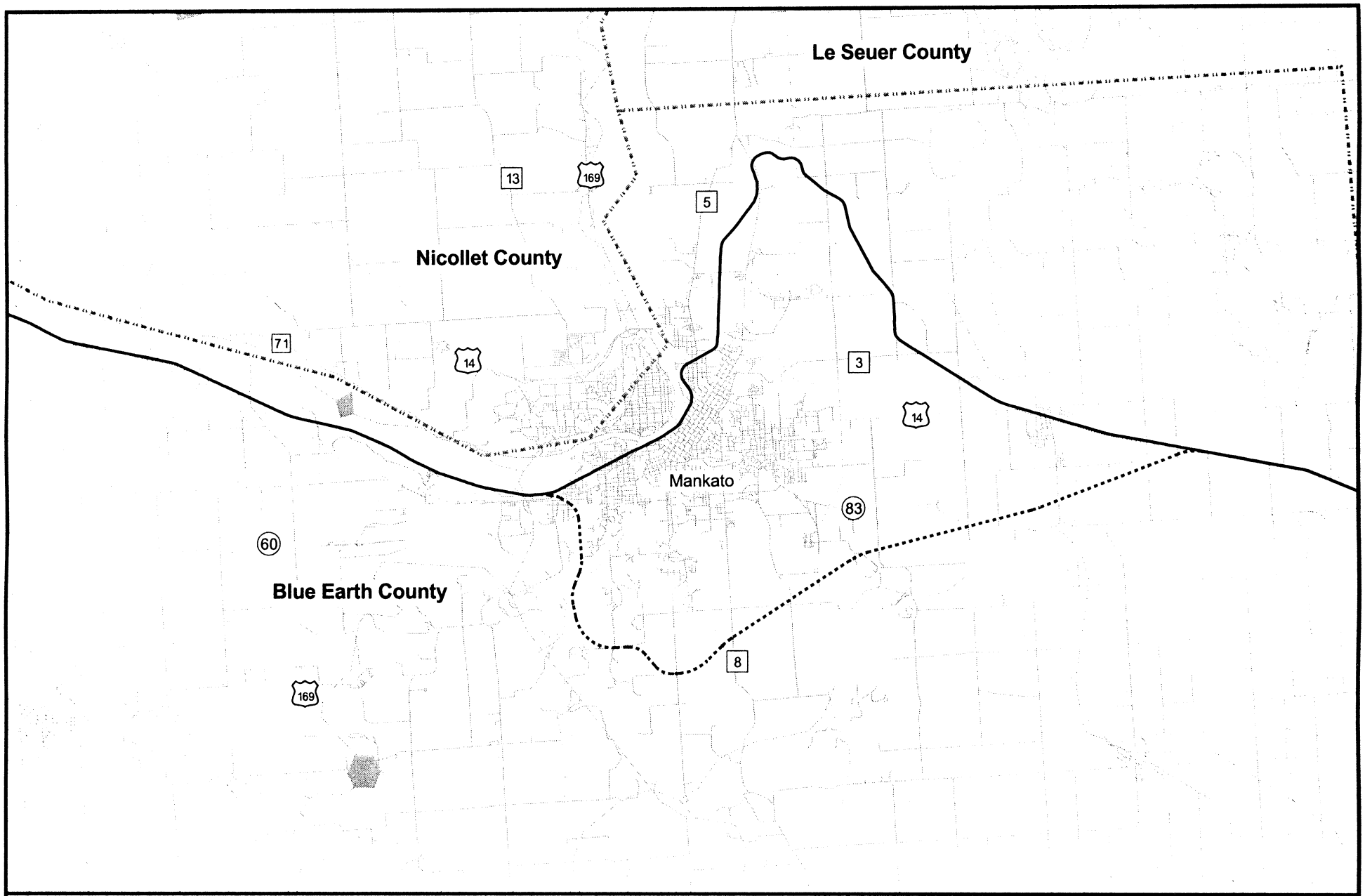
S
60 0 60 Miles

Existing Rail Line
New Construction Alternatives
County Lines

Figure 1-3
POWDER RIVER BASIN EXPANSION PROJECT
South Dakota Overview



N
W E
S

3 0 3 Miles

Existing Rail Line
New Construction
Roads
County Line
Streams

Figure 1-4
POWDER RIVER BASIN EXPANSION PROJECT
Mankato Alternative
Mankato, Minnesota

1.3.2 Owatonna

1.3.2.1 O-1 (No Action)

The no-action alternative, O-1, would include overall project approval, but denial of authority to construct and operate a connecting track to the I&M. No permits would be issued for the necessary construction. DM&E and I&M would continue to be unable to interchange traffic at Owatonna, although their lines are in close proximity. They would only be able to interchange traffic at Winona, via trackage rights over Canadian Pacific Railway Company (CP), which provides a less efficient routing of traffic to various markets in central Minnesota, Iowa, and Missouri. The O-1 Alternative would not allow either

DM&E or I&M to explore potential opportunities to acquire additional rail traffic due to having a more efficient rail route for specific shippers, nor would the potential corresponding savings in fuel be recognized.

1.3.2.2 O-2 (Proposed Action)

Alternative O-2 would include construction and operation of approximately 2.94 mile connecting track, to allow interchange of rail traffic with I&M. This connection would provide a north-south connection, with access to Chicago and the Twin Cities, as well as to various Mississippi River ports. The connection would form a "Y" to allow rail traffic movements both northbound through Owatonna, or southbound on the I&M (Fig. 1-5).

1.3.2.3 O-3 (Alternative Alignment)

A second alternative for connection to the I&M rail line, Alternative O-3, would include approximately 1.25 miles of new rail line construction. Alternative O-3 would begin at a point southeast of Owatonna, approximately 1.0 mile from Owatonna in the northeast. The alternative would split to form a "Y" and each spur would connect to I&M, creating north- and southbound connections (Fig. 1-5).

1.3.3 Bypasses

1.3.3.1 Owatonna Bypass

The Owatonna Bypass would include approximately 13 miles of new rail line. It would begin approximately 1.4 miles southeast of Havana, Minnesota on the existing DM&E line. It would extend westward from the existing DM&E rail line. The bypass would turn north connecting to the existing DM&E rail line. It would include connections to I&M to allow north- and southbound rail interchange (Fig. 1-5).

1.3.3.2 Rochester Bypass

The Rochester bypass would be approximately 34.1 miles in length. It would extend south from the existing DM&E rail line in Dodge County, Minnesota approximately 0.8 miles west of the Olmsted County line. The route would curve south, entering Olmsted County approximately 250 feet south of the existing rail line. Eventually the line would head north and join the existing DM&E rail line approximately 2,000 feet west of Eyota (Fig. 1-6).

1.3.3.3 Brookings Bypass

The bypass would extend the existing DM&E line 1.5 miles west of the town of Volga. The total length of the Brookings bypass is approximately 15.2 miles. The bypass would head west around the north side of Brookings eventually joining the existing DM&E rail line approximately 0.5 mile west of Aurora (Fig. 1-7).

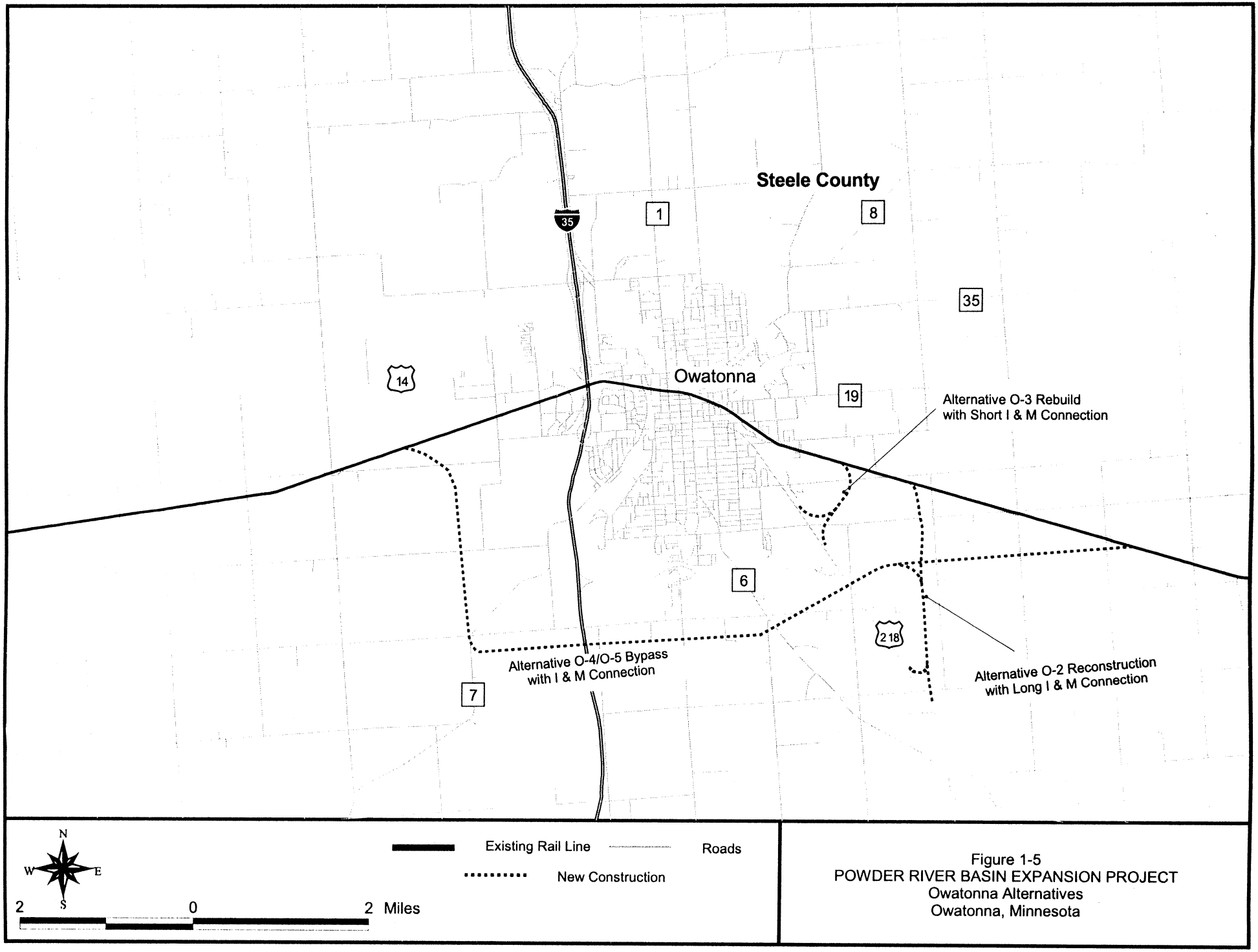


Figure 1-5
POWDER RIVER BASIN EXPANSION PROJECT
Owatonna Alternatives
Owatonna, Minnesota

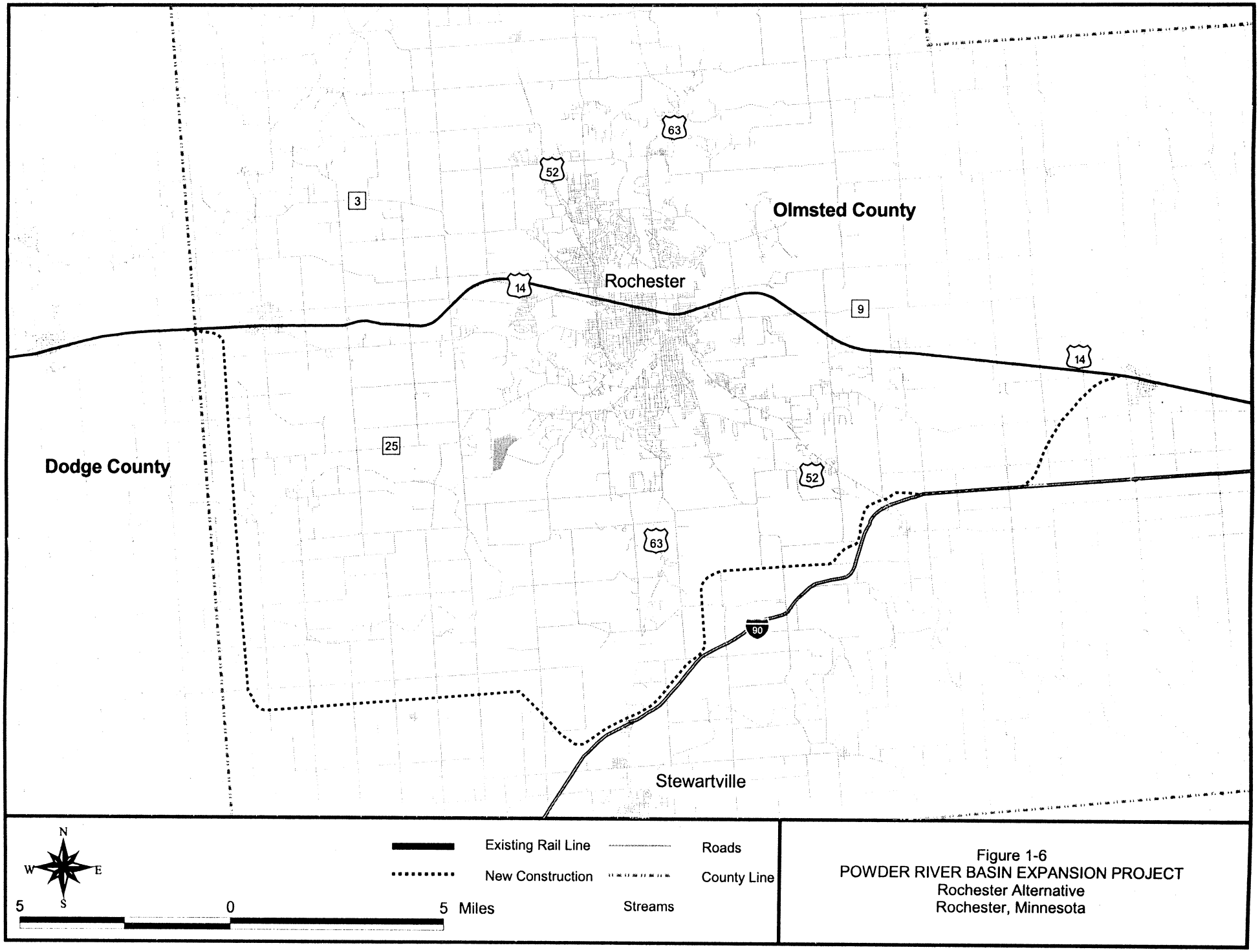
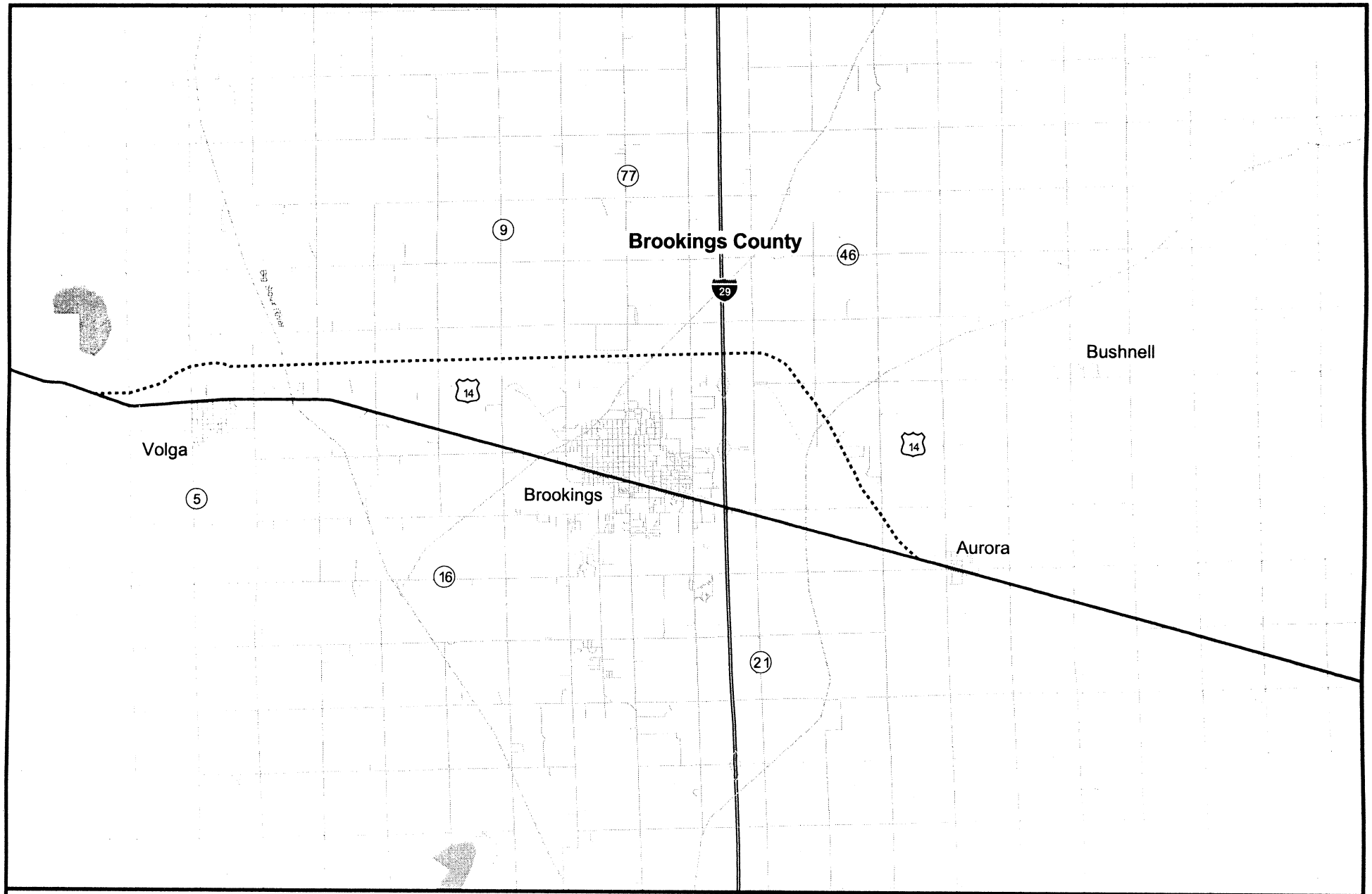


Figure 1-6
POWDER RIVER BASIN EXPANSION PROJECT
Rochester Alternative
Rochester, Minnesota



N
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3 0 3 Miles

Existing Rail Line
New Construction
Roads
Streams

Figure 1-7
POWDER RIVER BASIN EXPANSION PROJECT
Brookings Alternative
Brookings, South Dakota

1.3.4 Staging Yards

1.3.4.1 Middle East Staging and Marshaling Yard (Mankato)

The location of this yard is between MP 146.9 and MP 149.4. The dimensions of the yard are 400 feet by 2.5 miles. This yard would serve as a staging yard for loaded and empty coal trains and would support the interchange with UP at Mankato. This yard would be designed to accommodate a small amount of maintenance-of-way equipment. It would also serve as a crew change point. Approximately 250 to 300 jobs would be located here at full operations (DM&E 1999).

1.3.4.2 Waseca Marshaling Yard

This yard is planned to serve as a marshaling yard for traffic to and from the surrounding communities. Way freights would be based here and non-coal trains would stop to set out and/or pickup cars. This yard may contain a very small mechanical facility designed to accomplish emergency repairs on cars and locomotives and also the refueling of some locomotives. It would also accommodate a small amount of maintenance-of-way equipment. It is likely that 75 to 100 jobs would be based here at full operations (DM&E 1999).

1.3.4.3 East Staging and Marshaling Yard

This yard is planned to serve as a staging yard for loaded and empty coal trains moving to and from Minnesota City, Minnesota. It would also serve as a marshaling yard and support the interchange of traffic with UP and CP at Minnesota City. Helper locomotives to provide additional braking capability for trains moving down Lewiston Hill would be based here. This yard would contain a very small mechanical facility designed to accomplish emergency repairs to cars and locomotives and also the refueling of some locomotives. This yard would be designed to accommodate a limited amount of maintenance-of-way equipment. It would have a small office from which supervisors would oversee local operations. This would also be a crew base location for all train crews starting and finishing work between Utica and Winona. It is likely that 40 to 50 jobs would be based here at full operation (DM&E 1999).

1.4 SOUTH DAKOTA AND WYOMING NEW CONSTRUCTION

Extending the existing DM&E system to access Powder River Basin (PRB) coal mines would require construction of approximately 300 miles of new rail line along new rail right-of-way (ROW).

1.4.1 Alternative A (No Action)

The No-Action Alternative, Alternative A, would include no new construction of rail line or reconstruction of existing DM&E line in Minnesota, South Dakota, and Wyoming. The application before the Board for authority to construct, maintain, rebuild and operate the DM&E Railroad would not be approved. The Special Use Application submitted by DM&E for an easement under the Federal Land Management Policy Act of 19 (FLPMA) to cross portions of the BGNG in South Dakota and TBNG in Wyoming would not be granted by the U.S. Forest Service (USFS). The application for a right-of-way crossing portions of land administered by the U.S. Department of the Interior, Bureau of Land Management (BLM) in sections of South Dakota and Wyoming would not be granted. The U.S. Army Corps of Engineers would not issue a permit for impacting waters of the United States or wetlands. The U.S. Coast Guard (USCG) would not issue a permit for construction of rail bridge facilities over the Missouri River. The U.S. Department of the Interior, Bureau of Reclamation (Bureau) would not issue a permit for project impacts to lands and facilities that are part of the Angostura Reservoir and Irrigation Project. No state or local permits would be issued. Coal would continue to be mined in the PRB and transported by UP and BNSF. Coal mines would continue to open and increase production, potentially

increasing rail service problems both in the PRB at the mines and for the customers. As coal production increased, rail traffic would also increase. Upgrades to the existing joint line would be likely. Communities the existing coal traffic currently is transported through would likely experience increases in rail traffic and associated impacts related to noise, traffic delay, safety, and air emissions.

1.4.2 Alternative B (Proposed Action)

Alternative B would extend from the existing DM&E system north of Wall (Pennington County) and continue generally southwest along the Cheyenne River Valley. It would generally northwestward across Niobrara and Weston counties, splitting into a "Y" configuration to serve the mines in Converse and Campbell counties (Fig. 1-8).

1.4.3 Alternative C (Modified Proposed Action)

Alternative C, the Modified Proposed Action, was developed by realigning Alternative B to avoid environmentally sensitive areas. This alignment avoids RARE-2 areas and reduces impacts to the Cheyenne River Valley. However, for engineering reasons, in many areas it follows much the same alignment as Alternative B. This alignment uses DM&E's existing track westward to Wall, South Dakota. New construction would extend from the existing DM&E system north of Wall (Pennington County) and continue southwest (Fig. 1-8). This alignment avoids RARE-2 areas and reduces impacts to the Cheyenne River Valley. It would continue west toward the coal mines where it would split into a "T" configuration to service the mines south of Gillette, Wyoming. Chapter 2 of the DEIS provides a detailed description of this alternative.

1.4.4 Alternative C with the Phiney Flat Variation

This route modification of Alternative C was proposed to avoid environmentally sensitive areas associated with Spring Creek, a tributary to the Cheyenne River (Custer and Pennington counties) (Fig. 1-8). Chapter 2 of the DEIS provides a detailed description of this alternative.

1.4.5 Alternative C with the W G Flat Variation

This route modification of Alternative C was proposed to avoid environmentally sensitive areas associated with Hay Canyon, a tributary to the Cheyenne River (Fig. 1-8). Chapter 2 of the DEIS provides a detailed description of this alternative.

1.4.6 Alternative D (Existing Corridor Alternative)

This alternative uses existing track westward to Wall, South Dakota. The rail line would head southwest to Edgemont. From Edgemont the line would continue northward paralleling the existing BNSF right-of-way northwest to Donkey Creek Junction. At Donkey Creek Junction the line would follow the Joint Line south to access the mines. This alternative involve would utilization and rebuilding of existing DM&E rail line and new construction between Smithwick and Donkey Creek Junction and immediately adjacent to the existing Joint Line. Chapter 2 of the DEIS provides a detailed description of this alternative (Fig. 1-8).

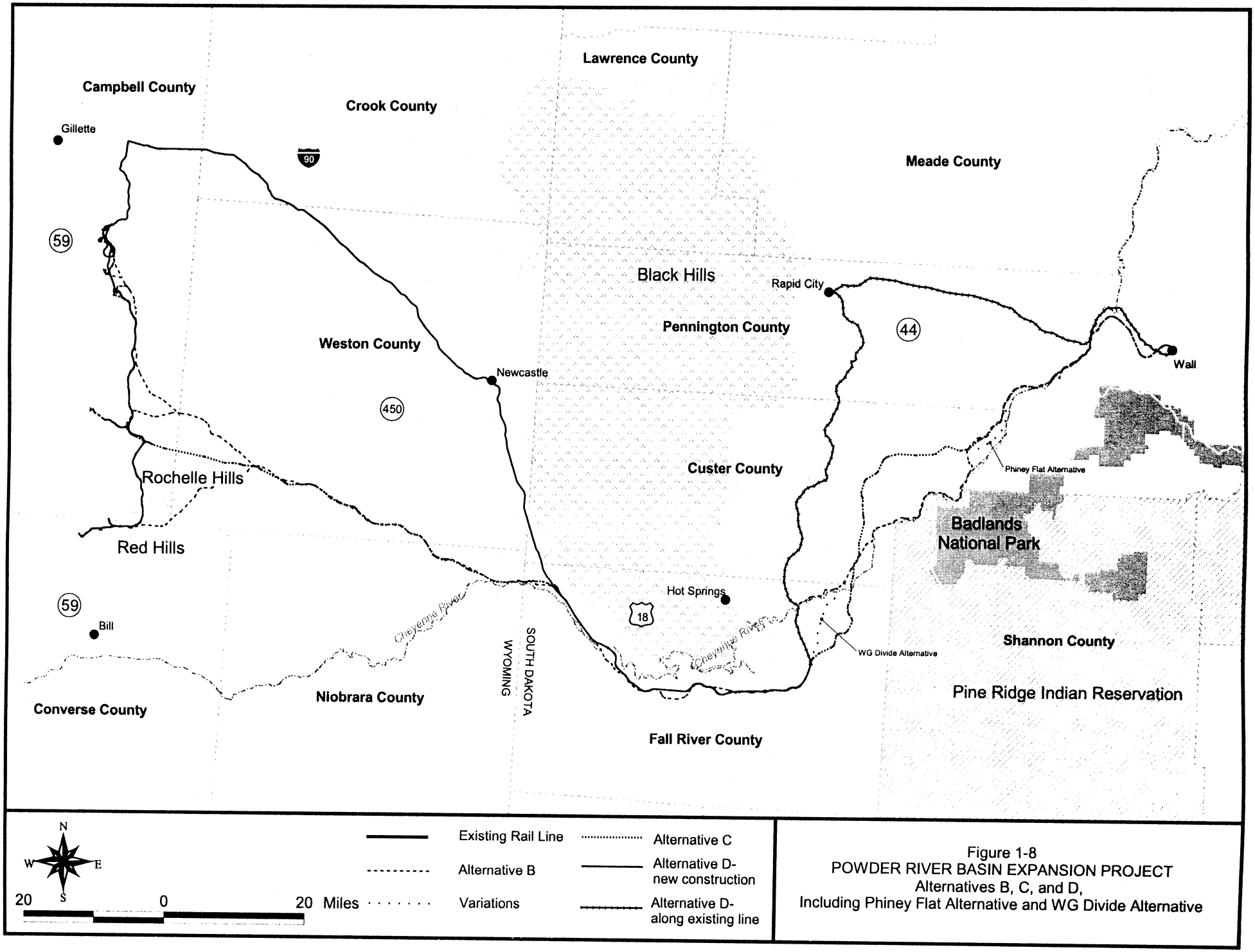

Figure 1-8
POWDER RIVER BASIN EXPANSION PROJECT
Alternatives B, C, and D,
Including Phiney Flat Alternative and WG Divide Alternative

1.4.7 Staging Yards under Alternative B

1.4.7.1 Middle West Staging and Marshaling Yard (Wall/Philip/Midland, South Dakota)

The location of this yard would be between MP 590.4 and MP 592.5. The dimensions of the yard would be 300 feet wide by 2.1 miles long. This yard is planned to serve as a staging yard for loaded and empty coal trains moving to and from mines in Wyoming. It would contain two marshaling tracks for use by manifest, grain, and way freight trains in serving local area customers. This yard would also serve as a crew change. It is likely that 40 to 50 jobs would be based here (DM&E 1999).

1.4.7.2 Middle Staging and Marshaling Yards and Shops (Huron-Wolsey, South Dakota)

This yard is planned to serve as the center of DM&E operations and maintenance. It would be designed to serve as the principal inspection and maintenance facility for all coal train equipment. Empty westbound coal trains would be inspected and switched here, receive freshly serviced and fueled locomotives and also receive the 1000-Mile Train Inspection and Certificate. Loaded eastbound coal trains would also be fully fueled and serviced here. Empty and loaded coal trains that could not be advanced would be held on staging tracks. This yard would have sufficient capacity to receive, classify, dispatch and store freight cars (DM&E 1999).

There would be a rail welding plant vehicle repair and maintenance shop and signal and communications repair shops. The yard would have an operations center and a central crew facility. All trains change crews at this yard. This yard would also serve as an interchange facility with the BNSF Railroad. It is likely that about 600 jobs would be located here at full operations. However, this number does not include contractor or support related jobs (DM&E 1999).

1.4.7.3 BNSF Interchange Yard (Dudley, South Dakota)

This yard would be located between MP 720.0 and MP 723.0 on the north side of the rail line. The dimensions of the yard would be 150 feet by 3.0 miles. This yard would be designed to be an interchange facility with the BNSF Railroad at Edgemont (Dudley), South Dakota. It would consist of a small group of tracks where the two railroads could deliver and pickup cars to and from the other. No employees are expected to be based at this yard (DM&E 1999).

1.4.7.4 West Staging Yard (Newcastle/Edgemont/Moorcroft, Wyoming)

The West Staging Yard would be located northwest of Edgemont in Weston County, Wyoming between MP 760.0 and MP 764.0 on the north side of DM&E's rail line. The dimensions of the yard are 1,300 feet by 3.1 miles. The yard would serve as a base of operations for trains serving the 11 coal mines in the immediate area. It would serve as a staging yard for empty trains and unit-train-only interchange between BNSF and DM&E. The yard would also have a small maintenance facility to provide emergency repairs to locomotives and cars and to provide locomotive refueling if required. The operating plan calls for fully fueled trains to leave the Middle Yard, load at the mines, and return to the Middle Yard without refueling. However, refueling capability would be provided at the West Staging Yard in case of disruptions due to severe weather, operating problems, or locomotives being reassigned enroute due to emergency situations. Also, maintenance work trains would need to be refueled at this yard. This yard would also have a small facility for maintenance-of-way equipment that would be used to maintain the tracks on the western end of the railroad.

This yard would have a major crew lodging and eating facility on the premises. It is likely that about 300 jobs would be based here at full operations. However, this would not include contract or support related jobs (DM&E 1999).

1.4.8 Staging Yards under Alternative C

1.4.8.1 Middle West Staging and Marshaling Yard (Wall/Philip/Midland, South Dakota)
The location of this yard would be the same as for Alternative B.

1.4.8.2 Middle Staging and Marshaling Yards and Shops (Huron-Wolsey, South Dakota)
The location of this yard would be the same as for Alternative B.

1.4.8.3 BNSF Interchange Yard (Dudley, South Dakota)
Under this alternative the yard would be located at MP 761.75. The dimensions of the yard would be 150 feet by 1.5 miles.

1.4.8.4 West Staging Yard (Newcastle/Edgemont/Moorcroft, Wyoming)-OPTION A
Under Option A the location of this yard would be between MP 787.0 and MP 793.0. The yard would be located on the Campbell Weston County line. The yard would be 1,300 feet by 6 miles and would impact 71 acres of National Forest Service (NFS) land, 78 acres of state land, and 101 acres of private land.

1.4.8.5 West Staging Yard (Newcastle/Edgemont/Moorcroft, Wyoming)-OPTION B
Option B is a 250 acre alternative for this yard. This alternative would avoid impacts to NFS lands, and is composed of private and state properties. The yard is located between MP 787.0 and MP 793.0.

1.4.9 Staging Yards under Alternative D
1.4.9.1 Middle West Staging and Marshaling Yard
The yard would be located in Custer County, South Dakota between MP 65.8 and 68.9. This segment of Alternative D would parallel the existing Chicago and Northwestern rail line. The yard would begin north of Fairburn and end just south of the city. The yard would be 300 feet by 3.1 miles.

1.4.9.2 Middle Staging and Marshaling Yards and Shops (Huron-Wolsey, South Dakota)
The location of this yard would be the same as discussed for Alternative B.

1.4.9.3 BNSF Interchange Yard (Dudley, South Dakota)
The location of this yard would be the same as discussed for Alternative B.

1.4.9.4 West Staging Yard (Newcastle/Edgemont/Moorcroft, Wyoming)
The West Staging Yard is located in Crook County, and is southeast of Moorcroft. All facilities and yard operations would be located between MP 563.0 and 568.0. The proposed yard would be 1,300 feet by 5 miles.

1.5 Rebuild Construction Activities
Because of years of deferred maintenance, much of DM&E's existing system is in poor condition. All of DM&E's existing system operates as either excepted track [1], or under speed restrictions (some as slow as 5 mph with 40 mph being the maximum allowed on the system), and generally limited to 263,000 pound cars (286,000 pound cars are considered the industry standard). Existing rail is generally 90-100 pound,

[1] Federal Railroad Administration term, defined at 49 CFR, § 213.4. By definition operation of trains in excess of 10 miles per hour, revenue passenger operations, and trains with more than five cars requiring hazardous materials (as defined in 49 CFR part 172) placards are prohibited on excepted track.

much of which is still jointed rail and as much as 100 years old. The existing system has limited sidings and other facilities such as maintenance yards, crew-change sites, and switching yards. Main line transit time averages approximately 150 hours (over 6 days), with rail car cycle times being approximately 12 days. Rebuilding of the existing system is necessary to facilitate safe and efficient transport of existing train traffic as well as unit coal trains.

The rebuild of the existing DM&E mainline from Winona, Minnesota westward to Wall, South Dakota would occur in such a way as to enable the line to be kept largely operational during the construction period. Sections of the rail line would be taken out of service for 12 to 24 hours, as is standard industry practice for rail line construction and maintenance. Rebuilding of the existing line would occur at several locations simultaneously. Some portions of the line would be closed to train traffic for a short period but closures could be scheduled around lower train traffic times, such as before crops are harvested.

The majority of the existing railbed is suitable for rebuilding the existing line to standards acceptable for 315,000-pound rail cars. While all the mainline would have the rail, ties, and ballast replaced, it is currently estimated that approximately 20 percent (approximately 120 miles) of the existing railbed subgrade [2] may require earthwork to improve its condition and suitability for the proposed project. In areas where subgrade or subballast work would be required, the line would be taken out of service, the ballast, ties and rail removed and suitable equipment brought in to repair the damaged or deteriorated sections of sub-grade and/or sub-ballast. Following rehabilitation of the railbed, new ballast, ties and rail would be installed.

For the majority of the main line, no rehabilitation of the sub-ballast or sub-grade would be necessary. Rebuilding of the existing line would be accomplished largely by rail-mounted equipment or equipment operating within the existing rail right-of-way. Sections of rail and ties would be removed by rubber-tired or rail-mounted equipment (such as boom trucks or cranes) and loaded onto rail flat cars. Ballast would be removed by front-end loaders and hauled off in dump trucks or rail cars or incorporated into the existing subgrade. Because of the deteriorated condition of DM&E's system, it is unlikely much of the rail, ties or ballast could be recycled or reused. Rail and ties of acceptable quality may be stockpiled for use along other sections of DM&E's system or in the construction of sidings. However, most of the material removed would be sold for scrap or disposed of consistent with environmental regulations.

Installation of new ballast, rail and ties would be done as described for the new construction. All new materials would be used; including 136 pound continuously welded rail, wood or concrete ties, and special fasteners in curves.

Numerous sidings, 35-45, would be constructed along the existing line to accommodate the additional rail mounted equipment necessary for construction and provide for continued rail service along the line. Sidings would be located within existing rail right-of-way, thus their locations would be limited to those areas where a sufficient right-of-way width, approximately 150 to 200 total feet, is available. Sidings would be constructed in similar fashion to other track construction, with earthmoving equipment expanding the existing rail bed to accommodate a siding and mainline track laid as previously discussed.

Additional sidings would be constructed during the rebuild process that would be necessary for operation of the system following completion of construction. Initially, the number of sidings and their locations

[2] The subgrade is the earthen or fill portion of the railbed upon which the subballast material is placed. Ballast is placed over the subballast.

would be established based on DM&E hauling its existing train traffic and the addition of 40 million tons of coal annually. As coal transport increases to the total of 100 million tons annually projected by DM&E, additional sidings would be added to accommodate traffic increases. Under the annual transport of 100 million tons of coal scenario, sidings would be approximately 3 to 7 miles long and spaced approximately 12 miles apart over the entire mainline, including the new rail line in South Dakota and Wyoming. Additionally, DM&E would upgrade many of its existing sidings and facilities serving its existing customers. Sidings would be designed to allow entry of trains from the main line at 40 mph.

Installation of grade crossings and crossing protection would be the same as for the new construction. Completion of the rebuild of the existing rail line is anticipated to take two construction seasons, generally the period between April 1 and November 1.

Following completion of project construction and existing line rebuild, the mainline DM&E system would consist of all new 136 pound, continuously welded rail. The system would be designed to accommodate 315,000-pound cars, although initially the largest cars would be the 286,000 pound variety.

1.6 New Construction Activities

Approximately 280 miles of new rail line would be constructed along new right-of-way. New rail line would be designed for 315,000 pound rail cars, operating in a maximum of 135-cars, either 3-6,000 horsepower locomotive or 4-4,400 horsepower locomotive trains, approximately 7,400 feet (1.4 miles) in length. Locomotives would be distributed throughout the train, with two in series at the lead and the third located either at the end of the train or located approximately two-thirds of the way back from the front of the train. Maximum operating speed on the new rail line would be 49 miles per hour (mph) for empty coal trains and other commodity trains and 45 mph for loaded coal trains. The new rail line would consist of 136 pound, continuously welded rail. Ties would be wood spaced at 19.5 inches or concrete spaced at 24 inches. Maximum grade for the line would ideally be 1.0 percent along tangent sections and 1.0 percent compensated on curves.

If the proposal is approved, right-of-way would be acquired and fenced. The right-of-way width for new rail line would be a minimum of 200 feet, centered on the rail line in most areas. In areas requiring significant cut or fill, additional right-of-way may be required to maintain railbed sideslopes. The construction area for the right-of-way would be restricted to the permanent right-of-way plus an additional 20 feet on either side of the permanent right-of-way's outer boundaries for fence construction, drainage, firebreaks, and access.

Rail line construction would likely occur at several locations simultaneously, starting with bridge and crossing construction. Five to seven bridge construction crews, consisting of approximately 50 workers each, could be working simultaneously, constructing bridges, culverts, cattle guards, and road, livestock and wildlife crossings. Cranes, dozers, and front-end loaders would be the equipment typically used. Much of the construction would involve placement of precast, concrete structures. The site would be prepared and the precast structures installed or cast structures formed and poured. Bridge and crossing construction would likely occur year-round. DM&E has indicated a precast concrete plant and staging yard would be established in Edgemont, South Dakota. Equipment and materials would be delivered by rail to this facility and construction crews would work east and west from Edgemont.

Construction and preparation of the rail bed would occur following bridge and crossing construction. As with bridges and crossings, five to seven crews of approximately 50 workers each would work on the railbed at different locations simultaneously, working east and west from Edgemont. Because of the

variable nature of area topography, gently rolling to steeply sloped, and the need to maintain a slight grade slope (ideally 1.0 percent or less), significant cut and fill would be necessary along some sections of the line. Cut and fill would be accomplished using heavy earthmoving equipment such as scrapers, dozers, power shovels, draglines, front-end loaders, and belly-dump trucks. Blasting in some areas may be necessary as part of cut activities. Cut material would be used for fill in other locations. Efforts would be made to have fill requirements equal cut material. However, haul distances between cut and fill areas or additional fill requirements may require borrow areas be found outside the rail right-of-way for access to fill material in closer proximity to fill areas. Additionally, extra right-of-way may be required to deposit cut material if it is not usable for fill in other areas due to its composition.

New rail bed construction would be accomplished using earthmoving and grading equipment, including bulldozers, scrapers, and dump trucks. Existing vegetation would be cleared and disposed of according to landowner requests and appropriate federal, state, and local requirements. The right-of-way would be grubbed and topsoil removed and stockpiled for later revegetation. Gravel and other materials required for the railbed would be acquired from local sources to minimize haul distances. Sub-grade material would be acquired within the permanent right-of-way or trucked from source areas. Sub-grade material would be installed and compacted to provide a stable, raised bed of 28 feet in width, comprised of gravels and soils upon which ballast, ties and rail would be laid.

During earthmoving activities, water trucks would be used to water the right-of-way and haul roads to help control dust. Water would also be applied to fill material to aid in compaction. Water would be moved along the right-of-way using irrigation piping and stored in pits along the right-of-way throughout the construction area. Water is anticipated to be obtained primarily from private stock ponds and wells, with the owners being compensated for the water used. Some water may be withdrawn from the Cheyenne River, if it is available and appropriate use agreements are obtained.

Disturbed areas would be revegetated after grading and earthmoving activities are completed. Areas disturbed during construction adjacent to the railbed would be graded as necessary and stockpiled topsoil spread over the area. Disturbed areas would be reseeded and mulched to help maintain soil stability and protect the seed until it can germinate and vegetation becomes established. Water trucks could be used if necessary to water revegetated areas until sufficient ground cover is established.

Following preparation of the sub-grade, sub-ballast material would be placed on the sub-grade and compacted to a depth of 6 to 12 inches. Ties and continuous welded rail would be laid on the sub-grade and welded in place. Signal and communication facilities would be installed. Ballast would be brought in by bottom drop rail cars. The rail and tie sections would be lifted by rail mounted tamping equipment and ballast dumped on the sub-grade and around the ties. Ballast would be compacted into place using tamping equipment to a minimum depth of 12 inches along tangent sections and in curves less than 2 degrees. Additional ballast would be used in curves of greater than 2 degrees. Following ballast compaction, the line section would be inspected and any flaws corrected. All new materials, including sub-ballast, ballast, ties and rail would be used.

It is likely that roads and bridges in the project area would be inadequate to handle the type of traffic and equipment required for construction of this project. DM&E would coordinate with the agency responsible for maintenance of each specific road (anticipated to be the State Departments of Transportation, county Highway Departments, United States Forest Service (FS), and Bureau of Land Management (BLM)) to develop and implement bridge and roadway requirements suitable for continued and safe use of roads accessing the construction areas.

Completion of construction is anticipated to take three construction seasons (April 1 through November 1). Bridge and crossing construction would occur year-round. However, earthwork could not be done when the ground is frozen, generally limiting railbed construction to April 1 through November 1.

Construction crews would work double shifts, between 7 am and midnight, six days a week. Equipment maintenance crews would work from midnight to 7 am.

1.7 Project Operations

Up to 100 million tons of coal (approximately 750,000 cars) and approximately 66,000 freight cars transporting primarily corn, wheat, soybeans, bentonite and kaolin clay, cement, and wood products would be transported over the system annually. Through coal trains would be an average of 115-135 cars in length, using either 4-4,400 horsepower or 3-6,000 horsepower locomotives, distributed within the train. Maximum train speeds would be 49 miles per hour. Four track maintenance periods up to six hours each, could be incorporated into the system operation every day.

Eastbound traffic would primarily consist of loaded trains, both coal and mixed freight, traveling at approximately 45 miles per hour. Westbound traffic would consist of primarily empty trains traveling at approximately 49 miles per hour. Westbound, empty trains would slow and switch onto passing sidings to allow loaded, eastbound trains to pass without need to stop or slow. Empty, westbound trains would generally not stop but would only slow to 40 miles per hour on sidings. However, occasionally they may be required to stop for a short period. After the loaded train had cleared, the empty train would switch back onto the mainline and accelerate up to normal operating speed.

Trains would be loaded at the various mines and dispatched to a western staging yard. From this yard, trains would be dispatched eastward. The train would continue, non-stop, to the next staging yard. Staging yards would be spaced based on transit times of approximately 7 hours, between 225 and 275 miles apart.

1.8 Maintenance Activities

DM&E would construct a new locomotive and rail car maintenance and repair facility as part of this project to accommodate the additional rolling stock and associated maintenance needs. This would be a state-of-the-art facility for scheduled maintenance, overhaul, inspection, testing, fueling, and major repairs, capable of maintaining 300 or more locomotives. In addition, staging yards would contain maintenance capabilities to handle common maintenance problems. Trains would be stopped at staging yards for equipment inspection and crew changes. Following inspection of rail cars and locomotives, any identified maintenance problems could be addressed at the staging yard or more substantial problems identified and referred to the main maintenance facility. Trains would be inspected at each staging yard and cleared before being dispatched onto the line. Rail cars and locomotives would receive scheduled maintenance and overhaul based on industry standards and recommendations.

DM&E personnel would perform general maintenance-of-way activities. Nine maintenance-of-way section headquarters for crews and equipment would be established at intervals throughout the system. In addition, contractors would be used for rail flaw testing, rail grinding, tie change-out, vegetation control, and other specialized tasks. Four, 6-12 hour windows would be available each day to perform maintenance activities on the line.

Vegetation control activities would also be part of regular maintenance along the rail line. Vegetation control measures would be designed to control noxious weeds and reduce the potential for rail-related fires. Herbicides approved by the Environmental Protection Agency (EPA) would be applied to the

railgrade, including the area of ballast, rail and ties by licensed personnel. In addition, DM&E would perform vegetation control activities as part of its fire prevention and suppression plan that would include one or more of the following:

- plowing or sterilizing a fire guard at least 10 feet wide on both sides of the right-of-way, 50 feet from the centerline of the main track where practical and necessary,
- burning the right-of-way on both sides of the track 50 feet from the centerline of the main track where practical and necessary,
- sterilizing the right-of-way for 12 feet on both sides of the centerline,
- applying a herbicide for 50 feet on both sides of the centerline where practical and necessary.

1.9 Potential Species Impacts

Construction of the PRB Expansion Project would involve potential impacts to certain federally listed endangered and threatened species. Requirements for the project include authorization by the Surface Transportation Board (STB), easements under the Federal Land Management Policy Act from the USFS, rights-of-way from the BLM and a permit from the U.S. Army Corps of Engineers (COE) pursuant to Section 404 of the Clean Water Act. All of these are federal actions that require compliance with the Endangered Species Act (ESA). This biological assessment summarizes the results of surveys for endangered and threatened species, and their habitats, along several proposed alternatives and provides information pertaining to the potential benefits of the project upon these species. It is submitted to the U.S. Fish and Wildlife Service (USFWS) in accordance with Section 7 of the ESA. In response, USFWS is requested to provide a Biological Opinion on the anticipated project effects and measures necessary to protect or conserve potentially impacted endangered or threatened species as they pertain to the environmentally preferred alternative.

Sixteen species of plants and animals known to occur, or potentially occurring, within the proposed project area are protected as ENDANGERED or THREATENED SPECIES or are under review for such statutes under the ESA (Table 1-1). The ESA affords protection to those species to be determined either endangered or threatened and their habitats. As defined by the ESA, an endangered species is "any species which is in danger of extinction throughout all or a significant portion of its range." A threatened species is "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." Under the ESA, it is illegal to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect listed endangered or threatened species. Violations of the ESA can result in substantial civil/criminal penalties, including fines and/or imprisonment.

A proposed species is one "for which a proposal to list the species has appeared in the Federal Register, and a final rule is pending." Species that have been evaluated and determined eligible for listing as endangered or threatened, but whose listing is currently precluded because of a need to take action on higher priority species, are listed as candidate species.

Table 1-1
ENDANGERED, THREATENED, CANDIDATE OR PROPOSED SPECIES

Common Name	Scientific Name	Federal Status
Black-footed Ferret	*Mustela nigripes*	Endangered
Peregrine Falcon	*Falco peregrinus*	Delisted[1]
Piping Plover	*Charadrius melodus circumcintus*	Endangered
Whooping Crane	*Grus americana*	Endangered
Interior Least Tern	*Sterna antillarum*	Endangered
Topeka Shiner	*Notropis topeka*	Endangered
Pallid Sturgeon	*Scaphirhynchus albus*	Endangered
American Burying Beetle	*Nicrophorus americanus*	Endangered
Minnesota Dwarf Trout Lily	*Erythronium propullans*	Endangered
Higgin's Eye Pearly Mussel	*Lampsilis higginsii*	Endangered
Winged Mapleleaf Mussel	*Quadrula fragosa*	Endangered
Karner Blue Butterfly	*Lycaeides melissa samuelis*	Endangered
Ute Ladies'-tresses Orchid	*Spiranthes diluvialis*	Threatened
Prairie Bush-Clover	*Lespedeza leptostachya*	Threatened
Leedy's Roseroot	*Sedum integrifolium* ssp. *leedyi*	Threatened
Western Prairie Fringed Orchid	*Platanthera praeclara*	Threatened
Bald Eagle	*Haliaeetus leucocephalus*	Threatened[2]
Mountain Plover	*Charadrius montanus*	Proposed
Swift Fox	*Vulpes velox*	Candidate
Sturgeon Chub	*Macrhybopsis gelida*	Candidate
Black-tailed Prairie Dog	*Cynomys ludovicianus*	Candidate

1-Peregrine falcons were originally included in the Biological Assessment; however, on August 25, 1999 the USFWS determined that the American peregrine falcon is no longer an endangered or threatened species pursuant to the Endangered Species Act of 1973. Therefore, the peregrine falcon is not discussed further in this document.

2-USFWS has proposed to remove the bald eagle from the endangered species list but potential impacts to bald eagles are included and analyzed in the BA.

PART 2
RELEVANT ECOLOGICAL IMPACTS

Habitat and other impacts to populations of endangered and threatened species can have an effect on the size or viability of these populations. Habitat availability is often a limiting factor for endangered and threatened species and the short- or long-term loss of suitable habitat can contribute to the decline of the populations. Plant species occurrence can depend upon local soil conditions within the species range.

The following describes habitats in the proposed project area that are significant to the endangered and threatened species discussed in this biological assessment and which may be affected by construction and/or operation of the railroad.

2.1 GRASSLANDS

2.1.1 Minnesota

Common vegetative species in southern Minnesota include big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*) and prairie dropseed (*Sporobolus heterolopis*). Minnesota natural vegetation originally consisted of northern coniferous forest, eastern deciduous forest and tall grass prairie. However, most of these areas were cleared for agriculture and today less than 1 percent of tall grass prairie exists. The proposed project passes through approximately 66 miles of pastureland, 200 miles of cropland and over 130 miles of woody vegetation (MDNR 1999).

2.1.2 South Dakota

Mixed grass prairie communities exist west of the Missouri River in South Dakota. These communities are made up of wheatgrass (*Elymus* spp.), needle grass (*Stipa* spp.), blue grama (*Bouteloua gracilis*), buffalo grass (*Buchloe* spp.) and little bluestem (*Schizachyrium scoparium*). Central South Dakota, from the Missouri River to the James River, is a transition zone between the drier western prairie and the wetter eastern part of the state. Common plant species include wheatgrass, little bluestem and needle grass. Plant communities found in eastern South Dakota include Indian grass and switchgrass (*Panicum virgatum*). The extreme eastern part of the project area is located within the historic range of the tall-grass prairie; however, this area is now mostly agriculture (McGregor et al. 1986).

2.1.3 Wyoming

The Powder River Basin can be characterized as a vast grasslands area, despite large expanses of sagebrush. Grasslands may be defined as areas with less than 50% sagebrush cover. Shrubland is defined as areas of greater than 50% sagebrush cover (Zeimans and Walker 1977). Most of these communities are currently used as rangeland.

Grasslands provide habitat for numerous species such as mountain plovers, swift fox, and black-footed ferrets. Even though some areas of grasslands in the Great Plains have been plowed for winter wheat production, large tracts of grass and shrub-dominated vegetation remain.

Mixed grass prairie communities are located in eastern Wyoming. Blue grama and buffalo grass dominate short-grass prairie. Mixed grass prairies can be divided into several types, but are all characterized by needle-and-thread grass (*Hesperostipa comata*), western wheatgrass (*Agropyron smithii*), threadleaf sedge (*Carex filifolia*), needleleaf sedge (*Salix interior*), junegrass (*Koeleria* spp.), Indian rice grass (*Oryzopsis hymenoides*), prickly pear cactus (*Opunita polyacantha*), scarlet globe mallow (*Sphaeralcea coccinea*), fringed sagewort (*Artemisia* spp.), and various species of milkvetch (*Astragalus* spp.) and locoweed (*Oxytrapis lambertii*). Mixed-grass prairies in the foothills are typically dominated by bluebunch wheatgrass (*Agropyron spicatum*) and sideoats grama (*Bouteloua curtipendual*).

On sandy soils, prairie sandreed (*Calamovilfa longifolia*), sand dropseed (*Sporobolus heterolepis*), sand sagebrush (*Artemisia* spp.), and yucca (*Yucca glauca*), may be common. Saline soils lead to an increased abundance of such halophytes as alkali sacaton (*Puccinellia airoides*), four-wing saltbush (*Atriplex canescens*), greasewood (*Sarcobatus vermiculatus*), and inland saltgrass (*Distichylis stricta*) (Zeimans and Walker 1977).

In addition to short- and mixed-grass prairie, there are also small tracts of tall-grass prairie on sandy soils or along streams. Common tall-grass prairie species include big bluestem, Indian grass, prairie dropseed, sideoats grama, and switchgrass (McGregor et al. 1986).

2.2 WOODLANDS

2.2.1 Minnesota

Southeastern, central and parts of western Minnesota contain deciduous forests, including the Maple-Basswood Forest, Oak Forest, and Lowland Hardwood Forest. The Maple-Basswood Forest is common from southeastern to west central Minnesota. Basswood (*Tilia americana*) and sugar maple (*Acer saccharum*) are common canopy species in this forest community. The Oak Forest is most common on dry to dry-mesic sites. Northern pin oak (*Quercus ellipsoidalis*) and white oak (*Quercus velutina*) dominate this forest. The Lowland Hardwood Forest communities can be found in areas of abundant soil moisture. Most are located along floodplains. Common Lowland Hardwood Forest species include silver maple (*Acer saccharinum*), cottonwood (*Populus deltoides*), and elm (*Ulmus* spp.) (MDNR 1999).

2.2.2 South Dakota

On the eastern edge of the proposed project area closer to the Black Hills, scattered woodlands of ponderosa pine (*Pinus ponderosa*), limber pine (*Pinus flexilis*), and juniper (*Juniperus* spp.) occur on outcrops of sandstone, limestone, scoria and shale bedrock resistant to grass growth.

2.2.3 Wyoming

The woodlands that exist in eastern Wyoming consist of ponderosa pine and occur on outcrops of sandstone and shale. Pine grows in many places throughout the Powder River Basin. In most cases, the trees will be scattered on the ridgetops only, with the sloping hillsides being covered with juniper and grass or sagebrush. Ponderosa pine is the major species, although some areas do contain limber pine. Shrubs contained in the understory are skunkbush sumac (*Rhus trilobata*), creeping juniper (*Juniperus horizontalis*), rocky mountain juniper (*Juniperus scopulorum*), and western snowberry (*Symphoricarpos occidentalis*) (Zeimans and Walker 1977).

The herbaceous layer is mostly grasses such as green needlegrass (*Stipa viridula*), sandberg bluegrass (*Poa secunda*), prairie junegrass (*Koeleria cristata*), stoney hills muhly (*Muhlenbergia cuspidata*), or side oats grama. Sites with coarser soils will contain bluebunch wheatgrass, little bluestem (*Andropogon scoparius*), or porcupine needlegrass (*Stipa spartea*). Silver sage (*Artemesia cana*) may also be present (Zeimans and Walker 1977).

2.3 RIPARIAN AREAS

2.3.1 Minnesota

The rivers in the proposed project area include the Mississippi, South Fork Whitewater, Zumbro, Straight, Minnesota, Blue Earth, Little Cottonwood, and Cottonwood. Floodplain forests occur within the floodplains of the major rivers and are well developed on floodplains in the Mississippi and Minnesota rivers. The Silver Maple Subtype, a type of floodplain forest, occurs mainly in the deciduous forest-woodland zone along the Minnesota and lower Mississippi rivers. Silver maples (*Acer saccharinum*) dominate the tree canopy in this subtype, and are present in the subcanopy and shrub layer as well. Green ash (*Fraxinus pennsylvanica*), cottonwood, and American elm (*Ulmus americana*) are often present in the canopy, but are most common as seedlings and saplings. The understory of the Silver Maple Subtype is

open, with less than 25% cover by tree seedlings and saplings. Herbs in the nettle family, including wood nettle (*Laportea canadensis*) and clearweed (*Pilea pumila*), dominate the groundlayer. Woody and herbaceous climbers are common, especially wild grape (*Vitis riparia*), wild cucumber (*Echinocystis lobata*), burcucumber (*Sicyos angulatus*), groundnut (*Apios americana*) and hog-peanut (*Amphicarpa bracteata*). In southern Minnesota, silver maple, black willow (*Salix nigra*), and cottonwoods are common canopy dominants. Scattered individuals or patches of river birch (*Betula nigra*), American elm, slippery elm (*Ulmus rubra*), green ash (*Fraxinus pennsylvanica*) and swamp white oak (*Quercus alba*) are also common in stands in southern Minnesota (MNHP 1993).

2.3.2 South Dakota

There are several floodplains in the proposed project area associated with the Cheyenne, Belle Fourche, and Missouri rivers. Riparian shrub and forest areas occur along floodplains of each of these larger rivers. Common species include cottonwood and willow (*Salix* spp.). Eventually, with succession due to dam control these forests will change to green ash with choke-cherry (*Prunus virginiana*) and silver buffalo berry (*Shepherdia argentea*) as understory. Sand and gravel bars located in the rivers and streams provide excellent sites for the establishment of cottonwoods and various species of willow.

2.3.3 Wyoming

Riparian communities in Wyoming are generally restricted to floodplains. The floodplains are typically arranged in terraces where former floodplains have become elevated because of stream downcutting and deposition. Terraces rarely flood and instead create an environment that can be transitional between the riparian and upland landscapes. Salt accumulation is often higher on terraces than in the floodplain. Consequently, halophytes, such as greasewood, typically occur on terraces, whereas the less salt-tolerant silver sage and Wyoming big sagebrush (*Artemisia tridentata*) occur in the lower floodplain that receives more water. Riparian areas provide habitat for wintering and nesting raptors and nesting areas for shorebirds such as least terns and piping plovers. In these riparian landscapes, meandering of the channel is typical except where rivers have cut canyons through the landscape or where steeper gradients lead to the formation of braided streams (Zeimans and Walker 1977).

Riparian forest vegetation occupies lower stream terraces and point bars as well as sandy islands within stream channels. It includes plains cottonwood trees (*Populus sargenti*), sandbar willow (*Salix interior*) and peach-leaf willow. Shrubby riparian habitats are usually dominated by willows and sedges. They are most often distributed along streams and near seeps (Zeimans and Walker 1977).

This zone is delineated as far as possible on the accompanying map. The presence of cottonwoods was the prime determinant for mapping purposes, but it should be kept in mind that the lush bottomland grasses, without cottonwoods, would extend up the small intermittent drainages. The presence of cottonwood signals a definite streamside community even if water is not flowing on the surface for most of the year. Three cottonwood species grow in the Powder River Basin: Plains cottonwood, narrow leafed cottonwood (*Populus angustifolia*), and lance leafed cottonwood (*Populus acuminata*). Under the cottonwoods, rocky mountain juniper may grow. Another more infrequent member of the community is the boxelder (Zeimans and Walker 1977).

Also along the stream channel grow willows such as the peach leafed willow (*Salix amygdalcides*), sandbar willow, and coyote willow (*Salix exigua*). The understory can be quite dense and complex containing such species as wild rose, chokecherry, sand cherry (*Prunus pumila*), bearberry (*Arctostaphylos uva-ursi*), currents (*Ribes* spp.) and other fruiting trees and bushes (Zeimans and Walker 1977).

Stream channel grasses tend to be taller and more lush than those on the surrounding hills. They include prairie cordgrass (*Spartina pectinata*), tufted hairgrass (*Deschampsia caespitosia*), basin wildrye (*Elymus*

cinereus) and Canada wildrye (*E. canadensis*), slender wheatgrass (*Agropyron trachycaulum*), bearded wheatgrass (*Agropyron caninum*), western wheatgrass, inland sedge (*Carex interior*), and mat muhly (*Muhlenbergia richardsonis*). Some forbes present are licorice (*Glycyrrhiza* spp.), aster (*Aster* spp.), golden pea (*Thermopsis* spp.), starwart (*Stellaria* spp.), virginsbower (*Clematis* spp.) and yarrow (*Achillea* spp.) (Zeimans and Walker 1977).

2.4 WETLANDS

There are several types of wetlands typically associated with the geographic region that the proposed project area traverses. These include palustrine, lacustrine, and riverine wetlands. Palustrine wetlands have emergent vegetation like cattails and bulrushes, or less aquatic plants such as smartweed (*Polygonum* spp.) and spikerush. Lacustrine systems include artificial impoundments or reservoirs, where riverine systems include rivers and streams. Semipermanently and permanently flooded palustrine and riverine wetlands are also associated with river drainages throughout the proposed project area.

Wetlands provide several environmental benefits within the proposed project area. Environmentally, wetlands provide important breeding and resting habitat for neotropical migrants and waterfowl, habitat for fish and amphibians, retention of flood flows and water purification. About 90% of wildlife use wetlands daily for water, cover, or foraging. Additionally, plants such as Ute ladies'-tresses orchid (*Spiranthes diluvialis*) are limited to very specific wetland areas as discussed in Section 3.12 of Part 3.

2.4.1 Minnesota

Southern and Western Minnesota contain the Prairie Pothole Region. Prairie potholes are shallow, water-holding depressions of glacial origin (Sloan 1972). These wetlands have great variability in size, depth and water permanence (Sloan 1972, Stewart and Kantrud 1972). The potholes range from seasonally flooded basins that hold water for only a few weeks to wet prairies, marshes, and permanent water. These temporary water holding basins frequently have an abundance of plant seeds and invertebrates, which makes them ideal feeding and resting areas for migrating waterfowl and shorebirds.

The dominant emergent species in Minnesota wetlands are usually graminoids such as cattails (*Typha* spp.), common reed grass (*Phragmites australis*), bulrushes (*Scirpus* spp.), rushes (*Juncus* spp.), spike rushes (*Eleocharis* spp.), and some umbrella sedges (*Cyperus* spp.) (MNHP 1993).

2.4.2 South Dakota

Seepage associated with distribution and application of irrigation water has increased wetland acreage, especially on the Bureau of Reclamation (BOR) irrigation projects in western South Dakota (primarily Belle Fourche and Angostura Reservoirs). In many parts of South Dakota, flowing artesian wells modified for livestock watering or fish production have increased wetland areas. In the unglaciated western part of South Dakota, stock ponds and dugouts constructed for livestock watering constitute an important part of area wetlands. About 60% of the wetlands in western South Dakota occur in association with stock ponds (McGregor et al. 1986).

2.4.3 Wyoming

Wet meadow vegetation occupies the lowest terrace level along stream channels as well as areas along vegetated channel banks. Wet meadow vegetation occurs along all sections of Antelope Creek and along major tributaries. This type of vegetation generally lacks an overstory of trees or shrubs, and forb and grass species dominate. Species include sedges, Baltic rush (*Juncus* spp.), alkali bluegrass (*Poa juncifolia*), prairie cordgrass (*Spartina pectinata*), saltgrass (*Distichylis stricta*), spikerush (*Eleocharis* spp.), and smooth scouring rush (*Juncus* spp.). The wetter meadows have shrub components consisting of willow (*Salix* spp.), and some of the drier meadows have a sagebrush (*Artemisia* spp.) component (Zeimans and Walker 1977).

2.5 SOILS

2.5.1 Minnesota

Soils in Minnesota have formed in loess and underlying glacial till. These soils are extremely fertile and productive. They can be classified into three taxonomic orders; 1) entisols, 2) alfisols, and 3) mollisols. Entisols are found in underdeveloped landscapes such as alluvial basins and steep slopes. Surface texture is mainly silt loam. Alfisols are found in upland areas of nearly level to moderately steep slopes. Organic matter is present in surface horizons. Surface texture is silt loam. Mollisols are similar to alfisols, but with larger accumulation of organic matter. Surface texture is silt loam.

2.5.2 South Dakota

The most productive soils in South Dakota are chernozems (black earth soils), which cover most of the state east of the Missouri River. These soils are rich in humus. Soils in western South Dakota are formed from weathering of sedimentary rocks. Soils in this region are classified as 1) entisols, 2) alfisols, 3) mollisols and; 4) aridisols. Aridisols are found on slopes and are formed from weathered shale. Some riparian zones have relatively stable soil profiles because the creek or river is at the bottom of a V-shaped valley incised in bedrock. In contrast, riparian mosaics on the alluvial soils of broad floodplains change rapidly due to disturbance by flooding. Additionally, freshly deposited alluvium along the channels of meandering streams form sandbars, usually composed of sand or gravel (Glass 1993, Blackstone 1988).

2.5.3 Wyoming

The soils of the Powder River Basin are typical, semiarid grassland soils found throughout the Western United States. Organic material is slow to accumulate due to the climate and vegetative conditions. The soils are residual in nature (ie: developed in place) and most were formed from weathered sandstone and shale bedrock materials. Alluvial soils are also present and are developed along stream bottoms from material derived from highland areas and deposited along the streams. These alluvial soils usually contain a fair amount of organic matter (Atlantic 1976a:14). The soils in the proposed project area are generally shallow and not well developed because of an abundance of erodible soil types, and a dry, relatively cool environment that slows soil development. Soils that are deeper occur at the lower topographic elevations in the proposed project area because of more rapid soil development or downslope sediment accumulation.

PART 3
POTENTIALLY IMPACTED SPECIES

3.1 BLACK-FOOTED FERRET

Though never common, black-footed ferrets once ranged over most of west-central North America as far north as Alaska. Historically, its range was almost identical to the range of three species of prairie dogs: black-tailed, Gunnison's, and white-tailed (USFWS 1988a). The slaughter of prairie dogs in the early 1900's, agricultural cultivation, and sylvatic plague have severely reduced the range and abundance of prairie dogs, which nearly resulted in the extinction of the black-footed ferret (USFWS no date-a). The black-footed ferret was listed as endangered in March 1967[1] under a law that preceded the ESA.

The black-footed ferret is nocturnal and extremely cryptic (Whitaker 1980). It lives in arid prairies in proximity to prairie dog colonies. Black-footed ferrets feed primarily on prairie dogs (90%) and utilize their burrows for dens. Large prairie dog towns are needed to support viable populations of ferrets. However, numerous small prairie dog towns may support ferrets, if the ferrets can move easily between them.

Four to five young are born in May or June. The young stay in the burrow until they are about 6 weeks old. By September the young have become increasingly solitary. Sexual maturity is reached at age 1 to 1.5 years. Life expectancy is probably less than 5 years (USFWS 1988a).

By 1972 the black-footed ferret was thought to be extinct. However, in 1981 a dog killed a black-footed ferret on a ranch near Meeteetse, Wyoming, which led to the discovery of a small ferret population. The population was closely monitored from 1982 to 1984. An advisory board was established in 1982 to determine what actions were needed to encourage the recovery of the ferret. Mark and recapture surveys and radio telemetry data estimated the population as 88 in 1983 and as 129 in 1984. In September 1984, the board suggested that a captive breeding program be established (USFWS 1988a).

In October 1985, six ferrets were taken into captivity for breeding. During the fall of 1986 and the spring of 1987, the last of 18 known wild ferrets were taken from the wild and placed into captivity (USFWS 1988a). A captive-breeding program was started at Sybille Canyon, Wyoming (now known as the National Black-footed Ferret Conservation Center). The original goal of the program was to establish 240 breeding adults in captivity and continue their return to the wild (USFWS no date-b).

A taskforce was put together in 1996 to make recommendations to USFWS. The long-term goal is to establish 10 free ranging populations of black-footed ferrets that each has a population made up of 30 or more breeding adults. By the year 2010, it is hoped that 1,500 free-ranging black-footed ferrets will live in the wild (USFWS 1988a, USFWS no date-b).

Project Area

According to available information compiled by Clark (1978), the Wyoming Game and Fish Department (WGFD) (Kinter and Martin 1992), USFWS (Jobman and Anderson 1991), Wyoming Natural Diversity Database (WNDDB 1999), and South Dakota Natural Heritage Database (SDNHDB 1998), historical evidence exists for black-footed ferrets within the project area. In South Dakota the following sightings or physical evidence exists for black-footed ferrets: 3 in Custer County, 2 in Fall River County, 5 in Pennington County and 3 in Shannon County. In Wyoming the following sightings or physical evidence exists for black-footed ferrets: 16 in Campbell County, 14 in Converse County, 6 in Niobrara County, and

[1] Federal Register, March 11, 1967, 32(48):4001.

6 in Weston County. Some of these sightings were rated by the various sources as "confirmed," "positive," or "probable" but most are farther than 20 miles from any project alternative. Those closer than 20 miles are listed in Table 3-1. Only three of these, (records of 2 skulls and 1 skin), are unquestionably physical evidence.

The USFWS's recent Biological Opinion in regards to the Continental Divide/Wamsutter II proposed project states that since Wyoming is relatively unique in retaining vegetation and wildlife communities largely unchanged from pre-settlement times extant populations of black-footed ferrets may still exist (USFWS 2000). Therefore, there is the chance of the discovery of an extant population of the species.

Table 3-1
Reports of Black-footed Ferrets
(within an approximate 20 mile distance of the project area)

County, State	Year Observed	Location Description or T R Sec	Distance from Alternative	Observation Rating
Pennington, SD	1921	3S 12E 17	1 mile, B & C	Not Rated /1
	1927	2S 9E 08	11 miles, C 6 miles, D	Not Rated /1
Fall River, SD	1980	near the city of Edgemont	<2 miles, B & C	Probable /2
	1983	9S 3E 07	<1 mile, B	Confirmed /2
Custer, SD	1984	6S 9E 17-20	1 mile, B & C	Probable /2
	1988	55N 5E 26	13 miles, C	Probable /2
Weston, WY	1895	near the city of Newcastle	<2 miles, D	Positive, Skin /3
	1910	near the city of Newcastle	<2 miles, D	Positive, Skull /3
	1930	18 mi. southwest of Upton on Deep Water Creek	18 miles, D	Positive /3
	1920-35	46N 65W 22-23	15 miles, D	Not Rated /1
	1972	5 miles S. Hwy 16 by South Dakota	4 miles, D	Not Rated /1
	1972	5 mi. south of Hwy 16 on South Dakota border	2 miles, D	Positive /3
Niobrara, WY	1976	36 miles N. Lusk, Hwy 85	12 miles, B & C	Confirmed /2
Crook, WY	1930	Four Horse Creek, south of Moorcroft	6-15 miles, D	Positive /3
	1971	Middle-Osage Comm. Pasture	> 10 miles, D	Positive /3
	1973	3 miles east Crook Co. line, 8 mile north I-90.	8 miles, D	Probable /3
	1977	Hwy 14 near Keyhole Res.	8 miles, D	Not Rated /1
Converse, WY	1972	41N 69W 21	<1 mile, B	Possible/Probable /1
	1979	41N 70W 32	<1 mile, B & C	Positive, Skull /1, 3
	1983	39N 71W SE 1/4	10 miles, B & C	Possible/Probable /1
Campbell, WY	1972	41N 69W 26	1 mile, C	Possible/Probable /1
	1974	43N 73W 05	16 miles, B & C	Confirmed /2
	1976	43N 70W 30	1.5 miles, B & C	Possible/Probable /1
	1976	43N 73W 24	13 miles, B & C	Possible/Probable /1
	1981	43N 72W 02	6.5 miles, B & C	Probable /1
	1981	43N 72W 11	9 miles, B & C	Confirmed /2
	1986	43N 70W 30	1 mile, B & C	Possible/Probable /1
	1987	45N 71W 23	5.5 miles, C	Possible/Probable /1

Notes:
1 Ratings of Possible/Probable not differentiated by Kinter and Martin, 1992
2 Ratings of Confirmed or Probable provided by USFWS 1981 and update (Jobman and Anderson, 1991)
3 Ratings of Positive or Probable from Clark, 1980
3 Information with no observation ratings from South Dakota Natural Heritage Database, 1998

Experimental populations of black-footed ferrets have been reintroduced to federally managed lands in South Dakota from 1994 through 1997. In 1996 reintroduction began in the Conata Basin/Badlands which are within portions of the BGNG and Badlands National Park. All black-tailed prairie dog colonies within the reintroduction area were mapped. Data obtained from the mapping indicates lower densities (number of prairie dogs per acre) on the periphery of core reintroduction areas (USFWS unpub. info.). Therefore, densities of black-tailed prairie dog colonies are low on BGNG that would be closest to the proposed project area.

The Black-footed Ferret Recovery Implementation Team has identified Thunder Basin National Grasslands (TBNG) as a high-priority reintroduction site for black-footed ferrets. The USFS has worked with The Nature Conservancy to block up USFS ownership in the vicinity of Rosecrans, south of the alternatives for this project. These blocked-up USFS lands would form the core of the TBNG's ferret reintroduction site. If the site is successful, ferrets may expand to prairie dog towns that would be crossed by the alternatives.

3.2 PIPING PLOVER

The piping plover is one of six belted plovers found in North America. Piping plover populations have declined dramatically since the early 1900's (USFWS 1994a). Decline of piping plovers in the Missouri River basin has been related to construction of dams and reservoirs that alter water flows making nesting habitat unavailable, river channelization that alters river hydraulics that likewise adversely affect nesting sites on unvegetated islands and sandbars, bioaccumulation of selenium, and human recreational use of nesting areas during the breeding period (Dinsmore 1983, Kruse et al. 1993). These population declines prompted USFWS to list the piping plover under the ESA in December 1985[2]. Piping plovers breeding on the Great Plains were listed as threatened, while those breeding on the Great Lakes were listed as endangered.

Piping plover arrive on the breeding grounds between mid-April and mid-May (Prindiville-Gaines and Ryan 1988, Haig and Oring 1985, Wiens 1986). The piping plover utilizes sandbars, sand pits, and gravel pits for nesting. Sandbar habitats used by this species are transient and dependent on the dynamic forces of the river. Sandbars used for nesting change from year to year as erosion and deposition by the river break down and reform sandbars, or vegetation encroaches. Additionally, during some years, no sandbars are exposed because of high flows. Some plovers have adapted to these changing conditions by shifting to sand pits along the river. While these areas do not necessarily provide optimal nesting habitat, they do provide the opportunity for some individuals to successfully reproduce when river sandbars are unavailable.

For sandbars to be successful nesting sites, they must be free of vegetation and surrounded by sufficient water to limit access by predators. Therefore, an optimal flow regimen must exist which is sufficiently high to create new sandbars in spring, low enough during the breeding season to expose the sandbars, but not so low that the sandbars become joined to adjacent terrestrial habitats. The magnitude of the optimal flow regimen may differ from year to year depending on the location, shape, and height of the sandbars created previously.

Males and females begin courtship and construct several nest scrapes which consist of shallow depressions scratched in the sand or gravel and frequently lined with small pebbles or shells (Haig 1992, USFWS 1994a). Eggs are laid beginning in May. One egg is laid per day for four days. Incubation lasts for 25 to 31 days (Wilcox 1959, Cairns 1977, Prindiville 1986, Wiens 1986, Haig and Oring 1988). Eggs hatch from late May to mid-June. Chicks are precocial (capable of moving around on their own soon after hatching) and able to leave the nest and begin feeding themselves within several hours (USFWS 1994a). Broods generally remain within the parents' territory. Chicks fledge between 21 and 35 days (Haig and Oring 1988, Wilcox 1959). Plovers generally start departing the breeding grounds in mid-July and are gone by the end of August (Wiens 1986).

[2] Federal Register, December 11, 1985, 50(238):50726-50734.

Piping plovers feed on a variety of invertebrates that they capture by picking and gleaning. Food taken includes worms, insects, crustaceans, mollusks, beetles, and grasshoppers (Bent 1929, Lingle 1988). Foraging activity generally occurs within a few inches either side of the water's edge.

Project Area

The piping plover only occurs in the project area during the breeding and nesting season. They have been recorded near Pierre, South Dakota on islands or sandbars in the Missouri River (SDNHDB 1998). Searches for piping plovers along the Cheyenne River and Lake Oahe revealed their presence but none were found nesting on sandbars in the Cheyenne River during 1986 and 1987 (Dirks et al. 1993a). Searches were conducted for piping plovers along 20 miles of the Cheyenne River in Custer and Pennington counties in 1994, but no evidence for the species was found (Hetlet 1994). Likewise, no piping plovers were observed during a survey conducted along approximately 28 miles of the Cheyenne River between Spring Creek and Wasta, South Dakota on June 26, 1999. Water flow rates measured at a USGS gauging station downstream of Wasta, South Dakota (Table 3-2) indicated that suitable nesting habitat for piping plovers was unavailable on this section of the river in 1999. USGS flow rate data indicates that suitable nesting habitats on sand bars and islands on the Cheyenne River have probably been submerged and/or scoured during the month of May, when the birds usually begin nesting, in 10 out of 15 years between 1983 and 1998.

Table 3-2
River Flow Data at 3 USGS Gauging Stations on the Cheyenne River, South Dakota
(in vicinities where interior least terns were observed nesting compared to river flows recorded before, during and after a survey for interior least terns and nesting piping plovers on June 26, 1999)

Interior Least Tern Observed Nesting Date	River Flows (Cubic Feet per Second) at Gauging Stations (with USGS Station Numbers) on the Cheyenne River, South Dakota		
	06423500-Downstream from Wasta, Pennington County	06438500-Near Plainview, Ziebach County	06439300-Near Cherry Creek, Ziebach County
June 7, 1986 /1	150	No data	486
June 1986 /2	1338 (June 1986 average)	No data	2,022 (June 1986 average)
August 4, 1987 /1	77	No data	339
June 26, 1988 /3	82	No data	204
June 30, 1995 /3	1,120	2,500 (estimated value)	No data
June 26, 1997 /3	876	No data	No data
June 27, 1997 /3	841	No data	No data
This Survey, Before and After:			
June 22, 1999	3,500 (350 = median for date)	7,500 (925 = median for date)	No data
June 26, 1999	2,300 (250 = median for date)	4,250 (700 = median for date)	No data
June 28, 1999	1,880 (9300 = median for date)	3,780 (675 = median for date)	No data

Notes: /1 data from South Dakota Ornithologists' Union, 1991, nesting on lower Cheyenne River near mainstream of Missouri River.
/2 observation reported by Michael Melius, Hermosa, South Dakota nesting on Cheyenne River island between Rapid Creek.
/3 data from SDNHDB, 1999, nesting on Cheyenne River in northern Pennington County near Haakon County.

3.3 WHOOPING CRANE

The whooping crane is found only in North America. Historically, its range extended from the Arctic coast south to central Mexico and from the Rocky Mountain region in Utah eastward to the Atlantic coast; but only two natural populations exist today (Tesky 1993). However, recent management actions in the United States and Canada have resulted in a gradual increase in their numbers. The ESA of 1973 (16

USC, 1531-1534;87 Stat. 884) resulted in the establishment of the Whooping Crane Recovery Team and development of the 1994 Whooping Crane Recovery Plan. The whooping crane was listed as threatened in 1967 (32 FR 4001) and as endangered in 1970.

Fall migration begins in September, and whooping cranes normally migrate in small flocks of less than 10. After spending about six months in their wintering grounds, they return to their nesting grounds in the north. Whooping cranes use a variety of habitats during migration such as croplands for feeding and riverine habitat for roost sites (Lingle et al. 1991). Cranes roost on submerged sandbars in wide unobstructed channels that are isolated from human disturbance (Armbruster 1990). Habitats utilized by whooping cranes in South Dakota include marshes, wet meadows, and grain fields near water. Similar habitats are utilized in Wyoming during the cranes' migrations (Ashton and Dowd 1991, Dorn and Dorn 1990). Large palustrine wetlands are also used for roosting and feeding during migration. Whooping cranes' diet includes crustaceans, amphibians and invertebrates (Allen 1952).

Today, most whooping cranes migrate from Wood Buffalo National Park in Canada to Aransas National Wildlife Refuge on the Texas coast. This route passes southeastward through northeastern Alberta, south central Saskatchewan, northeastern Montana, western North Dakota, western South Dakota, central Nebraska and Kansas, west central Oklahoma, and east central Texas. Scattered occurrences have been reported in adjacent states and provinces (USFWS 1994b).

In December 1993, there were approximately 261 whooping cranes. Until several years ago, whooping cranes occurred in western Wyoming (Ritter 1990). These birds were from the experimental flock from the Grays Lake National Wildlife Refuge in Idaho, which was initiated in 1975 as an experiment to cross-foster whooping crane eggs in nests of sandhill cranes (USFWS 1986a). The cross-fostering program was discontinued in 1989 and there are only 2 birds from the Grays Lake flock known to be alive in 1999. The wild populations consist of the Aransas/Wood Buffalo population, the only self-sustaining natural wild population; the reintroduced Florida population in the Kissimmee Prairie; and the Rocky Mountain population (USFWS 1994b). The largest captive population of 41 birds, including nine breeding pairs, is located at the Patuxent Research Refuge near Laurel, Maryland.

The need for protection and restoration of prime habitat along the migration corridors was identified by the USFWS in 1981. River management plans along the Platte River have been implemented to protect and maintain roosting sites in wetland meadows and marshes adjacent to the river channel. Human activity near these sites is restricted during the migration periods. Protection of instream flows in areas where impoundments and dams are present has been addressed, and studies of the effects of disturbance have been conducted in the wintering areas. The reduction in mortality for whooping cranes may be achieved through the minimization of the risks of chemical spills near critical habitat and reduction of the risk of collision with utility lines and fences. Utility lines are the principle known cause of loss during migration (USFWS 1994b). Collisions with utility lines are known to have accounted for the death or serious injury of at least 19 whooping cranes since 1956. Restrictions of detrimental human activities such as construction periods, aircraft altitude and flight path, and recreation in habitat areas may also provide benefit.

Project Area

The migration path of the Aransas/Wood Buffalo flock that nests in northern Canada and migrates to the Gulf of Mexico passes through central and western South Dakota, mainly in the Missouri River basin (Binkley and Miller 1988, Ashton and Dowd 1991). From 1957 through 1990, there have been 5 confirmed sightings of whooping cranes from Beadle County, 14 sightings from Hughes County, 20 sightings from Stanley County, 2 sightings from Haakon County, 7 sightings from Jackson County, and 5 sightings from Pennington County (USFWS unpub. data).

During the spring migration in 1988, a small group (4 adults and 1 young) of whooping cranes was observed feeding in a grain field north of Rapid Creek approximately 3 miles from Alternative D in Pennington County. A small group (5) of whooping cranes were observed a week later approximately 11

miles southeast of Wall in eastern Pennington County (SDNHDB 1999). The following year, 1989, one whooping crane was seen flying 3 miles east of Ellsworth Airfore Base in Pennington County during fall migration (USFWS 1989).

3.4 INTERIOR LEAST TERN

The interior least tern is one of three subspecies of New World least terns. The interior least tern was formally listed as federally endangered in 1985[3]. The decline of interior least terns throughout their breeding range in the Mississippi and Missouri river basins has been related to construction of dams and reservoirs that alter water flows making nesting habitat unavailable, river channelization that alters river hydraulics that likewise adversely affect nesting sites on unvegetated islands and sandbars, and human recreational use of nesting areas during the breeding period (Erwin 1983). In addition, bioaccumulation of contaminants in adults, particularly selenium derived from seleniferous soils and shales along the Missouri River, may be sufficient to cause embryo death or deformities (Dinsmore 1983, Kruse et al. 1993).

The interior least tern is a migratory species, breeding along large rivers within the interior of the United States. Interior least terns return to breeding and nesting areas from late April to early June (Faanes 1983, Hardy 1957, Wilson 1984, Wycoff 1960, Youngworth 1930).

Interior least terns nest in colonies on sand islands and sandbars in rivers. A key factor for nest site selection is continuous exposure of the site above water for at least 100 days during the nesting period from mid-May to the end of August (Smith and Renkin 1993). Suitable nesting areas contain little vegetation (less than 10 percent), with the vegetation present being less than four inches tall (Dirks et al. 1993a). Because nests are on the ground near water level they are vulnerable to flooding following natural precipitation pulses but also during hydroelectric dam operational water releases. Nests are also susceptible to avian and mammal predators and human disturbance (Rimmer and Deblinger 1992, Mayer 1993, Krusse et al. 1993, Schwalbach et al. 1993, Smith and Renken 1993). Interior least terns also nest on alkaline flats where they are also susceptable to flooding, predators, and human disturbance (Koenen et al. 1996).

Interior least terns excavate shallow scrapes in sand, soil or gravel (Carreker 1985). Suitable nesting habitat has apparently been created at pits created by sand and gravel mining operations adjacent to the Platte River in Nebraska (Sidle and Kirsch 1993). Once natural vegetation regrowth or reclamation occurs on abandoned pits, their suitability for nesting by interior least terns diminishes (Sidle and Kirsch 1993).

Interior least terns begin laying eggs around the end of May. If a nest of eggs or chicks is lost, the pair may nest a second time. The second nesting may occur as late as mid- to late July (Lingle 1988). Average clutch size is approximately 2.5 eggs per nest (Lingle 1988). Eggs are incubated for 17 to 31 days (Faanes 1983, Hardy 1957, Moser 1940, Schwalbach 1988, Cairns 1977). Chicks are precocial, but depend on their parents for food and care until fall migration (Massey 1972). Chicks fledge at approximately 21 days of age (Kirsch 1990). Parents and chicks will remain in the area of nesting colonies until departing for the winter. By early September, terns have usually left the colonies for southern wintering areas (Bent 1921, Hardy 1957, Stiles 1939).

Sandbar habitats used by interior least terns for nesting are ephemeral; thus, the terns are highly susceptible to loss of nests, eggs, or chicks because of high water. Although nesting usually is initiated during high flow periods causing terns to nest on higher areas of sandbars, Lingle (1988) found flooding to be the main cause of nest loss in riverine habitats. In some areas and during abnormally high or late spring flows, artificial habitats such as gravel and sandpits may provide the only suitable nesting habitat in an area (Lingle 1988). While these areas provide suitable nesting habitat, they require adult birds to fly

[3] Federal Register, May 28, 1985, 50(102)21784-21792.

greater distances to forage and may subject nests and chicks to a greater likelihood of loss from predators or human disturbance (Lingle 1988, Lackey 1994).

In addition to the presence of suitable nesting substrate, nesting sites are selected for presence of food fish such as shiners, suckers, killifish, gizzard shad and sunfish (Erwin 1983, Carreker 1985). Occasionally, crustaceans, insects, mollusks, and annelids may be taken (Whitman 1988). Foraging areas are usually near nesting sites; however, terns may travel several miles to fish (Talent and Hill 1985).

Project Area

Interior least terns occur in South Dakota. Successful nesting has been documented on the Missouri and Cheyenne rivers (Dirks et al. 1993b). Initiation of nesting in South Dakota may be dependent on water levels, occurring earlier during years with low water levels. Nesting usually begins in late May and chicks fledge by mid-July (Schwalbach et al. 1993).

Suitable nesting sites and foraging areas apparently occur along the Cheyenne River near its confluence with the Missouri River at Lake Oahe (Dirks et al. 1993a), upstream from Pierre, South Dakota. Two records of interior least terns on the Missouri River in the vicinity of Pierre, Hughes County and Fort Pierre, Stanley County were provided by SDNHDB (1998) but there were no records in the project area. Biologists with the BGNG conducted a search for interior least terns along 20 miles of the Cheyenne River in Pennington and Custer counties in 1994 but no evidence of the birds was found (Hetlet 1994). However, interior least terns were observed nesting on an island in the Cheyenne River in 1986, approximately midway between the confluence with Rapid Creek and Wasta, South Dakota (Melius 1999).

From 1988 through 1997, least terns have nested along the Cheyenne River in Pennington County several miles downstream from where the river is crossed by Alternative D (SDNHDB 1999). There are sand and gravel bars in the Cheyenne River where it parallels Alternatives B and C upstream from the Alternative D crossing but most are small and some partially covered with vegetation and may not be suitable for nesting (Hetlet 1994).

Interior least terns are known to nest along the Cheyenne River, upstream from its embayment at Oahe Reservoir but their occurrence farther upstream where the river parallels the proposed project is unknown. Mud, sand and gravel bars in the Cheyenne River have been mapped from 1:2400 scale aerial photographs in the area where the river is adjacent to both alternatives. The suitability of those sites for nesting by interior least terns has not been determined. Inundation frequencies prior to and during the nesting period, amount of vegetation cover established on bars, local abundance of food fish (fish less than 4 inches long) and concentration of predators all affect site suitability as nesting habitat (Carreker 1985). Minimum habitat areas required for nesting sites are unknown but small colonies of interior least terns have nested on a 0.22-acre island and 0.45-acre sandbar (Carreker 1985). These areas are larger than most potential nesting sites in the project area.

As part of this project a survey for interior least terns and piping plovers was conducted in June 1999 along approximately 28 miles of the Cheyenne River between Spring Creek and Wasta, South Dakota. No interior least terns were seen. During the survey, USGS water flow data on the river at Wasta, South Dakota (Table 3-2) indicated flows of 2,300 cubic feet per second (cfs). Many of the sand and gravel bars in the survey area had been under water several days prior to the survey, probably on June 22, 1999 when flows reached 3,500 cfs.

Comparisons of flows on the June 26, 1999 survey date with flows recorded at the Wasta USGS gauging station and other stations downstream on the Cheyenne River indicate much lower water flows on dates when least terns had been observed nesting in the past. Thus, during the June 26, 1999 survey water levels may have been too high for nesting to be initiated or sustained successfully.

3.5 TOPEKA SHINER

The Topeka shiner once inhabited waterways in Kansas, Iowa, Minnesota, Missouri, Nebraska, and South Dakota. The fish now occupies less than 10 percent of its original geographic range. Remaining populations inhabit small tributaries in several states including Minnesota and South Dakota (Tabor 1998, American Rivers 1997, USFWS no date-c). Much of the decrease has occurred over the past 25 years. The decline is due to increased sedimentation, eutrophication (enrichment of water in dissolved nutrients as in phosphates and often shallow with a seasonal deficiency in dissolved oxygen) and the introduction of piscivorous (fish eating) fish. Increased sedimentation and eutrophication can be attributed to human activities such as agriculture, water use, impoundment of water in lakes, construction of watering ponds, urban development, and highway construction (Cross and Collins 1995, American Rivers 1997). The USFWS designated the Topeka shiner as endangered under the Endangered Species Act on December 15, 1998[4].

The Topeka shiner inhabits clear, clean open pools near headwaters of streams having bottoms composed of sand, gravel or rubble. Most of these streams are perennial; however, some streams may cease flowing during dry seasons, but permanent pools are maintained by the percolation of water through the streambed. The fish feed on midge larvae, aquatic insects, and other organisms found on stream bottoms (Cross and Collins 1995, American Rivers 1997, Pflieger 1975).

The green sunfish is the most common predator inhabiting the Topeka shiner range. Introduction of game fish such as largemouth bass, crappie, white bass, northern pike, and channel catfish may affect the shiner during drought periods when the fish seeks refuge in impoundments or permanent stream pools occupied by these introduced fishes (Tabor 1998).

The Topeka shiner is reported to spawn over green sunfish and orange-spotted sunfish nests. Males establish territories around nests. Spawning occurs from late June to August with the young maturing in one year. Their life span is between two to three years (Cross and Collins 1995). Little else is known regarding breeding habits and development (Tabor 1998).

Land use practices, maintenance of altered waterways, and continuing tributary impoundment and channelization represent the greatest existing threats to the Topeka Shiner. Additionally, over-grazing of riparian zones and the removal of riparian vegetation diminish a watershed's ability to filter sediments, organic wastes, and other impurities from the stream system resulting in increased sedimentation and eutrophication (Manci 1989).

Project Area

In Minnesota the Topeka shiner has been found in Flandreau and Spring creeks (Lincoln County) which are crossed by the existing rail line. The fish may also inhabit tributaries to these creeks. The MNHDB has a 1973 record of the species from Lincoln County approximately 1 mile from the DM&E existing right-of-way. In South Dakota, as recently as 1997, the shiner was found in two streams in Brookings County (Tabor 1998). Recent collections of Topeka shiners have been made in the Big Sioux River watershed that includes the Medary, Deer, Sixmile and North Deer creeks and their tributaries in Brookings County. In Beadle and Kingsbury counties the Topeka Shiner has been recorded from the James River water shed which includes Middle Pearl and Pearl creeks and their tributaries (USFWS 1998 unpub. data). Cain Creek in Beadle and Hand counties is a potential Topeka shiner stream. Additionally, there are tributaries to Topeka shiner streams that cross the proposed project area in Hand County, South Dakota. This species was collected in the late 1960's from the Cheyenne River embayment at Lake Oahe. However, none have been reported in collections made since then.

No surveys have been completed for Topeka shiners near any of the new railroad alternatives in South Dakota.

[4] Federal Register, December 15, 1998, 63(240):69008-69021.

3.6 PALLID STURGEON

Despite being one of the largest freshwater fish in North America, the pallid sturgeon was not described as a species until 1905 (Forbes and Richardson 1905). Before that, pallid sturgeon were considered to be a different color morph of shovelnose sturgeon. The relatively late recognition of the sturgeon as a distinct species may have been because it was never very common. Pallid sturgeon are only rarely captured and the species may be close to extinction (USFWS 1993a). On September 6, 1990, the pallid sturgeon was listed as federally endangered (55 FR 36647).

Pallid sturgeon are a big river species. The fish is generally noted as a species of the Missouri River and its major tributaries (Keenlyne 1989). They occur within the mainstem of the Mississippi River downstream from its confluence with the Missouri River, the mainstem of the Missouri River as far upstream as Fort Benton, Montana, and the lower stretches of several major tributaries to these rivers. River stretches where pallid sturgeon have been recorded generally include turbid, swift waters with firm sand or gravel substrate (Bailey and Cross 1954).

USFWS (1993a) estimated sexual maturity for males to occur between ages 5 and 7. Females were estimated to begin egg development at 7 to 9 years of age, with sexual maturity not being reached until between age 15 and 20. Pallid sturgeon are believed to spawn only once every several years.

Pallid sturgeon are assumed to spawn between March and July, depending on location (Forbes and Richardson 1905, Gilbraith et al. 1988, Keenlyne and Jenkins 1993, Keenlyne 1996). Eggs are very adhesive and attach to bottom substrates and remain unattended until hatching (Keenlyne 1996, Gilbraith et al. 1988). Upon hatching, the larvae are buoyant and active and disperse with the current (Moyle and Cech 1982).

Project Area

Records of pallid sturgeon were provided by SDNHDB (1998). The records were from the Missouri River in Pierre, Hughes and Stanley counties (Lake Sharpe) between 1967 and 1989. The sturgeon is native to the Missouri and Mississippi rivers and persists in Lake Sharpe, South Dakota (Dryer and Sandvol 1993). Since pallid sturgeons prefer main channels of large, turbid rivers where they feed on fish and aquatic insects along the bottom (Kallemeyn 1983), suitable habitat does not exist in the vicinity of the alternatives paralleling the Cheyenne River. No evidence from any surveys exists for their occurrence in the Cheyenne River (Hampton 1998, USFWS 1993a)

3.7 AMERICAN BURYING BEETLE

The American burying beetle once ranged throughout the entire eastern United States and portions of extreme southeastern Canada (Anderson and Peck 1985). Historically, these areas were covered by vast expanses of mature deciduous forest. Portions of the species' western range also included tall- and short-grass prairie. The range and occurrence of the American burying beetle have declined significantly. Habitat loss (Anderson and Peck 1985) and forest fragmentation (NGPC 1995) appear to be the most likely reasons for decline. Because of the dramatic decline of the species and the probable extinction of the species throughout much of its historic range, the American burying beetle was listed as federally endangered in July 1989[5].

American burying beetles are active from late April through September (USFWS 1991). The American burying beetle is nocturnal and is generally active only when nighttime temperatures exceed 60 degrees Fahrenheit for several consecutive days. After emerging, adults set out in search of suitable carrion for brood production (Scott and Traniello 1989).

American burying beetles are the largest member of the genus and therefore capable of using larger carrion than other members of the genus. Optimal carrion size is 3.5 to 7.0 ounces (USFWS 1991a). A pair of American burying beetles will bury a carcass and the female will deposit her eggs above it. After

[5] Federal Register, July 13, 1989, 54(133):29652-29655.

the eggs hatch, the larvae fall from the egg chamber onto the carcass and as they grow, the parents actively feed or assist the larvae in feeding themselves (Milne and Milne 1976, Wilson and Fudge 1984, Fetherson et al. 1990).

The adults remain with their brood until the larvae pupate. At that time the young burrow into the soil. The pupated larvae emerge in 48-60 days as adults capable of reproducing. Adults emerging early in the season may successfully reproduce during the remaining year (Lomolino et al. 1994). Others will over-winter until the following season (USFWS 1991a, Kozol et al. 1988).

Preferred habitat for the American burying beetle has not been determined (Ratcliffe and Jameson 1992, Raithel 1991, Kozol et al. 1988). However, a variety of habitats have been suggested including riparian woodlands with rich humus, mixed agricultural land, and grasslands (Ratcliffe and Jameson 1992, Raithel 1991, Jameson and Ratcliffe 1989). However, grasslands are seldom used as breeding habitats because litter is nearly absent and grassland soils are often compacted, making carcass burial difficult (Lomolino and Creighton, 1996). American burying beetles have been found in the sandhills of northcentral Nebraska where there is sufficient carrion, even though sandy soils may make carcass burial difficult (Ratcliffe and Jameson, 1992). Recent studies in Oklahoma and Arkansas suggest American burying beetles prefer mature upland forest with low shrub growth, followed by grasslands (Lomolino et al. 1994). These studies also seem to indicate that the American burying beetle is more of a generalist, using a wider range of habitats than other burying beetles and that the presence of appropriate soil for carcass burial was more important than habitat type.

Project Area

The SDNHDB (1998) has a record of the beetle's occurrence in Brookings County within 1 mile of the existing railroad; however, no date was given. The USFWS lists records of the species occurrence in Brookings, Haakon, and Union counties for 1946. There is also an historic record (no date) of specimens collected near Nowlin and Haakon counties (Backlund and Marrone 1997, Lomolino et al. 1995). That collection site is the most western extension of the beetle in South Dakota and was apparently within the immediate vicinity of the existing rail line in the Bad River floodplain.

The existing railroad passes through nearly 51 miles of herbaceous rangeland and 4 miles of deciduous forest lands in South Dakota. These may be suitable for American burying beetles as well as the nearly 228 miles of right-of-way that traverses croplands and pastures in the state. Although the new railroad alternatives are farther west than the known range of the species (recent searches in Badlands National Park and Wind Cave National Park were unsuccessful - Backlund 1999), each alternative would affect herbaceous rangeland, forested (cottonwood) wetlands, croplands and pastures in varying amounts.

Given the proximity of collections in Cherry County, Nebraska and that the beetle is a strong flier and can travel long distances in search of carrion, they may be present in suitable habitats (USFWS 1991). At this time, any habitat in South Dakota with significant humus and/or topsoil suitable for burying carrion is considered potential beetle habitat.

3.8 MINNESOTA DWARF TROUT LILY

Minnesota dwarf trout lily occurs in woodland habitat, adjoining floodplains dominated by elm and cottonwood and on rich slopes where maple and basswood are dominant. It is the only plant species known to be endemic to Minnesota and probably has always been considered rare. It requires rich, moist areas in undisturbed forests. It is a glacial relict only occurring in Steele, Rice, and Goodhue counties in Minnesota. With increased urban sprawl, additional lands being used for agriculture and logging, the few remaining populations could be threatened. It is believed that the plant establishes new populations by becoming uprooted during high waters and being carried downstream. Conversion of floodplains to croplands reduces the possibility of establishment of new populations downstream and can erode the soils

and increase siltation in the areas the lily now inhabits (Sather no date). Minnesota dwarf trout lily was listed as a federally endangered species on March 26, 1986[6].

The plant's unusual reproduction strategy could be another factor contributing to its rareness. The Minnesota dwarf trout lily almost never produces seeds. It grows from an underground bulb. Population size increases when the underground stem of a flowering plant produces a single offshoot runner bearing a new bulb. Because only a small proportion of plants flower in any given year, only about one-tenth of all plants actually produce offspring (Sather no date).

It is believed that the Minnesota dwarf trout lily evolved from the white trout lily shortly after the last glaciation. Floodwaters could have uprooted the plants from their original location along the Cannon River and redeposited them downstream. This would account for the plant's limited geographical range at elevations of 960 to 1000 feet within the Cannon River watershed and tributaries (Sather no date).

Project Area

Most colonies of the Minnesota dwarf trout lily occur along a 7.5 miles stretch of the Straight and Cannon Rivers near Faribault, Minnesota. This area is approximately 15 miles upstream of the proposed construction in Owatonna, Minnesota.

3.9 HIGGIN'S EYE PEARLY MUSSEL

The Higgin's eye pearly mussel is a freshwater mussel. The present distribution o Higgin's eye pearly mussel is the St. Croix River, Wisconsin River and upper Mississippi River from Pool 6 to Pool 20. The mussel is found in waters of the states of Minnesota, Wisconsin, Iowa and Illinois. Between 1890 and 1920, Higgin's eye pearly mussel was one of many species heavily harvested to make mother-of-pearl buttons and pins. Higgin's eye pearly mussels initially may have declined due to commercial harvesting. However, impoundments, decreasing water quality, and channel dredging are the primary factors responsible for recent declines (USFWS 1983). Contemporary threats include pollution from agricultural and industrial runoff. By 1982, data indicated that this species had undergone a 53% decrease in its known range (USFWS 1997a). On June 14, 1976, it was listed as federally endangered (41 FR 24064).

The mussel inhabits areas of swift current, where it buries itself in mud-gravel bottoms. Depth of water is approximately 15 feet. The mussel leaves only the edge of its shell and its feeding siphons exposed. Reproduction requires a stable, undisturbed habitat, and a sufficient population of sauger and freshwater drum that play host to Higgin's eye larvae. When the male discharges sperm into the current, females downstream siphon in the sperm in order to fertilize their eggs, which they store in their gill pouches until the larvae hatch. The females then expel the larvae. Those larvae which manage to attach themselves to the gills of a host fish grow into juveniles with shells of their own. At that point, they detach from the host fish and settle into the streambed. They may live up to 50 years (USFWS no date-d).

Project Area

The mussel is found in the Mississippi River downstream from the Twin Cities and some of its larger northern tributaries. Although several collections of mussels have been made in the Minnesota River, South Fork of Zumbro River, and Straight River (tributary to the Cannon River) in the vicinity of the proposed project, no Higgin's eye pearly mussels have been collected in the project area (MNHBD 1998).

3.10 WINGED MAPLE LEAF MUSSEL

The historic range of the winged maple leaf covered eleven states in the north central portion of the United States; however, it has been eliminated from 99% of this range (Eldridge 1991). Siltation, chemical and agricultural pollution, and the damming of rivers to create reservoirs have eliminated the winged maple leaf from areas where it once existed. Currently the only known population exists in the St. Croix River, Wisconsin. The population in the St. Croix appears to be very small and localized, making it prone to stochastic (random) disturbances. Additional threats to the remaining population include

[6] Federal Register, March 26, 1986, 51(58):10521-10523.

expanded agricultural or modified land use, toxic substance spills, point discharges of harmful chemicals, low water levels, and large recreational boat traffic. It was listed as a federally endangered species by the USFWS on June 20, 1991 (56 FR 28349).

The winged maple leaf mussel is found in shallow gravel bars or riffles of medium to large clear-water rivers and streams. It buries itself in the gravel, sand or mud with only its feeding siphons exposed. Reproduction requires a stable, undisturbed habitat and a sufficient population of fish hosts to complete the mussel's larval development. When the male discharges sperm into the current, females downstream siphon in the sperm in order to fertilize their eggs, which they store in their gill pouches until the larvae hatch. The females then expel the larvae. Those that manage to find a fish host to clamp onto by means of clasping valves, grow into juveniles with shells of their own. At that point they detach from the host fish and settle into the streambed. An adult mussel may live up to 50 years (USFWS 1997b).

Project Area

The only known extant population in the Midwest occurs in the St. Croix River, Wisconsin. This population occurs just below the St. Croix Falls Dam and is approximately 125 miles upstream of Winona, Minnesota (Hornbach et al. 1996).

3.11 KARNER BLUE BUTTERFLY

The Karner blue butterfly occupies oak barren/savanna habitats where wild lupine grows. The plant serves as host for several of the insect's larval stages. Historically, the butterfly occurred in a narrow band extending from eastern Minnesota, across portions of Wisconsin, Illinois, Indiana, Michigan, Ohio, Canada, Pennsylvania, New York, Massachusetts, and New Hampshire. Since 1992 it has been extirpated from Ohio, Pennsylvania, and Massachusetts. The species decline can be attributed to the loss of habitat because of suppression of wildfires, development, and clearing of land for agricultural purposes (USFWS no date-e, Mitchell and Carnes no date). Today the butterfly is restricted to a few isolated spots where lupine is present (Scheider 1998). The butterfly was listed as endangered on December 14, 1992[7].

The butterfly produces two broods a year. In April, larvae hatch from the eggs that over-wintered from late summer of the previous year. The larvae enter the pupa stage, and emerge from their pupas as adult butterflies during the end of May and early June. The newly hatched adults mate and lay their eggs during June on or near wild lupine plants. The eggs hatch within a week and the larvae feed on the lupine for about three weeks. The larvae then pupate and emerge as adult butterflies in July. This generation will mate and lay eggs that won't hatch until the following spring (Scheider 1998). Winter snowpack protects the eggs from freezing; therefore, the range of the Karner blue only overlaps with the range of wild lupine where there is sufficient winter snowpack (USFWS no date-e).

Declining habitat suitability and size has accelerated the rate of localized population extinction. Additionally, Givnish et al. (1988) estimate that maximum dispersal distance for colonization of unoccupied habitats is approximately 0.5 miles. Since optimal habitats have become increasingly fragmented due to succession and alteration, colonization has become increasingly difficult (Shuey 1997).

Project Area

The butterfly has been recorded from the Whitewater Wildlife Management Area, Winona County in Minnesota. This area is approximately 3 miles from the existing DM&E rail line to be rebuilt. In 1998 the Minnesota County Biological Survey (MCBS) surveyed DM&E's existing line in Minnesota. No federally listed species were found during the survey. (However, due to the unique nature of working within active railroad rights-of-way, combined with the relatively short duration of the project, several important issues regarding data interpretation and limitations must be noted: 1) Time constraints precluded MCBS botanists from timing surveys in order to maximize the chances of observing rare species. Therefore, unobserved rare species may occur in these rights-of-way and not be reflected in the data, 2) Safety concerns of railroad companies strictly forbade field staff to cross the railroad track, except

[7] Federal Register, December 14, 1992, 57(240):59236-59244.

at public crossings; and 3) Time constraints precluded field staff from essentially conducting the survey twice. As a result, the survey effort rarely included both sides of the track. Although the inventory could not be repeated, botanists observed both sides of the right-of-way and took general notes, which are available with other survey data, and 4) There is great variation in the width of the railroad rights-of-way. The above limitations prevent area calculations from MCBS data therefore the 1998 results are linear (MDNR 1999)). Additionally, information provided from the MNHDB did not report wild lupine occurring in the proposed project area. Since no wild lupine was reported from either source, it is doubtful that Karner blue butterflies exist within the proposed project area.

The existing route in southeastern Minnesota partially coincides with oak savanna/barrens, so Karner blue butterflies could be present or in the vicinity of the existing railroad (Aaseng et al, 1993). There are approximately 4.9 miles of existing railroad that coincide with deciduous forests in Winona County but, if no wild lupine occurs within the right-of-way, it is doubtful that Karner blue butterflies exist within the proposed project area.

3.12 UTE LADIES'-TRESSES ORCHID

Suitable Ute ladies'-tresses orchid habitat is becoming uncommon with increased disturbances to stream systems and conversion of land to urban uses. Total population of Ute ladies'-tresses has declined to approximately 20,500 individuals. Geographic distribution of the plant includes the eastern Great Basin of western Utah and adjacent Nevada, the Colorado River drainage of eastern Utah, the eastern slope of the Rocky Mountains in southeastern and central Wyoming, south central Idaho and Montana. In eastern Wyoming, the orchid is known from Converse, Goshen, Laramie and Niobrara counties. It has not been recorded from South Dakota (Intermountain Ecosystems 1998). Ute ladies'-tresses orchid was listed as a federally threatened species in February 17, 1992[8].

The orchid flowers from late July through August depending on location and climatic conditions. However, the plant may not flower every year. *Spiranthes magnicamporum*, another species of Spiranthes, has been reported to bloom as rarely as once in every 20 years (Magrath 1973). Bumblebees are the main pollinators. Fruits of the orchid appear during late August through September (Dresler 1981, Sheviak 1984, Sipes et al. 1993, USFWS 1995a).

Ute ladies'-tresses orchid generally occurs between 4,300 to 7,000 feet in seasonally moist soils such as wet meadows, old stream channels, and seeps (Stone 1993). Suitable habitat includes open vegetation that is not densely overgrown or overgrazed. However, it may occur in grazed pastures with introduced grasses or in heavily disturbed sites that have been revegetated. The plant is flood tolerant and prefers well-drained soils with high moisture content, such as fine silt/sand to gravel and cobbles. It is not tolerant of extremely saline/alkaline soils (> 8.0 pH) or of long term standing water (USFWS 1995a). Plants often occur in clumps of two or more. White sweetclover (*Melilotus alba*), arrowgrass (*Triglochin* spp.), creeping bentgrass (*Agrostis stolonifera* L.), and baltic rush (*Juncus* spp.) are some of the plant species that appear to occur with the orchid in Wyoming (Hazlett 1996).

Project Area

Searches for Ute ladies'-tresses along the alternatives were conducted in South Dakota and Wyoming in September 1998. Because access to potential sites on private lands was restricted, only 22 sites could be adequately evaluated with four considered potential habitat for the species (Intermountain Ecosystems 1998). The four sites were at Hay Canyon South and Dry Creek in South Dakota (Fall River County) and at Lodgepole and School creeks in Wyoming (Weston County) (Table 3-3). Additionally, much of the proposed project area in the range of Ute ladies'-tresses orchid is substantially below 4,300 feet. The report prepared for the survey is included as Appendix .

[8] Federal Register, January 17, 1992, 57(12):2048-2053.

Table 3-3
Habitat Potential and Site Index for *Spiranthes diluvialis*

Site Name	USGS Quad/Legal Description	NWI Maps	Plant Association	Direct Access to Row	Potential Habitat
Box Elder Creek	Wasta, SD T1N, R14E, NE4, S31	R2UBA	cottonwood, sandbar willow	No	No
Spring Creek	Scenic SW, SD T2S, R12E, SW4, S29; NE4, S31	PEMA	cottonwood, sandbar willow	No	No
Battle Creek	RedShirt, WY T3S, R10E, NW4, S31	PEMA	cottonwood, American elm	No	No
French Creek	Fairburn NE, SD T5S, R9E, S5	PEMCH	no data	No	No data
Cheyenne River at Hay Canyon	Smithwick, SD NE/T7S, R8E, S1	R2UBG	cottonwood, sand vcbar willow, cordgrass	Yes	No
Hay Canyon North	Smithwick, SD NE/T7S, R8E, S12	PEMC	cordgrass, cattails	Yes	No
Hay Canyon South	Smithwick, SD NW/T8S, R8E, SE4, S2	PEMA, PUBH	cattails, bulrush, cordgrass	No	Yes
Sand Creek	Smithwick, SD T8S, R8E, NW4, S31	PEMC	cottonwood, plum	No	No
Horsehead Creek	Lone Well Creek East, SD T9S, R7E, S21	PEMA, PUB	cottonwood, red ash, cordgrass	No	No
Dry Creek	Lone Well Creek West, SD T9S, R6E, NE4, S29	PEMA	cattails, cordgrass, threesquare bulrush	Yes	Yes
Hat Creek	Heppner, SD T9S, R4E, SW4, S25	PEMA	cottonwood, cordgrass, wildrye	Yes	No
Plum Creek	Rumford, SD T9S, R4E, S31	PABFH	no data	No	No data
Red Canyon Creek	Edgemont, SD T8S, R3E, NW4, S29	PEMC	cottonwood, sand sagebrush	No	No
Beaver Creek	Twenty One Divide, WY T7S, R1E, S16	PEMC	cordgrass	No	No
Bobcat Creek	Riverview, WY T40N, R61W, S9	PEMA	sagebrush	No	No
Alkali Creek	Little Alkali Creek, WY T40N, R62W, S4	PEMA	greasewood, alkali sacaton	Yes	No
Lodgepole Creek	The Nose East, WY T42N, R64W, SW4, S32	PEMC	baltic rush, threesquare bulrush, cordrush	Yes	Yes
Lion Creek	Darlington Draw East, WY T42N, R67W	PEMA	sagebrush	No	No
Piney Creek	Darlington Draw West, WY T42N, R68W, S2	PEMA	sagebrush, cottonwood	No	No
Little Thunder Creek	Piney Canyon NW, WY T43N, R69W, SW4, S30	PEMA, PABFH	cordgrass	No	Low
School Creek	Piney Canyon NW, WY T42N, R69W, NW4, NE4, S6	PABFH	cordgrass	Yes	Yes
West Fork of Beckwith Creek	Piney Canyon SW, WY T41N, R69W, NE4, S8	PEMB, PABH	sagebrush	No	No
Black Thunder Creek	Open A Ranch, WY T44N, R70W, S14	PABFH	sagebrush	No	Low
East Fork Coal Creek	Rough Creek, WY T45N, R70W, S11	PEMAH	no data	No	No data
Dry Creek	Saddle Horse Butte, WY T47N, R70W, S29	PEMAH	no data	No	No data
Belle Fourche River	Saddle Horse Butte, WY T47N, R70W, S30	PEMAH, PEMCH	no data	No	No data
Caballo Creek	Saddle Horse Butte, WY T48N, R71W, S35	PEMCH, PABFH	no data	No	No data

3.13 PRAIRIE BUSH-CLOVER

Prairie bush-clover is one of twelve North American bush-clovers. It inhabits dry open areas in glaciated regions of Illinois, Iowa, Minnesota, and Wisconsin (Smith 1981). The plant grows on soils that are usually well drained. The largest populations of the plant occur in southwestern Minnesota and northwestern Iowa. Contributing factors to the decline of Prairie bush-clover include agricultural development, highway expansions, pipeline easements, and herbicide use (USFWS 1988b). The plant was listed as a federally threatened species on January 9, 1987[9].

Prairie bush-clover is found in coarse soils on north-facing slopes of 10-15 degrees. The plant tolerates disturbance well, occurring on rights-of-way and places which have been exposed to fires (Fernald 1950, Gleason and Cronquist 1963, Gleason 1952, Sather 1986, Clewell 1966a, Smith 1981). Prairie bush-clover reproduces by seed. Both chasmogamous (cross-pollinating) and cleistogamous (self-pollinating) flowers are produced (Clewell 1966b, Sather 1986). It appears reproductive success is more dependent on self pollinating flowers, than the pollinator dependent flowers (Sather 1988). Germination of the clover occurs from mid-May to mid-July with formation of leaf buds forming from late May through late August. Flowering occurs from July through August. Fruiting is from mid-August through September with seed dispersal occurring from mid-September through to the following summer (Sather 1986, Smith and Sather 1986). The pollinator is unknown at this time.

Project Area

Prairie bush-clover is known to occur in Brown, Dodge, Olmsted and Redwood counties in Minnesota. It has been recorded as recently as 1997 in Dodge County within 1 mile of the existing line (MNHDB 1998). In Brown County, between 1988 and 1992, eight sites were reported. Two of these sites were on cut-banks of former Chicago and Northwestern railbeds and another site found in 1992 was where DM&E's existing tracks intersect the Chicago and Northwestern track. These 3 sites are within MDNR Cottonwood Prairie Scientific and Natural Area, approximately 3 miles southwest of Springfield in Brown County (MNHDB, 1998).

The MCBS inventoried the entire DM&E rail line in Minnesota (278 miles) for prairie fragments and rare features. Thirty-six total miles of prairie within the right-of-way were identified. Prairie bush-clover was not found within DM&E right-of-way during the 1998 survey. (However, due to the unique nature of working within active railroad rights-of-way, combined with the relatively short duration of the project, several important issues regarding data interpretation and limitations need to be addressed: 1) time constraints precluded MCBS botanists from timing surveys in order to maximize the chances of observing rare species. Therefore, unobserved rare species may occur in these rights-of way and not be reflected in the data, 2) Safety concerns of railroad companies strictly forbade field staff to cross the railroad track, except at public crossings. Time constraints precluded field staff from essentially conducting the survey twice. As a result, the survey effort could rarely include both sides of the track. Although the inventory could not be repeated, botanists could observe both sides of the right-of-way and took general notes, which are available with other survey data, and 3) There is great variation in the width of the railroad rights-of-way. The above limitations prevent area calculations from MCBS data therefore the 1998 results are linear (MDNR 1999)).

3.14 LEEDY'S ROSEROOT

Leedy's roseroot is found in six locations in Minnesota and New York. Four populations are found in Filmor and Olmsted counties, Minnesota and the other two are found in upstate New York. Only one of the six populations occurs on Minnesota public land. The plant was listed as a federally threatened species on April 22, 1992[10].

Leedy's roseroot is found on limestone cliffs. Cracks in the limestone lead to underground caves where groundwater seeps to the surface and cool air provides a cool and wet environment for the species. The

[9] Federal Register, January 9, 1987, 52(6):781-785.
[10] Federal Register, April 22, 1992, 57(78):14649-14653.

caves often connect with sinkholes above ground and usually uphill. In Minnesota ground water contamination is the greatest threat to the continued survival of the plant (USFWS 1993b, Harrison 1992). The source of contamination can be from application of fertilizers and pesticides being applied to nearby fields and lawns and through filling or dumping in sink holes adjacent to the cliffs (USFWS 1998, Harrison 1992). Flowering occurs in early June. Bees and syrphus flies appear to be the pollinators (Clausen 1975). The seeds are wind dispersed.

Project Area

The plant has been recorded growing high on limestone cliffs along the Root River in Olmsted County. All Minnesota sites are found in drainages of the Root and Whitewater rivers at elevations between 900 and 1,240 feet. Neither river is in the proposed project area. Additionally, no suitable habitat for the species has been identified within the proposed project area.

3.15 WESTERN PRAIRIE FRINGED ORCHID

The western prairie fringed orchid historically occurred throughout central North America. It was found within the western Central Lowlands (U.S.), eastern Great Plains (U.S.), and Interior Plains (south-central Canada) (Lobeck 1957, Brownell 1984). In the United States, western prairie fringed orchids are known historically from 81 counties in 8 states. These states are North Dakota, South Dakota, Minnesota, Iowa, Nebraska, Kansas, Missouri, and Oklahoma. Currently, the species is believed extirpated from South Dakota and Oklahoma, and has been significantly reduced in areas of occurrence in Iowa, Kansas, Missouri, and Nebraska. Although the species has been found in 28 new counties since 1970, it has been found to no longer occur in approximately 75 percent of the original counties of occurrence (USFWS 1995b). The majority of populations of western prairie fringed orchids in the United States are located in the Red River Valley of North Dakota and Minnesota. Decline in the species is due to several factors such as conversion to cropland, overgrazing, intensive hay mowing, and draining of wetlands (Harrison 1989). The western prairie fringed orchid was listed as a federally threatened species by the USFWS on September 28, 1989[11].

Flowering occurs sporadically. A plant may flower several consecutive years, not flower for several years, or flower at random years over its lifetime. Exactly what stimulates flowering is unknown. However, it is proposed that flowering may be caused by burning (Bowles 1983, Bowles and Duxbury 1986), above average precipitation, and/or the number of growing degree days (Pleasants 1994). Flowering may last for up to 3 weeks, with individual flowers lasting up to 10 days.

Throughout its range the western prairie fringed orchid occurs in a variety of habitats. These include mesic portions of tallgrass prairie, sedge meadows, loess prairies, hay meadows and at the edge of wetlands. Prairies where the orchid is known to occur are dominated by typical tallgrass species which include big bluestem, little bluestem, and Indian grass. Within these areas, western prairie fringed orchids usually occur in the wetter areas where tufted hairgrass and switchgrass are common. Sedge meadow communities include sedges, rushes, and willows (USFWS 1995b). Although tallgrass prairie and sedge meadows appear to be the preferred habitat, western prairie fringed orchids have been found in non-climax communities. These communities include borrow areas, abandoned fields, and along roadways. These occurrences may indicate that some disturbance in an area, such as fire or intense grazing, may be necessary for orchid establishment (USFWS 1995b).

Project Area

The orchid was previously recorded from Dodge and Nicollet counties in Minnesota, although a search of the MNHDB did not result in any records of the western prairie fringed orchid occurring in the proposed project area (1998). Additionally a survey by the MCBS in 1998 along the existing DM&E rail line did not result in occurrences of the orchid (1999).

[11] Federal Register, September 28, 1989, 54(187):39857-39863.

3.16 BALD EAGLE

The bald eagle is a large bird of prey. It occurs throughout North America and once maintained breeding populations in Canada, Alaska, and 45 of the lower 48 states. It is the only sea eagle regularly occurring on this continent (AOU 1983). Bald eagle populations declined in the nineteenth and twentieth centuries because of hunting, trapping, habitat loss, development, mercury poisoning and organochlorine insecticides (Grier et al. 1983). In some areas of the historic breeding and nesting range, disturbance caused by human development may prevent current and future eagle nesting (Murphy 1965, Retfalvi 1965, Juenemann 1973, Weekes 1974, Grubb 1976, Anthony and Isaacs 1989), as well as result in abandonment of wintering areas (Stalmaster and Newman 1978, Knight and Knight 1984, Smith 1988).

The decline in bald eagle numbers prompted the species listing as federally endangered in 1978. Through research, conservation, management, and protection, the species population within the lower 48 states is increasing, as has its breeding range (Federal Register 1999). Since 1963, when the earliest census of the bald eagle's breeding population was taken (450 nesting pairs), there has been a ten-fold increase (USFWS 1995c). Improvements in the species status led to it being down-listed to federally threatened in July 1995 (60 FR 36010). On July 6, 1999 the USFWS proposed to remove the bald eagle from the List of Endangered and Threatened Wildlife.

Bald eagles may live as long as 30 years (Grier et al. 1983) with sexual maturity being obtained at 4 to 6 years of age. Mortality of juvenile birds is thought to be high and dependent on available winter habitat and the severity of winter weather. After surviving one or two winters, continued survivorship of immature eagles becomes more likely (Sherrod et al. 1977).

Once sexually mature, bald eagles may still not breed for several years. Bald eagles tend to use the same area for nesting in successive years and often use the same nest. Nests may reach considerable size, measuring several feet in diameter and depth and weighing several hundred pounds. As a result, bald eagles generally nest in large trees with strong branches or on rock cliffs (Sherrod et al. 1977).

A minimum of one square mile of essential habitat around a nest is considered necessary to successfully raise young (Grier et al. 1983). Nesting activities begin in late winter or early spring, depending on the latitude. One, two or occasionally, three eggs are laid. Fledging of chicks occurs approximately four months after eggs are laid.

The bald eagles' primary food source is fish (Grier et al. 1983). Both live and dead fish are eaten. Because of the bald eagles reliance on fish, nesting occurs in proximity to large water bodies, including lakes, rivers, and oceans.

Wintering bald eagles are found throughout the United States, but are most abundant in the Midwest and west. Each year, thousands of eagles winter in Utah, Colorado, South Dakota, Nebraska, Kansas, Oklahoma, and Missouri. These seven states account for over 90 percent of the bald eagles recorded during midwinter surveys in the Midwest and west, and nearly half the eagles counted nationwide (Grier et al. 1983).

Suitable wintering areas require an abundant and easily available food supply and cover for protection from the cold. Specific food items consumed by wintering bald eagles vary by geographic area and availability of items (Steenhof 1978). In western Wyoming, bald eagles consume carcasses of mule deer and domestic livestock (Jenkins 1982) including big game killed by trains and vehicles (Reeve unpub. data). Importance of big game and livestock carrion to wintering bald eagles in the Powder River Basin of northeast Wyoming have also been documented by Anderson and Patterson (1988). Thus, wintering

eagles may spend considerable time away from water in search of food. At night, bald eagles will select areas offering protection from the wind and severe weather. These areas are often dense stands of trees in areas where the topography helps afford protection from the elements.

Disturbance of a roost may lead to abandonment of the site (Steenhof 1976, Hansen et al. 1981, Keister 1981). Skagen (1980) reported that almost 43% of wintering eagles along the Skagit River flushed when approached within 500 meters by boats, people or vehicles. Bald eagle nesting territories in the Greater Yellowstone Ecosystem (GYE) and elsewhere have been abandoned as a result of human activities (GYE Bald Eagle Working Team 1983). One study indicated that nesting bald eagles flushed from nests when approaching humans were an average of 1,500 feet from the nest (Fraser et al. 1979).

Project Area

The bald eagle is a winter and nesting resident in the proposed project area. It is known to use lands adjacent to the project area for feeding, perching, and roosting. In Minnesota along the existing line the MNHDB reported nesting bald eagles in Winona County in 1997 along the spillway in the Upper Mississippi River Wildlife and Fish Refuge approximately 8 miles south of the city of Winona. Another report was recorded in 1994 along the Minnesota River north of Mankato in Nicollet County.

USFWS has monitored bald eagle communal roosts and winter concentration areas along the Missouri River, upstream and down from the DM&E bridge crossing at Pierre, South Dakota. Three nocturnal roosts (Suiter roost, Riverbank roost and Compton roost) are present within 0.25 and 0.75 mile of the existing line as it crosses the Missouri River on the west bank (USFWS 1991b). Concentrations of wintering eagles have been documented between DM&E's existing bridge at Pierre, South Dakota and Oahe Dam approximately 7 miles downstream of where the existing rail line veers from the Missouri River to pass along Medicine Knoll Creek (USFWS 1991).

Biologists with BGNG conducted ground surveys for bald eagles wintering along the Cheyenne River in South Dakota since 1994 (Hetlet 1995, 1996a, 1997a, 1998). Those survey results are provided in Table 3-4 and indicate considerable variation between years. However, distributions of bald eagles recorded in December of each year, 1994-1997, generally coincide with bald eagles observed during aerial surveys reported here for February 1999.

Available data indicates that bald eagles vacate the middle reaches of the Cheyenne River in South Dakota, at least between Edgemont and Wasta, South Dakota by late March. USFWS conducted an aerial survey of the Cheyenne River on March 26, 1998 (Peterson USFWS-Lake Andes National Wildlife Refuge, Lake Andes, SD unpub. data). Bald eagles were seen near Angostura Reservoir and on the lower reach of the Cheyenne River near its confluence with the Missouri River but none were observed on the middle reach. Similarly, USFS conducted surveys in May 1996 and 1997 along the same portions of the Cheyenne River that were included in December surveys but no bald eagles were seen either year (Hetlet 1996b, 1997b).

Data provided by the Wyoming Natural Diversity Database (WNDDB) listed several sightings of bald eagles within TBNG (WNDDB 1999). Bald eagles have attempted to nest on TBNG at least twice in the past, but both nests were unsuccessful (Byer 1992 unpub. data). Communal roosts in the vicinity of alternatives have been documented on TBNG by USFS (Byer USFS-TBNG unpub. data). Many of these have also been documented on the WGFD WOS as well as other observations of bald eagle winter concentration areas (Table 3-5). With few exceptions, habitats associated with those sites are coniferous woodlands, consistent with results of studies that demonstrate the thermal protection provided by conifers such as ponderosa pine.

Aerial surveys for nesting bald eagles and other raptors were conducted from April 11-13, 1999 along the new railroad alternatives B and C in South Dakota and Wyoming and the rebuild section from Wall, South Dakota (Pennington County) to Blunt, South Dakota (Hughes County). Ground surveys were conducted from April 22-28, 1999 along the remainder of the rebuild section from Winona, Minnesota to Blunt, South Dakota. Only one pair of bald eagles was seen perched near a nest on private land along the Cheyenne River in Wyoming (Weston County) on April 11; however, no follow-up survey was conducted. The site was more than 1 mile from any new railroad alternative.

Results of field surveys conducted in February 1999 along the alternatives are provided in Table 3-6. Most observations were of single eagles perched in deciduous cottonwood trees adjacent to rivers. All eagles that were observed along creeks and rivers were associated with stretches of ice-free water; no bald eagles were seen where water was frozen.

Table 3-4
Observations of Bald Eagles During Winter Surveys
Conducted by BGNG along the Cheyenne River in South Dakota from 1994 through 1997

December 1994			December 1995			December 1996			December 1997		
Number Seen[1]	T R Sec	Distance to Nearest Alternative (miles)[2]	Number Seen	T R Sec	Distance to Nearest Alternative (miles)	Number Seen	T R Sec	Distance to Nearest Alternative (miles)	Number Seen	T R Sec	Distance to Nearest Alternative (miles)
1 imm	3S 12E 19 NE	2.1 - S	1 imm	4S 11E 21 SW	0.5 - B	1 imm	4S 11E 31 NW	0.2 - B	1 ad	3S 12E 08 SE	1.9 - S
1 ad	4S 11E 29 NE	0.2 - B	1 ad	4S 10E 36 NE	0.6 - B	4 ads	5S 9E 27 NW	0.6 - B	1 imm	3S 12E 19 NE	2.0 - S
1 imm	4S 11E 32	0.2 - B	2 ads	4S 9E 13 SE	0.5 - B	2 ads	6S 9E 16 NW	1.8 - B	1 imm	3S 12E 19 NW	2.0 - S
1 ad	NW	0.1 - B	2 ads	5S 9E 27 NW	0.4 - B				1 ad	4S 11E 21 NW	0.4 - B
2 imm	5S 10E 18	0.2 - B	1 imm	5S 9E 27 NW	0.4 - B				2 ads	4S 11E 21 SW	0.5 - B
1 ad	NW	0.1 - B	1 ad	5S 9E 28 NE	0.3 - B				1 imm	4S 11E 28 SW	0.5 - B
1 imm	5S 9E 13 SW	0.4 - B	3 imm	5S 9E 28 SW	0.1 - B				1 ad	4S 11E 28 SW	0.4 - B
1 ad	5S 9E 22 NE	2.2 - B	1 ad	5S 9E 33 NE	0.5 - B				1 ad	4S 11E 32 NE	0.2 - B
1 imm	5S 9E 33 SW	2.2 - B	1 ad	5S 9E 33 NW	0.1 - B				1 ad	4S 11E 31 NW	0.3 - B
	6S 9E 21 SW								3 ads	5S 9E 23 NW	0.2 - B
	6S 9E 21 SW								1 imm	5S 9E 22 NE	0.1 - B
									1 ad	5S 9E 22 NE	0.1 - B
									2 ads	5S 9E 22 NW	0.1 - B
									1 ad	5S 9E 27 NW	0.5 - B
									1 imm	5S 9E 33 NW	0.1 - B
									1 imm	5S 9E 31 SW	0.1 - C
									1 ad	6S 9E 36 SE	0.1 - C
									1 imm	6S 8E 01 NE	0.1 - C

[1] - ad = adult eagle, imm = immature eagle
[2] - Alternative routes are S = Shared, B = Alternative B, C = Alternative C.

Table 3-5
Bald Eagle Winter Roosts and Concentration Sites with 5 or More Eagles Seen During Winter in Wyoming

Date Observed	Number Seen	Habitat (WGFD Code)	T	R	Sec	Approximate Distance to Nearest Alternative (miles)
2/4/83	12	not recorded	40N	69W	13	3.6 - B >8.0 - C
1/15/88	16	1.40 Ponderosa pine savannah	41N	68W	06 NW	2.0 - B 3.4 - C
2/21/83	6	5.11 Basin big sagebrush	41N	68W	34 SW of NE	3.0 - B 6.5 - C
1/18/83 2/4/83 3/27/85 1/5/88 1/9/89	10 15 10 7 17	not recorded not recorded not recorded 1.40 Ponderosa pine savannah 1.80 Pine-juniper	41N	69W	01 NW	2.5 - B 3.2 - C
3/5/79 3/11/79 2/5/80 1/19/82 1/10/83	5 9 12 16 8	not recorded 1.40 Ponderosa pine savannah 1.81 Pinyon pine-juniper 1.80 Pine-juniper not recorded	41N	70W	25 NW of SW	0.2 - B 1.8 - C
3/1/79	12	not recorded	41N	70W	25 SE	0.1 - B 2.5 - C
1/30/81 1/19/82 1/9/85	9 3 8	not recorded 1.80 Pine-juniper 1.40 Ponderosa pine savannah	42N	69W	05 NE of NE	>8.0 - B 1.1 - C
11/7/90	6	1.40 Ponderosa pine savannah	42N	69W	24	3.6 - B 3.8 - C
12/3/80 1/18/83 3/27/85	1 22 2	4.11 Basin big sagebrush not recorded not recorded	43N	69W	01 SW	0.2 - B 4.0 - C
1/30/83	10	not recorded	43N	70W	26	1.5 - B 1.0 - C
1/9/85	6	4.12 Wyoming big sagebrush	43N	71W	25 NW of NE	2.5 - B 2.5 - C
3/2/79 2/23/80	5 7	1.40 Ponderosa pine savannah 1.81 Pinyon pine-juniper	47N	70W	21 NW of SW	1.5 - B 1.5 - C

Wyoming Game and Fish Department Wildlife Observation System

Table 3-6
Observations of Bald Eagles Seen During 1999 Winter Bald Eagle Survey
(Alternatives B and C in South Dakota and Wyoming)

Date Observed	Number/Age Seen	Habitat	State	County	Quad	T R Sec	Lat/Long	Approximate Distance to Nearest Alternative (miles)
2/13/99	1 adult	cottonwood riparian Antelope Creek	WY	Converse	Dugout Creek	41N 70W 33 NE SW SW	43°28.70NN 105°16.76NW	0.1 - C
	1 adult	cottonwood riparian Ha Creek	WY	Campbell	Piney Canyon NW	43N 69W 04 SE SW SW	43°43.56NN 105°09.57NW	< 0.1 - B
	1 adult	cottonwood riparian Robbers Roost Creek	WY	Niobrara	Riverview	40N 61W 09 SW SE NE	43°27.55NN 104°11.24NW	0.3 - C
	1 adult	cottonwood riparian Cheyenne River	WY	Niobrara	Twentyone Divide	40N 60W 20 NE NE NE	43°26.14NN 104°05.04NW	< 0.1 - B & C
	1 adult	Ponderosa pine woodland	SD	Fall River	Rumford	9S 4E 27 NW NW SW	43°14.28NN 103°38.47NW	0.6 - C
2/14/99	1 immature 2 adults	riparain bluff Cheyenne River	SD	Custer	Red Shirt NE	4S 11E 16 SE NW NE	43°42.36NN 102°48.27NW	0.4 - B
	1 adult	cottonwood riparian Cheyenne River	SD	Pennington	Red Shirt NE	4S 11E 10 NE SW NW	43°42.98NN 102°47.48NW	1.0 - B
	1 adult	cottonwood riparian Cheyenne River	SD	Custer	Red Shirt SW	5S 10E 18 NE NE SE	43°37.05NN 102°58.05NW	0.2- B
	3 adults	cottonwood riparian Cheyenne River	SD	Custer	Red Shirt SW	5S 9E 13 SW NE SW	43°36.68NN 102°59.96NW	0.2 - B
	2 adults	cottonwood riparian Cheyenne River	SD	Custer	Fairburn SE	5S 9E 22 NW SW SE	43°35.79NN 103°01.97NW	< 0.1 - B
	1 adult	cottonwood riparian Cheyenne River	SD	Custer	Fairburn SE	5S 9E 28 NE NW NE	43°35.52NN 103°03.06NW	0.3 - B
	1 immature 2 adults	cottonwood riparian Bad River	SD	Jones	Capa NW	2N 27E 17 NW SE SE	44°07.68NN 100°53.42NW	0.7 – existing

3.17 MOUNTAIN PLOVER

The summer range of the Mountain plover once extended over the short-grass prairies of the western Great Plains from northern Montana to southern Mexico. However, both their numbers and range have sharply decreased with loss of breeding and wintering habitats. These losses are attributed to conversion of native prairies to cropland, range management practices, oil and gas exploration, chemical spraying, urban sprawl and prairie dog extermination. Breeding strongholds exist in small areas of native prairie in Montana and Colorado. The plover also breeds in Wyoming, New Mexico, Oklahoma and Texas (NGPC no date-a). The mountain plover is proposed for listing as a threatened species[12].

Mountain plovers inhabit flat, short-grass prairie, and sagebrush grasslands that historically supported large herbivores such as bison and pronghorn antelope (Knopf 1996). In Montana and Wyoming, the plover is closely associated with prairie dog colonies. However, research from Colorado (Graul 1975) and Utah (Ellison 1998) suggests that the occurrence of breeding mountain plovers may be distributed more in relation to other breeding plovers (aggregation of nest sites) rather than apparently suitable habitat. Nests are scrapes on the ground, commonly in exposed areas or may be next to conspicuous objects. Nests may also be lined with materials found nearby such as lichens, grasses, and cow manure chips (Leachman and Osmundson 1990).

Results of a study conducted in northeast Wyoming showed that mountain plovers nested at sites with low or absent shrub growth and where grasses and forbs were also short (Parrish et al. 1993). In that study, mountain plovers seldom nested on prairie dog colonies but adults with broods were seen on colonies (Parrish et al. 1993).

In eastern Wyoming, the birds arrive in April from wintering grounds in southern California and northern Mexico. Eggs are laid from mid-April into early June. The average clutch contains 3 eggs that are dark olive buff with black markings. The incubation period is 29 days during which time there is a high incidence of egg mortality caused by predation, hail, and livestock. Chick mortality is highest the first three days. According to Graul (1976) only half of the chicks reach fledging age of 33-34 days. Chick mortality is attributed to predation, poor nutrition, disease, and separation from the adult (Leachman and Osmundson 1990).

Young mountain plovers reach sexual maturity at one year of age and probably breed for two years. Some birds return to the same nesting area each year and some chicks return to the area where they were hatched. The birds leave their principal breeding grounds between August and October for wintering areas.

The diet of mountain plovers is primarily insects, particularly beetles, grasshoppers, and crickets. Foraging generally occurs in areas of extensive ground disturbance or areas where vegetation is less than one inch tall. Such areas include prairie dog towns, heavily grazed pastures, dirt or gravel roads, and recently plowed fields (Knopf 1996).

Project Area

Surveys for occurrence of mountain plovers on black-tailed prairie dog colonies were conducted on TBNG annually since 1993. During the 1997 survey a total of 26 adults and 20 juvenile plovers were seen within approximately 4,900 acres of prairie dog colonies surveyed (Byer USFS-TBNG unpub. report). Sites were recorded on either side of State Highway 450 and on the east side of State Highway 59. Mountain plovers were seen on one National Biological Survey breeding bird survey route (Newcastle) in Wyoming but none were reported on breeding bird survey routes in South Dakota.

[12] Federal Register: February 16, 1999, 64(30):7587-7601.

Mountain plovers have also been documented in annual wildlife monitoring reports on coal mines and nearby areas in Campbell County, Wyoming near the alternatives (WNDDB 1999).

3.18 SWIFT FOX

The historical range of the swift fox included the area between the Rocky Mountains on the west, the western border of Minnesota and Iowa on the east, west central Texas and eastern New Mexico on the south, and the southern regions of British Columbia, Alberta, Saskatchewan and Manitoba on the north. Today, the swift fox can be found in South Dakota, Wyoming, Montana, Nebraska, Colorado, Oklahoma, Kansas, New Mexico, Texas, and as reintroduced populations in Canada (Dunn 1977).

The swift fox is unafraid of man therefore it has been easily trapped and poisoned by efforts aimed at coyotes and wolves. Other factors affecting the decline of the swift fox include fragmentation or destruction of suitable habitat, interspecies competition, prey reduction by rodent control, hunting, and predation. Studies conducted in western Kansas and Colorado indicate predation by coyotes is as high as 87% among juveniles and 65% among adults. The swift fox was previously listed as endangered in 1970, but was removed from listing in the U.S. because of controversy over its taxonomy. However, it has remained listed in Canada. In 1995 a petition to list the swift fox as endangered in the northern part of its range was submitted to the USFWS. The USFWS concluded their listing as warranted, but precluded by higher listing priorities. The swift fox is currently federally listed as a candidate species (50 CFR Part 17).

The swift fox is currently state listed as endangered in Nebraska, threatened in South Dakota and protected in Wyoming. In contrast, they are still legally harvested in Colorado, New Mexico, Kansas, and Texas (Dunn 1997).

The fox occupies short- and mixed-grass prairies, and other arid areas and often inhabit prairie dog colonies (Carbyn 1993). Native grasses in this habitat include buffalo grass, blue grama, and western wheat grass. Shrubs present include sagebrush (*Artemisia* spp.) and saltbush (*Atriplex* spp.). Common sunflower (*Helianthus annuus*), western ragweed (*Ambrosia psilostachya*), and prickly pear occur in swift fox habitats that were previously cultivated. Soil in the area of the den ranges from clay-loam to sandy loam (Dunn 1997).

The fox excavates its own den or enlarges another animal's den. Denning sites of the swift fox are usually well-drained slopes or hilltops with short or sparse vegetation. The den usually has 3 to 4 entrances. Unlike other canids, swift fox use dens all year-round. This solitary fox seldom ventures more than 1.9 miles from its den (Dunn 1997).

The fox is nocturnal and an opportunistic feeder. Its diet includes rabbits, rats, mice, birds, insects, grasses, carrion, and berries. Studies conducted on the stomach contents of the fox show that a majority of its diet during the summer season is grasshoppers (Dunn 1997).

Pair bonds develop during October and November. The female swift fox is monoestrous, breeding from late December to February. Gestation is 51 days with 3 to 5 young born in March to April. The pups emerge from the den in one month and are weaned at 6 to 7 weeks. They are fully grown in 4 to 5 months with a life span of 8 to 10 years. Dispersal of pups begins in August and they are capable of breeding during the first breeding season following birth (Carbyn 1993).

Project Area

There are records of swift fox from the project vicinity in Custer and Fall River counties, South Dakota (SDNHDB 1998) and on the Wall Creek and Fall River Ranger Districts, BGNG (Hetlet and Hodorff 1997).

Recent surveys conducted in central and eastern Wyoming included sites in Weston, Campbell, Niobrara and Converse counties. Swift foxes have been recorded from Converse and Weston counties, roughly coinciding with distributions reported by trappers and USFS observations on TBNG (Woolley et al. 1995).

3.19 STURGEON CHUB

The sturgeon chub occurs throughout the Missouri River drainage and the lower Mississippi River (USFWS 1993c). Alterations of the larger rivers through impoundment, channelization, and snag removal that have reduced the amount of riffle habitats appear to be some of the causes of the decline of the sturgeon chub. These alterations have also resulted in changes to the historic hydrograph of the river, reducing or eliminating dramatic seasonal changes in flow. Releases from impoundments have altered the normal temperature of the river by reducing water temperatures that may be an important cue for spawning. Additionally, predation from picivorous sport fishes stocked in the Missouri River basin may be contributing to population declines. The sturgeon chub was federally listed as a Category 2 species in the 1980's. The sturgeon chub was reclassified as a Category 1 (Candidate) species in July 1994. USFWS is preparing documents that would recommend the species for listing as an endangered species (USFWS 1999b)[13].

This member of the minnow family inhabits shallow sand or gravel bottom zones in areas with strong currents in warm and highly turbid medium to large rivers (Lee et al., 1980). Little is known about overall life history of the sturgeon chub because their habitat makes detailed observation and study difficult (USFWS 1993c). The species is believed to live up to four years with both sexes maturing at 2 years of age (Stewart 1981, Werdon 1992). Spawning is expected to occur from June through July, depending on the location, with spawning occurring later in more northerly portions of the range (Stewart 1981, Jenkins 1980, Werdon 1992, Cross 1967). Fertilized eggs drift downstream, hatching in approximately one day. Young grow quickly until mature at 2 years, after which, growth slows (Stewart 1981, Werdon 1992). The diet of the sturgeon chub is larval aquatic insects (Collins et al. 1995).

Project Area

Sturgeon chub have been repeatedly documented in South Dakota in the Cheyenne River in Pennington and in Custer counties as recently as 1994 (USFWS 1993a, USFWS 1993b, SDNHDB 1998). A study conducted by SDSU, USGS and BRD in 1996 between Angostura Dam and Lake Oahe did not locate any sturgeon chub until sampling below Red Shirt, South Dakota where turbidity increased. No chubs were collected between the Angostura Dam and Red Shirt, South Dakota.

While their occurrence in the portion of the Cheyenne River proximate to Alternatives B and C for the new railroad has been demonstrated repeatedly, they may also still occur in tributary streams to the Cheyenne River, given collections made in similar stream habitats in Wyoming. Surveys were conducted during October 1999 in several tributary streams at or near proposed railroad crossing by Alternatives B and C. The sampled streams, all with flowing water, included Spring Creek, Rapid Creek, and Box Elder Creek (Pennington County); Cottonwood Creek, French Creek, Battle Creek (Custer County); and Hat Creek (Fall River County). No sturgeon chubs were collected at any of the sites.

In Wyoming, populations of sturgeon chub are only known to occur in the Powder River in Campbell County.

[13] Federal Register: January 18, 1995, 60(11):3613-3615.

3.20 BLACK-TAILED PRAIRIE DOG

Black-tailed prairie dog numbers once reached into the billions. They inhabited over 100 million acres of short-grass prairie. However, since the turn of the century, the black-tailed prairie dog has declined by 98% and its historic range has been reduced to less than one percent (Johnson 1997). It is estimated that only 700,000 acres of prairie dog habitat remain (NWF 1997a). Today, large complexes of black-tailed prairie dogs occur in only three states: Montana, South Dakota, and Wyoming (NWF 1997b). This decline is a result of habitat fragmentation through agriculture and urban development, active poisoning, population reduction through state and federally supported animal control programs, recreational shooting, and wildlife disease (Johnson 1997).

Prairie dogs are social animals and live in large colonies or towns in short- and mid-grass prairie. The colonies are further divided into wards by topographical barriers and finally into coteries. The coteries consist of one adult male, one to four adult females and any offspring less than two years of age. The prairie dog is diurnal and is active from sunrise to sunset. They excavate extensive tunnels and burrows for shelter and protection (Nowak 1991). The prairie dog's diet consists of grasses and forbs.

A prairie dog is sexually mature at approximately two years of age (Zoo. Soc. 1996). Breeding takes place in March and early April with gestation lasting approximately one month. Four to six young are born and stay in the burrow for six weeks (NGPC no date-b). Young males leave the coterie as juveniles and usually gain control of another coterie. Females stay in their natal coterie (Nowak 1991).

Prairie dogs play an important role in their ecosystem. Badgers, coyotes, weasels, golden eagles, hawks, black-footed ferrets and other predators feed upon the prairie dog. Additionally several species such as rabbits, other small rodents, burrowing owls, snakes and black-footed ferrets use vacant burrows. Mountain plover, grasshopper sparrows, and other ground nesting birds are found in greater numbers in prairie dog towns and native grasses are also more abundant (NGPC no date-b). The prairie dogs' continued survival is imperative to the federally endangered black-footed ferrets' survival. The USFWS has determined that the listing of the species is warranted but precluded by other higher priority actions[14].

Project Area

Black-tailed prairie dog colonies occur throughout the project area in western South Dakota and Wyoming. Black-tailed prairie dog colonies were mapped along Alternative C from black-and-white aerial photographs (1:2,400) extending to approximately 1,000 feet on each side of the alternative's centerline. Additional colonies have been mapped by the Forest Service (as current as 1998) and the WGFD mapped colonies through the late 1980's. Maps of colonies on private lands have been provided by county weed and pest control district agents in South Dakota and Wyoming. These data are compiled in Table 3-7 and show that all alternatives would affect prairie dog colonies but that Alternative C would cross the most colonies (a function of mapping effort conducted along that alternative). Mapped prairie dog colonies intersected by Alternative B are not as complete as for Alternative C since, except for those sections that coincide with or closely parallel Alternative C, no aerial photography exists along Alternative B.

The current activity status of each prairie dog colony is unknown: some colonies have become inactive due to sylvatic plague epizootics and others have been poisoned by county weed and pest control agents and/or private land owners. For most of the colonies that have been mapped there is no additional information about the extent or proximity of other colonies that would form a local colony complex.

[14] See Federal Register: February 4, 2000, 65(24):5476.

Table 3-7
Miles of proposed right-of-way under Alternatives B, C, and D that would intersect black-tailed prairie dog colonies in South Dakota and Wyoming

Alternative	State	Miles of Proposed ROW per Land Owner Intersecting Prairie Dog Colonies				
		USFS	BLM	State	Private	Total
B[1]	South Dakota	0.2	0	0	3.2	3.4
	Wyoming	1.7	0	1.5	4.9	8.1
	Total	**1.9**	**0**	**1.5**	**8.1**	**11.5**
C[2]	South Dakota	0	0	0.2	4.9	5.1
	Wyoming	1.7	0	1.6	9.1	12.4
	Total	**1.7**	**0**	**1.8**	**14.0**	**17.5**
D[3]	South Dakota	0	0	0.1	2.8	2.9
	Wyoming	0.3	0	0.2	2.8	3.3
	Total	**0.3**	**0**	**0.3**	**5.56**	**6.2**

[1] - Prairie dog colonies mapped from aerial photographs where Alternative B coincides with Alternative C, by USFS on TBNG, and by WGFD.
[2] - Prairie dog colonies mapped from aerial photographs, by USFS on TBNG, and by WGFD.
[3] - Prairie dog colonies mapped from aerial photographs where Alternative D coincides with Alternative C, by USFS on TBNG, and by WGFD.

PART 4
IMPACT EVALUATION

This Part discusses general impacts common to all alternatives and the potential impacts of each project action alternative on the Federally listed endangered and threatened species, species proposed for listing and candidate species potentially occurring in the project area. When the impacts of alternatives are similar it is noted. Additionally, impacts to each species occurring in Minnesota and South Dakota along only the rebuild portion of the proposed construction would not be differently affected by Alternatives B, C, or D, therefore; impacts for each individual alternative are not listed. Species impacts are not addressed for alternatives if impacts to the species are not anticipated.

Project activities which may cause short-term impacts if species or habitat is present include direct mortality by field vehicles and construction machinery, avoidance of habitats and/or temporary habitat loss near construction sites and potential short-term degradation of habitats.

Project activities that may cause long-term impacts, if species or their habitats are present, are similar to the short-term impacts listed above. Long-term impacts include direct mortality by trains and maintenance vehicles, avoidance of habitats that are near the tracks, and potential long-term deterioration of habitats. Aquatic habitats could be affected where there was sediment discharge or accidental release of toxic substances (fuels or oil). Additionally, long-term herbicide use could degrade habitats. To mitigate these potential impacts DM&E would employ measures to minimize and control the sediment discharge. Additionally, the chance of spills during construction and operation of the rail line would be minimal because fuel would be stored away from waterways and a contingency plan would be in place.

Potential indirect long-term impacts to ground nesting birds could also occur if predators are drawn to a nesting area because of carrion concentrations along tracks. Long-term impacts to habitats used by terrestrial and aquatic species due to surface disturbances are also expected to be similar to those described under short-term impacts. However, once construction machinery is withdrawn from the right-of-way and revegetation is successful, the total amount of some habitats affected by surface disturbance are expected to be reduced over the long-term.

Noise due to train traffic is expected to be a long-term impact to some species. The degree to which anticipated noise levels displace species is unknown and undoubtedly varies by species and local conditions. Abandonment of occupied habitats within some distance of the railroad is likely, particularly by nesting birds.

Long-term runoff of sediments could impact aquatic organisms downstream in much the same way as described under short-term impacts.

4.1 BLACK-FOOTED FERRET

4.1.1 Minnesota

This species does not occur in Minnesota; therefore, there would be no impacts.

4.1.2 South Dakota and Wyoming

Black-footed ferrets have been reintroduced to the Conata Basin/Badlands in South Dakota as a nonessential experimental population. Similarly, black-footed ferrets are being considered for reintroduction to TBNG in Wyoming. There are approximately 15,000 acres of a prairie dog complex within the potential reintroduction area, known as the Rosecrans Site (Byer and Luce no date), but only 5,502 acres of that complex on TBNG have been managed to exclude poisoning with rodenticides and

recreational shooting (Byer and Luce no date). Elsewhere on TBNG prairie dogs continue to be subject to recreational shooting although control through poisoning has been temporarily halted on Forest Service lands.

As potential habitat for black-footed ferrets, black-tailed prairie dog colonies occur throughout the project area in South Dakota and Wyoming. Locations of prairie dog colonies coinciding with each alternative were obtained from diverse sources (Table 3-7) and some of those were mapped by WGFD during the late 1980's and are not current. The extent of potential black-footed ferret habitat with relatively high habitat function and value (active prairie dog colonies within large complexes not threatened by sylvatic plague, poisoning or recreational shooting) that would be affected by any alternative is unknown.

4.1.2.1 Alternative B (Proposed Action)

4.1.2.1.1 Construction Impacts

The only documented evidence of black-footed ferrets are a 1983 confirmed (Jobman and Anderson, 1991) sighting in the vicinity of Edgemont, South Dakota; a ferret skull found in Converse County, Wyoming in 1979; 2 confirmed sightings (1974 and 1981) in Campbell County and 1 confirmed sighting from Niobrara County (all within 16 miles of proposed route alternatives).

Alternative B would cross 4.9 miles of the proposed black-footed ferret reintroduction site, the Rosecrans Reintroduction Area, on TBNG. Construction impacts and long-term operational impacts to this area would likely make it unsuitable for reintroduction of the species.

4.1.2.1.2 Operational Impacts

If black-footed ferrets are found in the proposed project areas impacts could include deaths caused by train and increased vehicle traffic, fragmentation of habitat (prairie dog colonies), increased predator presence, spread of disease by predators and increased shooting of prairie dogs (Case 1978, Bennett 1991). Recreational shooting can reduce local prairie dog populations by 35 to 69 percent (Knowles 1988; Vosburgh and Irby 1998). Additionally, ferret mortality can occur by ingesting dead prairie dogs killed with rodenticides (Hillman 1968).

County weed and pest control agents provided locations of scattered prairie dog colonies along Alternatives B and C within all counties in South Dakota and Wyoming and indicated many have been treated by them or by landowners with poisoned grain during the past decade. Typically, prairie dog populations can recover from shooting in one year (B. Perry personal communication with PIC Technologies, Inc. 1999); while recovery following cessation of poisoning can take one to two years (Knowles 1986; Cincotta et al. 1987; Apa et al. 1990). Recovery of populations following plague, however, occurs much slower and some populations may never recover to pre-epizootic levels (Mulhern and Knowles 1995). Sylvatic plague is fatal to black-footed ferrets (Williams et al. 1994). Table 3-7 lists the miles of short- and long-term disturbances of prairie dog habitat.

4.1.2.2 Alternative C (Modified Proposed Action)

4.1.2.2.1 Construction Impacts

Construction of Alternative C would have similar impacts as Alternative B. The possibility that black-footed ferrets exist in the proposed project area is remote; however, if an extant population exists deaths could result from vehicles during construction.

4.1.2.2.2 Operational Impacts

Operational impacts include black-footed ferret deaths caused by train and increased vehicle traffic, fragmentation of habitat (prairie dog colonies), increased recreational shooting of prairie dogs, spread of disease and an increase in predators. Table 3-7 lists the miles of short- and long-term disturbances of prairie dog habitat.

4.1.2.3 Alternative C with the Phiney Flat Variation
Impacts for this alternative would be similar to Alternatives B and C.

4.1.2.4 Alternative C with the W G Flat Variation
Impacts for this alternative would be similar to Alternatives B and C.

4.1.2.5 Alternative D (Existing Transportation Corridors)
4.1.2.5.1 Construction Impacts
Construction of Alternative D would have similar impacts as Alternatives B and C. If an extant population exists deaths could result from vehicles during construction.

4.1.2.5.2 Operational Impacts
Black-footed ferrets could be impacted by increased vehicular and train traffic, fragmentation of prairie dog colonies, increased recreational shooting and the spread of disease by an increase in predators. Table 3-7 lists the miles of short- and long-term disturbances of prairie dog habitat.

4.2 PIPING PLOVER
4.2.1 Minneosta
This species does not occur in Minnesota; therefore, there would be no impacts.

4.2.2 South Dakota and Wyoming
4.2.2.1 Alternative B (Proposed Action)
4.2.2.1.1 Construction Impacts
Noise disturbance due to construction could affect nesting piping plovers, although most reports of plovers vacating nests have focused on humans approaching nests on foot rather than noise levels and vehicular frequencies associated with railroads or highways (Dinsmore 1983). Depending on where the work camps are located and the level of human activity in the project area more piping plovers may be affected.

Spills of petroleum products such as diesel fuels or lube oils during construction of the proposed project could affect aquatic invertebrates which piping plovers rely on for their food source. However, DM&E would store these substances (fuels and oil) away from drainages and a Spill Prevention Control and Countermeasure (SPCC) plan would be in place.

The presence of selenium and other trace elements in soils within the project area is unknown. If present in similar concentrations to those found in marine shales along the Missouri River (4.79-13.60 mg/kg dry weight) increased selenium loads in the Cheyenne River could occur following erosion and runoff from construction sites (Ruelle 1993). However, this is unlikely since DM&E would employ erosion and sedimentation control measures during construction activities to minimize impacts on water resources.

Bioaccumulation of selenium and possibly other trace elements could adversely affect piping plovers known to nest on the Cheyenne River downstream. Also, construction adjacent to the river may require riprap or more substantial structures to stabilize the riverbank that in turn could change river flow dynamics. Change in river flow could alter existing deposition and erosion regimes that created local mud, sand, or gravel bars that provide suitable nesting habitats. However, these areas could be lost and others created. Habitats currently overgrown could be scoured, making them again suitable for nesting. Many of the piping plovers found in the proposed project area have adapted to nesting at sandpits, which would be unaffected by changes in river flows.

Construction of Alternative B during spring and early summer along the corridor of the Cheyenne River could displace piping plovers from sandbars or islands within the river. However, water flows in the Cheyenne River during some years would inundate or scour sandbars and islands, making them unsuitable for nesting. If that were the case during construction, there would be no short-term impacts to piping plovers. In years with low water flows, construction activities prior to nesting may cause them to avoid the area. Since piping plovers appear to tolerate distant noise associated with highways and railroads, they may nest anyway, resulting in minimal impacts.

4.2.2.1.2 Operational Impacts

Long-term impacts to piping plovers may include noise and nest disturbance from increased human activity. Selenium concentrations in subbituminous coal from the Powder River Basin (0.73 ppm) are far below concentrations found in bituminous coals of the mid-west and Appalachian basins (range of 2.5 to 5.7 ppm) (Ensminger 1977). Thus, elevated selenium levels due to coal dust entering water or soils is unlikely.

Spills of petroleum products such as diesel fuels or lube oils during construction of the proposed project could affect aquatic invertebrates which piping plovers rely on for their food source. However, DM&E would store these substances (fuels and oil) away from drainages and a Spill Prevention Control and Countermeasure (SPCC) plan would be in place in case of spills.

4.2.2.2 Alternative C (Modified Proposed Action)

4.2.2.2.1 Construction Impacts

Construction of this alternative would have similar impacts as Alternative B. Nesting piping plovers could be disturbed by construction noise. Spills of petroleum products could affect aquatic invertebrates. However, DM&E would have SPCC plans in place in case of spills and would store toxic (fuels and oil) substances away from drainages.

DM&E would employ erosion and sedimentation control measures during construction activities to minimize impacts on water resources.

Bioaccumulation of selenium and possibly other trace elements could adversely affect piping plovers known to nest on the Cheyenne River downstream as well as potential nests within the project area. Construction occurring adjacent to the river may require riprap or other structures for stabilization that in turn could change the flow of the river.

Construction during spring and early summer along the Cheyenne River corridor could displace piping plovers if they select sandbars or islands within the river to nest. However, high water flows in the Cheyenne River during some years would destroy any potential nesting habitats. If that were the case during construction, there would be no short-term impacts to piping plovers.

4.2.2.2.2 Operational Impacts

Carrion along the track may result in an increase in predators that may lead to relatively high nest predation for nests in the vicinity of the rail line compared to those further removed (Reeve 1990, Hein & Andelt 1996). Additional impacts include noise and nest disturbance from increased human activity. Significant amounts of coal dust entering water or soils is unlikely.

4.2.2.3 Alternative C with the Phiney Flat Variation

Impacts for this alternative would be similar to Alternatives B and C.

4.2.2.4 Alternative C with the W G Flat Variation

Impacts for this alternative would be similar to Alternatives B and C.

4.2.2..5 Alternative D (Existing Transportation Corridors)
4.2.2.5.1 Construction Impacts
Nesting piping plovers could be disturbed by construction noise, although this alternative would have fewer impacts to nesting piping plovers than Alternatives B and C since it only crosses the Cheyenne River once. Spills of petroleum products during construction could affect aquatic invertebrates which piping plovers rely on for their food source. Since the alternative crosses the river only once, the opportunity for the possibility of a spill occurring is even more unlikely than for the other alternatives. However, DM&E has SPCC plans in place in case of spills and would store toxic (fuels and oil) substances away from drainages to reduce the potential for release into a waterway.

DM&E would employ erosion and sedimentation control measures during construction activities to minimize impacts on water resources due to possible selenium accumulation.

Construction of Alternative D during spring and early summer along the Cheyenne River corridor could displace the birds. However, Alternative D would cross the Cheyenne River only once, between the confluence of Spring Creek and Wasta, and would only affect nesting areas in proximity to this crossing. Due to this limited opportunity to affect potential nesting areas, Alternative D would not be expected to impact piping plovers.

4.2.2.5.2 Operational Impacts
The impact to piping plovers from nest predation would be less for this alternative than for Alternatives B and C. Elevated selenium levels due to coal dust entering water or soils is unlikely.

4.3 WHOOPING CRANE
4.3.1 Minnesota
This species does not occur in Minnesota; therefore, there would be no impacts.

4.3.2 South Dakota and Wyoming
No impacts to whooping cranes are anticipated since the only documentation of their occurrence within the proposed project area is infrequently during migrations.

4.4 INTERIOR LEAST TERN
4.4.1 Minnesota
Interior least terns are known to nest along the Missouri River and have been observed near DM&E's bridge crossing at Pierre, South Dakota and downstream at the Farm Island Recreation Area (SDNHDB 1998). In this area, approximately 4.8 miles of the existing railroad is within 500 feet of the Missouri River.

4.4.1.1 Construction Impacts
Nesting interior least terns appear tolerant of vehicular and railroad traffic, but abandon nests and colonies if directly disturbed by pedestrians, off-road vehicles, pets and livestock (Carreker 1985), or recreational activities (Kruse et al. 1993, Mayer 1993). Increased human activity during construction may impact nesting interior least terns.

Spills of petroleum products could affect fish which interior least terns rely on for their food source. However, DM&E would have SPCC plans in place in case of spills and would store toxic (fuels and oil) substances away from drainages.

Traditionally, wood treated with creosote used to inhibit wood-destroying fungi, has been the principal material for rail ties and bridge construction where small drainages were crossed. Coal tar creosote is

heavier than water and practically insoluble (Budavari et al. 1989). Phenols, which may be components of creosote, are highly toxic by ingestion, inhalation or skin absorption (Talmage 1977). Contamination of local water sources could occur if railroad ties or other similar products are stored near waterways which in turn could impact invertebrates that the birds feed upon.

4.4.1.2 Operational Impacts

There could be an increase in carrion along the track, which could draw more predators to the area. Ground nesting birds are extremely susceptible to predation.

4.4.2 South Dakota and Wyoming

4.4.2.1 Alternative B (Proposed Action)

4.4.2.1.1 Construction Impacts

Construction impacts are similar to those listed under Section 4.2.2.1.1 for the piping plover. Increased human activity during construction could impact nesting interior least terns. If selenium occurs in the soils, increased sediment loads in the Cheyenne River could occur following erosion and runoff from construction sites increasing selenium concentrations. However, this is unlikely since DM&E would employ erosion and sedimentation control measures during construction activities. Bioaccumulation of selenium could impact interior least terns known to nest downstream of erosion sites. Construction occurring adjacent to the river may require riprap or other structures for stabilization that in turn could change the flow of the river. Change in river flow could alter existing deposition and erosion regimes that created local mud, sand, or gravel bars that provide suitable nesting habitats. However, these areas could be lost and others created. Habitats currently overgrown could be scoured, making them again suitable for nesting.

Contamination of local water sources could occur if railroad ties or other similar products are stored near waterways and runoff from these storage areas is not properly contained.

Spills of petroleum products could contaminate adjacent waters. However, DM&E would have SPCC plans in place in case of spills and would store fuels and oil away from drainages.

Construction of this alternative during spring and early summer along the Cheyenne River corridor could displace interior least terns if they select sandbars or islands within the river to nest.

4.4.2.1.2 Operational Impacts

Operational impacts are similar to those listed for piping plovers under Section 4.2.2.1.2. An increase in predators may result from the increase in carrion along the track. Ground nesting birds, such as interior least terns, are extremely susceptible to nest predation.

Elevated selenium levels due to coal dust entering water or soils is unlikely since selenium concentrations in subbituminous coal from the Powder River Basin (0.73 ppm) are far below concentrations found in bituminous coals of the mid-west and Appalachian basins (range of 2.5 to 5.7 ppm) (Ensminger 1977). Thus, elevated selenium levels due to coal dust contamination of water or soils is unlikely.

4.4.2.2 Alternative C (Modified Proposed Action)

4.4.2.2.1 Construction Impacts

Construction impacts are similar to those listed under Alternative B. Increased human activity during construction may impact nesting interior least terns. Birds are known to abandon nests and colonies if directly disturbed by pedestrians, off-road vehicles and pets (Kruse et al. 1993, Mayer 1993).

DM&E would employ erosion and sedimentation control measures during construction activities to avoid possible increased loads of selenium in the Cheyenne River. Bioaccumulation of selenium and possibly

other trace elements could adversely affect interior least terns known to nest on the Cheyenne River downstream as well as potential nests within the project area. Therefore, construction adjacent to the river may require riprap or more substantial structures to stabilize the riverbank that could change river flow dynamics. The change in river flow could alter existing deposition and erosion regimes that created local mud, sand, or gravel bars that might serve as suitable nesting habitats. However, many of the piping plovers found in the proposed project area have adapted to nesting at sandpits which would be unaffected by changes in river flows.

There is a remote possibility of spills of petroleum products occurring that could affect fish that interior least terns eat. However, DM&E would have SPCC plans in place in case of spills and would store toxic (fuels and oil) substances away from drainages.

Interior least terns could be displaced during construction along the Cheyenne River.

4.4.2.2.2 Operational Impacts
Once the rail line is operational there could be an increase in predators that could impact interior least terns.

Selenium concentrations in subbituminous coal from the Powder River Basin (0.73 ppm) are far below concentrations found in bituminous coals of the mid-west and Appalachian basins (range of 2.5 to 5.7 ppm) (Ensminger 1977). Thus, elevated selenium levels due to coal dust entering water or soils is unlikely.

4.4.2.3 Alternative C with the Phiney Flat Variation
Impacts for this alternative would be similar to Alternatives B and C.

4.4.2.4 Alternative C with the W G Flat Variation
Impacts for this alternative would be similar to Alternatives B and C.

4.4.2.5 Alternative D (Existing Transportation Corridors)
4.4.2.5.1 Construction Impacts
Construction impacts are similar to those listed under section 4.2.2.1.1 for the piping plover. Increased human activity during construction may impact nesting interior least terns.

If selenium occurs in the soils, increased loads in the Cheyenne River could occur following erosion and runoff from construction sites. However, this is unlikely since DM&E would employ erosion and sedimentation control measures during construction activities. Additionally, this alternative crosses the Cheyenne River only once therefore there should be fewer impacts due to construction along the river.

Spills of petroleum products could affect fish which interior least terns rely on for their food source. However, DM&E would have SPCC plans in place in case of spills and would store toxic (fuels and oil) substances away from drainages.

Interior least terns could be displaced during construction. However, Alternative D would cross the Cheyenne River once, between the confluence of Spring Creek and Wasta and be within 0.5 mile of the river for only 8 miles in Pennington County, approximately half the distance of any other alternative.

4.4.2.5.2 Operational Impacts
Once the rail line is operational there may be an increase in predators. Local concentrations of predators could impact ground-nesting birds (Baker et al. 1999), including interior least terns that are in close proximity to the rail line.

Selenium concentrations in subbituminous coal from the Powder River Basin (0.73 ppm) are far below concentrations found in bituminous coals of the mid-west and Appalachian basins (range of 2.5 to 5.7 ppm) (Ensminger 1977). Thus, elevated selenium levels due to coal dust entering water or soils is unlikely.

4.5 TOPEKA SHINER

4.5.1 Minnesota

The existing railroad crosses streams known to be or potentially inhabited by Topeka shiners at 12 sites in Minnesota (Table 4-1). The railroad is within 500 feet of those streams for approximately 5.2 miles. Those crossing sites and areas within 500 feet of streams are most likely to be at risk of increased sedimentation during construction and operation. Sedimentation could adversely affect water and substrate quality since Topeka shiners inhabit cool, low order prairie streams with good water quality and mostly with silt-free substrates of gravel, cobble, and sand.

4.5.1.1 Construction Impacts

Topeka shiners downstream from the project area could be adversely affected if petroleum products were accidentally discharged into aquatic environments. Such materials are toxic to algae, invertebrates, and fish. However, DM&E would have SPCC plans in place in case of spills and would store these substances away from drainages. Short-term impacts could occur during construction with increased sedimentation due to runoff from cut-and-fill activities, placement of bridges and culverts in drainages, and erosion from the disturbed construction right-of-way.

4.5.1.2 Operational Impacts

During operation, short- or long-term impacts could occur downstream if there were derailments and accidental releases of diesel fuels and other petroleum products. However, this is unlikely because of increased safety of the rail line. Impacts would be most likely if derailments or accidental releases are within 500 feet of surface waters where there may be insufficient riparian vegetation to prevent flows from entering drainages.

4.5.2 South Dakota and Wyoming

The existing railroad crosses streams known to be or potentially inhabited by Topeka shiners at 41 sites in South Dakota (Table 4-1). The railroad is within 500 feet of those streams for approximately 13.2 miles. Those crossing sites and areas within 500 feet of streams are most likely to be at risk of increased sedimentation during construction and operation. Sedimentation could adversely affect water and substrate quality since Topeka shiners inhabit cool, low order prairie streams with good water quality and mostly with silt-free substrates of gravel, cobble, and sand.

4.5.2.1 Construction Impacts

Construction impacts would be similar to those listed for Minnesota.

4.5.2.2 Operational Impacts

Operational impacts would be similar to those listed for Minnesota.

Table 4-1
Topeka Shiner Streams by DM&E's Existing Rail Line

State	County	Existing Railroad Crossings and Paralleling Streams inhabited by Topeka Shiners	
		Number of Stream Crossings	Distance of ROW within 500 feet of Streams (miles)
Minnesota	Lincoln	12	5.2
South Dakota	Brookings	24	8.6
	Kingsbury	5	1.5
	Beadle	8	2.2
	Hand	4	0.9
Total:		53	18.4

4.6 PALLID STURGEON

4.6.1 Minnesota

This species does not occur in Minnesota; therefore, there would be no impacts.

4.6.2 South Dakota and Wyoming

From 1967 to 1989 there have been records of pallid sturgeon in the Missouri River between DM&E's existing bridge crossing at Pierre, South Dakota downstream to the Medicine Knoll Creek confluence and where the existing railroad parallels the Missouri River. In this portion of the existing railroad, there are approximately 4.8 miles where the tracks are within 500 feet of the Missouri River.

Rebuilding the existing railroad is not likely to contribute to further degradation of riverine habitats inhabited by pallid sturgeons. Sturgeons are adapted to turbid waters, possibly depending on turbidity as cover from predators and feeding on fish species likewise adapted to turbid water. Consequently, any increases in sedimentation in the Missouri River due to construction and operation of the rebuild project, such as rehabilitation of the existing or construction of a new rail bridge over the river, is not likely to pose a hazard to pallid sturgeon in the river. Pallid sturgeon inhabiting the Missouri River in the project area or downstream could be adversely affected if petroleum products were accidentally discharged into aquatic environments.

4.6.2.1 Alternatives

Since suitable habitat does not exist in the vicinity of the alternatives paralleling the Cheyenne River there would be no impacts.

4.7 AMERICAN BURYING BEETLE

4.7.1 Minnesota

This species does not occur in Minnesota; therefore, there would be no impacts.

4.7.2 South Dakota and Wyoming

Potentially suitable habitat is crossed by the existing railroad from Brookings County in eastern South Dakota to Pennington County, South Dakota in the west and includes cropland, pastures, grassland (herbaceous rangeland) and deciduous forestlands. The American burying beetle may occur wherever suitable habitat is present. Nearly 460 miles of existing railroad cross these land cover types in South Dakota. However, farmed cropland would probably not be suitable habitat due to frequent disturbances and pesticide use. Additionally, the right-of-way would provide only limited habitat for carrion species and American burying beetle's presence within the ROW would be incidental if they even occurred within the project area. Impact projections are impossible because of inadequate information about the beetles' distribution in the vicinity of the existing rail line. Adequate litter could have developed along

DM&E's right-of-way where limited or no maintenance work has occurred. Consequently, there could be adequate litter developed in which beetles could bury carrion.

Estimates of potential habitats affected can be made, based on general habitat and soils types where suitable soils are assumed to include sandy soils (those with high wind erosion potential) and prime farmland soils (those with relatively well-developed topsoils). These soils are considered sensitive to impacts by any of the alternatives. Other soils in the project area that might be inhabited by American burying beetles include those with silt loam, loam and sandy loam textures.

4.7.2.1 Alternative B (Proposed Action)

4.7.2.1.1 Construction Impacts

American burying beetle habitat within the right-of-way may be disturbed or lost during construction and operation of the rail line. More likely are impacts due to construction such as removal and compaction of soils, but only if beetles are present within construction rights-of-way. Once the ballast is laid and the earth compacted in the right-of-way it is unlikely these areas would be suitable habitat for the beetle.

Though not documented in the vicinity of Alternative B in South Dakota, American burying beetles could occur in suitable soils. Suitable soils include those with high sand content (soils with high wind erosion potential) and those with relatively well developed topsoil. Soils in both groups are sensitive to impacts by Alternative B. Given the recent collections of American burying beetles in southern South Dakota in riparian areas, grasslands, and grasslands with interspersed stands of cottonwoods (Backlund and Marrone, 1997), Alternative B could affect similar potentially suitable habitats along the route in South Dakota. Over 3 miles (approximately 73 acres within ROW) of forested (cottonwood riparian) wetlands and 113 miles (approximately 2739 acres within ROW) of herbaceous rangeland would be affected. Also, this alternative would pass through 20.5 miles (approximately 497 acres within ROW) of cropland and pasture that could also serve as suitable habitats.

Potential habitat that may be disturbed by construction of Alternative B is provided in Table 4-7. Construction disturbance would probably contribute short- and long-term impacts to American burying beetles if the beetles are actually present. There are approximately 33 miles (approximately 800 acres within the ROW) in South Dakota where Alternative B would pass through soils and habitats that might be used by American burying beetles for burying carrion and reproduction. The majority of those soils, 26 miles (approximately 630 acres within the ROW), are potentially prime farmland soils but it is unknown whether all or some are irrigated and/or cultivated. It is assumed that irrigation and/or cropland would make a site unsuitable for American burying beetles due to frequent disturbances.

Impacts due to artificial lights, which are known to attract and disorient many species of nocturnal insects, could occur if construction takes place at night.

Table 4-7
Potential American Burying Beetle Habitat along Alternative B

County State	Suitable Soil Type	Distance (miles) of potential habitat crossed				
		Cropland Pasture	Herbaceous Rangeland	Forested Wetland	Deciduous Forest	County Total
Pennington SD	Sandy, Erosive	0	0.06	0	0	0.06
	Prime Farmland	0.99	1.36	0	0	2.35
Custer SD	Sandy, Erosive	0	1.12	0.47	0	1.59
	Prime Farmland	1.02	2.86	0.74	0	4.62
Fall River SD	Sandy, Erosive	0.60	5.07	0.26	0	5.93
	Prime Farmland	7.62	10.66	0.53	0	18.81
Alternative B Total:		10.23	21.13	02.00	0	33.36

4.7.2.1.2 Operational Impacts

Impacts due to artificial lights in staging areas could occur. Other operational impacts are expected to be minimal since once the rail line is operational, soils within the right-of-way would be compacted and unsuitable for the American burying beetles.

4.7.2.2 Alternative C (Modified Proposed Action)

4.7.2.2.1 Construction Impacts

Impacts would be similar to those for Alternative B. Table 4-8 lists potential American burying beetle habitat along Alternative C. There are approximately 35 miles (approximately 849 acres within the ROW) in South Dakota where Alternative C would pass through suitable soils in potential habitats that might be used by American burying beetles, 2 miles more than Alternative B. Nearly 27 miles (approximately 655 acres of the ROW) of Alternative C passes through soils with characteristics of prime farmland, but whether all or some are irrigated and/or cultivated is unknown.

Habitat of the American burying beetle may be disturbed and/or lost. Removal and compaction of soils during construction could also impact the beetles, but only if they are present within construction rights-of-way. Impacts due to artificial lights, which are known to attract and disorient many species of nocturnal insects, could occur if construction takes place at night.

Table 4-8
Potential American Burying Beetle Habitat along Alternative C

County State	Suitable Soil Type	Distance (miles) of potential habitat crossed				
		Cropland Pasture	Herbaceous Rangeland	Forested Wetland	Deciduous Forest	County Total
Pennington SD	Sandy, Erosive	0	0.84	0	0.20	1.04
	Prime Farmland	0.99	1.90	0	0	2.89
Custer SD	Sandy, Erosive	0	0	0	0	0
	Prime Farmland	2.95	1.13	0	0	4.08
Fall River SD	Sandy, Erosive	1.28	6.36	0.12	0	7.76
	Prime Farmland	5.79	13.13	0.73	0	19.65
Alternative C Total		11.01	23.36	0.85	0.20	35.42

4.7.2.2.2 Operational Impacts

Operational impacts would be similar to Alternative B.

4.7.2.3 Alternative C with the Phiney Flat Variation

4.7.2.3.1 Construction Impacts

Impacts for this alternative would be similar to Alternatives B and C. Overall disturbances by this alternative are over 3 miles more than disturbances by Alternative B and about 0.5 mile more than Alternative C. American burying beetles could occur in suitable soils along the Phiney Flat Variation. The amount of disturbances by the Phiney Flat Route Variation in these soils and potentially suitable habitats are provided in Table 4-9.

Table 4-9
Potential American Burying Beetle Habitat along Alternative C with the Phiney Flat Alternative

County State	Suitable Soil Type	Distance (miles) of potential habitat crossed				
		Cropland Pasture	Herbaceous Rangeland	Forested Wetland	Deciduous Forest	County Total
Pennington SD	Sandy, Erosive	0	0.84	0	0.46	1.30
	Prime Farmland	0.99	1.90	0	0	2.89
Custer SD	Sandy, Erosive	0	0	0	0	0
	Prime Farmland	4.05	1.37	0	0	5.42

Table 4-9
Potential American Burying Beetle Habitat along Alternative C with the Phiney Flat Alternative

County State	Suitable Soil Type	Distance (miles) of potential habitat crossed				
		Cropland Pasture	Herbaceous Rangeland	Forested Wetland	Deciduous Forest	County Total
Fall River SD	Sandy, Erosive	1.28	5.08	0.12	0	6.48
	Prime Farmland	5.79	13.41	0.73	0	19.93
Alternative C with the Phiney Flat Alternative Total:		12.11	22.60	0.85	0.46	36.02

4.7.2.3.2 Operational Impacts
Impacts would be similar to Alternatives B and C.

4.7.2.4 Alternative C with the W G Flat Variation
4.7.2.4.1 Construction Impacts
Impacts for this alternative are similar to Alternatives B and C. American burying beetles could occur in suitable soils and potentially suitable habitats along the W G Flat Variation in South Dakota. Those potentially affected areas are provided in Table 4-10. Overall disturbances by the W G Flat Route Variation to suitable soils and potential habitats used by American burying beetles is over 3 miles more than disturbances by Alternative B, about 1.4 miles more than Alternative C and 0.8 miles more than the Phiney Flat Variation.

Table 4-10
Potential American Burying Beetle Habitat along Alternative C with the W G Flat Alternative

County State	Suitable Soil Type	Distance (miles) of potential habitat crossed				
		Cropland Pasture	Herbaceous Rangeland	Forested Wetland	Deciduous Forest	County Total
Pennington SD	Sandy, Erosive	0	0.84	0	0.46	1.30
	Prime Farmland	0.99	1.90	0	0	2.89
Custer SD	Sandy, Erosive	0	0	0	0	0
	Prime Farmland	3.38	1.21	0	0	4.59
Fall River SD	Sandy, Erosive	2.10	6.06	0.12	0	8.28
	Prime Farmland	7.65	11.38	0.73	0	19.76
Alternative C with the W G Flat Alternative Total:		14.12	21.39	0.85	0.46	36.82

4.7.2.4.2 Operational Impacts
Operational impacts for this alternative would be similar to Alternatives B and C.

4.7.2.5 Alternative D (Existing Transportation Corridors)
4.7.2.5.1 Construction Impacts
Construction of this alternative would have similar impacts as Alternatives B and C. However, this alternative passes through more miles of American burying beetle potential habitat. Habitat of the beetle may be disturbed and/or lost. Removal and compaction of soils during construction could also impact the beetles, but only if they are present within construction rights-of-way. Additionally, impacts due to artificial lights, which are known to attract and disorient many species of nocturnal insects, could occur if construction takes place at night and if the beetle is found to occur in the proposed project area.

There are approximately 42 miles (approximately 1018 acres within the ROW) in South Dakota where Alternative D would pass through suitable soils in potential habitats that might be used by American burying beetles, 8 miles more than Alternative B and between 5 and 6 miles more than Alternative C or either of the variations. Over 34 miles (approximately 824 acres within the ROW) of Alternative D

passes through soils with characteristics to be prime farmlands, but whether all or some are irrigated and/or cultivated is unknown (Table 4-11).

Table 4-11
Potential American Burying Beetle Habitat along Alternative D

County State	Suitable Soil Type	Distance (miles) of potential habitat crossed				
		Cropland Pasture	Herbaceous Rangeland	Forested Wetland	Deciduous Forest	County Total
Pennington SD	Sandy, Erosive	0.08	0	0	0	0.08
	Prime Farmland	4.06	0.99	0	0	5.05
Custer SD	Sandy, Erosive	0	0	0	0	0
	Prime Farmland	2.06	5.00	0	0	7.06
Fall River SD	Sandy, Erosive	0.97	6.06	0.12	0	7.15
	Prime Farmland	7.96	13.63	0.73	0	22.32
Alternative D Total:		15.13	25.68	0.85	0	41.66

4.7.2.5.2 Operational Impacts
Operational impacts are similar to Alternatives B and C.

4.8 MINNESOTA DWARF TROUT LILY
4.8.1 Minnesota
Minnesota dwarf trout lily occurs in woodland habitats adjoining floodplains in Steele, Rice and Goodhue counties in Minnesota. Construction would occur in Steele County; however the area of proposed construction is approximately 15 miles south of where the lily is found east of Faribault, Minnesota. The MNHDB has no record of the lily occurring in the proposed project area. Suitable habitat does not occur in the proposed project area; therefore, no impacts to the Minnesota dwarf trout lily are expected.

4.8.2 South Dakota and Wyoming
This species does not occur in South Dakota or Wyoming; therefore, there would be no impacts.

4.9 HIGGIN'S EYE PEARLY MUSSEL
4.9.1 Minnesota
The MNHDB (1998) provided reports of mussel surveys conducted in the Mississippi River during 1990 (Burlington Northern Railroad bridge crossing) and 1995 (Lock and Dam 6 tailwaters) in Winona County; in the South Fork of the Zumbro River during 1988 in the vicinity of Rochester, Olmsted County; in the Straight River (tributary to the Cannon River) during 1987 in the vicinity of Owatonna, Steele County; and in the Minnesota River during 1989 in Brown, Nicollet and Blue Earth counties between New Ulm and Mankato. These mussel survey sites were within 1-2 miles of the existing railroad. While several mussel species that are listed as state endangered and threatened in Minnesota were found during those surveys, no Higgin's eye pearly mussels were found. If the species is present, sedimentation of inhabited waters could adversely affect it. Accidental release of petroleum products could also adversely affect the species. Given the known limits of the species' distribution and local survey efforts, it is unlikely to be present in the project area and vicinity. Therefore, the species is not expected to be impacted by this project.

4.9.2 South Dakota and Wyoming
This species does not occur in South Dakota and Wyoming; therefore, there would be no impacts.

4.10 WINGED MAPLELEAF MUSSEL

4.10.1 Minnesota

No impacts to the winged mapleleaf mussel are anticipated as a result of any part of this project since the only extant population of this species occurs below the St. Croix Falls dam on the St. Croix River, Wisconsin, 125 miles upstream from Winona, Minnesota.

4.10.2 South Dakota and Wyoming

This species does not occur in South Dakota and Wyoming; therefore, there would be no impacts.

4.11 KARNER BLUE BUTTERFLY

4.11.1 Minnesota

Portions of the existing rail line are within 1 mile of potential Karner blue habitat, mesic oak savannah (MNHDB 1998). However, none of the MNHDB site description records for mesic oak savannah or any other unique vegetation associations near the rail line include *Lupinus perennis*, or any other lupine species. No impacts to the Karner blue butterfly are anticipated as a result of any part of this project. Additionally, DM&E's existing line in Minnesota was surveyed by the MCBS in 1998. Wild lupine was not found at that time.

4.11.2 South Dakota and Wyoming

This species does not occur in South Dakota and Wyoming; therefore, there would be no impacts.

4.12 UTE LADIES'-TRESSES ORCHID

4.12.1 Minnesota

This species does not occur in Minnesota; therefore, there would be no impacts.

4.12.2 South Dakota and Wyoming

4.12.2.1 Alternative B (Proposed Action)

Two sites along Alternative B were identified during surveys in 1998 that have been determined potential habitat for Ute ladies'-tresses; one site in Wyoming (Lodgepole Creek) and one site in South Dakota (Dry Creek). One other site in South Dakota (Plum Creek) and three in Wyoming (East Fork Coal Creek, Dry Creek, and Caballo Creek) could not be evaluated because access was denied. In Wyoming, Alternative B would cross a total of 0.12 mile (approximately 3 acres of the ROW) of wet meadows, palustrine emergent wetland temporarily and seasonally flooded, that could be potential habitat for the orchid. The route in South Dakota would cross 0.78 mile (approximately 18 acres of the ROW) of the same wetland type.

4.12.2.1.1 Construction Impacts

Direct impacts to this species would most likely occur during construction if machinery and surface disturbances obliterated local populations. Additionally, Ute ladies'-tresses orchid could be impacted with the introduction of noxious weeds or exotics resulting from revegetation, borrow material and/or railroad ties.

4.12.2.1.2 Operational Impacts

Direct impacts could occur from maintenance of DM&E's rights-of-way if herbicide spraying is required or if noxious weeds are introduced.

4.12.3.1 Alternative C (Modified Proposed Action)

Four sites along Alternative C were identified during surveys in 1998 that have been determined potential habitat for Ute ladies'-tresses; two sites in Wyoming (Lodgepole Creek and School Creek) and two sites in South Dakota (Hay Canyon South and Dry Creek). Two other sites in South Dakota (French Creek and Plum Creek) and three in Wyoming (East Fork Coal Creek, Belle Fourche River, and Caballo Creek)

could not be evaluated because access to the proposed right-of-way was denied. In Wyoming, Alternative C would cross a total of 0.16 mile (approximately 4 acres of the ROW) of wet meadows, palustrine emergent wetland temporarily and seasonally flooded, that could be potential habitat for the orchid. The route in South Dakota would cross 0.70 mile (approximately 17 acres of the ROW) of the same wetland type.

4.12.3.1.1 Construction Impacts
Construction of this alternative would have similar impacts as Alternative B. Machinery and surface disturbances during construction could kill existing populations. Additional impacts include the introduction of noxious weeds from revegetation and borrow material. Individuals of Ute ladies'-tresses inhabiting the construction right-of-way would be eliminated, both for the short- and long-term.

4.12.3.1.2 Operational Impacts
Operational impacts would be similar to Alternative B.

4.12.4.1 Alternative C with the Phiney Flat Variation
Two sites along Alternative C with the Phiney Flat Route Variation in South Dakota were identified during surveys in 1998 that have been determined potential habitat for Ute ladies'-tresses. Those sites are Hay Canyon South and Dry Creek. In South Dakota, the Phiney Flat Route Variation would cross a total of 0.8 mile (approximately 19 acres of ROW) of wet meadows, palustrine emergent wetland temporarily and seasonally flooded, that could be potential habitat for the orchid. The route in Wyoming would cross 0.16 mile (approximately 4 acres of ROW) of the same wetland type; the same amount affected as Alternative C, above.

4.12.4.1.1 Construction Impacts
Construction of this alternative would have similar impacts as Alternatives B and C.

4.12.4.1.2 Operational Impacts
Operational impacts would be similar to Alternatives B and C.

4.12.5.1 Alternative C with the W G Flat Variation
One site along Alternative C with the W G Flat Variation in South Dakota was identified during surveys in 1998 that has been determined as potential habitat for Ute ladies'-tresses. That site is at Dry Creek. In South Dakota, the W G Flat Variation would cross a total of 0.57 mile (approximately 14 acres of ROW) of wet meadows, palustrine emergent wetland temporarily and seasonally flooded, that could be potential habitat for the orchid. This alternative in Wyoming would cross 0.16 mile (approximately 4 acres of ROW) of that wetland type; the same amount affected as Alternative C, above.

4.12.5.1.1 Construction Impacts
Construction of this alternative would have similar impacts as Alternatives B and C.

4.12.5.1.2 Operational Impacts
Operational impacts would be similar to Alternatives B and C.

4.12.6.1 Alternative D (Existing Transportation Corridors)
One site along Alternative D was identified during surveys in 1998 that has been determined potential habitat for Ute ladies'-tresses. That site is in South Dakota where Alternative D and Alternative C coincide and cross Dry Creek. One other site in South Dakota (Plum Creek) and three in Wyoming (East Fork Coal Creek, Belle Fourche River, and Caballo Creek) could not be evaluated because access to the proposed right-of-way was denied. In South Dakota, Alternative D would cross a total of 0.27 mile (approximately 6.5 acres of ROW) of wet meadows, palustrine emergent wetland temporarily and

seasonally flooded, that could be potential habitat for the orchid. The route in Wyoming would cross 0.81 mile (approximately 20 acres of ROW) of that wetland type, more than affected by Alternative B and Alternative C, above. In both states, most wet meadows impacted by the alternative are on private lands.

4.12.6.1.1 Construction Impacts

Construction of this alternative would have similar impacts as Alternatives B and C. However, there are fewer potential habitat locations for Ute ladies'-tresses along Alternative D. Direct impacts to this species would most likely occur during construction if machinery and surface disturbances obliterated local populations. Additionally Ute ladies'-tresses orchid could be impacted with the introduction of noxious weeds or exotics resulting from revegetation, borrow material and/or railroad ties.

4.12.6.1.2 Operational Impacts

Operational impacts would be similar to Alternatives B and C.

4.13 PRAIRIE BUSH-CLOVER

4.13.1 Minnesota

4.13.1.1 Construction Impacts

A 1998 inventory conducted by the MCBS did not record the presence of prairie bush-clover along DM&E's existing right-of-way. However, the plant has been recorded within one mile of the proposed project area in Brown and Dodge counties (MNHDB 1998). Direct impacts to this species would most likely occur during construction if machinery and surface disturbances destroyed local populations, but only if the plant is present within construction rights-of-way. Table 4-12 is a summary of data collected by the Minnesota County Biological Survey along DM&E's existing right-of-way that could be potential habitat for the species. If the plant was found along the right-of-way it could be impacted with the introduction of noxious weeds or exotics resulting from revegetation, borrow material and/or railroad ties.

4.13.1.2 Operational Impacts

Operational impacts include the spraying of herbicides and grass fires along DM&E's rights-of-way. However, fire appears to promote the regeneration of native plants including prairie bush-clover.

Table 4-12
Minnesota County Biological Survey Data on Native Prairies within DM&E's Right-of-Way

County	Total miles of Prairie in ROW	Number of Prairie Remnants	Number of Prairie Types and Range of Prairie Quality [1] as Potential Habitat			
			Dry Prairies	Prairie Quality Range	Mesic Prairies	Prairie Quality Range
Olmsted	3.2	10	0	--	10	8-Fair 1-Good 1-Very Good
Dodge	0.9	4	0	--	4	4-Fair
Steele	1.7	3	0	--	3	2-Fair 1-Good
Waseca	3.2	16	0	--	14	4-Fair 10-Good
Blue Earth	0.9	3	1	1-Good	0	--
Brown	8.8	8	0	--	8	2-Fair 3-Good 3-Very Good
Redwood	3.0	5	0	--	5	2-Fair 2-Good 1-Very Good

Table 4-12
Minnesota County Biological Survey Data on Native Prairies within DM&E's Right-of-Way

County	Total miles of Prairie in ROW	Number of Prairie Remnants	Number of Prairie Types and Range of Prairie Quality [1] as Potential Habitat			
			Dry Prairies	Prairie Quality Range	Mesic Prairies	Prairie Quality Range
Lyon	4.3	10	0	--	10	4-Fair 4-Good 2-Very Good
Lincoln	5.5	6	1	1-Good	3	3-Fair

[1] – Prairie Quality Rating Guidelines (MCBS 1999)
Very Good: > 70% native grass cover, > 15 native wildflower species, < 10% native trees and shrubs, < 10% disturbance Indicators
Good: > 55% native grass cover, > 10 native wildflower species, < 25% native trees and shrubs, < 25% disturbance Indicators
Fair: > 25% native grass cover, > 6 native wildflower species, < 50% native trees and shrubs, < 50 % disturbance Indicators

4.13.2 South Dakota and Wyoming
This species does not occur in South Dakota and Wyoming; therefore, there would be no impacts.

4.14 LEEDY'S ROSEROOT
4.14.1 Minnesota
The plant is restricted to limestone cliffs that lead to underground caves. There is no documentation of the plant occurring in the proposed project area; therefore no impacts to the plant or its habitat are anticipated.

4.14.2 South Dakota and Wyoming
This species does not occur in South Dakota and Wyoming; therefore, there would be no impacts.

4.15 WESTERN PRAIRIE FRINGED ORCHID
4.15.1 Minnesota
The orchid was previously recorded from Dodge and Nicollet counties in Minnesota, although no records of the western prairie fringed orchid have been reported within 1.0 mile of the existing DM&E railroad (MNHDB 1998). Additionally, a survey by the MCBS in 1998 along the existing DM&E rail line did not result in occurrences of the orchid. However, MCBS did delineate remnants of wet prairies, potential habitat for the western prairie fringed orchid, within DM&E's existing right-of-way. Two remnant wet prairies were identified in each of the counties of Lincoln, Blue Earth, and Waseca. While there may be potential habitats, in addition to native wet prairies, within the existing right-of-way (the orchid also occurs in borrow areas, abandoned fields, and along roadways), the availability of potential habitat suitable for western prairie fringed orchids appears limited. (The species has not been recorded in the proposed project area). No impacts to the plant or its habitat are anticipated.

4.15.2 South Dakota and Wyoming
This species does not occur in South Dakota and Wyoming; therefore, there would be no impacts.

4.16 BALD EAGLE
4.16.1 Minnesota
Bald eagles may winter along the Minnesota River within the rebuild portion of the proposed project area. Although most breeding records for bald eagles are distributed in the northeastern and northcentral portion of Minnesota, 2 nests have been documented in the project vicinity. One nest was recorded from the Minnesota River floodplain, 1.7 miles from DM&E's existing rail line, north of Mankato, Blue Earth

County, and the other on the Mississippi River floodplain 1.1 miles from the exiting rail line near Winona, Minnesota (MNHDB 1998).

4.16.1.1 Construction Impacts

Since bald eagles tend to avoid human activities during all times of the year, construction activities can temporarily displace eagles during their migration, wintering, and nesting periods. Typically, the recommended spatial buffers for endangered and threatened species are 1.0 miles. Spatial buffer zones recommended for raptor nesting protection are also encouraged for activities occurring proximal to raptor winter concentration areas from November through March. The USFWS recommends maintaining a spatial buffer equal to one-half of the recommended buffers for nests unless site-specific topography or vegetation allow for smaller buffers. Daily activities, which must occur within, recommended spatial buffers at winter night roost sites should be scheduled after 0900 hours, after which most raptors have vacated their roost. Likewise, daily activities should terminate at least one hour prior to official sunset to allow birds an opportunity to return to the roost site undisturbed.

Approximately, 28 miles of the existing railroad passes within 0.5-mile of potential bald eagle winter habitats in Minnesota (Table 4-13). Short-term construction disturbances, such as noise and increased human activity, could affect wintering bald eagles. Approximately 31 miles of existing rail line would be within 1.0 mile of potential habitats in Minnesota (Table 4-13). Potential bald eagle nesting habitats also occur within both 0.5 and 1.0 mile of the existing rail line where there are cottonwood riparian woodlands. Though the only known bald eagles nests in the project vicinity are more than 1.0 mile from the existing railroad, more may nest closer in the future as nesting populations expand their range. Future nests would not likely be impacted by the project as nesting pairs would be exposed to train activity on a regular basis, including prior to nesting. They would be expected to be tolerant of train disturbance during subsequent nesting.

Disturbances to eagles when they are migrating would probably not displace them from habitats that are key to their survival since during this time they are generally moving between habitats.

Table 4-13
Potential Bald Eagle Winter Habitats Along Existing Railroad ROW.

Location	ROW within 0.5 mile of Potential Habitat (miles)	ROW within 1.0 mile of Potential Habitat (miles)
Minnesota River – Blue Earth County	20.2	22.1
Minnesota River – Brown County	7.4	9.3
Missouri River – Hughes County	14.0	17.1
Missouri River – Stanley County	2.5	3.1
Bad River – Stanley County	14.5	16.1
Existing Railroad Total:	58.6	67.7

4.16.1.2 Operational Impacts

Bald eagles may be displaced from feeding sites, perch sites, and/or nocturnal communal winter roosts and nest sites due to noise and human activity along the right-of-way during operation of the train. Eagle mortalities could occur if bald eagles were drawn to the rail line to feed upon carrion left on the tracks.

4.16.2 South Dakota and Wyoming

Approximately, 31 miles of the existing railroad passes within 0.5-mile of potential bald eagle winter habitats in South Dakota. Short-term construction disturbances, such as noise and increased human activity, could affect wintering bald eagles. Approximately 36 miles of existing rail line would be within 1.0 mile of potential habitats in Minnesota.

4.16.2.1 Alternative B (Proposed Action)

4.16.2.1.1 Construction Impacts

Potential impacts to wintering bald eagles would be from human activity associated with project construction, operation, or maintenance. Approximately 82 miles and 126 miles of Alternative B would be within 0.5 and 1.0 miles, respectively, of potential bald eagle wintering habitat. Construction of this alternative during winter within the TBNG and along the corridor of the Cheyenne River in South Dakota and its major tributaries in Wyoming (Black Thunder Creek, Little Thunder Creek and Antelope Creek) is likely to displace wintering bald eagles from perches and feeding areas or make those sites temporarily unsuitable. Sites within at least a 0.5-mile up to a 1-mile zone of the Cheyenne River and major tributaries that could be affected are provided in Table 4-14. No bald eagle nests occur within 1.0 mile of this alternative. Noise from blasting and the operation of heavy earthmoving equipment and other activities associated with construction and preparation of the rail bed could potentially disturb bald eagles. Some trees suitable as bald eagle winter roost sites or future nesting sites could be removed during construction. However, winter construction would generally be scattered throughout the project area and limited to the immediate area of culvert and bridge installations. This would limit the potential to disturb wintering eagles to those sites where construction was actually occurring. While some roost sites may be disturbed, others would not, providing areas for eagles to roost undisturbed.

Since wintering bald eagles in some areas feed on big game carrion, they sometimes suffer direct mortalities when struck by vehicles while feeding at roadsides. It is unlikely that slow moving construction vehicles would inadvertently kill eagles feeding on carcasses. However, personal vehicles driven to and from construction sites would increase traffic on local roads. Increased traffic could lead to increased big game road kills and increased risk of mortality to eagles feeding along the roadways.

4.16.2.1.2 Operational Impacts

Alternative B would be within 0.5 miles of potential bald eagle wintering habitat for approximately 82 miles in South Dakota and Wyoming (Table 4-14). Nearly 126 miles of the right-of-way is within 1.0 mile of potential wintering habitat. Disturbances to wintering bald eagles could occur along 82 to 126 miles of Alternative B during project operation because of train noise and increased human activity. If roosts do not provide sufficient cover or buffer from this disturbance they would be abandoned. As eagles are exposed to train activity throughout the PRB, they are expected to have some level of tolerance to trains. Therefore, only minor impacts to roosting eagles would be expected during train operations.

Potential nesting habitat for bald eagles occurs throughout the project area. Although no nests are currently known, future nesting could occur as eagles expand their range and increase in number. Future nests would not likely be impacted by the project as nesting pairs would be exposed to train activity on a regular basis, including prior to nesting. They would be expected to be tolerant of train disturbance during subsequent nesting.

Table 4-14
Potential Bald Eagle Wintering Habitats Along Alternative B Right-of-Way

County State	ROW within 0.5 mile of Potential Habitat (miles)	ROW within 1.0 mile of Potential Habitat (miles)
Pennington SD	12.33	22.96
Custer SD	21.70	24.28
Fall River SD	17.23	28.32
Niobrara WY	4.29	7.08
Weston WY	14.17	24.90
Converse WY	6.43	9.52

Table 4-14 Potential Bald Eagle Wintering Habitats Along Alternative B Right-of-Way		
County State	**ROW within 0.5 mile of Potential Habitat (miles)**	**ROW within 1.0 mile of Potential Habitat (miles)**
Campbell WY	5.76	8.90
Alternative B TOTAL:	81.91	125.96

Train operations would likely lead to mortality of big game, resulting in carcasses along the rail line. Trains could kill bald eagles gorging themselves on these carcasses so as not being able to fly off the tracks when a train approaches. Such mortalities have been recorded elsewhere in Wyoming where bald eagles feed on big game carcasses along highways and railroads (Lockwood 1999). Actual mortality is difficult to predict as it would depend on many factors such as location of carcasses in relation to the rail line, operating times of trains, availability of food in other areas, and the presence of eagles. Only incidental mortality would be anticipated. Future nests would not likely be impacted by the project as nesting pairs would be exposed to train activity on a regular basis, including prior to nesting. They would be expected to be tolerant of train disturbance during subsequent nesting.

4.16.3.1. Alternative C (Modified Proposed Action)

4.16.3.1.1 Construction Impacts

Over 58 miles of Alternative C passes within 0.5-miles of potential bald eagle winter habitats in each of the counties in South Dakota and Wyoming. This is less than the 82 miles of Alternative B that is estimated to be within 0.5-mile of potential winter habitats. If short-term construction related disturbances affected wintering bald eagles 1 mile away, almost 95 miles of Alternative C would be within that distance from potential habitats identified in Table 4-5, but less than the 126 miles of Alternative B right-of-way within the 1-mile zone.

Construction of this alternative would have similar impacts as Alternative B. Impacts to bald eagles include disturbance by construction activities that could displace them during wintering and nesting periods, mortality caused by vehicles driving to and from the construction site and loss of suitable roosting habitat if trees are removed for construction.

Construction during winter within TBNG and along the corridor of the Cheyenne River in South Dakota and its major tributaries in Wyoming (Black Thunder Creek, Little Thunder Creek and Antelope Creek) is likely to displace wintering bald eagles from perches and feeding areas or make those sites temporarily unsuitable. Estimates of potential bald eagle wintering habitats within 0.5-mile and 1-mile zone of the Cheyenne River and major tributaries that could be affected by Alternative C are provided in Table 4-14.

4.16.3.1.2 Operational Impacts

Mortalities resulting from bald eagles being struck by trains while they are feeding on carrion along the rail line could occur. Human activity during maintenance activities could also disturb roosting and nesting bald eagles.

Table 4-15 Potential Bald Eagle Wintering Habitats Along Alternative C Right-of-Way		
County State	**ROW within 0.5 mile of Potential Habitat (miles)**	**ROW within 1.0 mile of Potential Habitat (miles)**
Pennington SD	14.12	22.82
Custer SD	0	2.01
Fall River SD	11.00	21.11
Niobrara WY	4.21	7.16
Weston WY	12.71	18.82
Converse WY	6.33	9.60

Table 4-15 Potential Bald Eagle Wintering Habitats Along Alternative C Right-of-Way		
County State	**ROW within 0.5 mile of Potential Habitat (miles)**	**ROW within 1.0 mile of Potential Habitat (miles)**
Campbell WY	10.03	13.02
Alternative C TOTAL:	58.40	94.54

4.16.4.1 Alternative C with the Phiney Flat Variation

4.16.4.1.1 Construction Impacts

Twenty-six miles of the Phiney Flat Variation passes within 0.5-mile of potential bald eagle winter habitats in affected counties in South Dakota, 1.0-mile more than Alternative C for the same counties. Approximately 51 miles of the Phiney Flat Variation would be within 1.0-mile of potential habitats in South Dakota (Table 4-16), nearly 6 miles more than Alternative C in South Dakota.

Types of impacts would be similar to Alternatives B and C, although more bald eagle habitat could be affected than by Alternative C.

Table 4-16 Potential Bald Eagle Wintering Habitats Along Alternative C with Phiney Flat Variation Right-of-Way		
County State	**ROW within 0.5 mile of Potential Habitat (miles)**	**ROW within 1.0 mile of Potential Habitat (miles)**
Pennington SD	14.13	23.53
Custer SD	0.88	5.94
Fall River SD	11.00	21.11
Alternative C with Phiney Flat Variation TOTAL:	26.01	50.58

4.16.4.1.2 Operational Impacts

Impacts would be similar to Alternatives B and C.

4.16.5.1 Alternative C with the W G Flat Variation

4.16.5.1 Construction Impacts

Nearly 26 miles of the W G Flat Variation passes within 0.5-mile of potential bald eagle winter habitats in the counties in South Dakota, the same as the Phiney Flat Variation and about 1 mile more than Alternative C where it passes through the same counties. If short-term construction related disturbances affected wintering bald eagles 1 mile away, over 48 miles of the W G Flat Variation would be within that distance from potential habitats (Table 4-17). This would be almost 2.5 miles less than the Phiney Flat Variation, but over 2 miles more than Alternative C in South Dakota. All the Alternative C routes would affect less potential bald eagle habitat in South Dakota than Alternative B.

Impacts would be similar to Alternatives B and C.

Table 4-17 Potential Bald Eagle Wintering Habitats Along Alternative C with W G Flat Variation Right-of-Way		
County State	**ROW within 0.5 mile of Potential Habitat (miles)**	**ROW within 1.0 mile of Potential Habitat (miles)**
Pennington SD	14.12	22.82
Custer SD	0	1.96

Table 4-17 Potential Bald Eagle Wintering Habitats Along Alternative C with W G Flat Variation Right-of-Way		
County State	**ROW within 0.5 mile of Potential Habitat (miles)**	**ROW within 1.0 mile of Potential Habitat (miles)**
Fall River SD	11.70	23.39
Alternative C with W G Flat Variation TOTAL:	25.82	48.17

4.16.4.2 Operational Impacts
Impacts would be similar to Alternatives B and C.

4.16.5 Alternative D (Existing Transportation Corridors)
4.16.5.1 Construction Impacts
Nearly 30 miles of Alternative D passes within 0.5-mile of potential bald eagle winter habitats in two counties in Wyoming and two in South Dakota. This is less than the 82 miles of Alternative B and 58 miles of Alternative C that are estimated to be within 0.5-mile of potential winter habitats. If short-term construction related disturbances affected wintering bald eagles 1 mile away, almost 46 miles of Alternative D would be within that distance from potential habitats identified in Table 4-18, less than the 126 miles of Alternative B and 95 miles of Alternative C rights-of-way within the 1-mile zone. Specifically in South Dakota, Alternative D would affect less potential habitats along the Cheyenne River than either the Phiney Flat or W G Flat alternatives.

Construction of this alternative would have similar impacts as Alternatives B and C; however, fewer miles of proposed construction would impact the Cheyenne River and its tributaries where bald eagles would likely be located. Bald eagles roosting or nesting in the proposed project area could be disturbed by human activity during construction. Additionally, personal vehicles driving to and from the construction sites could kill bald eagles feeding on carrion along the roads.

Construction during winter within TBNG and along the corridor of the Cheyenne River in South Dakota and its major tributaries in Wyoming (Black Thunder Creek, Little Thunder Creek and Antelope Creek) is likely to displace wintering bald eagles from perches and feeding areas or make those sites temporarily unsuitable within at least a 0.5-mile up to a 1-mile zone surrounding construction activities. Estimates of potential bald eagle wintering habitats within 0.5-mile and 1-mile zone of the Cheyenne River and major tributaries that could be affected by Alternative D are provided in Table 4-18.

4.16.5.2 Operational Impacts
Maintenance activities may disturb bald eagles along the rail line. Additionally, trains may kill bald eagles if the eagles frequent rail line rights-of-way to feed on carrion.

Disturbances to wintering bald eagles could thus occur along 30 to 46 miles of Alternative D during the short- and long-term if eagles are affected by noise associated with train traffic 0.5-mile to 1 mile away.

Table 4-18 Potential Bald Eagle Wintering Habitats Along Alternative D Right-of-Way		
County State	**ROW within 0.5 mile of Potential Habitat (miles)**	**ROW within 1.0 mile of Potential Habitat (miles)**
Pennington SD	7.85	9.36
Custer SD	0	0
Fall River SD	11.20	20.01
Niobrara SD	0	0
Weston SD	0	0

Table 4-18
Potential Bald Eagle Wintering Habitats Along Alternative D Right-of-Way

County State	ROW within 0.5 mile of Potential Habitat (miles)	ROW within 1.0 mile of Potential Habitat (miles)
Converse SD	6.33	9.60
Campbell SD	4.47	7.01
Alternative D TOTAL:	29.85	45.98

4.17 MOUNTAIN PLOVER

Mountain plover show high site fidelity to breeding territories between years and nest aggregation sites may be more important than the availability of suitable habitat. Therefore, the amount of mountain plover suitable habitat that may be disturbed during construction of this project could be overstated if these areas are not part of the species historic nesting sites.

4.17.1 Minnesota

This species does not occur in Minnesota; therefore, there would be no impacts.

4.17.2 South Dakota and Wyoming

4.17.2.1 Alternative B (Proposed Action)

4.17.2.1.1 Construction Impacts

Since mountain plovers nest on the ground, adult birds, eggs and young are susceptible to mortality by vehicles and construction equipment, especially along 2-track range roads and undeveloped areas along the alignment of Alternative B and within the project area. Noise disturbance could displace mountain plovers from nesting near the new construction. Mountain plovers are known to nest on short-grass prairie in association with prairie dog colonies. Table 3-7 provides estimates of the amount of prairie dog colonies potentially disturbed or lost due to Alternative B. Approximately 279 acres of potential nesting habitat would be converted to railroad right-of-way. Additional habitat outside the right-of-way may be unsuitable for nesting due to human activity and noise during construction.

4.17.2.1.2 Operational Impacts

Operation of Alternative B could result in disturbance to nesting plovers selecting to nest within or near the right-of-way. However, expected disturbance would be minimal as mountain plovers would experience regular train events prior to selecting to nest and would likely be somewhat acclimated to this. Human activity associated with maintenance activities would be less common and could disturb nesting birds, leading to nest abandonment. Nests in proximity to the rail line, including in the right-of-way and adjacent areas, may be more susceptible to predation from predators traveling the rail line in search of carrion that stumble upon the nest and take the opportunity for a quick meal.

4.17.3.1 Alternative C (Modified Proposed Action)

4.17.3.1.1 Construction Impacts

Construction of this alternative would have similar impacts as Alternative B. Mountain plovers or their nests may be lost from vehicles traveling to and from the construction site and operation of heavy equipment. Nests in adjacent areas may be abandoned because of disturbance. Table 3-7 provides estimates of the amount of prairie dog colonies potentially disturbed or lost due to Alternative C. Additional habitat outside the right-of-way may be unsuitable for nesting due to human activity and noise during construction. Approximately 424 acres of prairie dog colony nesting habitat would be converted to railroad right-of-way.

4.17.3.1.2 Operational Impacts

Once the proposed project is constructed there may be an increase in predators because of the presence of carrion along the rail line. Additionally, mammals and raptors may prey upon nesting mountain plovers.

4.17.4.1 Alternative C with the Phiney Flat Variation
Impacts would be similar to Alternatives B and C.

4.17.5.1 Alternative C with the W G Flat Variation
Impacts would be similar to Alternatives B and C.

4.17.6.1 Alternative D (Existing Transportation Corridors)
4.17.6.1.1 Construction Impacts
Construction of this alternative would have similar impacts as Alternatives B and C. Noise during construction could displace mountain plovers from nesting in the area. Table 3-7 provides estimates of the amount of prairie dog colonies potentially disturbed or lost due to Alternative C. Approximately 150 acres of potential nesting habitat would be converted to railroad right-of-way. Additional habitat outside the right-of-way may be unsuitable for nesting due to human activity and noise during construction.

4.17.6.1.2 Operational Impacts
Predators drawn to carrion along the track could prey on mountain plovers and their young.

4.18 SWIFT FOX
4.18.1 Minnesota
This species does not occur in Minnesota; therefore, there would be no impacts.

4.18.2 South Dakota and Wyoming
4.18.2.1 Alternative B (Proposed Action)
4.18.2.1.1 Construction Impacts
Swift fox are probably found using all upland habitats in the vicinity of the proposed project in South Dakota and Wyoming. They are more at risk where the proposed project crosses prairie dog colonies (Refer to Table 3-7). Removal of vegetation from the project area may reduce prey species and potential swift fox habitat. This species is occasionally killed by vehicular traffic, which has been estimated as contributing 5 percent of annual swift fox mortality in one study, but most swift fox mortality is from coyotes (Rongstad et al. 1989). Swift fox dens could be destroyed by heavy equipment and the fox may be displaced due to construction activity and human presence.

4.18.2.1.2 Operational Impacts
Swift foxes will consume carrion (Samuel and Nelson 1982, Uresk and Sharps 1986, Scott-Brown et al. 1987) and so are vulnerable to being struck by trains if they feed on carcasses along the railroad. However, they will not approach carrion that is being utilized by coyotes (Rongstad et al 1989).

4.18.3.1 Alternative C (Modified Proposed Action)
4.18.3.1.1 Construction Impacts
Construction of this alternative would have similar impacts as Alternative B. Impacts include a reduction in prey species, loss of swift fox habitat (Refer to Table 3-7) and mortalities from vehicular traffic.

4.18.3.1.2 Operational Impacts
Operational impacts for this alternative are similar to Alternative B.

4.18.4.1 Alternative C with the Phiney Flat Variation
Impacts would be similar to Alternatives B and C.

4.18.5.1 Alternative C with the W G Flat Variation
Impacts would be similar to Alternatives B and C.

4.18.6.1 Alternative D (Existing Transportation Corridors)
4.18.6.1.1 Construction Impacts
Impacts would be similar to Alternatives B and C. Swift fox habitat would be lost (Refer to Table 3-7) and the removal of vegetation may reduce prey species. Swift fox may be killed by vehicular traffic travelling to and from the proposed construction sites.

4.18.6.1.2 Operational Impacts
Impacts would be similar to Alternatives B and C. Swift fox could be struck by trains while feeding on carcasses along the railroad.

4.19 STURGEON CHUB
4.19.1 Minnesota
This species does not occur in Minnesota; therefore, there would be no impacts.

4.19.2 South Dakota and Wyoming
4.19.2.1 Alternative B (Proposed Action)
4.19.2.1.1 Construction Impacts
Changes in stream flow due to bank stabilization could impact downstream habitats as could accidental release of petroleum products.

Accidental releases of toxic (fuel, lubricants, oils) substances present during construction could lead to mortality of Sturgeon chubs if these substances enter the Cheyenne River. Generally, these materials would not be stored near drainages and vehicles would be serviced at designated maintenance areas. Only minimal amounts of these substances would be present at an individual construction site. As with sedimentation, impacts from accidental spills would be most likely if the spill occurred at a crossing of the Cheyenne River, one of its tributaries, or in proximity to the river (Table 4-19).

Water depletions from the Cheyenne River could impact the species during construction. Sturgeon chubs probably spawn in late spring to midsummer (Lee et al. 1980) and may depend on deep water with fast currents to allow eggs and larva to be carried downstream (USFWS 1993c). Since flows in the Cheyenne River are highly variable, dependent in part on water released from Angostura Reservoir, water withdrawals for project construction could exacerbate existing limiting flow regimes, particularly during drought conditions.

Table 4-19
Alternative B Sites within 500 feet of the Cheyenne River or Tributary Streams

	Cheyenne River		Perennial Tributary Streams	
County State	Number of Sites	Total Distance (miles)	Number of Sites	Total Distance (miles)
Pennington SD	15	0.80	26	1.96
Fall River SD	5	0.96	25	5.44
Custer SD	40	4.29	75	7.68
Weston WY	0	0	0	0
Niobrara WY	0	0	0	0
Converse WY	0	0	0	0
Campbell WY	0	0	6	1.21
Alternative B Total:	60	6.05	132	16.29

4.19.2.1.2 Operational Impacts
During operation, impacts could also result from increased sedimentation or accidental spills. Increased sedimentation could occur during maintenance of bridges or culverts. Spills from maintenance equipment

or derailments could also occur. However, the limited amount of material released from maintenance equipment would not likely be sufficient to affect Sturgeon chub. Derailments would be unlikely because of the implementation of standard inspection and maintenance procedures. Any impacts from a spill would likely be localized and short-term as the released material, if it even entered the water, would be quickly diluted to concentrations below toxic levels.

4.19.3.1 Alternative C (Modified Proposed Action)

4.19.3.1.1 Construction Impacts

Construction of this alternative would have similar impacts as Alternative B. Sturgeon chub are susceptible to increased sediment that could occur during construction. Additionally, accidental releases of diesel fuels and other petroleum products could occur during construction. However, DM&E would have a SPCC plan in place and would store toxic (fuels and oil) substances away from drainages.

Impacts would be most likely if potential discharge sites are within 500 feet of surface waters where there may be insufficient riparian vegetation to prevent flows from entering drainages.

Table 4-20 indicates the number of sites and/or distances at which this alternative would be within 500 feet of the Cheyenne River or tributary streams with perennial flows. There are 144 sites on the Cheyenne River and perennial tributary streams, combined, where Alternative C is within 500 feet of the drainages. More than 20 miles of Alternative C is within 500 feet of the Cheyenne River and tributaries, only 2 miles less than Alternative B. These sites are believed to be those most likely where sediments and/or accidental releases of toxic compounds could be discharged.

Table 4-20
Alternative C Sites within 500 feet of the Cheyenne River or Tributary Streams

	Cheyenne River		Perennial Tributary Streams	
County State	Number of Sites	Total Distance (miles)	Number of Sites	Total Distance (miles)
Pennington SD	35	3.95	44	4.88
Fall River SD	3	0.86	20	2.99
Custer SD	0	0	28	6.56
Weston WY	0	0	0	0
Niobrara WY	1	0.34	0	00
Converse WY	0	0	0	0.90
Campbell WY	0	0	12	
Alternative C Total:	40	5.15	104	15.33

4.19.3.1.2 Operational Impacts

Impacts would be similar to Alternative B and would include increased sedimentation during maintenance activities or accidental spills from maintenance equipment or during derailments.

4.19.4.1 Alternative C with the Phiney Flat Variation

4.19.4.1.1 Construction Impacts

Impacts would be similar to Alternatives B and C. Table 4-21 indicates the number of sites and/or distances at which this alternative would be within 500 feet of the Cheyenne River or tributary streams with perennial flow. There are 106 sites on the Cheyenne River and perennial tributary streams, combined, where the Phiney Flat Variation is within 500 feet of the drainages where impacts to aquatic resources could occur. This would be 80 sites less than Alternative B and 26 less than Alternative C in the same South Dakota counties.

Table 4-21 Alternative C with the Phiney Flat Variation Sites within 500 feet of the Cheyenne River or Tributary Streams				
	Cheyenne River		Perennial Tributary Streams	
County State	Number of Sites	Total Distance (miles)	Number of Sites	Total Distance
Pennington SD	36	3.95	48	5.01
Fall River SD	3	0.86	19	2.99
Custer SD	0	0	6	1.58
Phiney Flat Variation Total:	39	4.81	67	9.58

4.19.4.1.2 Operational Impacts
Impacts would be similar to Alternatives B and C.

4.19.5.1 Alternative C with the W G Flat Variation
4.19.5.1.1 Construction Impacts
Impacts would be similar to Alternatives B and C and would include. Table 4-22 lists the number of sites and/or distances at which this alternative would be within 500 feet of the Cheyenne River or tributary streams with perennial flow. There are 134 sites in these areas where the W G Flat Variation is within 500 feet of the drainages where impacts to aquatic resources could occur. This is 28 sites more than the Phiney Flat Variation, but 52 sites fewer than Alternative B and about the same number of sites as Alternative C in the same South Dakota counties.

Table 4-22 Alternative C with the W G Flat Alternative Sites within 500 feet of the Cheyenne River or Tributary Streams				
	Cheyenne River		Perennial Tributary Streams	
County State	Number of Sites	Total Distance (miles)	Number of Sites	Total Distance (miles)
Pennington SD	36	3.95	45	4.88
Fall River SD	4	0.86	21	2.99
Custer SD	0	0	28	6.56
Alternative C with the W G Flat Alternative Total:	40	5.15	94	15.33

4.19.5.1.2 Operational Impacts
Impacts would be similar to Alternatives B and C.

4.19.6.1 Alternative D (Existing Transportation Corridors)
4.19.6.1.1 Construction Impacts
Impacts would be similar to Alternatives B and C. Sturgeon chub appear susceptible to increased sedimentation that could occur during and following construction of the proposed project. Further, changes in stream flow due to bank stabilization structures could impact downstream habitats as could accidental release of petroleum products. Impacts would be most likely if potential discharge sites are within 500 feet of surface waters where there may be insufficient riparian vegetation to prevent flows from entering drainages. Table 4-23 indicates the number of sites and/or distances at which the Alternative D route would be within 500 feet of the Cheyenne River or tributary stream with perennial flows.

There are 68 sites on the Cheyenne River and perennial tributary streams, combined, where Alternative D is within 500 feet of the drainages, fewer than the 192 sites and 144 sites intersected by Alternative B and

Alternative C, respectively. Less than 14 miles of Alternative D is within 500 feet of the Cheyenne River and tributaries, 9 miles less than Alternative B and nearly 7 miles less than Alternative C. These sites are believed to be those most likely where sediments and/or accidental releases of toxic compounds could be discharged.

Table 4-23
Alternative D Sites within 500 feet of the Cheyenne River or Tributary Streams

County State	Cheyenne River		Perennial Tributary Streams	
	Number of Sites	Total Distance (miles)	Number of Sites	Total Distance (miles)
Pennington SD	3	1.95	30	3.25
Fall River SD	3	0.73	20	5.70
Custer SD	0	0	0	0
Weston WY	0	0	0	0
Niobrara WY	0	0	0	0
Converse WY	0	0	0	0
Campbell WY	0	0	0	1.65
Alternative D Total:	6	2.68	62	10.60

4.19.6.1.2 Operational Impacts
During operation, short- or long-term impacts could occur downstream if there were derailments which released diesel fuels or other petroleum products into the Cheyenne River hydrologic basin.

4.20 BLACK-TAILED PRAIRIE DOG
4.20.1 Minnesota
This species does not occur in Minnesota; therefore, there would be no impacts.

4.20.2 South Dakota and Wyoming
4.20.2.1 Alternative B (Proposed Action)
4.20.2.1.1 Construction Impacts
At least 11.5 miles (approximately 279 acres of the ROW) of Alternative B would pass through prairie dog colonies in South Dakota and Wyoming. Direct impacts to black-tailed prairie dogs are most likely to occur during the construction phase of the project if the animals occur in the right-of-way. These impacts include mortality from construction equipment and vehicles, loss of habitat, and recreational shooting.

4.20.2.1.2 Operational Impacts
Long-term impacts include fragmentation of black-tailed prairie dog colonies' habitat, increased mortality by train and vehicular traffic, increased predation and disease from predators traveling along the rail line, and increased recreational shooting from increased human activities.

4.20.2.2 Alternative C (Modified Proposed Action)
4.20.2.2.1 Construction Impacts
At least 17.5 miles (approximately 424 acres of the ROW) of Alternative C would pass through prairie dog colonies in South Dakota and Wyoming compared to at least 11.5 miles of Alternative B and 6.2 miles of Alternative D.

Construction of this alternative would have similar impacts as Alternative B. Prairie dogs may be killed during construction by vehicular and construction traffic.

4.20.2.2.2 Operational Impacts
Fragmentation of prairie dog colonies could impact the reintroduction of black-footed ferrets. Black-tailed prairie dog mortality could increase due to train traffic, increased predation and spread of disease by predators.

4.20.2.3 Alternative C with the Phiney Flat Variation
Impacts of this alternative would have similar impacts as Alternatives B and C.

4.20.2.4 Alternative C with the W G Flat Variation
Impacts of this alternative would have similar impacts as Alternatives B and C.

4.20.2.6 Alternative D (Existing Transportation Corridors)
4.20.2.6.1 Construction Impacts
Construction of this alternative would have similar impacts as Alternative B and C.

At least 6.2 miles (approximately 150 acres of the ROW) of Alternative D would pass through prairie dog colonies in South Dakota and Wyoming compared to at least 11.5 miles of Alternative B and 17.5 miles of Alternative C. But since Alternative D is mostly within an existing railroad corridor, fewer prairie dog colonies would be affected, particularly if vegetation growth within the existing right-of-way has been minimized by maintenance.

4.20.2.6.2 Operational Impacts
Long-term impacts include increased mortality by train traffic and increased predation.

PART 5
CUMULATIVE IMPACTS

Cumulative effects are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation.

Since most of the existing railroad in Minnesota and South Dakota passes through private lands where current land uses are mostly human developments or agricultural (93 percent of the lands crossed in Minnesota and 80 percent of the lands crossed in South Dakota), it is reasonably certain that those land uses will continue, if not expand to other lands, in the future. Similarly, the project alternatives analyzed for building the new railroad in South Dakota would cross private lands ranging from 84 percent (Alternative B) to 98 percent (Alternative D) of the total length. In Wyoming, the percentage of private lands crossed ranges from 67 percent for Alternative C to 80 percent for Alternative D. Land use along the new rail line extension alternatives is mostly a combination of agriculture and livestock grazing, the latter occurring on private, state and Federal lands. Table 5-1 summarizes the measurable effects to habitats potentially or known to be occupied by listed endangered, threatened, proposed, candidate and petitioned species that would result from implementing alternatives for new railroad construction and rebuild of the existing rail line.

5.1 BLACK-FOOTED FERRET

5.1.1 Existing Contributing Factors

Black-footed ferrets were one of the first species to be identified as endangered under the Endangered Species Preservation Act of 1966 and were listed as endangered in 1967. At that time, no specific reasons for listing species as endangered were provided. Later, reasons for endangerment of ferrets were provided in the recovery plan. They include: 1) aggressive control or extermination of prairie dogs, 2) reduction of prairie dog populations by sylvatic plague, 3) susceptibility of black-footed ferrets to canine distemper and other diseases, and 4) susceptibility of small, isolated populations to extinctions due to demographic and environmental variation (USFWS 1988b).

5.1.2 Foreseeable Impacts

Expansion of coal bed methane development on lands in the Powder River Basin could impact this species because of fragmentation of prairie dog colonies. However, coal bed methane development is a federal activity and is not considered a cumulative impact. Black-footed ferrets' survival is linked to prairie dogs. If any of the affected colonies are of suitable size for ferret reintroduction, these sites could be rendered unsuitable and jeopardize efforts to reestablish ferrets in the wild. Since at least half of prairie dog colonies are on private and state lands, impacts to prairie dogs (poisoning, habitat alteration and loss, recreational shooting) will continue and sylvatic plague will continue to be a threat to extant populations. Some states actively promote unregulated and unlimited prairie dog shooting for sport. In many areas development (including minerals, oil and gas) proceeds without regard to the impact on prairie dogs or their habitat. All of these factors continue to influence prairie dog populations, which in turn influence black-footed ferret populations.

5.2 PIPING PLOVER

5.2.1 Existing Contributing Factors

The primary threats to the piping plover are habitat modification and destruction and human disturbance to nesting adults and flightless chicks. USFWS identified the elimination of suitable nesting sites on in-river islands and sandbars because of dam construction as a contributing factor in piping plover decline. Those effects are present on the Missouri River and on the Cheyenne River, below Angostura Reservoir.

5.2.2 Foreseeable Impacts

Since the 1950's, Angostura Reservoir has provided irrigation water for livestock forage and grain crops. Currently, the Bureau of Reclamation is preparing an EIS that will address future operation of the Angostura Dam and Irrigation Project. Additional water withdrawals by private landowners from the Cheyenne River probably will occur and continue in the future.

Continued water development upstream of piping plover habitat may affect the birds. Elevated water temperatures affect forage fish physiology, which influences fish survival rate, growth rate, embryonic development, and susceptibility to parasites and disease. Channelization, irrigation, and the construction of reservoirs and pools have contributed to the elimination of much of the piping plover sandbar-nesting habitat in the Missouri River system. The Missouri River Bank Stabilization and Navigation Project is an example. The wide and braided character of the Missouri River was engineered into reservoirs and a single, narrow navigation channel. Sandbars virtually disappeared between Sioux City, Iowa and St. Louis, Missouri. Current regulation for the Missouri River dam discharges pose additional problems for piping plovers nesting in remaining habitats. Reservoir storage of flows responsible for scouring sandbars has resulted in the encroachment of vegetation along many rivers and greatly reduced channel width. In addition, river mainstem reservoirs now trap much of the sediment load, which results in less aggradation and more degradation of the riverbed and, subsequently, fewer sandbars. Water development on the Platte River system has also been extensive. Continuing water depletions reduce the width and/or depth of water surrounding nest sites, which may increase predation and human disturbance; increased depletions in turn permit vegetation encroachment into nesting areas.

5.3 WHOOPING CRANE

5.3.1 Existing Contributing Factors

Whooping cranes were one of the first species to be identified as endangered under the Endangered Species Preservation Act of 1966 and were listed as endangered in 1967. The whooping crane recovery plan identified the following as contributing to their endangerment: 1) life history and sociobiological characteristics, 2) predation of nests, unpredictable weather during nesting and migration, drought leading to food shortages and fire destruction of nests, 3) human disturbances during nesting, 4) habitat conversion (mid-continental prairies and prairie pot-holes) to agriculture and construction of powerlines within principal migration corridors, 5) environmental pollution, particularly due to oil spills in the Gulf of Mexico, that could threaten wintering areas, and 6) shooting deaths (USFWS 1986a).

5.3.2 Foreseeable Impacts

Migrating whooping cranes may occasionally utilize wetlands and/or grain fields in the vicinity of the existing railroad along the Bad and Missouri rivers in South Dakota. Sixty-four percent of the existing railroad in those areas (Haakon, Jones, Stanley, and Hughes counties) coincides with human developments and croplands, the latter potentially providing feeding and resting sites during migrations. The same land use in those areas is likely to continue and possibly expand in the future.

5.4 INTERIOR LEAST TERN

5.4.1 Existing Contributing Factors

USFWS identified the following as the principal factors that have contributed to the species' endangerment: 1) nest predation by terrestrial carnivores as well as domestic pets contributing to declining reproductive success, and 2) elimination of suitable nesting sites on in-river islands and sandbars due to dam construction with altered flow regulations, whether leading to nest inundation or by altering river flows that formerly scoured islands, removing permanent vegetation and creating new islands and sandbars as suitable nesting habitat. Those effects are present on the Missouri River and on the Cheyenne River, below Angostura Reservoir.

5.1.2 Foreseeable Impacts

Since the 1950's, Angostura Reservoir has provided irrigation water for livestock forage and grain crops. Currently, Bureau of Reclamation is preparing an EIS that will address future operation of the Angostura Dam and Irrigation Project. Additional water withdrawals by private landowners from the Cheyenne River probably will occur and continue in the future.

5.5 TOPEKA SHINER

5.2.1 Existing Contributing Factors

Sedimentation and eutrophication (diminished dissolved oxygen resulting from release of nutrients in streams) have been cited as primary impacts to Topeka shiners. Intensive agricultural developments within inhabited watersheds and diminished aquifer recharge has led to siltation and pollution of streams, which may become warm, muddy and ephemeral during summers. Impoundments on tributaries and channelization of drainages has also reduced in-stream flows and degraded habitats while over-grazing by livestock in riparian zones has reduced water quality. These practices have, and will continue to occur, on private and agricultural lands in southwestern Minneosta and eastern South Dakota in the vicinity of the existing railroad.

5.1.2 Foreseeable Impacts

The continued implementation of small watershed flood control programs in portions of the species' range is a continued threat to the population. Feedlot operations on or near streams are also known to impact prairie fishes due to organic input resulting in eutrophication.

The Vermillion River basin contains the largest complex of Topeka shiner populations in South Dakota. Multiple reservoir construction is now planned on streams occupied by the Topeka shiner in this basin, further threatening the species. Additionally, the continued use of pesticides and fertilizers near stream channels the fish may inhabit could be detrimental to their continued survival.

5.6 PALLID STURGEON

5.6.1 Existing Contributing Factors

Dams and altered water flows on the Missouri River have blocked sturgeon migration, eliminated or altered spawning habitats, reduced food sources, altered water temperatures, reduced turbidity, and changed the hydraulics of the river (Dryer and Sandvol 1993). Along with over-fishing, pollution, (principally from organic wastes but also from insecticide residues and trace metals) has contributed to the species' decline.

Destroyed and altered habitats are believed to be the primary cause of adverse effects on reproduction, growth, and survival of the pallid sturgeon, as well as other fish species native to the Missouri, Platte, and Mississippi rivers. Recovery of the pallid sturgeon is unlikely to be successful without restoring the critical portions of morphology, hydrology, temperature regimes, and sediment/organic matter transport to the rivers that provide the life requisites for the pallid sturgeon.

5.6.2 Foreseeable Impacts

Six mainstem dams on the Missouri River without fish passage facilities block pallid sturgeon migrations and have inundated spawning and nursery areas. The remaining mainstem riverine habitat between dams and downstream of the dams has been altered by removal of snags, reductions in sediment and organic matter transport and deposition, channel bed degradation, flow modification, and hypolimnetic releases. Since most pollution sources are from private lands and commercial enterprises (packinghouses, stockyards, landfills, mines, sewage treatment plants, and industrial effluents), water quality degradation is expected to continue.

5.7 AMERICAN BURYING BEETLE

5.7.1 Existing Contributing Factors

Reasons for declines of American burying beetles are unclear. Some have speculated that destruction of virgin forests is to blame, however populations have been found in native grasslands. Widespread use of pesticides, principally DDT, may have contributed to endangerment, but there is no supporting evidence. Agricultural and grazing practices within the beetle's range could have changed vertebrate species composition and densities, making suitable carrion difficult for beetles to locate.

5.7.2 Foreseeable Impacts

As human populations increase in more remote areas, beetles could be impacted by artificial lights and electronic bug-zappers. If any of these are current sources of species' endangerment, they are likely to continue since all occur on private lands.

As linear projects are constructed, there is the possibility of increasing edge habitat which may result in the increase in the occurrence and density of vertebrate predators and scavengers such as the American crow, raccoon, fox, oppossum, and skunk, which compete with the American burying beetle for carrion. Increased agricultural and grazing practices within the beetle's range compound the changes in vertebrate species composition and densities caused by habitat fragmentation. Additionally, as the human population increases and more remote areas are inhabited, impacts due to artificial lights (which are known to attract and disorient many species of nocturnal insects) may be a threat to the species.

5.8 MINNESOTA DWARF TROUT LILY

5.8.1 Existing Contributing Factors

The most significant reasons for the plant's current status are biological and historical. The species is a narrow endemic that spreads very slowly. Direct habitat destruction probably accounts for the greatest population losses over the last century. Expansion of the cities of Faribault and Zumbrota probably has destroyed colonies. Agricultural development may also impact the species. Where cultivation has occurred at the base of bluffs, colonies may have been destroyed.

5.8.2 Foreseeable Impacts

Since the species is restricted to only a few sites, most of which are on private lands, it is subject to physical disturbance by people driving off-road vehicles, conversion of habitat to cropland, residential or commercial development and removal by wildflower collectors.

5.9 HIGGIN'S EYE PEARLY MUSSEL

5.9.1 Existing Contributing Factors

Habitat modification including land use changes, river channel modifications, and pollution continue to affect this mussel. Large to medium clear water streams where the species is found have been lost due to continued development of impoundments, channelization, soil erosion and sediment accumulation originating from land use practices.

5.9.2 Foreseeable Impacts

Expanded agriculture or modified land use practices in the watershed, toxic substance spills, point discharges of harmful chemicals, low water levels and recreational boat traffic continue to be a threat to its population.

5.10 WINGED MAPLELEAF MUSSEL

5.10.1 Existing Contributing Factors

Development of impoundments, channelization, soil erosion, and sediment accumulation contributed to the mussel being listed.

5.10.2 Foreseeable Impacts
Continued habitat modification and expanded agriculture practices in watersheds could further impact the species. Power plant operations can cause toxic substance spills, point discharges, and low water levels which could impact the mussel.

5.11 KARNER BLUE BUTTERFLY
5.11.1 Existing Contributing Factors
Oak savannah habitat on which this species depends have been modified or eliminated by urbanization, silviculture, and fire suppression, which has led to altered vegetation succession with diminished habitat suitability. These contributing factors to the species' endangerment are likely to continue since most occur on private lands.

5.11.2 Foreseeable Impacts
The continued loss or alteration of habitat from industrial, commercial, and residential development; fire suppression and habitat fragmentation are likely to continue.

5.12 UTE LADIES'-TRESSES ORCHID
5.12.1 Existing Contributing Factors
The species is primarily threatened by loss and modification of riparian habitat through urbanization, stream channelization, and construction projects in wetlands and meadows.

5.12.2 Foreseeable Impacts
Overgrazing or heavy summer grazing and trampling by livestock in occupied habitat is detrimental. Introduction of exotic weeds and indiscriminate application of herbicides both can affect populations. Habitats on private lands will continue to be affected by agriculture and livestock grazing.

Additionally, expansion of coal bed methane development on lands in the Powder River Basin could impact Ute ladies'-tresses orchid if ground disturbing activities occur within existing populations or suitable habitat (wetlands) for the species to establish. However, coal bed methane development is a federal activity and is not considered a cumulative impact.

5.13 PRAIRIE BUSH-CLOVER
5.13.1 Existing Contributing Factors
Agricultural development, as well as quarrying, road and residential developments, have been cited as responsible for eliminating this plant from most of its former prairie habitat. Heavy livestock grazing could also be detrimental.

5.13.2 Foreseeable Impacts
The practices noted above are expected to continue for the life of this project. The steady increase in conversion of prairies to agricultural land use, increased linear projects such as construction of roads and railroads, herbicide use and mowing will result in a decrease in suitable habitat for the species.

5.14 LEEDY'S ROSEROOT
5.14.1 Existing Contributing Factors
Ground water contamination by municipal and residential wastes and agricultural pesticides, decreased ground water seepage, and physical destruction of cliff habitats have contributed to this species' decline.

5.14.2 Foreseeable Impacts
Future water contamination could impact this species.

5.15 WESTERN PRAIRIE FRINGED ORCHID

5.15.1 Existing Contributing Factors

The species is primarily threatened by loss and modification of habitat through conversion to cropland, overgrazing by livestock, hay mowing, drainage of wetlands and fire suppression.

5.15.2 Foreseeable Impacts

Insecticide use has and will continue to affect the species' pollinator, hawkmoths. Water demands on private and public lands are likely to lower ground water tables, thereby affecting wetlands inhabited by the orchid (Hansen et al, 1999). Habitats on private lands will continue to be affected by agriculture, livestock grazing, mowing, habitat conversion and application of insecticides.

5.16 BALD EAGLE

5.16.1 Existing Contributing Factors

The USFWS has proposed to remove the bald eagle as a threatened species from the endangered species list citing success of recovery and protection efforts. Recovery and protection efforts include protection of wintering and nesting habitats on Federal lands and regulation of adverse activities on private lands under various protective laws, the prohibition of collecting bald eagles, reduction and regulation of harmful chemicals, principally DDT and other toxic pesticides, and reduction of known mortality sources such as electrocution from power lines, and indiscriminate shooting.

5.16.2 Foreseeable Impacts

Human populations in areas affected by the proposed project are likely to expand in the future; therefore, there will probably be some cumulative effects of additional project-related disturbances to bald eagles. While those may temporarily or permanently displace some individuals from wintering and feeding sites near the project, such displacement may or may not negatively affect those individuals' reproductive success and/or long-term survival.

Coal bed methane expansion on lands in the Powder River Basin could impact bald eagles due to increased activity and loss of some foraging habitat. However, coal bed methane development is a federal activity and is not considered a cumulative impact. Three bald eagle winter roost sites are known to occur within the project area.

5.17 MOUNTAIN PLOVER

5.17.1 Existing Contributing Factors

Mountain plover habitat is threatened by the conversion of grasslands to croplands and urban uses, domestic livestock management, and other land uses (e.g., prairie dog control, and mineral development) throughout this species breeding and wintering range. Many grasslands are not suitable breeding habitat, and therefore, are not used by mountain plovers. Conversion of these grasslands to cropland also can be considered detrimental because such conversion may create locally acceptable habitat on which mountain plovers are then exposed to tilling. Consequently, grassland conversion may be considered a threat to mountain plover conservation whether or not the grasslands are presently suitable breeding habitat, particularly when conversions are proposed within the southern portion of the bird's breeding range. This species has been proposed for listing as threatened because, in part, a significant amount of their breeding habitats in grasslands have been converted to agriculture. Such effects also apply to loss of prairie dog colonies in which mountain plovers may nest. Livestock grazing practices do not mimic grazing effects by bison and do not promote vegetative conditions suitable for mountain plover nesting.

5.17.2 Foreseeable Impacts

Prairie dog control on private lands is expected to continue as well as conversion of grasslands to croplands. Additionally, range management practices for domestic livestock, together with extensive

eradication of prairie dogs and other burrowing rodents will continue to adversely affect mountain plover habitat.

Oil, gas and mineral leasing and development occur throughout the breeding range of the mountain plover. Ongoing development of natural gas resources in southwest Wyoming now exceeds the rate of development projected three years ago, and the volume of natural gas development expected to occur could make the rate of development the highest in the Nation. Oil and gas development requires construction of individual well pads, access roads, travel corridors, and pipelines. Mineral resources found within the range of the mountain plover include coal, uranium-vanadium, bentonite, and hard rock minerals. Many of these resources occur on public lands and are commonly mined using surface mining techniques. However, coal bed methane development is a federal activity and is not considered a cumulative impact. Up to 25 percent of mountain plover habitat at the Antelope Coal Mine in Converse County, Wyoming, has been affected by mining disturbance in the past. Other surface coal mining is proposed in Wyoming that may impact mountain plovers or their habitat. In southwest Wyoming the "checkerboard" pattern of alternating private and public land (Federal and State sections) also reduces the effectiveness of Federal plover conservation measures.

The expansion of coal bed methane development on lands in the Powder River Basin could impact this species. The expansion would entail drilling, completing, operating, and reclaiming approximately 3,000 new productive wells and related production facilities in Campbell and Converse counties in Wyoming. Mountain plover could be displaced because of noise, human activity and vehicles using two-track roads.

Land exchange or disposal by Federal agencies may also involve mountain plover habitat. Land exchanges on the Thunder Basin National Grassland in Wyoming have resulted in transfer of known habitat on private land to Forest Service ownership.

5.18 SWIFT FOX

5.18.1 Existing Contributing Factors

Swift fox currently are not a protected species under the ESA. Loss of native prairie habitat, trapping, hunting, automobiles and prey reduction from rodent control are some reasons for its continued decline. Since the animal is not listed under the ESA, in many states it is still legal to shoot swift fox. Prairie dog poisoning on private and Federal lands has reduced prey availability for the species and may concentrate swift fox in the same areas where coyotes hunt. This may lead to greater predation of coyotes on swift fox. Coyote control by animal damage control agents may have accidentally affected swift fox. But, increase coyote control may benefit swift fox by reducing coyote populations, thereby reducing their overall predation on swift fox (Hansen et al. 1999).

5.18.2 Foreseeable Impacts

Swift fox are susceptible to mortality on highways and also vulnerable to trapping, whether inadvertent or deliberate. These sources of impacts are likely to continue.

The expansion of coal bed methane development on lands in the Powder River Basin could impact swift fox. Human activity, noise and mortalities from maintenance vehicles could be some of the impacts from this development.

5.19 STURGEON CHUB

5.19.1 Existing Contributing Factors

The sturgeon chub is presently a candidate species and receives no protection under ESA. However, the sturgeon chub was petitioned for listing as endangered because of habitat alteration (flooded river valleys, altered temperature and flow regimes, reduced sediment transport and turbidity, habitat fragmentation, restricted movements) by dams.

5.19.2 Foreseeable Impacts

Impacts to the sturgeon chub have resulted by continued small-scale impoundments, levees, and diversion projects throughout the Missouri River basin. Presently, only one-third of the river remains in a free-flowing state. Water manipulation through dams and irrigation diversions continues to threaten the species. Water manipulation, habitat loss, and predation are the greatest threats facing sturgeon chub populations. Further fragmentation of sturgeon chub populations due to dam construction and channelization are a potential threat to the species, reducing genetic variability and preventing repopulation of tributaries after severe drought conditions. Dredging for channel maintenance and sand/gravel extraction may be an obstacle to fish movement.

Future habitat losses are likely to result from energy development (coal mining) in the upper Missouri River Basin. Other impacts to sturgeon chub may result from inter-basin diversions and increased municipal, industrial and irrigation usage. Power plant and water supply intakes may entrain and impinge sturgeon chub.

5.20 BLACK-TAILED PRAIRIE DOG

5.20.1 Existing Contributing Factors

Black-tailed prairie dogs were petitioned for listing as threatened because of multiple factors that include conversion of prairie habitats to agriculture, urbanization of occupied habitats, sport shooting, sylvatic plague, poisoning on rangelands grazed by livestock, and extensive fragmentation of grasslands. However, the USFWS has determined that listing the species is warranted but precluded by other higher priority acts. Presently, prairie dog poisoning has been suspended on Federal lands. Prairie dog shooting is regulated by state wildlife agencies; but the Forest Service can and has issued closure orders in the past for prohibiting specific activities including shooting or the discharge of firearms (Hansen et al. 1999).

5.20.2 Foreseeable Impacts

Expansion of coal bed methane development on lands in the Powder River Basin could impact this species due to fragmentation of prairie dog colonies.

Since at least half of prairie dog colonies are on private and state lands, impacts to prairie dogs (poisoning, habitat alteration and loss, recreational shooting) will continue and sylvatic plague will continue to be a threat to extant populations. Some states actively promote unregulated and unlimited prairie dog shooting for sport. And since the animal is not protected under the ESA, in many areas development (including minerals, oil and gas) proceeds without regard to the impact on prairie dogs or their habitat. All of these factors continue to influence prairie dog populations, which in turn influence black-footed ferret populations.

Table 5-1
Summary of Measurable Effects to Habitats

Species	Potential or Occupied Habitat	Measurable Effects to Habitat Parameter	Measurement of Effect to Habitat Parameter by Alternative						
			Existing Railroad	Alternative B	Alternative C	Phiney Flat Alternative	W G Flat Alternative	Alternative D	Mitigation Possible
Black-footed ferret	Potential	miles within prairie dog colonies in SD and WY	Unknown	11.5	17.5	17.5	17.5	6.2	Yes
Piping plover	Potential	Miles within 1.0 mile Miles within 0.5 mile Miles within 500 feet of rivers in SD	20.2 16.5 4.8	75.6 51.2 6.1	46.9 25.1 4.8	50.6 26.0 4.8	48.2 25.8 5.2	29.4 19.1 2.7	Yes
Whooping crane	Potential	Miles within 1.0 mile Miles within 0.5 mile Miles within 500 feet of rivers in SD	36.3 31.0 8.7	none	none	none	none	none	No
Interior least tern	Potential	Miles within 1.0 mile Miles within 0.5 mile Miles within 500 feet of rivers in SD	20.2 16.5 4.8	75.6 51.2 6.1	45.9 25.1 4.8	50.6 26.0 4.8	48.2 25.8 5.2	29.4 19.1 2.7	Yes
Topeka shiner	Occupied	Miles within 500 feet Number of sites within 500 feet of streams in MN and SD	18.4 53	none	none	none	none	none	Yes
Pallid sturgeon	Potential	Miles within 500 feet Number of sites within 500 feet of rivers in SD	8.7 59	21.1 186	19.2 130	14.4 106	20.5 134	11.6 56	Yes
American burying beetle	Potential	Miles within potentially suitable land cover (including suitable soils on new railroad) in SD	460.0	33.4	35.4	36.0	36.8	41.7	No
Minnesota dwarf trout lily	No Potential	None	none	none	none	none	none	none	not applicable
Higgin's eye pearly mussel	No Potential	None	none	none	none	none	none	none	not applicable
Winged maple leaf mussel	No Potential	None	none	none	none	none	none	none	not applicable
Karner blue butterfly	Potential	Miles within potential deciduous forest land cover in MN	5.0	none	none	none	none	none	Yes
Ute ladies'-tresses orchid	Potential	Miles within wet meadow wetlands	none	0.90	0.86	0.96	0.73	1.08	Yes

Table 5-1
Summary of Measurable Effects to Habitats

Species	Potential or Occupied Habitat	Measurable Effects to Habitat Parameter	Measurement of Effect to Habitat Parameter by Alternative						
			Existing Railroad	Alternative B	Alternative C	Phiney Flat Alternative	W G Flat Alternative	Alternative D	Mitigation Possible
		Number of potential habitat sites crossed in SD and WY		2	4	4	3	1	
Prairie bush-clover	Potential	Number of dry, mesic prairie remnants intersected in MN	59	none	none	none	none	none	Yes
Leedy's roseroot	No Potential	None	none	none	none	none	none	none	not applicable
Western prairie fringed orchid	Potential	number of wet prairie remnants intersected in MN	6	none	none	none	none	none	Yes
Bald eagle	Occupied	Miles within 1.0 mile Miles within 0.5 mile Miles within 500 feet of rivers in MN, SD, WY	67.7 58.6 14.2	125.0 81.9 6.1	94.5 58.4 5.2	99.2 59.3 5.2	96.8 59.2 5.5	46.0 29.9 2.7	Yes
Mountain plover	Occupied	Miles within grasslandMiles within prairie dog colonies in WY	none	120.7 8.1	208.0 12.4	108.0 12.4	108.0 12.4	67.1 3.3	Yes
Swift fox	Occupied	Miles within grassland, Shrub steppe-miles within prairie dog colonies in SD and WY	none	248.8 11.5	230.4 17.5	226.3 17.5	227.2 17.5	267.4 6.2	Yes
Sturgeon chub	Occupied	Miles within 500 feet Number of sites within 500 feet of rivers and tributaries in SD	none	21.1 186	19.2 130	14.4 106	20.5 134	11.6 5.6	Yes
Black-tailed prairie dog	Occupied	Miles within prairie dog colonies in SD and WY	unknown	11.5	17.5	17.5	17.5	6.2	No

PART 6
CONCLUSIONS

The proposed PRB expansion project is designed to provide efficient and competitive rail service from coal mines in Wyoming's Southern Powder River Basin to more eastern electrical utilities. The project involves construction and operation of approximately 280 miles of new rail line in Minnesota, South Dakota and Wyoming and rebuilding of approximately 600 miles of existing rail line in Minnesota and South Dakota. Table 6-1 summarizes preliminary determination of effects to Federally listed endangered, threatened, proposed, candidate and petitioned species that could result from implementing different alternatives for this project in Minnesota, South Dakota, and Wyoming.

6.1 BLACK-FOOTED FERRET

The species' recovery is dependent on captive breeding animals and their reintroduction to suitable habitats. One reintroduction site is within portions of BGNG and Badlands National Park, the Conata Basin/Badlands site in South Dakota. Another proposed reintroduction site is on TBNG, the Rosecrans site in Wyoming. Since Alternative B would pass though that site on TBNG, it would likely no longer be suitable for reintroduction of black-footed ferrets thus Alternative B would impede the species' recovery.

None of the other alternatives for new railroad construction would affect ferret reintroduction. But, because of continued reductions in prairie dog populations on private lands (Hansen et al. 1999) and the spread of sylvatic plague and other diseases through extant prairie dog populations, black-footed ferrets are likely to remain endangered during and after project completion. However, successful reestablishment of reintroduced populations will reduce risks of the species' extinction.

However, if extant populations exist in the project area they may be impacted. The USFWS's Biological Opinion in response to the Continental Divide/Wamsutter II proposed project stated that the Service's Black-footed survey Guidelines (1989) may not be applicable to large projects and suitable habitat was redefined. Additionally, in the Biological Opinion the USFWS takes the position that the lethal take of an individual black-footed ferret does not give rise to a finding of jeopardy.

6.2 PIPING PLOVER

The primary threats to piping plover are habitat modification and destruction, and human disturbance during nesting season. While construction and operation of new railroad alternatives and rebuilding the existing railroad will not alter in-stream flows in the same way that dams do, water removal from the Cheyenne River during construction could reduce flows temporarily. Additional water depletions would reduce the width and/or depth of water surrounding nest sites, which may increase predation and human disturbance. Construction of stabilization measures required on Cheyenne River banks could alter river hydraulic dynamics, thus altering island and sandbar erosion or deposition patterns downstream. Neither water depletion nor altered river hydraulics is likely to adversely affect piping plovers if they do not occur during the nesting period. Construction of alternatives B or C would impact more areas along the Cheyenne River than Alternative D. Alternative D crosses the river only once. The project is not expected to contribute to any change in the species' status during or after completion.

6.3 WHOOPING CRANE

It is doubtful that any short- or long-term projects effects would actually influence whooping cranes. The project is not expected to contribute to any change in the species' status during or after completion.

6.4 INTERIOR LEAST TERN

USFWS identified elimination of suitable nesting sites on in-river island and sandbars and nest predation as the principal factors contributing to the species decline. While construction and operation of new railroad alternatives and rebuilding the existing railroad will not alter in-stream flows in the same way that dams do, water removal from the Cheyenne River during construction could reduce flows temporarily. Additional water depletions would reduce the width and/or depth of water surrounding nest sites, which may increase predation and human disturbance. Increased water depletions also allow for vegetation encroachment into nesting areas, making them less suitable as nesting habitat. Extreme depletions may dewater river reaches sufficiently to kill small fishes, the least tern's principal food.

Construction of stabilization measures required on Cheyenne River banks could alter river hydraulic dynamics, thus altering island and sandbar erosion or deposition patterns downstream. Neither water depletion nor altered river hydraulics is likely to adversely affect interior least terns if they do not occur during the nesting period, but only if terns are nesting contemporaneously with construction and water withdrawn from the Cheyenne River.

Other potential project impacts to interior least terns include noise during construction and operation causing displacement from nesting and feeding areas and accidental releases of petroleum products and creosote from ties, that could affect terns and/or their food supply. Construction of either alternatives B or C would impact more areas along the Cheyenne River than Alternative D; since Alternative D crosses the river only once. The project is not expected to contribute to any change in the species' status during or after completion.

6.5 TOPEKA SHINER

Sedimentation and eutrophication have been cited as primary impacts to this species. In those counties where the Topeka shiner presently exists (Lincoln County, Minnesota; Brookings, Kinsgbury, Beadle, and Hand counties, South Dakota), ninety-eight percent of the existing railroad route is through human developments and croplands.

Mitigation measures such as: prohibiting in-stream construction during the shiner's spawning period (May 15 to August 15) in any inhabited or potentially inhabited streams; utilization of span bridges instead of culverts to cross streams inhabited by Topeka shiners; avoiding placing any structures, such as pilings or bents, within stream channels; utilization of concrete rail ties rather than creosote-treated wood anywhere the route is within 500 feet of a stream or tributary inhabited or potentially inhabited by Topeka shiners; and the use of best-management practices during rebuild and operation of the existing railroad which should minimize any discharge and habitat degradation to inhabited streams crossed or adjacent to the railroad. The project is not expected to contribute to any change in the species' status during or after completion.

6.6 PALLID STURGEON

Destroyed and altered habitats are believed to be the primary cause of adverse effects to the species survival. The new railroad project alternatives and rebuild and operation of the existing railroad could contribute to pollution through accidental release or chronic discharge of petroleum products and creosote from ties, that could affect pallid sturgeons downstream. It is impossible to predict if, when and where these short- and long-term project effects would actually influence sturgeons since the likelihood of such events is unknown: mitigation measures and best-management practices will be implemented to minimize any discharge to the Cheyenne River. The project is not expected to contribute to any change in the species' status during or after completion.

6.7 AMERICAN BURYING BEETLE

It is unclear why American burying beetles are on the decline. The new railroad alternatives and rebuild of the existing railroad may increase edge habitat which could be used by predators and scavengers (American crow, raccoon, fox, opossum, and skunk), potential competitors with the American burying beetle for carrion as well as

potentially preying on beetles. Too, construction machinery could crush beetles but it is impossible to predict if, when and where project components would actually impact burying beetles since none are known to occur in the project area. Therefore, it is impossible to project the impacts of the project on this species. Only minimal impacts, if any, would be anticipated because the species in not expected to be present. The project is not expected to contribute to any change in the species' status during or after completion.

6.8 MINNESOTA DWARF TROUT LILY

There is no indication that the species occurs within the project area or would be affected by rebuilding and operating the existing railroad in Minnesota. The project is not expected to contribute to any change in the species' status during or after completion.

6.9 HIGGIN'S EYE PEARLY MUSSEL

There is no indication that the species occurs within the project area or would be affected by rebuilding and operation of the rail line in Minnesota. The project is not expected to contribute to any change in the species' status during or after completion.

6.10 WINGED MAPLELEAF MUSSEL

There is no indication that the species occurs within the project area or would be affected by rebuilding and operating the existing railroad in Minnesota. The project is not expected to contribute to any change in the species' status during or after completion.

6.11 KARNER BLUE BUTTERFLY

Oak savannah habitat has been modified or eliminated by urbanization, silviculture, and fire suppression contributing to the species endangerment. There is no indication that the existing railroad in Minnesota coincides with suitable habitat for Karner blue butterflies. Unless the species' only known larval food plant, wild lupine (*Lupinus perennis*), is found growing in the construction right-of-way, the project would not impact the Karner blue butterflies. The project is not expected to contribute to any change in the species' status during or after completion.

6.12 UTE LADIES'-TRESSES ORCHID

The primary threat to this species is loss and modification of riparian habitat. Although this species is not known to occur in any counties within the analysis areas in South Dakota and Wyoming, it was included on lists of potential species inhabiting the project area in the Cheyenne River drainage by USFWS. Four sites along Alternative B were identified as potential habitat for the orchid; compared to two sites along Alternative C and one site along Alternative D. Proposed mitigation for this species should ensure that potential cumulative effects contributed by the proposed new railroad alternatives do not occur. The project is not expected to contribute to any change in the species' status during or after completion.

6.13 PRAIRIE BUSH-CLOVER

Agricultural development and road and residential developments have been cited as the primary causes of the species decline. Rebuilding the existing railroad has the potential to impact at least one known population of this species that has been observed growing within or near the existing right-of-way in Brown County, MN and the existing railroad intersects mesic and dry prairie remnants, potential habitat for prairie bush-clover. Searching for prairie bush-clover prior to construction and protecting populations found within construction zones is the only practicable means to completely eliminate impacts to the species. The project is not expected to contribute to any change in the species' status during or after completion.

6.14 LEEDY'S ROSEROOT

Suitable habitat for the species is not present along the existing railroad in southeastern Minnesota and there is no indication that the species occurs within the project area or would be affected by rebuilding and operating the existing railroad in Minnesota. The project is not expected to contribute to any change in the species' status during or after completion.

6.15 WESTERN PRAIRIE FRINGED ORCHID

This species is primarily threatened by loss and modification of habitat. Although this species is not known to occur in any counties within the analysis areas in Minnesota and South Dakota, it was included on lists of potential species inhabiting the project area in adjacent Pipestone and Rock counties, Minnesota by USFWS.

There are several wet prairie remnants intersected by the existing railroad in 3 counties in Minnesota. Searching for western prairie fringed orchid prior to construction and protecting populations found within construction zones is the only practicable means to completely eliminate impacts to the species. The project is not expected to contribute to any change in the species' status during or after completion.

6.16 BALD EAGLE

Construction and operation of the new railroad and rebuilding the existing railroad are likely to be sources of disturbance and potential mortality to wintering bald eagles in Minnesota, South Dakota, and Wyoming. Proposed mitigation can reduce the likelihood of direct eagle mortality by operating trains through removal of any carrion from tracks and rights-of-way. However, noise and activities associated with construction and operation of the railroad are likely to disturb wintering eagles within some distance of the tracks along the Minnesota River (Minnesota); Bad and Missouri rivers (South Dakota): and the Cheyenne River (Wyoming and South Dakota).

Mitigation measures and stipulations will provide some measure of protection to bald eagles if applied to lands adjacent to rivers crossed by the new railroad alternatives and existing railroad reconstruction. Those measures could reduce risks of the project contributing significant cumulative effects. The project is not likely to contribute to any change in the species' status during or after completion.

6.17 MOUNTAIN PLOVER

Mountain plover habitat is threatened by the conversion of grasslands to croplands and urban uses, domestic livestock management, mineral development and prairie dog control. If prairie dog management on Federal lands was directed to expanding colonies and populations, the effect would be beneficial to mountain plover. Mitigation measures will provide some measure of protection to the species if applied to lands crossed by the new railroad alternatives. These measures could reduce risks of the project contributing significant cumulative effects that would change the species' status during or after completion. Alternative B impacts approximately 279 acres of potential nesting habitat compared to 424 acres impacted by Alternative C and 150 acres impacted by Alternative D.

The amount of suitable habitat available may be broad. Mountain plover may not be limited to the availability of suitable habitat.

6.18 SWIFT FOX

Loss of native habitat, trapping, hunting, vehicular traffic and prey reduction from rodent control are some reasons for the animal's continued decline. Swift fox probably use all upland habitats within the proposed project area in South Dakota and Wyoming. If prairie dog management on Federal lands was directed to expanding colonies and populations, the effect would be beneficial to swift fox. Mitigation measures will provide some measure of protection to the species if applied to lands crossed by the new railroad alternatives. These measures

could reduce risks of the project contributing significant cumulative effects that would change the species' status during or after completion.

6.19 STURGEON CHUB

Habitat alteration and water withdrawals have contributed to the species decline. While construction and operation of new railroad alternatives will not alter in-stream flows in the same way that dams do, water removal from the Cheyenne River during construction could reduce flows temporarily. Additional water depletions could isolate sturgeon chubs in pools with poor water quality and/or increase their risk of predation by introduced piscivorous fish. Construction of stabilization measures required on Cheyenne River banks could alter river hydraulic dynamics, thus altering channel characteristics and potential spawning sites in the immediate area. Mitigation measures and best-management practices employed during construction and operation of the new railroad alternatives should minimize any discharge and water depletions to the Cheyenne River at periods when sturgeon chub are likely to be most vulnerable. Alternative B impacts the Cheyenne River and its tributaries more times than alternatives C and D. The project is not expected to contribute to any change in the species' status during or after completion.

6.20 BLACK-TAILED PRAIRIE DOG

Multiple factors that impact prairie dog populations include conversion of prairie habitats to agriculture, sport shooting, sylvatic plague, fragmentation of grasslands, and poisoning. Each of the new railroad project alternatives pass through prairie dog colonies and construction activities are expected to adversely impact individual prairie dogs; but not contribute significantly to species viability rangewide. Once construction is completed, previously disturbed work zones are likely to be re-colonized as long as healthy populations remain in the vicinity. Alternative B would impact approximately 279 acres of prairie dog colonies compared to 424 acres under Alternative C and approximately 150 acres under Alternative D.

Table 6-1
Preliminary Determination of Effects to Federally Listed Endangered, Threatened, Proposed, Candidate and Petitioned Species

Species	Rebuild in MN and SD	New Build in Minnesota		New Build Alternatives in South Dakota and Wyoming				
	Existing	Mankato	Owatonna	B	C	Phiney Flat	W G Flat	D
Black-footed ferret	No Effect	No Effect	No Effect	Likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect
Piping plover	No Effect	No Effect	No Effect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect
Whooping crane	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Interior least tern	Not likely to adversely affect	No Effect	No Effect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect
Topeka shiner	Not likely to adversely affect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Pallid sturgeon	Not likely to adversely affect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
American burying beetle	Not likely to adversely affect	No Effect	No Effect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect
Minnesota dwarf trout lily	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Higgin's eye pearly mussel	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Karner blue butterfly	Not likely to adversely affect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Ute ladies'-tresses orchid	No Effect	No Effect	No Effect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect
Prairie bush-clover	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	No Effect	No Effect	No Effect	No Effect	No Effect
Leedy's roseroot	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Western prairie fringed orchid	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	No Effect	No Effect	No Effect	No Effect	No Effect
Bald eagle	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect
Mountain plover	No Effect	No Effect	No Effect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect
Swift fox	No Impact	No Impact	No Impact	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect
Sturgeon chub	No Impact	No Impact	No Impact	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect
Black-tailed prairie dog	No Impact	No Impact	No Impact	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect	Not likely to adversely affect

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(*SPIRANTHES DILUVIALIS* SHEVIAK)

Submitted to:

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1.0 INTRODUCTION

1.1 Scope

On February 20, 1998, the Dakota, Minnesota & Eastern Railroad Corporation (DM&E) filed an application with the Surface Transportation Board (Board) for authority to construct and operate new rail line facilities in east-central Wyoming, southwest South Dakota, and south-central Minnesota. A large portion of the project involves construction of 280.9 miles of new rail line across southwestern South Dakota and east central Wyoming. Because construction and operation of this project has the potential to result in significant environmental impacts, the Board's Section of Environmental Analysis (SEA) has determined that the preparation of an Environmental Impact Statement (EIS) is appropriate.

Analysis in the EIS will address the proposed activities associated with the construction and operation of new rail facilities and their potential environmental impacts on threatened and endangered species, as appropriate. Ute ladies' tresses (*Spiranthes diluvialis* Sheviak), a low elevation orchid of riparian and palustrine habitats has the potential of occurring in the project area (USFWS per. comm. 1998a). Therefore, the U.S. Fish and Wildlife Service (USFWS) requested an inventory to evaluate the potential project impacts to the orchid and its potential habitat (USFWS per. com. 1998a).

USFWS and Wyoming Natural Diversity Database (WYNDD) cautioned that locating flowering individuals would be difficult because of the late season inventory. Additionally, USFWS personnel indicated the orchid is difficult to find and identify unless flowering and it may only flower every 3-5 years. Therefore, absence during the flowering period in suitable habitat is not considered confirmation that the species is not present. It was determined by the USFWS that documenting the presence or absence of potential habitat was appropriate and if present, new populations would be noted.

1.2 Orchid Life History and Distribution

The USFWS listed Ute ladies' tresses as threatened in January of 1992 under authority of the Endangered Species Act of 1973 (USFWS 1992). *Spiranthes diluvialis* is a perennial, terrestrial orchid usually with a single stem 8 to 20 inches tall, and 3 to 15 small white or ivory-colored flowers arranged in a terminal spike. Geographic distribution of the orchid includes the eastern Great Basin of western Utah and adjacent Nevada, Colorado River drainage of eastern Utah, eastern front of the Rocky Mountains, and south central Idaho and Wyoming.

In Nebraska, the orchid has been found along the Niobrara River in Platte County (Hazlett 1996). In eastern Wyoming, the orchid is known from Converse, Goshen, Laramie, and Niobrara counties (WYNDD per. comm. 1998). To date, the orchid has not been found in South Dakota (USFWS per. comm. 1998b).

Spiranthes diluvialis is a late summer blooming species with a narrow phenological window of approximately five weeks (July 25th - Sept. 7th). Throughout its range, the orchid has been documented as requiring soil saturation, open areas where vegetation is low, and a distinct growth position along stream banks (Franklin 1992, Kass 1994). In eastern Wyoming and western Nebraska, it has been found on moist cutbanks of saline palustrine meadows or abandoned river channels, and on alluvial terraces adjacent to creeks (Hazlett 1996).

In Wyoming, plant species that appear to consistently occur with the orchid include white sweetclover (*Meliotis officinalis*), arrowgrass (*Triglochin maritimum*), creeping bentgrass (*Agrostis stolonifera*) and baltic rush (*Juncus balticus*) (Hazlett 1996).

1.3 Description of Project Area

Project area is located primarily on the periphery of the Black Hills in southwestern South Dakota, and extends northwest to the Powder River Basin of northeastern Wyoming. According to Fenneman (1931), the project area is included in the Great Plains physiographic province. Elevation ranges from 3,300 ft. at Wasta, S. D. in the east, to 4,500 ft. at Gillette, Wy. in the west. Project area climate is continental and influenced by spring and summer precipitation occurring mainly from March-through September. Annual precipitation varies from approximately 8 inches in Gillette to approximately 15 inches at Wasta (USDA-SCS 1985).

Vegetation in the project area is characterized as short and mixed-grass prairie. Short grass prairie is characterized by the dominance of two common short grasses blue grama (*Bouteloua gracilis*) and buffalograss (*Buchloe dactyloides*). Mixed-grass prairie can be divided into several types, but all are characterized by needle-and-thread (*Stipa comata*), western wheatgrass (*Elymus smithii*), Sandberg bluegrass (*Poa sandbergii*), and Indian ricegrass (*Oryzopsis hymenoides*). Mixed-grass prairie in the foothills is typically dominated by bluebunch wheatgrass (*Elymus spicatum*), little bluestem (*Andropogon scoparius*), and sideoats grama (*Bouteloua curtipendula*) (Knight 1994). Plant species nomenclature follows Dorn (1977).

2.0 METHODS

2.1 Field Inventory & Planning

Field inventory was conducted from September 14th to 25th by Ronald J. Kass, botanist for Intermountain Ecosystems and Carol Cunningham of Burns and McDonnell. Known locations of orchid were visited in southeastern Wyoming. These sites included: (1) Sprager Creek (Laramie Co.), (2) Bear Creek (Goshen Co.), and (3) Van Tassell Creek (Niobraba Co.). Two days were spent searching known sites, gathering data on the species condition, and becoming familiar with orchid habitat. After field inventory members felt comfortable with the search protocol, visits to potential orchid sites in the project area were scheduled.

Twenty-seven potential habitat sites were located by reviewing National Wetland Inventory Maps (NWI) and aerial photographs of the proposed railway alignment. Criteria for potential habitat were any intermittent, perennial or palustrine wetlands within a 1,000 foot corridor of the modified proposed alternative route. Right-of-way (ROW) would be 200 feet, however, a 1,000 foot corridor was surveyed to allow for minor adjustments in the alignment. Each potential site was visited systematically in the field starting at Wasta following the line southwest to Gillette and then visiting sites along the North/South coal mine line near Gillette.

Landowners were contacted and permission was requested prior to each site visit. Only public lands and those for which access was obtained were surveyed. In some areas where access was not obtained, areas outside the proposed ROW were surveyed to gain information on the potential conditions within the ROW. At each site for which access was obtained, the entire area was searched in detail by walking linear transects within the 200 foot ROW. In other areas, visual observations from adjacent areas, generally public roads, were made.

Pertinent ecological information was recorded and photographs were taken at each site (Appendix A-Photo Log). Potential habitat was evaluated primarily on four parameters: (1) presence of a reliable water source throughout the growing season, (2) suitable vegetation structure and composition, (3) suitable channel morphology, and (4) presence of indicator species. Those areas considered as potential habitat were delimited on aerial photographs (Appendix B).

3.0 RESULTS

3.1 Visits to Known Locations

Three known locations of the orchid were visited in southeastern Wyoming. The site at Sprager Creek in Laramie County, Wy. was characterized as a seasonally to semi-permanent flooded palustrine wet meadow that was hayed periodically and the orchid could not be located during a two hour search. The orchid was located at the Bear Creek site (Goshen Co.) on alluvial terraces in a palustrine wet meadow. Plants were in post-fruit and stunted because of continual haying.

The site at Van Tassell Creek (Niobraba Co.) was characterized as a seasonally flooded palustrine meadow that was periodically hayed and grazed. The orchid was not located at this site after a two hour search. It is quite possible that orchids at the Sprager Creek and Van Tassell sites were absence because of the continual haying, grazing or lack of growth due to a less than optimal year.

3.2 Field Inventory Constraints

Access to private property was severely restricted and only 30% (8 of 27) of sites considered potential habitat (based on review of maps and aerial photographs) within the actual ROW were inventoried. Remaining sites were evaluated from a distance usually from a road nearest the actual ROW. Fourteen sites received off-site searches from the road or nearest access point, and 5 sites could not be accessed within a reasonable distance to collect data (No data). Four of the 22 sites or 18% of the sites were considered as potential habitat for Ute ladies' tresses.

3.3 Potential Habitat Descriptions

The following is a brief description of the potential habitats visited and includes a characterization of potential habitats, likelihood of orchid occurrence, and access type. Table 1 provides a comprehensive site index of the inventory data.

1. **Box Elder Creek--**This site was characterized as a meandering perennial stream with steep, dry, banks vegetated to sandbar willow (*Salix exigua*). Plains cottonwood (*Populus deltoides* var. *occidentalis*) was growing on the broad floodplains. Direct access to the ROW was denied and the site was evaluated from the road as **no potential** because of the high, dry, densely vegetated banks (Appendix A: photos 1).

2. **Spring Creek---**This site was characterized as a meandering perennial stream with steep, dry, banks vegetated to sandbar willow and western wheatgrass (*Elymus smithii*). Plains cottonwood was growing on the broad floodplains. Direct access to the ROW was denied and the site was evaluated from the road as **no potential** because of the high, dry, densely vegetated banks (Appendix A: photos 2).

3. **Battle Creek--** The ROW crosses north of Battle Creek in a ravine vegetated with plains cottonwood and American elm (*Ulmus americana*). Direct access to the ROW was denied and the site was evaluated from the road. The site was evaluated as **no potential** because vegetation was very dense, and landscape position of the ravine was too high in relation to the creek (Appendix A: photo 3).

4. **French Creek--**Access was denied to this site and it could not be evaluated from a distance (no photo).

5. **Cheyenne River at Hay Canyon--**This site was characterized as a meandering perennial stream with steep, dry, banks vegetated to sandbar willow and cordgrass (*Spartina pectinata*). Plains cottonwood was growing on the broad floodplains. ROW access was permitted at this site but it was evaluated as **no potential** because of the high, dry, densely vegetated banks (no photo).

6. **Hay Canyon North---**This site was characterized as a saline wet meadow vegetated to cordgrass on the high, dry banks. A series of springs were present on sloping terrain and supported dense stands of cattails (*Typha latifolia*) and bulrush (*Scirpus sp.)*. ROW access was permitted at this site but it was evaluated as **no potential** because of dense vegetation and high, dry, banks (Appendix A: photo 4).

7. **Hay Canyon South---**These sites were characterized as a series of saline wet meadows/marshes vegetated to mainly cattails and cordgrass. ROW access was permitted to several of these site. It was determined that several of these site could be evaluated as **potential habitat** because of suitable vegetation structure, channel morphology, and hydrology (Appendix A: photo 5).

8. **Sand Creek--**The site was characterized as a riparian woodland with heavy understory of silver buffaloberry (*Spherdia argentea*) and wild plum (*Prunus americana*). ROW access was denied and the site was evaluated as **no potential** because of the heavy understory vegetation. (Appendix A: photo 6).

9. **Horsehead Creek--**This site was characterized as a perennial to intermittent stream with some vegetated cutbanks lined with cordgrass and floodplains vegetated to plains cottonwood and red ash (*Fraxinus pennsylvanica*). ROW access was denied and the site was evaluated from the highway. The site was evaluated as **no potential** because cutbanks were high, dry, and densely vegetated (Appendix A: photo 7).

10. **Dry Creek---**This site was characterized as a perennial to intermittent stream with some vegetated cutbanks and abandoned oxbows lined with cattails, cordgrass, and three square bulrush (*Scirpus pungens*). Uplands are dominated by sagebrush and grasses. Access was permitted to the ROW. The site was evaluated as **potential habitat** because vegetation composition and structure were suitable, and cutbanks were gently sloping, moist, and lightly vegetated (Appendix A: photo 8).

11. **Hat Creek--** This site was characterized as a perennial stream with cordgrass and Canadian wildrye (*Elymus canadensis*) growing on the cutbanks. Floodplain vegetation was dominated by plains cottonwood. Access was permitted to the ROW. The site was evaluated as **no potential** because vegetation composition and structure were not suitable, and cutbanks were generally steep, densely vegetated, and shaded (Appendix A: photos 9).

12. **Plum Creek---**Access was denied and the site could not be evaluated from a distance (no photo).

13. **Red Canyon Creek--**This site was characterized as a channelized perennial stream with little or no vegetation associated with the stream channel. Adjacent floodplains were vegetated to plains cottonwood and sand sagebrush. ROW access was denied and the site was evaluated as **no potential** habitat from the highway (Appendix A: photo 10).

14. **Beaver Creek**--This site was characterized as a channelized perennial stream vegetated to grass, and the adjacent floodplains were vegetated to plains cottonwood and sand sagebrush. ROW access was denied and the site was evaluated as **no potential habitat** from the road (Appendix A: photo 11).

15. **Bobcat Creek**--This site was characterized as an intermittent stream vegetated to Wyoming sagebrush (*Artemisia tridentata var. wyomingensis*). Access was denied to this site and the **no potential habitat** was determined from the highway (Appendix A: photo 12).

16. **Alkali Creek**--This site was characterized as a perennial stream with greasewood (*Sarcobatus vermiculatus*), alkali sacaton (*Sporoblus airoides*), and plains cottonwood growing along the broad floodplains. Access was permitted to this site but it was evaluated as **no potential** because of the highly dry, alkaline conditions and dense vegetation (Appendix A: photo 13).

17. **Lodgepole Creek**---This site was characterized as a perennial to intermittent stream with some vegetated cutbanks and abandoned oxbows lined with cattails, cordgrass, and three square bulrush. Uplands were dominated by Wyoming sagebrush and grasses. Access was permitted to the ROW. The site was evaluated as **potential habitat** because vegetation structure and composition, channel morphology, and hydrology were suitable (Appendix A: photo 14).

18. **Lion Creek**--This site was characterized as an intermittent stream vegetated to Wyoming sagebrush with **no potential** because of lack of suitable vegetation composition, and generally arid conditions. ROW access was denied to this site and it was observed from the highway (no photo).

19. **Piney Creek**--This site was characterized as a perennial to intermittent stream vegetated to Wyoming sagebrush with **no potential** because of vegetation composition and generally arid conditions. ROW access was denied at this site and it was observed from a gravel road (Appendix A: photo 15).

20. **Little Thunder Creek**--This site was characterized as a perennial to intermittent stream vegetated to cordgrass with **no potential** because of arid conditions. ROW access was denied at this site and it was observed from a secondary gravel road (Appendix A: photo 16).

21. **School Creek**--This site was characterized as a perennial stream vegetated to cordgrass. ROW access was permitted and this site was evaluated as **potential habitat** because of suitable vegetation structure, hydrology, and channel morphology (Appendix A: photo 17).

22. **West Fork of Beckwith Creek**--This site was characterized as an intermittent stream vegetated to Wyoming sagebrush with **no potential habitat** due to the lack of vegetation composition. ROW access was denied to this site and it was observed from the gravel road (no photo).

23. **Black Thunder Creek---**This site was characterized as an intermittent stream vegetated to Wyoming sagebrush with **no potential habitat** due to lack of suitable vegetation composition ROW access was denied to this site and it was observed from a gravel road (no photo).

24. **East Fork of Coal Creek--**Access was denied to this area and no data is available.

25. **Dry Creek--**Access was denied to this area and no data is available.

26. **Belle Fourche River---**Access was denied to this area and no data is available.

27. **Caballo Creek---**Access was denied to this area and no data is available.

Table 1. Site Index for *Spiranthes diluvialis*.

Site Name	USGS Quad/Legal Description	NWI Maps	Plant Association	Direct Access to ROW	Potential Habitat
Box Elder Creek	Wasta, SD. T1N, R14E, NE4, S31	R2UBA	cottonwood, sandbar willow	No	No
Spring Creek	Scenic SW, SD. T2S, R12E, SW4, S29; NE4, S31	PEMA	cottonwood, sandbar willow	No	No
Battle Creek	RedShirt, Wy. T3S, R10E, NW4, S31	PEMA	cottonwood, American elm	No	No
French Creek	Fairburn, NE, SD. T5S, R9E, S5	PEMCH	No data	No	No data
Cheyenne River at Hay Canyon	Smithwick, NE, SD. T7S, R8E, S1	R2UBG	cottonwood, sandbar willow, cordgrass	Yes	No
Hay Canyon North	Smithwick, NE, SD. T7S, R8E, S12	PEMC PEMA	cordgrass, cattails	Yes	No
Hay Canyon South	Smithwick, NW, SD. T8S, R8E, SE4, S2; SW4, S1	PEMA, PUBH PEMC	cattail, bulrush, cordgrass	Yes	Yes
Sand Creek	Smithwick SD/ T8S, R8E, NW4 S31	PEMC	cottonwood, plum	No	No
Horsehead Creek	Lone Well Creek East, SD. T9S, R7E, S21	PEMA, PUBH	cottonwood, red ash, cordgrass	No	No

Site Name	USGS Quad/Legal Description	NWI Maps	Plant Association	Direct Access to ROW	Potential Habitat
Dry Creek	Lonewell Cr. West, SD. T9S, R6E, SE4, NE4, S29	PEMA	cattails, cordgrass, three-square bulrush	Yes	Yes
Hat Creek	Heppner, SD. T9S, R4E, SW4, S25	PEMA	cottonwood, cordgrass, wildrye	Yes	No
Plum Creek	Rumford, SD. T9S, R4E, S31	PABFH	No data	No	No data
Red Canyon Creek	Edgemont, SD. T8S, R3E, NW4, S29	PEMC	cottonwood, sand sagebrush	No	No
Beaver Creek	Twenty One Divide, Wy-SD T7S, R1E, S16	PEMC	cordgrass,	No	No
Bobcat Creek	Riverview, Wy. T40N, R61W, S9	PEMA	sagebrush	No	No
Alkali Creek	Little Alkali Creek, Wy. T40N, R62W, S4	PEMA	greasewood, alkali sacaton	Yes	No
Lodgepole Creek	The Nose East, Wy. T42N, R64W, SW4, S32	PEMC	baltic rush, three-square bulrush, cordgrass	Yes	Yes
Lion Creek	Darlington Draw East, Wy. T42N, R67W, NE4, S21	PEMA R4SBA	sagebrush	No	No

Table 1. Site Index for *Spiranthes diluvialis* (continued).

Site Name	USGS Quad/Legal Description	NWI	Plant Association	Access to ROW	Site Potential
Piney Creek	Darlington Draw West, Wy. T42N, R68W, S2	PEMA	sagebrush, cotttonwood	No	No
Little Thunder Creek	Piney Cyn. NW, Wy. T43N, R69W, SW4, S30	PEMA, PABFH	cordgrass	No	No
School Creek	Piney Cyn. NW, Wy. T42N, R69W, NW4, NE4, S6	PABFH	cordgrass	Yes	Yes
West Fork of Beckwith Creek	Piney Cyn, SW, Wy. T41N, R69W, NE4, S8	PEMB PABH	sagebrush	No	No
Black Thunder Creek	Open A Ranch, Wy. T44N, R70W, S14	PABFH	sagebrush	No	No
East Fork Coal Creek	Rough Creek, Wy. T45N, R70W, S11	PEMAH	No data	No	No data
Dry Creek	Saddle Horse Butte, Wy. T47N, R70W, S29	PEMAH	No data	No	No data
Belle Fourche River	Saddle Horse Butte, Wy. T47N, R70W, S30	PEMAH PEMCH	No data	No	No data
Caballo Creek	Saddle Horse Butte, Wy. T48N, R71W, S35	PEMCH PABFH	No data	No	No data

4.0 DISCUSSION

4.1 Field Inventory Summary

Four of the 22 sites or 18% of the inventoried sites were considered as potential habitat for Ute ladies' tresses. Hay Canyon South, Dry Creek, Lodgepole Creek, and School Creek met the parameters for suitable hydrology, channel morphology, vegetation composition and structure (Table 1). Potential habitats were generally seasonally flooded to semi-permanently flooded channels and abandoned meanders vegetated to cattails, bulrush, cordgrass and baltic rush. Often, these potential habitats had a drier perimeter of creeping bentgrass (*Agrostis stolonifera*), white sweetclover (*Meliotis officinalis*), and foxtail barley (*Hordeum jubatum*). The presence of associated species or indicators species such as white sweetclover were present in at least two of the four sites.

Unsuitable habitats were areas where the banks were too dry, steep, shaded or overgrown with dense and tall vegetation. Intermittent streams vegetated to sagebrush, wet meadows vegetated to dense cordgrass or riparian areas dominated by big cottonwoods were common in the project area and were not considered as potential habitat. It is realized that a rare species is capable of expanding its range and range of habitats, and that it can respond to different sets of environmental circumstances such as different indicator or associated species. For example, in Utah the orchid is found growing in similar hydrologic and geomorphic conditions but is found with a host of different indicator or associated species (Kass 1997). These changing circumstances were taken in consideration when evaluating potential habitats outside the known range of the species (i.e. South Dakota).

4.2 Potential Habitats For Future Inventory

It should be realized that only a subset of potential habitats were inventoried because of access constraints. The inventory was also confounded by a late season search, grazing, haying and a drier than normal growing season. Given these confounding factors, it is probable that *Spiranthes diluvialis* could be found in the project area.

Hay Canyon in Fall River County, S.D. is a long, narrow canyon supporting a diverse systems of palustrine habitats along the ROW. This inventory sampled only a very small portion of Hay Canyon and future investigation is warranted, especially in North Hay Canyon. The inventory could not access the Belle Fourche River or Caballo Creek but these areas should be checked for suitable habitats. The Cheyenne River is the most frequently encountered watercourse along the proposed railway. Despite its frequency of riverine and palustrine habitats, the inventory did not find any suitable habitats for the orchid.

5.0 LITERATURE CITED

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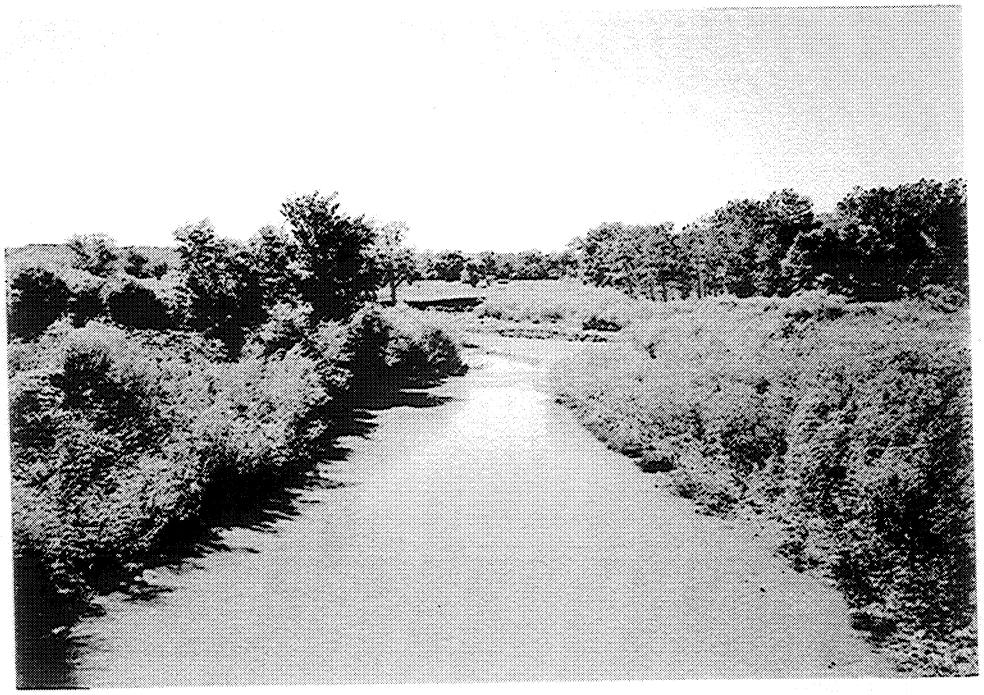
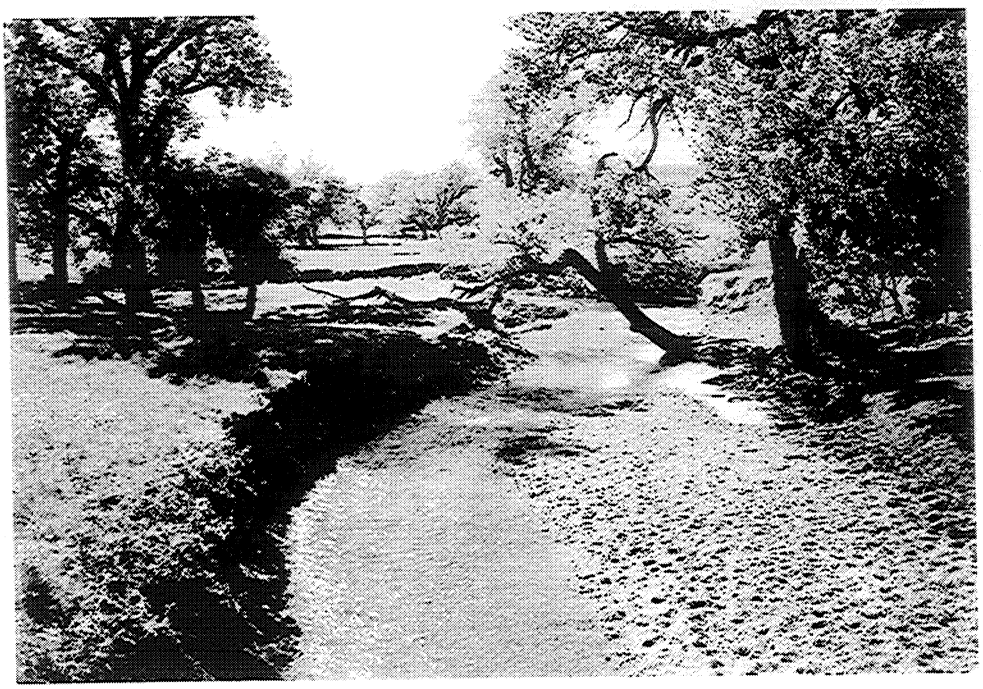
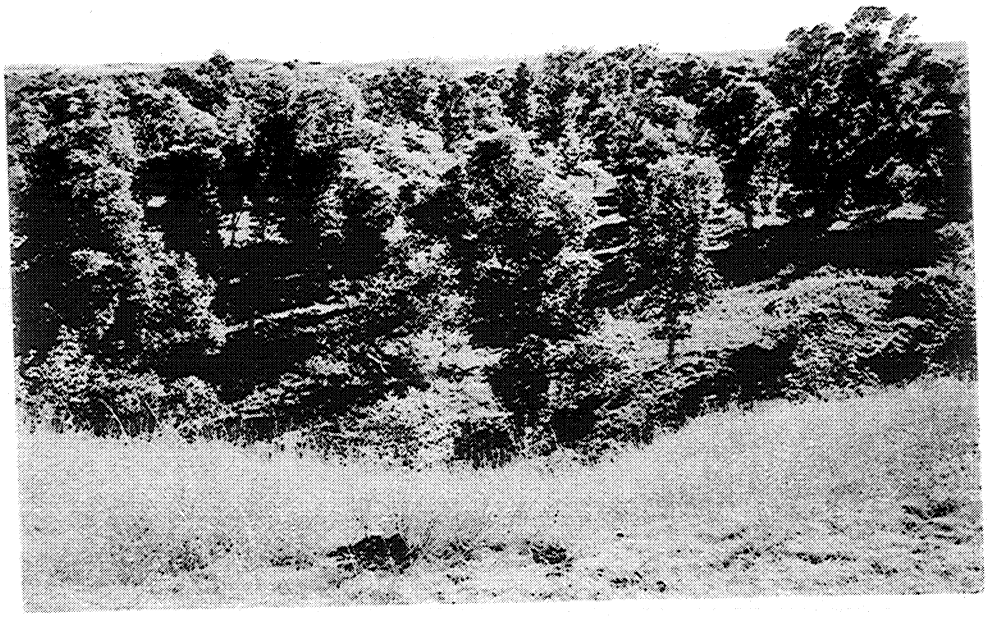
APPENDIX A
Photo Log



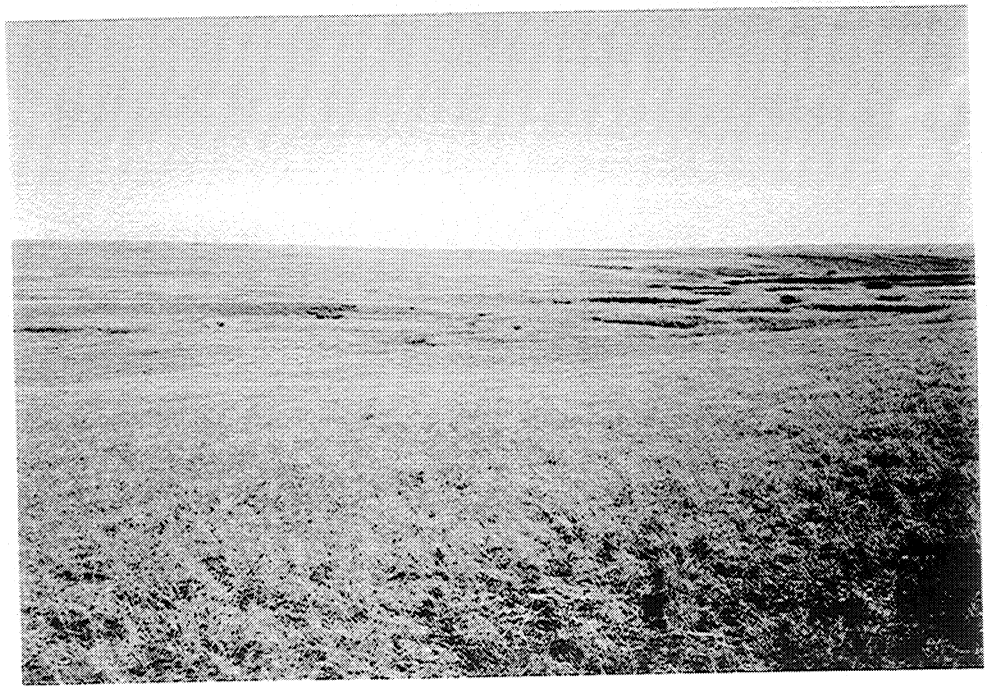
Box Elder Creek
Photo 1



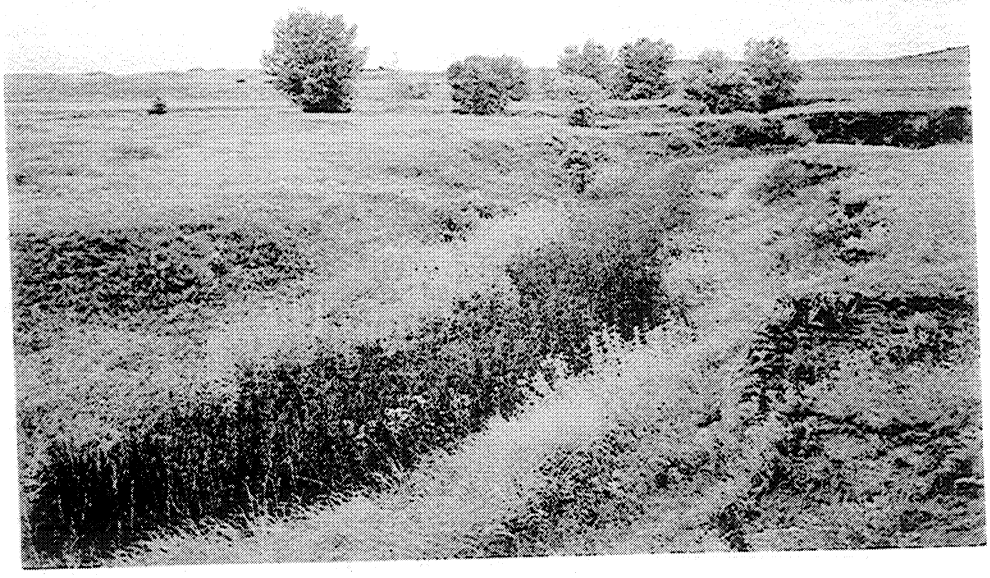
Spring Creek
Photo 2



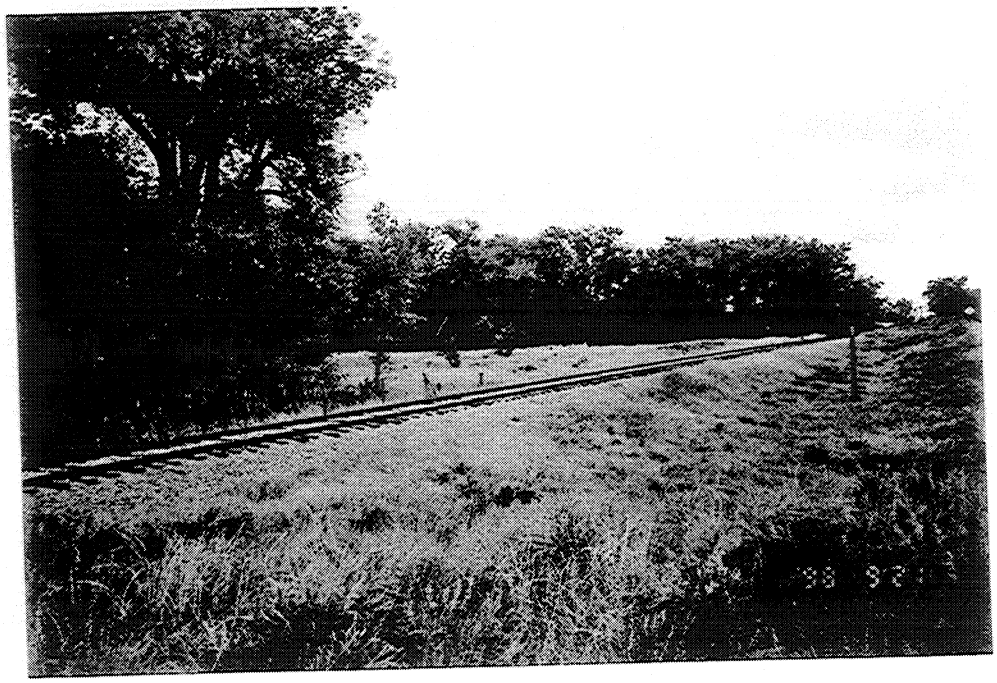
Battle Creek
Photo 3



Hay Canyon North
Photo 4



Hay Canyon South
Photo 5



Sand Creek
Photo 6

Horsehead Creek
Photo 7

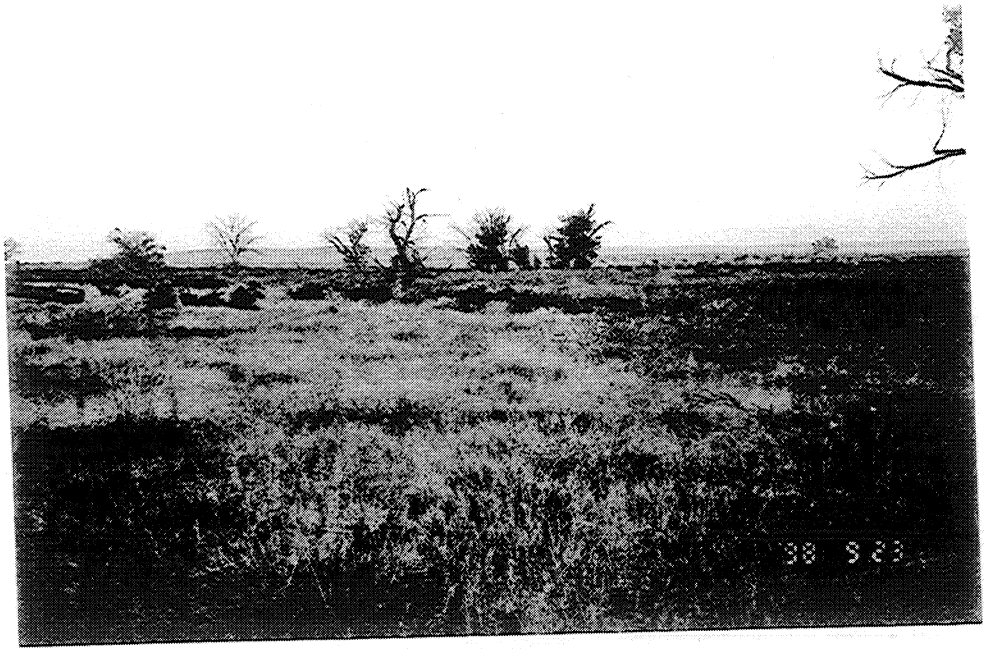
Dry Creek
Photo 8

Hat Creek
Photo 9

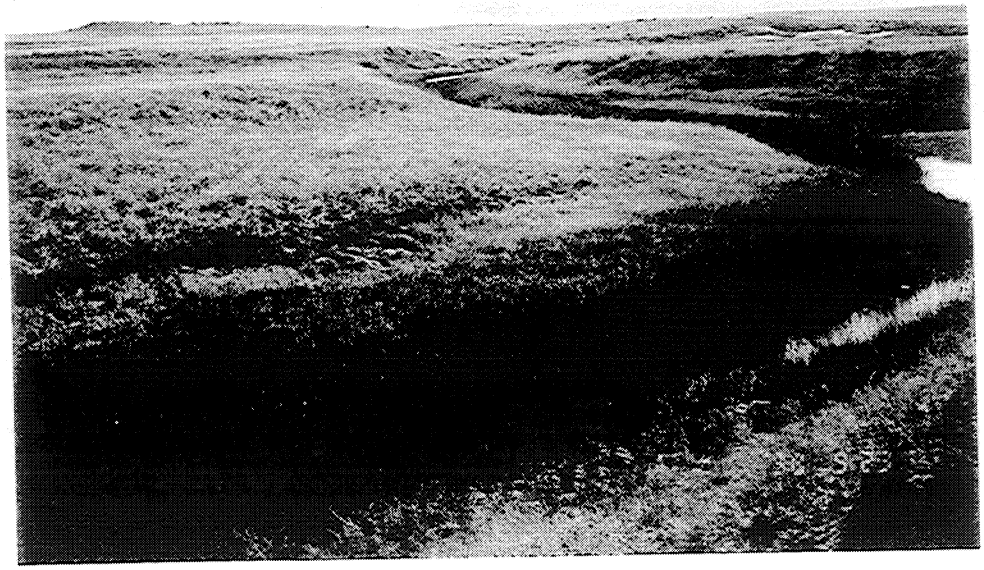
Red Canyon Creek
Photo 10

Beaver Creek
Photo 11

Bobcat Creek
Photo 12

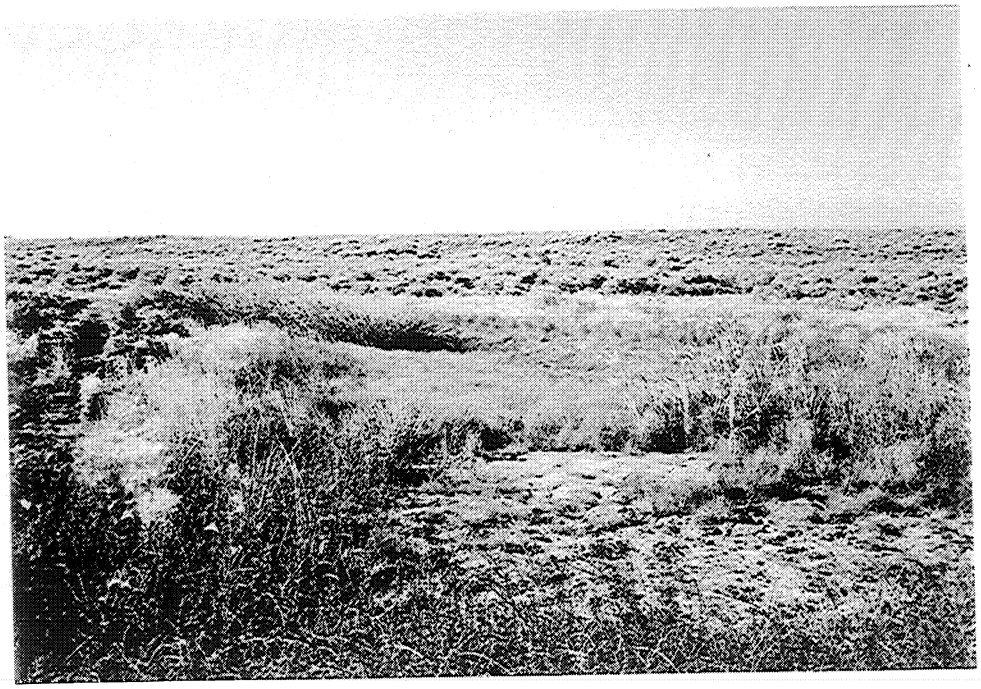


Alkali Creek
Photo 13

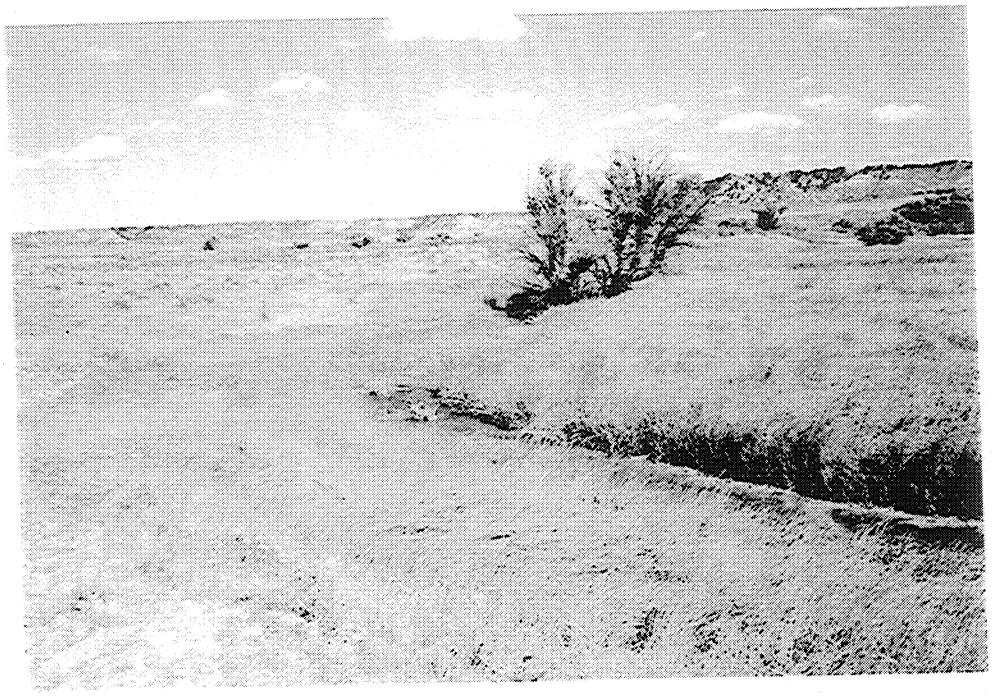


Lodgepole Creek
Photo 14

Piney Creek
Photo 15



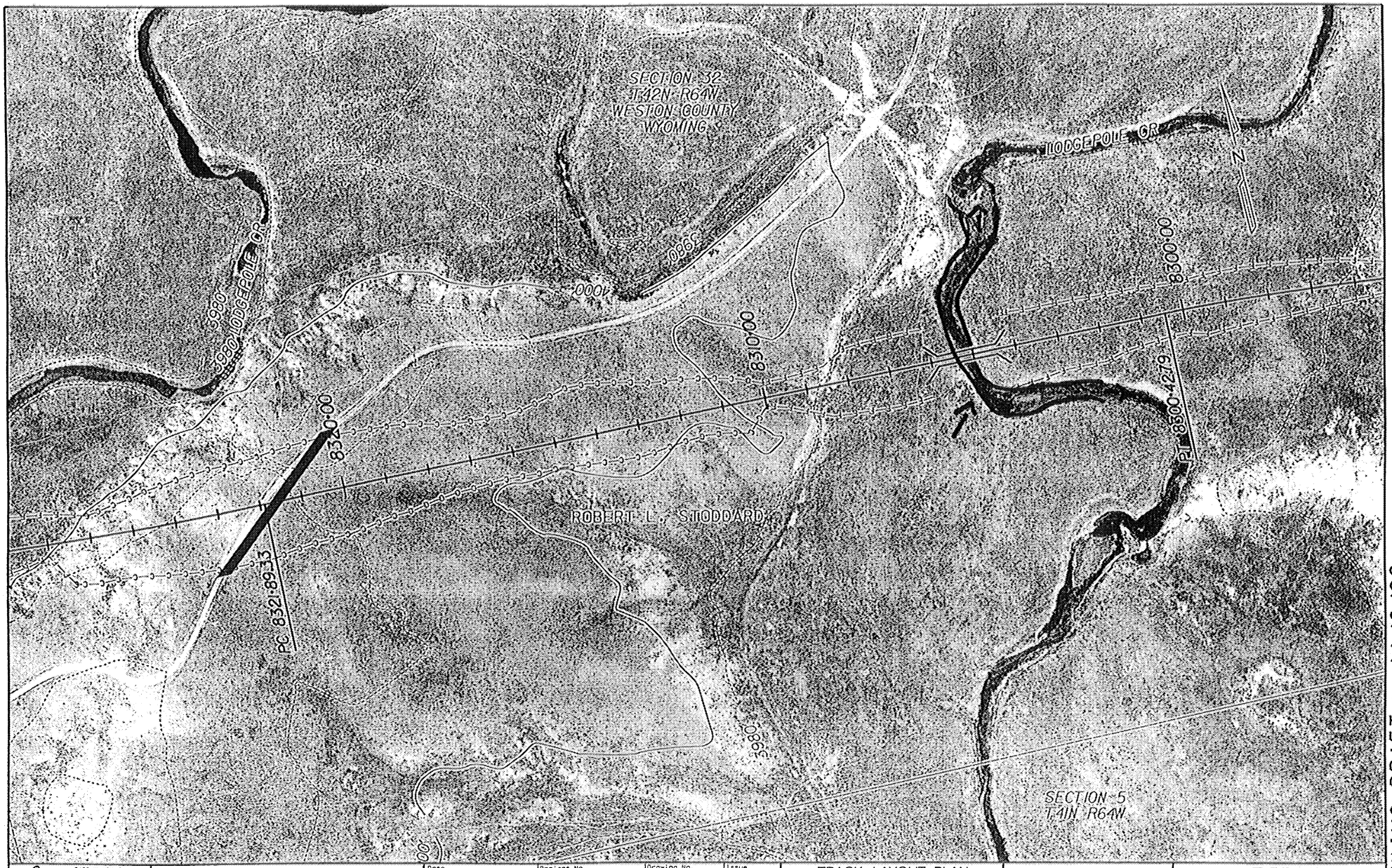
Little Thunder Creek
Photo 16



School Creek
Photo 17

APPENDIX B

Location Maps of Potential Habitats



LODGEPOLE CREEK

WORKING DRAFT - 11/6/98

8400 W. 110th St
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Overland Park, KS 66210
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www.etg-sad.com

HDR Engineering, Inc.

HNTB ARCHITECTS ENGINEERS PLANNERS

Date 05 NOV 1998	Project No. 00000-000-000	Drawing No.	Issue
Scale 1" = 200', 20' C.I.	CADD File Name ...\0055.sht		
Sheet 55 of 69			

TRACK LAYOUT PLAN
STA. – TO – STA.
Section 7 - Wyoming/S Dakota Border to "Y"

POWDER RIVER BASIN
COAL EXPANSION PROJECT

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POWDER RIVER BASIN COAL EXPANSION PROJECT

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APPENDIX L

Resource Technical Reports and Impact Assessment for the Proposed Dakota, Minnesota & Eastern Railroad

Forest Management Plan Amendments

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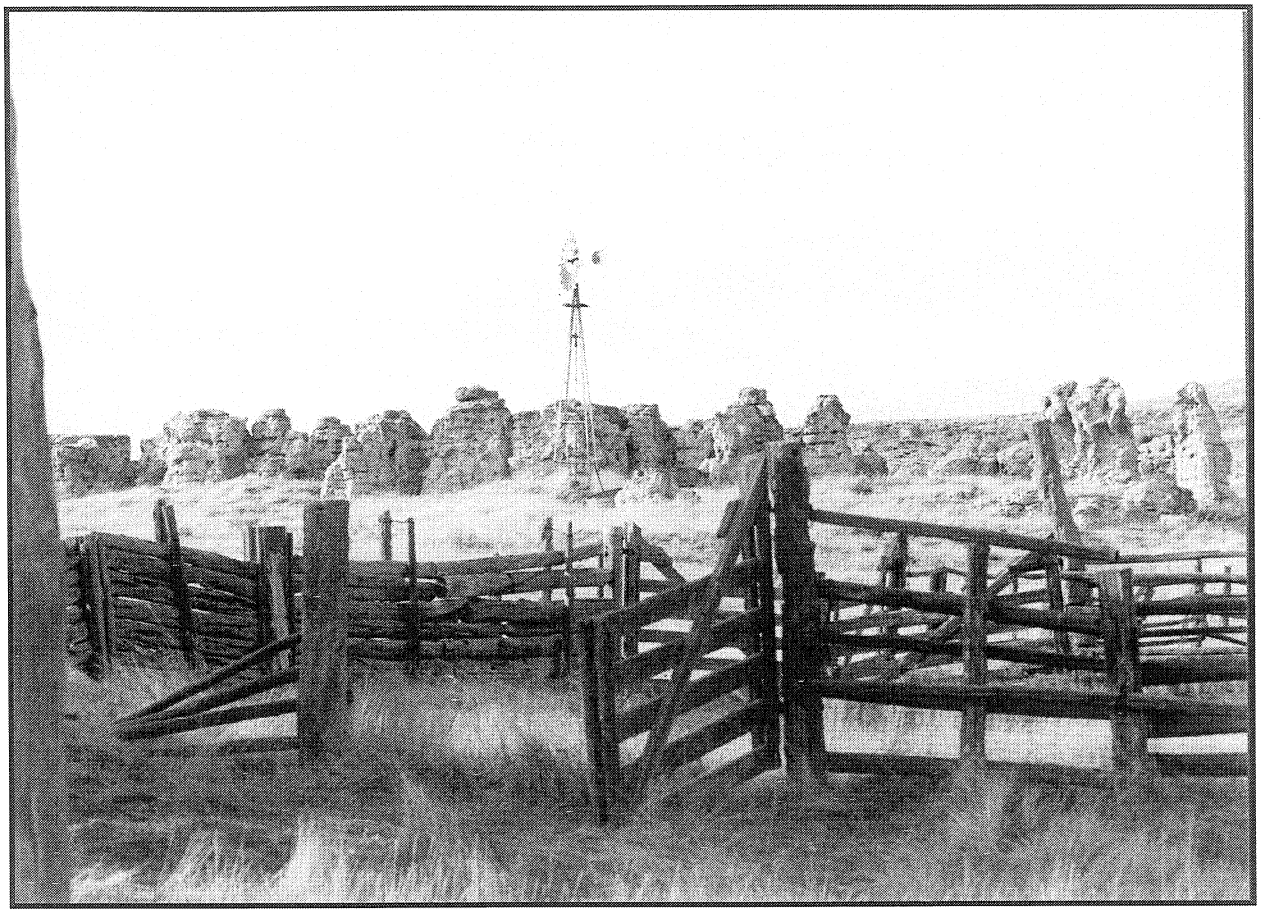

Resource Technical Reports and Impact Assessment for the Proposed Dakota, Minnesota & Eastern Railroad

Prepared by:
U.S. Department of Agriculture
Medicine Bow/Routt National Forest and Nebraska National Forest
and
U.S. Department of the Interior
Bureau of Land Management, Newcastle Field Office
(Cooperating Agencies)

For the:
U.S. Department of Transportation
Surface Transportation Board
(Lead Agency)

May 2000

Cover Photo by Charlene Rainville

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CHAPTER ONE - INTRODUCTION AND PLAN CONSISTENCY ANALYSIS

This report was prepared by the U.S. Department of Agriculture, U.S. Forest Service (Forest Service)[1], and the U.S. Department of the Interior, Bureau of Land Management (BLM), to describe the environmental impacts associated with construction, operation and maintenance of a new railroad proposed by the Dakota, Minnesota & Eastern Railroad Corporation (DM&E). In February 1998, DM&E applied to the U.S. Department of Transportation, Surface Transportation Board (STB), for authority to construct and operate a new railroad from its existing main line near Wall, South Dakota to existing Southern Powder River Basin (SPRB) coal mines in eastern Wyoming.[2] Additionally, DM&E proposed to upgrade its existing main line track, structures, systems and facilities in Minnesota and South Dakota to create a reliable and highly-efficient coal transportation system. For purposes of this report, the line extension from Wall to the SPRB coal mines is referred to as the "new railroad". Any activity associated with the upgrade of DM&E's existing main line system in Minnesota and South Dakota is referred to as the "rebuild". This report deals exclusively with the impacts associated with the new railroad in South Dakota and Wyoming.

The Forest Service is acting upon DM&E's application for an easement, pursuant to the Federal Land Policy and Management Act (FLPMA), to cross portions of Buffalo Gap National Grassland (BGNG) in South Dakota and Thunder Basin National Grassland (TBNG) in Wyoming. The BLM is acting upon a separate application for a right-of-way across public lands in South Dakota and Wyoming. The U.S. Army Corps of Engineers (COE) will be acting upon an application for a permit to dredge and fill waters of the United States and adjacent wetlands. The U.S. Coast Guard (USCG) will be required to issue a permit for construction of a new bridge across the Missouri River near Pierre, South Dakota (part of the rebuild). The Bureau of Reclamation (BOR) will be required to issue approvals to cross irrigation ditch easements in the Angostura Unit (irrigation district) in western South Dakota.

These Federal agencies are participating in the preparation of an environmental impact statement (EIS) for the project. The STB is the "lead agency" with the Forest Service, BLM, COE, BOR and USCG participating as cooperating or consulting agencies. Each agency is expected to issue a separate decision relative to the project.

This report was prepared for the STB for inclusion, as appropriate, into the EIS. Other Federal, state and local agencies will provide input to the EIS under a variety of separate regulatory processes. This report contains detailed descriptions of the affected environment and the environmental consequences of each of the alternatives for the new railroad and supports the disclosures made in the EIS. For completeness, this report addresses environmental consequences on both Federal and non-Federal lands.

1.1 Project Purpose

The purpose of DM&E's project is to transport low sulfur coal from existing coal mines in the SPRB south of Gillette, Wyoming to midwestern electric utilities. The SPRB of Wyoming is the dominant producer of low sulfur coal in the western United States. Currently, coal is transported from the SPRB mines by Burlington Northern and Santa Fe Railway Corporation (BNSF) and Union Pacific Railroad (UP) using what is known as the "joint line". However, the SPRB coal mines are capable of producing more coal than current transportation providers can ship. In addition, several of the SPRB coal producers are seeking regulatory approval to expand production levels[3] or develop new lease areas. DM&E's new railroad would provide additional transportation capacity to these mines. DM&E believes it can offer lower-cost operations and shorter, more efficient routes for current SPRB coal production to a range of utilities. Although DM&E proposes to transport coal as its principal commodity, other shippers would benefit from improved services.

DM&E's existing rail line is experiencing safety and service problems based on its deteriorated condition.[4] This project would allow DM&E to rebuild its main line system which would greatly improve safety and service provided to all shippers. Without rebuilding DM&E's existing main line, it is anticipated that current rail service in central South Dakota and southern Minnesota would cease.

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[1] Medicine Bow-Routt National Forest (Laramie, Wyoming) and Nebraska National Forest (Chadron, Nebraska)

[2] Copies of the application and supporting information, including maps and supplemental filings, can be found at DM&E's web site at http://www.dmerail.com

[3] BLM provides Powder River Basin coal production statistics at http://www.wy.blm.gov/minerals/coal/prb/pages/deq-aqd.html. According to the BLM, as of March 1999, applications had been filed with the Wyoming Department of Environmental Quality/Air Quality Division to increase production from SPRB coal mines by 90 million tons per year. Applications for increased production were on file for Belle Ayr, Jacobs Ranch, Black Thunder, and North Antelope/Rochelle.

[4] DM&E was created in 1986 through the acquisition of a line that Chicago and North Western Transportation Company had planned to abandon. Despite investments of over $100 million, serious service and safety problems continue to plague the railroad. These problems result from many years of deferred maintenance by the previous owners.

1.2 General Project Location and Alternatives

1.2.1 General Project Location. If approved, DM&E's new railroad would be constructed in western South Dakota and eastern Wyoming (see Figure 1-1). Generally, DM&E's preferred route for the new railroad (Alternative B) would leave the existing main line north of Wall and proceed south and southwest along the Cheyenne River valley in South Dakota. Between Wall and Smithwick, South Dakota the new railroad would pass north and west of Badlands National Park and the Pine Ridge Indian Reservation, crossing through BGNG. South of Smithwick the new railroad would turn to the west and proceed around the south end of the Black Hills to Edgemont, South Dakota. From Edgemont, DM&E's preferred route would follow an existing railroad corridor (BNSF) to about the South Dakota-Wyoming border. Once in Wyoming the new railroad would proceed across the northeastern corner of Niobrara County, north of the Cheyenne River, and across the southwestern portion of Weston County. TBNG would be crossed in Weston, Converse, and Campbell counties. The SPRB coal mines would be accessed in both Campbell and Converse counties.

1.2.2 Alternatives. This report addresses the following alternatives for the new railroad:

- Alternative A - No Action Alternative;
- Alternative B - DM&E's Proposed Action;
- Alternative C - Modified Proposed Action; and
- Alternative D - Existing Corridors Alternative.

In addition, this report addresses 2 route variations for portions of Alternative C in western South Dakota. In response to comments from Federal and state agencies, the Phiney Flat and W G Flat route variations were designed by DM&E to reduce loss of important wildlife habitat and wetland/riparian areas. Alignment options for accessing the Black Thunder and North Antelope mines are also addressed in this report.

A summary of the alternative lengths, by landowner, is provided on Table 1-1. The vast majority of the lands which would be crossed by the alternatives is private. Nearly 80 percent of Alternatives B and C and 90 percent of Alternative D are privately-owned.

1.2.2.1 Alternative A - No Action Alternative. This alternative serves as the baseline for estimating the impacts of other alternatives presented in this report. The National Environmental Policy Act (NEPA) requires that a No Action Alternative be considered in all environmental documents. In this instance, no action would mean that no new construction of rail line or reconstruction of DM&E's existing main line would occur. Under this alternative DM&E would likely cease to be an economically viable railroad and existing rail service to much of central South Dakota and southern Minnesota would cease.

1.2.2.2 Alternative B - Proposed Action (Applicant's Proposal). This alternative is the original action proposed by DM&E [but modified in response to operational constraints (grade) on the existing railroad between Wall and Wasta, South Dakota] in their February 20, 1998 application to the STB. That application described the project as follows:

- construct, operate, and maintain approximately 296 miles of new rail line facilities in east-central Wyoming, southwest South Dakota, and south-central Minnesota, including a 13 mile segment at Mankato, Minnesota and a 3 mile segment interchange near Owatonna, Minnesota;
- rebuild, operate and maintain approximately 13 miles of existing track on DM&E's Black Hills Subdivision Branch Line in Fall River County, South Dakota; and
- rebuild, operate and maintain approximately 600 miles of existing main line between Wall and Winona, Minnesota.

The route for Alternative B from Wall to the SPRB coal mines is shown on Figure 1-1. Under Alternative B, and with the incorporation of acceptable mitigation measures, the STB would issue a decision to grant DM&E the authority to construct, operate and maintain a railroad in Minnesota, South Dakota, and Wyoming. The Forest Service would issue an easement under FLPMA to allow DM&E to construct, operate and maintain a new railroad across portions of BGNG in South Dakota and TBNG in Wyoming. The BLM would issue a right-of-way allowing DM&E to do the same on public lands in South Dakota and Wyoming. The COE would issue a permit to allow dredging and filling of waters of the United States, including wetlands. All other relevant Federal, state and locally-required permits would be issued by the responsible agencies.

Reconstruction of the existing railroad would be accomplished, correcting deficiencies and bringing the existing railroad into compliance with industry standards. Low sulfur coal would be provided to midwestern electric utilities from coal mines in the SPRB, helping to meet increasing demand. Additionally, service to existing DM&E shippers would continue and improve. A detailed description of the Alternative B route is included in Chapter 2 of this report.

1.2.2.3 Alternative C - Modified Proposed Action (Including Route Variations). Alternative C is a modification of Alternative B (see Figure 1-1). This alternative was developed by DM&E based on comments received from the public, Federal, state and local agencies and private landowners during scoping for the EIS.

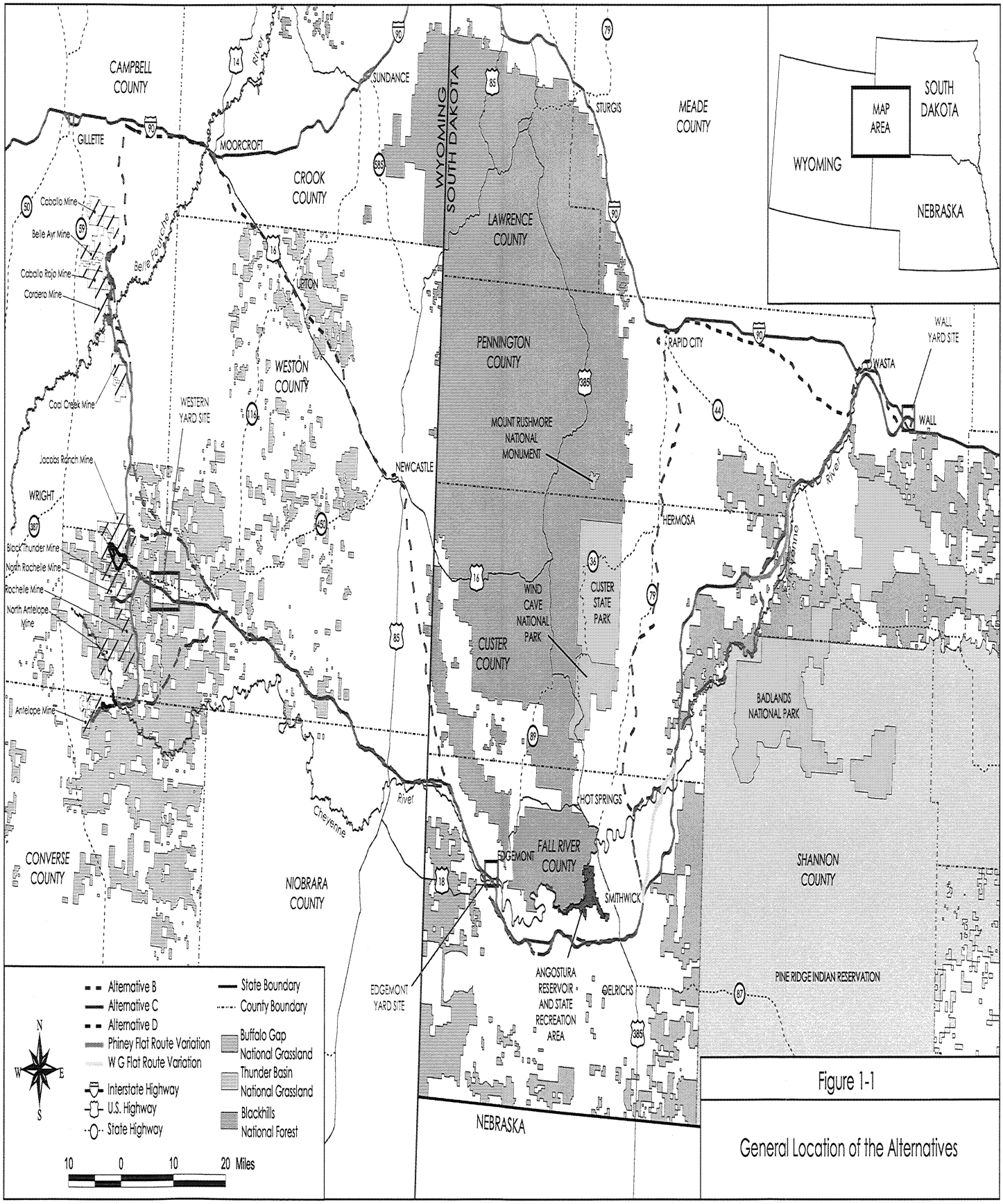

Figure 1-1

General Location of the Alternatives

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Table 1-1 Miles of New Railroad by Landowner						
Alternative	**Total Length**	**Forest Service**	**BLM**	**U.S. Department of Energy**	**State**	**Private**
Alternative A	0	0	0	0	0	0
Alternative B	296.1	51.9	5.7	0.3	10.1	228.1
Alternative C	273.8	38.9	4.9	0	11.7	218.3
Alternative C with Phiney Flat Route Variation	274.6	38.1	4.9	0	11.7	219.9
Alternative C with W G Flat Route Variation	272.6	38.9	5.0	0	11.7	217.0
Alternative D	360.0	26.7	3.0	0	10.8	319.5
Black Thunder North Mine Loop Option (1)	4.5	0.6	0	0	1.2	2.7
Black Thunder South Mine Loop Option (1)	7.1	3.1	0	0	0.7	3.3
North Antelope East Mine Loop Option (1)	1.5	0	0	0	0	1.5
North Antelope West Mine Loop Option (1)	2.4	0	0	0	0	2.4
1 = Black Thunder and North Antelope Mine Loop options are not included in the mileage summaries for Alternatives B, C or D but could be applied to any of the alternatives.						

Although routed similarly to Alternative B in many areas, Alternative C avoids a number of roadless areas on BGNG, reduces many conflicts with wetlands and flood plains along the Cheyenne River and avoids a black-footed ferret (Federally-endangered) recovery site and other important wildlife habitats on TBNG.

Under Alternative C, and with the incorporation of acceptable mitigation measures, STB would issue a decision to grant DM&E authority to construct, operate and maintain a railroad in Minnesota, South Dakota, and Wyoming. The Forest Service would issue an easement under FLPMA to allow DM&E to construct, maintain and operate a new railroad across portions of BGNG and TBNG. The BLM would issue an easement allowing DM&E to do the same on public lands. The COE would issue a permit to allow dredging and filling of waters of the United States and adjacent wetlands. All other Federal, state and locally-required permits would be issued by the respective agencies. Reconstruction of the existing railroad would be accomplished, correcting deficiencies and bringing the railroad into compliance with industry standards. Low sulfur coal would be provided to midwestern utilities, helping to meet increasing demand. Additionally, service to DM&E's existing shippers would continue and improve.

Two route variations have been proposed by DM&E to reduce environmental impacts associated with Alternative C in western South Dakota (see Figure 1-1). These route variations were designed to avoid wildlife habitat and wetland/riparian areas in Hay Canyon and along Spring Creek. Detailed descriptions of Alternative C and the route variations are included in Chapter 2 of this report.

1.2.2.4 Alternative D - Existing Corridors Alternative. During public scoping for the EIS a number of comments were received that suggested the new railroad be constructed using existing railroad corridors in western South Dakota and eastern Wyoming. The comments suggested DM&E use its existing railroad lines between Wall and Rapid City, South Dakota and Rapid City and Smithwick instead of constructing a new railroad through the Cheyenne River valley. Alternative D was developed to explore the feasibility of using these and other existing corridors.

DM&E has stated that Alternative D is uneconomic and technically not feasible to operate because of excessive grades and curves in South Dakota and the general circuitous nature of the route in Wyoming. According to DM&E, the company has completed an exhaustive review of possible realignments between Smithwick and Rapid City but has been unable to identify a route that meets the project's heavy haul design criteria. The circuitous route to the SPRB mines makes the alternative uneconomic (particularly when most of the coal is expected to come from the southern mines). DM&E has further stated that if Alternative D is selected by the agencies, DM&E would abandon the project.[5] DM&E's 404(b)(1) showing, prepared for the COE, contains detailed information that describes why the company has been unable to identify an economic and technically feasible route using existing corridors.

From a NEPA standpoint, however, just because DM&E is not itself capable of implementing Alternative D does not necessarily make the alternative unreasonable. The Council on Environmental Quality (CEQ) specifically

[5] DM&E's position regarding Alternative D was summarized in a June 9, 1999 letter to STB. That letter can be reviewed on DM&E's web site at http://www.dmerail.com. The letter can be found on the web site under STB Regulatory Filings/EIS Final Scope Comments, June 9 1999, Alternative Route Analysis/Kevin V. Schieffer letter to STB.

addressed this issue in its "Forty Most Asked Questions" published in the Federal Register on March 16, 1981. According to CEQ, "*Section 1502.14* (40 CFR) *requires the EIS to examine all reasonable alternatives to the proposal. In determining the scope of alternatives to be considered, the emphasis is on what is "reasonable" rather than on whether the proponent or applicant likes or is itself capable of carrying out a particular alternative. Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant.*"

Alternative D would follow DM&E's existing railroad from Wasta to Rapid City (see Figure 1-1). At Rapid City, the alternative would turn south along an existing railroad corridor owned by DM&E (known as the Black Hills Subdivision Branch Line) to near Smithwick. At Smithwick the alternative would turn west and follow the route for Alternative C to the South Dakota-Wyoming border. However, rather than turning west at the border, Alternative D would continue northwest along an existing BNSF corridor through Newcastle and Moorcroft, Wyoming. East of Gillette (at Donkey Creek), Alternative D would turn south and proceed to the SPRB mines using a route similar to Alternative C.

1.2.2.5 Proposed Mine Loop Options. Impacts associated with 4 mine loop options in Wyoming are addressed in this report. The Black Thunder North and South mine loops are located north and south of State Highway 450, respectively, in Campbell County. The North Antelope East and West loops are located in Converse County.

1.2.2.6 Proposed Yard Sites. This report also addresses the impacts associated with 3 yard sites designed to support the efficient operation of Alternative C. One yard would be located at the beginning of the alternative northeast of Wall (see Figure 1-1). The Wall Yard will serve as a staging yard for loaded and empty coal trains and will also include 2 marshaling tracks for use by manifest, grain and way freight trains. A second yard would be constructed northeast of Edgemont. This Edgemont Interchange Yard will provide an interchange point with BNSF - allowing a connection for transferring construction material from BNSF to the new railroad. In the future, way freight and grain could be transferred to and from BNSF at this interchange. The third yard associated with Alternative C is the Western Yard which would be located on the Campbell-Weston County line in Wyoming (see Figure 1-1). This yard will be a major rail staging facility and is expected to include maintenance and minor repair facilities. The yard will provide staging for trains to service the mines and a crew change point.

These 3 yards were designed to serve Alternative C. Although required, no yards that would serve Alternatives B or D have been identified. Therefore, potential impacts associated with yards for these alternatives are not addressed in this report.

1.2.2.7 Alternatives Considered but Eliminated from Detailed Study. Other alternatives were considered but rejected by the STB and cooperating/ consulting agencies. It was determined that these alternatives were not reasonable or feasible and, therefore, did not meet the purpose of or need for the project. These alternatives are not discussed in this report but are described in detail in the EIS and DM&E's COE 404(b)(1) showing document.

1.3 Consistency with BLM Resource Management Plans

The alternatives would affect only small, isolated parcels of BLM-managed lands (hereafter termed public lands). Along its entire length, Alternative B would cross less than 6 miles of public lands and Alternatives C and D would cross about 5 and 3 miles, respectively (see Table 1-1).

The alternatives would be constructed through 3 BLM field office areas. Public lands which would be crossed by the alternatives in South Dakota are managed by the South Dakota Field Office in Belle Fourche, South Dakota. The resource management plan (RMP) for this field office area was prepared in 1985. Public lands in Wyoming which would be crossed by the alternatives are managed by the Newcastle and Buffalo Field offices (Newcastle and Buffalo, Wyoming). The Newcastle Field Office recently updated its RMP (1999). However, the Buffalo Field Office RMP is older (1985). The new railroad would be consistent with the land use management direction and/or multiple use objectives in the RMPs for the small, isolated parcels of public lands which would be crossed.

1.4 Forest Service Land and Resource Management Plans Consistency Analysis

The alternatives would cross 2 national grasslands - BGNG and TBNG. Lands managed by the Forest Service [hereafter National Forest System (NFS) lands] represent approximately 17.5 percent (51.9 miles) of the Alternative B alignment and 14.2 percent (38.9 miles) of the Alternative C alignment. Only approximately 7.4 percent (26.7 miles) of the Alternative D alignment consists of NFS lands.

The National Forest Management Act [36 CFR 219.10(e)] requires consistency between projects being proposed and national forest land and resource management plans (forest plans). For this report, 2 existing forest plans (Nebraska and Medicine Bow Forest Plans) were evaluated for consistency with standards and

guidelines, as well as whether or not the new railroad alternatives would be consistent with the desired future condition of the NFS lands affected. The Medicine Bow National Forest Plan was issued in 1985 and the Nebraska National Forest Plan in 1984 (Forest Service, 1985 and 1984, respectively). In addition, because the Northern Great Plains National Grassland Land and Resource Management Plans are in the process of being prepared (a draft EIS and proposed grassland plans were released in July, 1999)[6], the draft standards and guidelines for the proposed BGNG and TBNG grassland plans (see Forest Service, 1999a and 1999b) were evaluated to determine whether any of the railroad alternatives would predispose the desired future condition of BGNG or the TBNG, if implemented.

The miles which would be crossed by the alternatives in each current and proposed forest plan management prescription area are presented on Table 1-2. Table 1-3 lists whether each railroad alternative would be consistent with the existing and proposed requirements and standards and guidelines.

1.4.1 Forest Plan Direction, Management Requirements and Prescriptions, and Standards and Guidelines. Both the Nebraska and Medicine Bow forest plans require the Forest Supervisor to ensure that all outstanding and future permits and other occupancy and use documents which affect NFS lands are consistent with the forest plan including both forest and management area direction. The management direction contained in the forest plans is used in analyzing proposals by prospective users of NFS lands like DM&E. Forest direction consists of goals, objectives, and management requirements for the forest, including associated national grasslands. The goals and objectives provide broad overall direction regarding the type and amount of goods and services the forest will provide. They are expressed in broad general terms and are timeless (i.e., they have no specific date by which they are to be completed). The management requirements contained in the forest direction set the minimum standards that must be maintained while achieving these goals and objectives.

1.4.1.1 Existing Nebraska National Forest Plan

Plan Direction. One of the goals contained in the Nebraska Forest Plan specifically addresses management of BGNG. That goal states "*manage the Buffalo Gap ... National Grasslands to demonstrate, in accordance with the Bankhead-Jones Farm Tenant Act, to the local community and other interested publics solid land use practices for livestock grazing, wildlife habitat protection and improvement, soil conservation and watershed protection, resource protection during mineral operations, recreation development, and other grassland agriculture practices*". The forest plan further provides for the exploration, development and extraction of mineral resources while minimizing adverse environmental effects and provides for adequate transportation systems to meet the demands of users (Forest Service, 1984).

Management Requirements. The Nebraska Forest Plan establishes management requirements. Management requirements provide broad multiple-use management direction and generally apply to all areas of the forest including BGNG. These management requirements are listed on Table 1 in Appendix A of this report. The management requirements set the baseline conditions that must be maintained while managing the forest. They establish the environmental quality requirements, natural and depletable resource requirements and mitigation measures that apply to the entire forest including the national grasslands.

Substantive changes which alter the intent of the management requirements may not be made without amending or revising the forest plan. Editorial and other minor modifications to the management requirements, which do not alter their intent, may be made without amending or revising the forest plan.

The Nebraska Forest Plan provides general direction to provide access for resource development. Because the new railroad would transport mineral resources developed, in part, on NFS lands, Forest Service approval of a special use permit to construct and operate the new railroad would be consistent with this general direction.

The Nebraska Forest Plan provides general direction that states "*choose facility and structure design, color of materials, location and orientation to meet the adopted visual quality objective(s) for the management area*" (see Appendix A, Table 1). While the alternatives would be consistent with the modification visual quality objective (VQO) of Management Prescriptions 4G and 6G, they would not be consistent with the partial retention VQO of Management Prescription 9A (explained further below).

Approximately 2.6 miles of partial retention VQO would be crossed by Alternative B on BGNG. Alternative C and its route variations would cross between 0.4 to 0.7 miles of partial retention VQO. NFS lands would not be affected by Alternative D on BGNG. Where the operating railroad crosses this VQO, the railroad is expected to dominate the view which is inconsistent with the prescription requirement and the plan's management requirements.

General direction in the forest plan requires management of hardwood draws and riparian areas to sustain their "*inherent biological, physical, and visual values*" (see Appendix A, Table 1). Alternatives B and C

[6] Information regarding the Northern Great Plains grassland planning process can be found at http://www.fs.fed /ngp

Table 1-2
Miles of Each Forest Plan Management Area Prescription Which Would be Crossed by the Alternatives (1)

Forest Plan Management Area Prescription	Alternative B	Alternative C	Alternative C with Phiney Flat Route Variation	Alternative C with W G Flat Route Variation	Alternative D	Black Thunder North Mine Loop	Black Thunder South Mine Loop
1984 Nebraska National Forest Plan (Buffalo Gap National Grassland)							
4G - Emphasis on Habitat Indicator Species	7.7	2.3	2.1	2.3	0	0	0
6G - Emphasis on Livestock Grazing	6.0	3.1	2.8	3.1	0	0	0
9A - Emphasis on Riparian Area Management	2.6	0.7	0.4	0.7	0	0	0
1985 Medicine Bow National Forest Plan (Thunder Basin National Grassland)							
4B - Emphasis on Habitat Indicator Species	16.3	10.5	10.5	10.5	10.8	0	0
4C - Emphasis on Wildlife Habitat in Woody Draws and Other Woody Vegetation Areas on Rangelands	0.9	0.9	0.9	0.9	0.8	0	0
6B - Emphasis on Livestock Grazing	6.8	5.9	5.9	5.9	0.1	0	0
9A - Emphasis on Riparian Area Management	4.9	4.4	4.4	4.4	4.0	<0.01	0.4
12A - Surface Mining Development	6.7	11.1	11.1	11.1	11.0	0.6	2.7
1999 Proposed National Grasslands Plan for Thunder Basin and Buffalo Gap National Grasslands							
1.2 - Recommended for Wilderness	2.7	0	0.0	0.0	0	0	0
2.1 - Special Interest Areas	2.0	2.4	2.4	2.4	0	0	0
3.63 - Black-footed Ferret Reintroduction Habitat	4.9	0	0.0	0.0	0	0	0
3.64 - Special Plant and Wildlife Habitat	0	0.6	0.6	0.6	0	0	0
3.65 - Rangelands with Diverse Natural-Appearing Landscapes	4.9	5.3	5.3	5.3	2.2	0	0
3.68 - Big Game Range	6.8	4.1	4.1	4.1	5.7	0	0
4.32 - Dispersed Recreation: High Use	0	0	0	0.0	4.7	0	0
5.12 - General Forest and Rangelands: Range Vegetation Emphasis	4.9	3.0	3.0	3.0	0	0	0
6.1 - Rangeland with Broad Resource Emphasis	17.6	9.5	8.7	9.5	0	0	0
8.4 - Mineral Production and Development	8.1	14.0	14.0	14.0	14.1	0.6	3.1

1 = Alternative A (No Action) and the North Antelope East and West mine loops would not affect NFS lands.

Table 1-3
Alternative Consistency with Each Forest Plan Management Area Prescription Which Would be Crossed (1)

	Consistency with Forest Plan						
Forest Plan Management Area Prescription	**Alternative B**	**Alternative C**	**Alternative C with Phiney Flat Route Variation**	**Alternative C with W G Flat Route Variation**	**Alternative D**	**Black Thunder North Mine Loop**	**Black Thunder South Mine Loop**
1984 Nebraska National Forest Plan (Buffalo Gap National Grassland)							
Forest Plan Management Requirements	Not Consistent	Not Consistent	Not Consistent	Not Consistent	Not Crossed	Not Crossed	Not Crossed
4G - Emphasis on Habitat Indicator Species	Consistent	Consistent	Consistent	Consistent	Not Crossed	Not Crossed	Not Crossed
6G - Emphasis on Livestock Grazing	Consistent	Consistent	Consistent	Consistent	Not Crossed	Not Crossed	Not Crossed
9A - Emphasis on Riparian Area Management (2)	Not Consistent	Not Consistent	Not Consistent	Not Consistent	Not Crossed	Not Crossed	Not Crossed
1985 Medicine Bow National Forest Plan (Thunder Basin National Grassland)							
Forest Plan Management Requirements	Not Consistent	Not Consistent	Not Consistent	Not Consistent	Not Consistent	Not Crossed	Not Crossed
4B - Emphasis on Habitat Indicator Species	Not Consistent (3)	Not Consistent	Not Consistent	Not Consistent	Not Consistent	Not Crossed	Not Crossed
4C - Emphasis on Wildlife Habitat in Woody Draws and Other Woody Vegetation Areas on Rangelands	Not Consistent	Not Consistent	Not Consistent	Not Consistent	Not Consistent	Not Crossed	Not Crossed
6B - Emphasis on Livestock Grazing	Consistent	Consistent	Consistent	Consistent	Consistent	Not Crossed	Not Crossed
9A - Emphasis on Riparian Area Management (2)	Not Consistent	Not Consistent	Not Consistent	Not Consistent	Not Consistent	Not Consistent	Not Consistent
12A - Surface Mining Development	Consistent	Consistent	Consistent	Consistent	Consistent	Consistent	Consistent
1999 Proposed National Grasslands Plan for Thunder Basin and Buffalo Gap National Grasslands							
Grassland Wide Management Requirements	Not Consistent	Not Consistent	Not Consistent	Not Consistent	Not Consistent	Not Crossed	Not Crossed
1.2 - Recommended for Wilderness	Not Consistent	Not Crossed	Not Crossed	Not Crossed	Not Crossed	Not Crossed	Not Crossed
2.1 - Special Interest Areas	Consistent	Consistent	Consistent	Consistent	Not Crossed	Not Crossed	Not Crossed
3.63 - Black-footed Ferret Reintroduction Habitat	Not Consistent	Not Crossed	Not Crossed	Not Crossed	Not Crossed	Not Crossed	Not Crossed
3.64 - Special Plant and Wildlife Habitat	Not Crossed	Consistent	Consistent	Consistent	Not Crossed	Not Crossed	Not Crossed
3.65 - Rangelands with Diverse Natural-Appearing Landscapes	Not Consistent	Not Consistent	Not Consistent	Not Consistent	Not Consistent	Not Crossed	Not Crossed
3.68 - Big Game Range	Not Consistent	Not Consistent	Not Consistent	Not Consistent	Not Consistent	Not Crossed	Not Crossed
4.32 - Dispersed Recreation: High Use	Not Crossed	Not Crossed	Not Crossed	Not Crossed	Consistent	Not Crossed	Not Crossed
5.12 - General Forest and Rangelands: Range Vegetation Emphasis	Consistent	Consistent	Consistent	Consistent	Not Crossed	Not Crossed	Not Crossed
6.1 - Rangeland with Broad Resource Emphasis	Consistent	Consistent	Consistent	Consistent	Not Crossed	Not Crossed	Not Crossed
8.4 - Mineral Production and Development	Consistent	Consistent	Consistent	Consistent	Consistent	Consistent	Consistent

1 = Alternative A (No Action) and the North Antelope East and West mine loops would not affect NFS lands.
2 = Includes requirements in the Watershed Conservation Practices Handbook Standards and Design Criteria, FSH 2509.25, effective March 22, 1999.
3 = Adequate mitigation would need to be developed to offset impacts to the Rosecrans Black-footed Ferret Reintroduction Site.

would be inconsistent with this general direction. Alternative B would impact riparian areas on NFS lands along Cottonwood Creek, Spring Creek and at several locations adjacent to the Cheyenne River. Riparian impacts on NFS lands along Cottonwood Creek and the Cheyenne River would be eliminated by Alternative C but the impacts to Spring Creek would remain. The Phiney Flat Route Variation of Alternative C would eliminate riparian impacts on NFS lands along Spring Creek. The biological, physical, and visual values of riparian areas crossed by the operating railroad on NFS lands on BGNG would not be sustained by Alternatives B and C. However, the impacts would be substantially reduced by implementing the Phiney Flat Route Variation for Alternative C.

Special use management requirements (non-recreation based) have been adopted for the Nebraska National Forest (see Appendix A, Table 1). These management requirements prohibit *"the approval of any special use application that can be reasonably met on private or other Federal lands unless it is clearly in the public interest"*. The STB has made an initial determination that DM&E's proposed project satisfies the transportation-related requirements of 49 U.S.C. 10901 and is, therefore, at least not inconsistent with the public necessity and convenience.[7] STB regulations state that *"the Board shall issue a certificate...unless the Board finds that such activities are inconsistent with the public convenience and necessity..."* While the statute does not define "*public convenience and necessity*", a 3-part test has been developed to aid in this determination. The test requires a determination of whether: 1) the applicant is financially fit to undertake the construction and provide service; 2) there is a public demand or need for the proposed service; and 3) the construction project is in the public interest and will not unduly harm existing services. In its December 9, 1998 decision STB determined that DM&E's new railroad meets the 3-part test.

However, STB's initial determination does not grant approval to construct the project. No final decision by STB permitting construction to begin would be issued until such time as all statutory requirements - under both environmental and transportation law - have been satisfied. In fact, it is possible that in their final analysis STB could determine that, due to possible adverse environmental impacts, the public interest dictates that the application be denied even though the criteria of 49 U.S.C. 10901 have otherwise been met.

Management requirements of the Nebraska Forest Plan address the location of transportation and utility corridors by providing specific standards and guidelines for avoidance. The forest plan requires avoidance of the following management areas unless the impact of the corridor can be mitigated:

- developed recreation areas;
- roadless and undeveloped areas (RARE II);
- research natural areas;
- riparian areas;
- proposed wild and scenic river segments; and
- Bessey Nursery.

Not all of the alternatives would be capable of complying with these avoidance requirements. Alternative B would cross roadless and undeveloped areas on BGNG (see Chapter 3) and it is unlikely that adequate mitigation could be designed to minimize, to acceptable levels, the impacts to the wilderness characteristics of these areas that would occur from the noise and visual intrusion of an operating railroad. Alternatives C (including both route variations) and D would not directly affect roadless or undeveloped areas on BGNG.

Alternatives B and C would cross riparian areas on BGNG. Alternative B would have the largest impact on riparian areas on NFS lands on BGNG. Alternative B would impact riparian areas along Cottonwood Creek, Spring Creek and at several locations adjacent to the Cheyenne River. Riparian impacts on NFS lands along Cottonwood Creek and the Cheyenne River would be eliminated by Alternative C but the impact to Spring Creek would remain. The Phiney Flat Route Variation of Alternative C would reduce riparian impacts on NFS lands along Spring Creek.

Management Area Prescriptions. Management area direction consists of individual management area prescriptions. The management area prescriptions contain requirements specifying which activities will be implemented to achieve goals and objectives within the management area. Management requirements are specific to individual management area prescriptions and are applied in addition to the management requirements described above.

Three management area prescriptions would be affected by Alternatives B and C on BGNG. Alternative D would not affect NFS lands on BGNG. Approximate miles crossed in each management area prescription by the alternatives are provided on Table 1-2. As is shown on Table 1-3, it has been determined that Alternatives B and C (including both route variations) would be consistent with Management Area Prescriptions 4G and 6G. However, neither alternative would be consistent with Management Area Prescription 9A.

Management area prescriptions which would be affected by the alternatives on BGNG, and the consistency of the alternatives with the prescription requirements, are discussed below.

[7] STB Finance Docket 33407. A copy of the decision is available on STB's web site at http://www.stb.dot.gov

Management Area Prescription 4G - Emphasis on Habitat of Indicator Species

Management Prescription Summary. Management emphasis is on the habitat requirements of sharp-tailed grouse, pronghorn antelope, and deer. The goal is to optimize habitat capability and, thus, numbers of species jointly agreed to with state fish and wildlife agencies. The promotion of grassland agriculture and sustained yield management of forage, fish and wildlife, water, recreation, and minerals is emphasized. NFS lands are to be integrated with private land for sound land conservation and utilization. Recreation and other human activities are regulated to favor needs of the designated wildlife species.

General Direction and Standards and Guidelines. All of the general direction recommendations and standards and guidelines for this management area prescription are listed on Table 2 in Appendix A. The alternatives would be consistent with the general direction and standards and guidelines for this prescription. Specific direction and standards and guidelines with direct applicability to the railroad alternatives are discussed briefly below.

This prescription recommends that management activities be designed and implemented to blend with the natural landscape. Specifically, the standards and guidelines for this prescription do not allow exceedance of the adopted VQO of modification. Modification is 1 of 5 VQOs historically used by the Forest Service to define acceptable degrees of alteration of the natural landscape. The degree of alteration permitted using this system is measured in terms of the changes in visual contrast with the surrounding landscape. The 5 VQOs, in descending order of allowable contrast, are: preservation; retention; partial retention; modification; and maximum modification.

Under the modification VQO, management activities may dominate the landscape. However, facilities, buildings, roads, signs, etc., should borrow from the adjacent environment in terms of the materials, textures and colors used. For example, large clear cuts and powerlines may dominate the landscape but their visual impact should still be minimized in places using mitigation measures such as dulling metal surfaces, reseeding, leaving scattered tree groups, etc. DM&E's proposed project would be consistent with the level of contrast allowed by the modification VQO.

However, the Forest Service would still require mitigation of visual impacts to the extent feasible. It is anticipated that conditions of approval addressing facility color, material and texture would be included in any special use permits issued by the Forest Service for activities on NFS lands. Additional visual screening would be addressed based on site-specific conditions.

Management Area Prescription 4G requires the Forest Service to "*maintain or improve habitat capability for deer, pronghorn antelope, and sharp-tailed grouse.*" The alternatives are not expected to significantly effect habitat capability for deer, pronghorn antelope or sharp-tailed grouse on BGNG. Only a small portion of BGNG would be affected by Alternatives B and C. In addition, DM&E is currently working with the South Dakota Department of Game, Fish and Parks (SDGFP) and the U.S. Fish and Wildlife Service (USFWS) to develop mitigation strategies to offset adverse impacts to all wildlife from implementation of the project. It is anticipated that these measures would be adequate to mitigate any impacts to deer, pronghorn antelope, and sharp-tailed grouse on NFS lands on BGNG and that the alternatives would be consistent with this general direction.

Management Area Prescription 6G - Emphasis on Livestock Grazing

Management Prescription Summary. Management emphasis is on livestock grazing and periodic heavy forage utilization occurs. The promotion of grassland agriculture and sustained yield management of forage, fish and wildlife, water, recreation, and minerals are emphasized. Range condition is maintained through use of forage improvement practices, livestock management, and regulation of other resource activities. Investment in structural and nonstructural range improvements to increase forage utilization is moderate to high.

General Direction and Standards and Guidelines. The general direction and standards and guidelines for this management area prescription are listed on Table 3 in Appendix A. The alternatives would be consistent with the general direction and standards and guidelines. The VQO for the management area prescription is modification (see above discussion) and the alternatives would not significantly reduce forage requirements to support big game population levels (see Chapter 4).

Management Area Prescription 9A - Emphasis on Riparian Area Management

Management Prescription Summary. Unlike other management prescriptions, Management Area Prescription 9A is not specifically mapped in the Nebraska Forest Plan. Rather, it exists as inclusions in other mapped management prescriptions. These areas are defined as the "*aquatic ecosystem, the riparian ecosystem, and adjacent ecosystems that remain within approximately 100 feet measured horizontally from both edges of all perennial streams and from the shores of lakes and other still water bodies.*" Clarification of the definition of riparian areas is provided in the recent amendments to the Forest Service's Watershed

Conservation Practices Handbook (FSH 2509.25). Management now emphasizes the water influence zone. The water influence zone is the geomorphic flood plain, riparian ecosystem, and inner gorge. Its minimum horizontal width (from top of each bank) is the greater of 100 feet or the mean height of mature dominant late-seral vegetation. It includes adjacent unstable and highly erodible soils.

For purposes of this report, these areas were identified using a geographic information system (GIS). Each perennial and ephemeral stream [based on 7.5-minute U.S. Geological Survey (USGS) topographic quads] and all wetlands identified on USFWS National Wetland Inventory maps were buffered 100 feet to determine where this management prescription occurs.

The goals of management for this prescription are to provide healthy, self-perpetuating plant communities, meet water quality standards, provide habitats for viable populations of wildlife and fish, and provide stable stream channels and still waterbody shorelines. The aquatic ecosystem may contain fisheries habitat improvements and channel stabilizing facilities that harmonize with the visual setting and maintain or improve wildlife or fish habitat requirements. The linear nature of stream side riparian areas permits programming of management activities which are not visually evident or are visually subordinate.

General Direction and Standards and Guidelines. General direction recommendations and standards and guidelines for this management area prescription contained in the Nebraska Forest Plan are listed on Table 4 in Appendix A. Alternatives B and C would not be consistent with the general direction or standards and guidelines for this prescription. Inconsistencies are explained below.

The VQO for this management prescription is partial retention. Management activities may be evident but should be subordinate to the natural landscape. Activities may introduce forms, lines and colors not found in the natural landscape but they should not dominate the view. For example, a road or pipeline cut may be evident but should not be the dominant feature of the landscape - natural features should attract the viewer's attention. Lines should follow natural contours. Colors found in the natural environment should be repeated and openings in vegetation should be irregular. The operating railroad would not be consistent with the partial retention VQO. When a train is present, it would dominate the view and attract the viewer's attention, particularly in the fore- and middleground. Natural features would be subordinate to the operating railroad.

The forest plan contains general direction that limits use of heavy equipment for construction during periods when soil is least susceptible to compaction or rutting. Alternatives B and C would not be consistent with this general direction. It will be necessary for construction of bridges to occur year round including during the period when soils are wet and subject to compaction and rutting. Best management practices (BMPs), such as using mats, are being developed to address concerns regarding compaction and rutting. However, some compaction and rutting would occur during construction in riparian areas regardless of the BMPs employed.

General direction for this management prescription states that proposed new land use facilities (i.e, roads, buildings) will not normally be located within 100-year flood plain boundaries. However, because of the linear nature of the railroad, it would be impossible to select a route that is operationally viable that avoids flood plains. To address flood plain issues, DM&E is in the process of completing hydrology and hydraulic studies that are designed to reduce the risk of damage to the track and water conveyance structures from flooding and to protect downstream and upstream uses.

This management prescription requires maintenance of at least 80 percent of potential ground cover within 100 feet from the edges of all perennial streams, lakes and other waterbodies, or to the outer margin of the riparian ecosystem, where wider than 100 feet. The alternatives would not be consistent with this standard. At stream crossings, all ground cover would be removed within the construction right-of-way to the water's edge. Ground cover would be completely removed in the construction right-of-way through riparian areas.

The management prescription contains a number of specific standards and guidelines that apply to the location of new roads and trails on BGNG (see Appendix A, Table 4), including construction techniques (which have been incorporated as standards and guidelines in the forest plan) designed to minimize impacts to aquatic and riparian ecosystems. The prescription requires all roads and trails to be located outside riparian areas unless alternative routes have been reviewed and rejected as being more environmentally damaging. Further, the prescription prohibits new roads and trails from paralleling streams except where absolutely necessary. In addition, streams must be crossed at right angles and crossings located at points of low bank slope and firm surfaces. The forest plan clearly intends to protect riparian and aquatic ecosystems from disturbance associated with roads and trails. However, these standards and guidelines were developed in 1984, well before the new railroad was contemplated. Therefore, it could be argued that these standards and guidelines do not apply to DM&E's proposal (railroads are not specifically included in the general direction).

On-the-other-hand, it is clear that Alternatives B and C would not be consistent with these standards and guidelines if they are applicable. Crossings of streams

are dictated by grade and curve limitations associated with the railroad design. Consequently, the locations of stream crossings cannot be adjusted to comply with these standards and guidelines. Alternative B would have the largest impact on riparian areas on NFS lands on BGNG. Alternative B would impact riparian areas on NFS lands along Cottonwood Creek, Spring Creek and at several locations adjacent to the Cheyenne River. Riparian impacts on NFS lands along Cottonwood Creek and the Cheyenne River would be eliminated by Alternative C but the impact to Spring Creek would remain. The Phiney Flat Route Variation of Alternative C would significantly reduce riparian impacts on NFS lands along Spring Creek.

Watershed Conservation Practices Handbook Standards and Design Criteria. In addition to the requirements for Management Area Prescription 9A found in the current Nebraska Forest Plan, the Forest Service has recently adopted a number of additional standards and design criteria that will apply to construction of the alternatives on NFS lands. These standards and design criteria, listed on Table 5 in Appendix A, can be found in FSH 2509.25, effective March 22, 1999.

One of the additional standards included in FSH 2509.25 restricts activities in the water influence zone to only those "*actions that maintain or improve long-term stream health and riparian ecosystem condition.*" The alternatives would not be consistent with the riparian ecosystem portion of this standard. Where crossed by the alternatives, riparian ecosystem condition would be degraded from both direct and indirect impacts. All activities associated with the alternatives that would occur within wetland or stream portions of the water influence zone on BGNG are regulated by the COE and the South Dakota Department of Environment and Natural Resources (SDENR). Regulatory programs implemented by those agencies will assure that no adverse impacts occur to the long-term health of streams.

Mitigation pursuant to the COE's 404 permitting program will replace any direct wetland loss associated with the project. Direct impacts will include the loss of a relatively narrow strip of riparian habitat to the railroad track bed. This loss would be most severe where the alternatives have been routed within drainages because of grade restrictions. The direct loss would be permanent (for the life of the project). Indirect impacts from noise would also occur. Noise impacts would degrade the condition/habitat suitability of adjacent riparian areas. There are no regulatory programs that require mitigation of indirect adverse impacts to riparian ecosystems. DM&E, in consultation with the SDGFP and USFWS, is voluntarily exploring mitigation opportunities to offset these types of impacts.

A design criteria included in FSH 2509.25 prohibits actions that will cause long-term change away from the desired condition in any riparian or wetland vegetation community. Within the railroad right-of-way the alternatives would not be consistent with this design criteria. The nature of the railroad requires fill be placed under the tracks. Where that fill is added to wetland or riparian communities, the function and value of the vegetative community under the track will cease to exist. This is a relatively narrow impact area (generally less than 200 feet wide) and impacts would be most severe where the alternatives have been routed along drainages to accommodate grade restrictions. In addition, the COE's 404 permitting process will require DM&E to replace lost wetland function and value. Although the site-specific impact would result in a change in desired condition of wetland and riparian vegetation communities within the railroad right-of-way, the overall function and value of wetlands and riparian communities within each basin would be retained in the long-term.

The handbook requires installation of stream crossings on straight and resilient stream reaches, as perpendicular to flow as possible. Alternatives B and C would not be consistent with these design criteria. Because of design constraints on curves and grade, in some cases the alternatives have been routed parallel to drainages (see discussion above for Spring Creek, Cottonwood Creek and the Cheyenne River). Consequently, some crossings of streams would not occur perpendicular to flow nor at straight or resilient reaches. In addition, because of the meandering nature of Spring Creek, both Alternatives B and C would require a number of crossings of this stream. Under both alternatives Spring Creek would be relocated in a number of areas to reduce the number of crossings (see Chapter 4). The Phiney Flat Route Variation of Alternative C would avoid construction parallel to Spring Creek.

The handbook favors the installation of bottomless arches instead of pipe culverts. The railroad proposes to install culverts and concrete boxes and would, therefore, not be consistent with this design criteria. Another design criteria in the handbook requires all roads, trails, and other soil disturbances be designed to "roll" with the terrain as feasible. The railroad's design generally limits grade to 1 percent or less. Consequently, a heavy haul railroad could not be designed to "roll" with the terrain. The alternatives would consist of a series of cuts and fills that level the track bed regardless of the rolling nature of the terrain.

1.4.1.2 Existing Medicine Bow National Forest Plan

Plan Direction. The goals for management of TBNG contained in the Medicine Bow Forest Plan state: *"demonstrate grassland management and utilization of Thunder Basin National Grassland's resources and values in harmony with nature's requirements and behavior to foster long-term economic stability and*

productivity of the land base and quality of life of the people and communities in the area." The forest plan permits occupancy and use of NFS lands only upon compliance with "*conditions for protection and administration of the National Forest System lands and resources; for the promotion of public health, welfare, safety or convenience; or when public needs cannot be met on private lands.*" Similar to the Nebraska Forest Plan, the Medicine Bow Forest Plan provides for the exploration, development and production of mineral resources in a manner which adequately protects other resources and the environment.

Management Requirements. Appendix A, Table 6 lists the management requirements for the Medicine Bow Forest Plan and whether the alternatives evaluated in this report would be consistent with the general direction and standards and guidelines. Consistency issues with the management requirements are discussed below.

General direction in the forest plan requires sites with unique or exceptional wildlife habitat to be managed for their inherent values as part of the national grassland. Alternative B would cross through the Rosecrans Area on TBNG which has been designated as a reintroduction site for the Federally-endangered black-footed ferret. From a ferret recovery standpoint, the prairie dog towns in the Rosecrans Area provide exceptional wildlife habitat. In fact, the USFWS ranks the Rosecrans Area in the top 10 nationwide candidate sites for ferret reintroduction/ recovery. Consequently, Alternative B would not be consistent with this general direction. In addition to potential conflicts in the Rosecrans Area, all the alternatives would also cross habitats in the vicinity of the Rochelle Hills identified by the Wyoming Game and Fish Department (WGFD) as crucial elk winter range. Several elk calving areas are also located in close proximity to the alternatives (see Chapter 3). It is the policy of the Wyoming Game and Fish Commission that "no net loss" of these unique wildlife habitats occurs. The railroad alternatives would result in a net loss (from direct and indirect impacts) of these habitats and would be inconsistent with the general direction contained in the forest plan.

General direction for visual resource management in the forest plan requires projects to blend soil disturbance into natural topography to achieve a natural appearance, reduce erosion and rehabilitate ground cover. Soil disturbance during construction of the alternatives would not blend with the natural topography because of the need to cut and fill to meet the grade requirements for the track. The alternatives would not be consistent with this general direction.

Approximately 4 to 5 miles of Alternatives B, C and D would cross areas designated as Management Area Prescription 9A in the Medicine Bow Forest Plan. Management Prescription 9A has a VQO of partial retention. Management activities may be evident in this management prescription but should be subordinate to the natural landscape. Activities may introduce forms, lines and colors not found in the natural landscape but they should not dominate the views. Other natural features should attract the viewer's attention. Where the alternatives would cross or run parallel to Management Area Prescription 9A, the railroad is expected to dominate the natural landscape and the views, particularly when a train is present. Other natural features would likely be subordinate to the railroad. Therefore, Alternatives B, C and D would not be consistent with this general direction on TBNG.

The forest plan also requires NFS lands to be managed to provide habitat for recovery of endangered and threatened species. Alternatives C and D would not adversely affect habitats for currently listed Federally-endangered or -threatened species. A bald eagle winter roost occurs in the vicinity Alternatives B and C on NFS lands. However, the status of the roost site is unknown and the bald eagle has been proposed for removal from the list. Alternative B would cross NFS lands designated for reintroduction of the black-footed ferret. Unless adequate mitigation could be developed, it is anticipated that habitat fragmentation and noise from the operating railroad through the Rosecrans Area would adversely affect the site and its suitability for ferret reintroduction/ recovery.

Several species occur on TBNG which could be listed as Federally-threatened or -endangered in the future. The mountain plover has been proposed for listing as threatened by the USFWS. It likely occurs in prairie dog towns across TBNG and is a management indicator species for the grassland. The USFWS recently completed an evaluation of the status of the black-tailed prairie dog. Based on existing information the USFWS determined that listing as threatened was warranted but precluded at this time. Black-tailed prairie dog towns would be crossed by all the alternatives but are particularly abundant along Alternative B in the Rosecrans Area. It is expected that the USFWS will be petitioned to list the sage grouse as threatened in the future. Listing decisions for these and possibly other species are anticipated during the construction period for the railroad.

The Medicine Bow Forest Plan contains a number of management requirements that provide seasonal restrictions for human activities in the vicinity of important wildlife resources and their habitats. These requirements are listed below:

a. No activities are allowed within 1 mile of an active bald eagle nest or peregrine falcon nest from February 1 to July 31 if they would cause nesting failure or abandonment. No activities are allowed

within 0.5 miles of an active bald eagle or peregrine falcon nest at any time if they would cause disturbance of the adult birds on the nest;

b. No activities are allowed within 1 mile of an active bald eagle winter roost site from November 1 to April 1 if they would cause reduction of use of the roost;

c. No activities are allowed within 0.25 miles of an active golden eagle nest from February 1 to July 31 if they would cause nesting failure or abandonment;

d. No activities are allowed within 0.25 miles of an active ferruginous hawk, Swainson's hawk, goshawk, osprey, or prairie falcon nest from March 1 to July 31 if they would cause nesting failure or abandonment;

e. No activities are allowed within 300 feet of any raptor (identified in item d, above) nest at any time if they would cause nest abandonment, unless specific practices are successfully implemented to maintain or increase nesting opportunities at other sites;

f. New roads or other developments will be placed out of sight of the existing raptor nest if possible, unless specific practices are successfully implemented to maintain or increase nesting opportunities at other sites;

g. No activities are allowed within 0.25 miles of any rookery from March 1 to July 31 if they would cause abandonment of the rookery, unless specific practices are successfully implemented to maintain or increase the opportunities at other rookery sites; and

h. No activities are allowed within 0.25 miles of a sage grouse or sharp-tailed grouse lek at any time if they would cause abandonment of the lek, unless specific practices are successfully implemented to maintain or increase the existing habitat capability for grouse.

Although they could be reasonably imposed on construction activities, the operating railroad would not be capable of complying with these seasonal restrictions. As is discussed in Chapter 2, at peak 34 coal trains would pass along the track daily and traffic would occur round the clock. It would be impossible to operate the railroad economically along any of the alternatives and comply with these requirements. For the project to proceed on NFS lands, the Forest Service would be required to amend the forest plan and waive these standards and guidelines for areas directly and indirectly affected by operation of the railroad.

The forest plan provides general direction stating that all activities be designed and implemented to protect and manage riparian ecosystems. All of the alternatives on TBNG would result in direct and indirect impacts to riparian ecosystems. These impacts would be mitigated somewhat through the COE's 404 permitting process. However, it is likely that the COE would limit replacement to only those acres of wetland habitat that would be directly lost through construction activities. DM&E is exploring mitigation opportunities to offset indirect habitat impacts. Without such mitigation the alternatives would be inconsistent with this general direction.

Similar to the Nebraska Forest Plan, the Medicine Bow Forest Plan special use management requirements (non-recreation based) prohibit "*the approval of any special use application that can be reasonably met on private or other Federal lands unless it is clearly in the public interest*" (see Appendix A, Table 6). Discussion contained in Section 1.4.1.1, Management Requirements, also applies to TBNG.

A portion of DM&E's proposed Western Yard includes a small, isolated parcel of NFS lands. Essentially, installation of the yard on this parcel would preclude all other uses of the parcel. Public use of the parcel would not be possible because it would be contained within the fenced railroad yard. Because of the level of impact on this parcel, the Forest Service has determined that it would be preferable to exchange this parcel for private lands in the Rosecrans Area. Management requirements in the forest plan specifically address land disposal. Priorities for disposal include:

- to states, counties, cities, or other Federal agencies when disposal will serve a greater public interest;
- in small parcels intermingled with mineral or homesteads patents;
- when suitable for development by the private sector, if development (residential, agricultural, industrial, recreational, etc.) is in the public interest;
- when critical or unique resource (wetlands, flood plains, essential big game winter range, threatened or endangered species habitat, historical or cultural resources, critical ecosystems, etc.) effects are mitigated by reserving interests to protect the resource, or by exchange where other critical resources to be acquired are considered to be of equal or greater value; and
- in national grasslands, when they offer no opportunity to meet national grassland demonstration objectives.

Disposal to the private sector for industrial development is allowed by the Medicine Bow Forest Plan so long as the disposal is deemed to be in the public interest (see discussion of public convenience and necessity in Section 1.4.1.1, above). One of the priorities for disposal listed in the forest plan is the Federal acquisition of critical resources. The Forest Service is targeting acquisition of private lands in the Rosecrans Area in exchange for the parcel within DM&E's proposed Western Yard Site. DM&E would be required to obtain, at

their cost, lands deemed suitable by the Forest Service for exchange. The Wall Yard and Edgemont Interchange Yard would not affect NFS lands.

Management Area Prescriptions. Five management area prescriptions would be affected by Alternatives B, C and D on TBNG. Approximate miles which would be crossed by the alternatives in each management area prescription are provided on Table 1-2. As is shown on Table 1-3, it has been determined that Alternatives B, C and D would be consistent with Management Area Prescriptions 6B and 12A. Similar to BGNG, none of the alternatives (except Alternative A) would be consistent with Management Area Prescription 9A and the additional standards and design criteria adopted recently for FSH 2509.25. In addition, the alternatives would not be consistent with Management Area Prescriptions 4B and 4C which emphasize wildlife habitat.

Management Area Prescription 4B - Emphasis on Habitat for One or More Management Indicator Species

Management Prescription Summary. Management emphasis is on the habitat needs of one or more management indicator species. Species with compatible habitat needs are selected for an area. The goal is to provide effective habitat and increase or maintain numbers of the species. The prescription can be applied to emphasize groups of species such as early succession dependent or late succession dependent, in order to increase species richness or diversity. Vegetation characteristics and human activities are managed to provide effective habitat for the selected species or to meet population goals jointly agreed to with the state fish and wildlife agencies.

General Direction and Standards and Guidelines. Appendix A, Table 7 lists the general direction and standards and guidelines for Management Area Prescription 4B. The general direction requires the Forest Service to manage this area for habitat needs of management indicator species and maintain habitat capability at 80 percent. Potential habitat capability will be reduced below this threshold adjacent to the operating railroad and there would be a loss of habitat for management indicator species which is inconsistent with the general direction for this prescription.

Another inconsistency is general direction to retain prairie dog towns needed to provide essential habitat for the black-footed ferret. Alternatives C and D would be consistent with this general direction. However, without adequate mitigation, Alternative B would not. Alternative B would cross the Rosecrans Area which has been designated a reintroduction site for the black-footed ferret. If this alternative is selected, a detailed mitigation plan would be required to address potential impacts to the reintroduction site. That plan would need to determine how reintroduced black-footed ferrets would be allowed to maintain access to prairie dog towns located on both sides of the track in the reintroduction area. That plan would also need to address noise, vibration and other potential impacts.

Management Area Prescription 4C - Emphasis on Wildlife Habitat in Woody Draws and Other Woody Vegetation Areas on Rangelands

Management Prescription Summary. Management emphasis is on wildlife habitats in hardwood and shrub-dominated draws and other areas of woody vegetation to sustain their inherent biological, physical, and visual values. Generally, the management prescription anticipates that wildlife habitat will improve.

General Direction and Standards and Guidelines. Table 8 in Appendix A provides the direction and standards and guidelines for this management prescription. The alternatives would not be consistent with the general direction for wildlife habitat improvement and maintenance. The forest plan requires this area to be managed to maintain wildlife habitats in good condition and management is required to improve wildlife habitat. Where crossed by the railroad, habitat quality would degrade to less than good condition from direct, as well as indirect, impacts. It is anticipated that some species which depend on woody draws and/or woody vegetation areas would avoid areas indirectly affected by noise from the operating railroad.

The management prescription requires the retention of turkey roosts, including adjacent trees used for cover. A survey for turkey roosts has not been completed. If present, they could be impacted directly or made unsuitable for use from noise. If so, the alternatives would not be consistent with this standard unless mitigation is developed to offset the impact.

Management Area Prescription 6B - Emphasis on Livestock Grazing

Management Prescription Summary. The area is managed for livestock grazing and range condition is currently at or above the satisfactory level. Intensive grazing management systems are favored over extensive systems. Range condition is maintained through use of forage improvement practices, livestock management, and regulation of other resource activities. Periodic heavy forage utilization occurs. Conflicts between livestock and wildlife are resolved in favor of livestock.

General Direction and Standards and Guidelines. Appendix A, Table 9 lists the direction and standards and

guidelines for this management prescription. The alternatives would be consistent with all of the standards and guidelines and general direction.

Management Area Prescription 9A - Emphasis on Riparian Area Management

Management Prescription Summary. The summary is the same as the description for Management Prescription 9A on BGNG found in Section 1.4.1.1.

General Direction and Standards and Guidelines. The direction and standards and guidelines for this management area prescription can be found on Table 10 in Appendix A. As was described in Section 1.4.1.1 for BGNG, the alternatives would not be consistent with a number of the general directions and standards and guidelines.

The VQO for this management prescription is partial retention. Management activities may be evident but should be subordinate to the natural landscape. Activities may introduce forms, lines and colors not found in the natural landscape but they should not dominate the view. The operating railroad is likely to dominate the view and will usually attract the viewer's attention, particularly in the fore- and middleground. When trains are present, the natural landscape would be subordinate to the operating railroad which is inconsistent with the partial retention VQO.

On TBNG, wildlife habitat maintenance and improvement standards and guidelines require the retention of all snags, except hazard trees in recreation areas. Cottonwoods cannot be harvested unless regeneration can be assured. In addition, the standards and guidelines require maintenance of nest trees and potential nest trees for raptors as large as possible in diameter, adjacent to water bodies. The alternatives would not be consistent with these requirements. All vegetation within the construction right-of-way would be cleared.

It is not known if snags occur within the construction right-of-way. If so, they would be cleared during construction. Although surveys have not identified raptor nests in the construction right-of-way, potential nest trees do exist and would be removed during construction. Loss of these potential nest trees is expected to be insignificant but is inconsistent with the requirements of the management prescription.

The prescription requires the retention of turkey roost trees and associated cover trees. A survey for turkey roosts has not been completed. If roost/cover trees exist within the construction right-of-way they would be cleared. Impacts from noise at adjacent roost sites may make the site unsuitable. Loss of these trees would be inconsistent with the management prescription.

The forest plan requires this area be managed to "maintain wildlife habitat in good condition". Where this management area prescription would be crossed by the alternatives, the quality of wildlife habitat is expected to decrease within the construction right-of-way as well as in areas adversely affected by noise from the operating railroad. The alternatives would not be consistent with the general direction to maintain wildlife habitat in good condition.

The alternatives would not be consistent with the general direction to use heavy equipment for construction during periods when soils are least susceptible to rutting and/or compaction and to prevent soil disturbance and compaction in riparian ecosystems. All alternatives would result in disturbance to riparian ecosystems on NFS lands on TBNG. In addition, it will be necessary for construction of bridges to occur year round including during periods when soils are wet and subject to rutting and compaction. BMPs (such as using mats) are being developed to address concerns regarding compaction and rutting. However, some compaction and rutting would occur during construction in riparian areas regardless of the BMPs employed.

Watershed Conservation Practices Handbook Standards and Design Criteria. In addition to the requirements for Management Area Prescription 9A, the Forest Service has recently adopted a number of additional watershed standards and design criteria that apply to construction of the alternatives on NFS lands. These standards and design criteria, listed on Table 11 in Appendix A, can be found in FSH 2509.25, effective March 22, 1999. The alternatives would not be consistent with a number of the design criteria contained in the handbook. The inconsistencies would be similar to those described previously for BGNG in Section 1.4.1.1.

Management Area Prescription 12A - Provides for Surface Mining Development

Management Prescription Summary. Management emphasis is to encourage and facilitate, where possible, surface mining development for coal. The major goal is to improve reclamation procedures and provide improved range, wildlife habitat, or a mix of other resource outputs in accordance with the prescription previously, or subsequently, applied to these lands.

General Direction and Standards and Guidelines. All of the alternatives and the Black Thunder North and South mine loop options would cross this management prescription on TBNG. As can be seen on Table 12 in Appendix A, the alternatives would be consistent with the directions and standards and guidelines.

1.4.1.3 Northern Great Plains Management Plans Revision. The Forest Service is in the process of

preparing updated plans for the national grasslands in the northern great plains. A draft EIS to support the planning effort and proposed grassland plans for BGNG and TBNG were released in July 1999 (Forest Service, 1999c). The Forest Service is currently evaluating comments received from the public on the draft EIS. The final EIS is expected to be released for public comment at the end of 2000.

The draft EIS did not consider DM&E's pending application. The new railroad is listed as "Other Topics Raised But Not Addressed" on page 1-16 of the draft EIS. The draft EIS lists DM&E's project under "Topics to be Addressed by the Forest Service at the Project Level".

The proposed grassland plans for BGNG and TBNG (Forest Service 1999a and 1999b, respectively) are based on Alternative 3 analyzed in the draft EIS. This is the Forest Service's preferred alternative. Alternative 3 would modify the current management plans for the grasslands by adopting additional special area designations, such as special interest areas (SIA), and placing added emphasis on native plants and animals and recreation opportunities.

To date, both BGNG and TBNG have been managed under more general forest plans for the national forests in which the grasslands occur. The purpose of the proposed grassland plans is to provide guidance for all resource management activities on the grassland. The proposed grassland plans suggest management standards and guidelines, describe resource management practices, levels of resource production, people-carrying capacities, and the availability and suitability of lands for resource management.

After approval, the final grassland plans will provide a framework to guide day-to-day resource management operations and subsequent land and resource management decisions made during project planning. The National Forest Management Act requires that resource plans and permits, contracts, and other instruments issued for the use and occupancy of NFS lands be consistent with the final grassland plans. Site-specific project decisions must also be consistent with the final grassland plans, unless the plans are modified by an amendment.

Consistency of the railroad alternatives with the proposed grassland plans for BGNG and TBNG is addressed below. It is important to remember when reading the following discussion that the management requirements and prescriptions are draft and subject to change based on comments received from the public on the draft EIS and proposed grassland plans.

Proposed Grassland Wide Standards. Both the BGNG and TBNG proposed grassland plans contain specific grassland wide standards. Essentially, the same grassland wide standards are applied to both grasslands. Standards are actions that must be followed or are required limits to activities in order to achieve grassland goals and objectives. Site-specific deviations from standards must be analyzed and documented in grassland plan amendments. The determination of whether an individual project is consistent with the grassland plan is based on whether the project follows grassland wide standards.

Proposed grassland wide standards for BGNG and TBNG are listed on Table 13 in Appendix A. Certain activities associated with the alternatives would not be consistent with some of the grassland wide standards. They are described below.

The proposed grassland plans require that activities and facilities be located away from the water's edge or outside the riparian areas, woody draws, wetlands and flood plains unless alternatives have been assessed and determined to be more environmentally damaging. Activities are also required to maintain the integrity of the riparian ecosystem. The alternatives would not be consistent with these standards. Implementation of the alternatives would have adverse direct and indirect impacts on riparian ecosystems on NFS lands. The integrity of the riparian ecosystem would also be affected by noise from the operating railroad. The most severe impacts would be associated with Alternative B on BGNG. Some riparian habitat would be lost from construction activities, particularly along Alternative B adjacent to Spring Creek, Cottonwood Creek and the Cheyenne River. Alternative C would also affect the riparian ecosystem on NFS lands adjacent to Spring Creek (but not Cottonwood Creek and the Cheyenne River). The Phiney Flat Route Variation of Alternative C would eliminate much of the direct and indirect riparian impacts on NFS lands associated with Alternative C.

Protection of all raptor nests (including owl nests), unless known to be inactive for at least the last 5 years, is required by both proposed grassland plans. This standard requires protection to be based on proposed management activities, human activities existing before nest establishment, species, topography, vegetation cover, and other factors. The alternatives would not be consistent with this standard. Raptor surveys have shown that there are a number of raptor nests in relatively close proximity to the alternatives - some of these nests are located on NFS lands. Operation of the railroad is expected to make some of these nesting sites unsuitable in the future, particularly those used by sensitive species such as ferruginous hawks, and the occupants will be required to find other suitable nesting habitat away from the railroad.

A bald eagle winter roost is known to occur within 1 mile of the alternatives on TBNG. The proposed grassland wide standards prohibit human activities within 1 mile of bald eagle winter roosting areas from November 15 through February if disturbance could cause an

adverse effect. The proposed grassland plans specifically identify ground-disturbing construction (i.e., range developments, trail or road construction, etc.), seismic surveys, or other activities resulting in high human density and/or noise as activities which could have an adverse effect. The alternatives would not comply with this standard as it would not be economically feasible to restrict operation of the railroad from November 15 through February. A seasonal restriction on construction could be imposed which would reduce impacts during the construction phase.

The proposed grassland wide standards prohibit human activities within 1 mile of ferruginous hawk nests from March 1 through July 31 if disturbance would likely cause nest abandonment or failure. Examples of disturbance which could have an adverse effect identified in the standard includes ground-disturbing construction (i.e., range developments, trail or road construction, etc.), seismic surveys, or other activities resulting in high human density and/or noise. Surveys have identified ferruginous hawk nests within 1 mile of the alternatives on NFS lands. The alternatives would not comply with this standard as it would not be economically feasible to restrict operation of the railroad from March 1 through July 31. A seasonal restriction on construction could be imposed which would reduce impacts during the construction phase.

The proposed grassland plan would prohibit human activity within 1 mile of sharp-tailed grouse display grounds between March 15 and May 15 if disturbance would likely cause abandonment of display grounds. Sharp-tailed grouse display grounds have been identified within 1 mile of the alternatives on NFS lands. As with raptor nests, it would not be possible to operate the railroad in such a manner that restricts noise impacts on these display grounds between March 15 and May 15. The alternatives would not be consistent with this guideline.

A 0.25 mile exclusion is proposed around swift fox dens from March 1 through July 30. Future surveys will be necessary to identify swift fox dens in close proximity to the railroad. However, it will not be possible to restrict railroad operations within the specified dates. Some abandonment/displacement may occur if den sites are located in close proximity to the alternatives.

Sage grouse leks occur in close proximity to the alternatives at a number of locations, particularly on TBNG. The proposed grassland wide standards prohibit human activities within 2 miles of sage grouse leks from March 1 through June 15 if they would likely cause disruption of breeding or abandonment of leks. The alternatives would not be consistent with this standard. It would not be possible to restrict operation of the railroad within 2 miles of the leks during the specified period. Some adverse impacts to leks, including possible abandonment, are expected. The standards also prohibit construction or placement of structures or facilities within 0.25 miles of sage grouse leks if they are likely to cause disruption of breeding or abandonment of the lek. There are known leks within 0.25 miles of the alternatives. The alternatives would not be consistent with this standard. Rerouting the alternatives to avoid these lek buffers would not be possible without adversely affecting the operating grade of the railroad.

To conserve habitat for at-risk cavity-nesting species, the proposed grassland plans contain a guideline that prohibits harvest of dead trees greater than 10 inch diameter in riparian areas and in other prairie woodlands. The alternatives would not be consistent with this guideline. All trees within the construction right-of-way would be cleared.

As part of the plans revision the Forest Service inventoried TBNG and BGNG under a new Scenery Management System. Appropriate scenic integrity levels (SIL) were selected for each management area based on the intent of the management area prescription. SIL class assigned to each management area which would be crossed by the alternatives are listed on Table 1-4.

The alternatives would cross a range of SIL classes. Alternatives B and C would cross areas designated in the proposed grassland plans as high SIL class. Management objectives are based on retention. This level refers to landscapes where the valued landscape character appears intact. Deviations may be present but must repeat the form, line, color, texture and pattern common to the landscape character so completely and at such scale that they are not evident. Alternatives B and C would be inconsistent with this SIL class.

All the alternatives would cross areas with a moderate SIL class. This level refers to landscapes where the valued landscape character appears slightly altered. Management objectives are based on partial retention. Noticeable deviations must remain visually subordinate to the landscape character being viewed. As was discussed previously, the operating railroad is not expected to subordinate to the natural landscape, especially in the foreground and middleground. The alternatives would be inconsistent with the moderate SIL class.

The majority of the NFS lands that would be crossed by the alternatives are designated as low SIL class. The management objective for this SIL class is modification. This level refers to landscapes where the valued landscape character appears moderately altered. Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, vegetative type changes or architectural styles outside the landscape being viewed. They should not only appear as valued character outside the landscape being viewed but compatible or compli-

Table 1-4 Proposed Management Area Prescription Scenic Integrity Level Classification	
Management Prescription Area	**SIL Class**
1.2- Recommended for Wilderness	High
2.1 - Special Interest Areas	High
3.63 - Black-footed Ferret Reintroduction Habitat	Low
3.64 - Special Plant and Wildlife Habitat	Moderate
3.65 - Rangelands with Diverse Natural-Appearing Landscapes	Moderate in foreground and middleground, Low in background of scenic classes 1-2; Low in all areas scenic classes 3-7
3.68 - Big Game Range	Moderate in foreground and middleground, Low in background of scenic classes 1-2; Low in all areas scenic classes 3-7
4.32 - Dispersed Recreation: High Use	Moderate
5.12 - General Forest and Rangelands: Range Vegetation Emphasis	Moderate in foreground and middleground, Low in background of scenic classes 1-2; Low in all areas scenic classes 3-7
6.1 - Rangeland with Broad Resource Emphasis	Low
8.4 - Mineral Production and Development	Low

mentary to the character within. The alternatives would be consistent with this SIL class

Geographic Area Direction. In addition to the grassland wide standards and guidelines, the proposed grassland plans also provide direction by geographic areas. Geographic areas include management direction that is too specific to apply across an entire national grassland or several national grasslands.

All of the NFS lands which would be crossed by the alternatives on BGNG are within the Fall River Northeast Geographic Area. One of the objectives for this geographic area in the proposed grassland plan is to increase average pasture size over the decade by 10 percent. The alternatives may not be consistent with this objective. The railroad would be fenced on both sides to prevent livestock from gaining access to the tracks.

Where pastures are crossed by the railroad, it may be necessary to provide access under the tracks so that livestock can utilize each side of the pasture split by the tracks. However, in some pastures remnants will be created. Even if these remnants are incorporated into adjacent pastures on the same side of the track, the average pasture size could decrease.

On TBNG, Alternatives B and C would cross the Broken Hills, Cellar Rosecrans, Fairview Clareton, and Highlight Bill geographic areas. Alternative D would cross the Broken Hills, Highlight Bill and Upton Osage geographic areas. The alternatives would be consistent with the direction in the proposed TBNG Grassland Plan for the Fairview Clareton and Highlight Bill geographic areas. However, the Broken Hills, Cellar Rosecrans and Upton Osage geographic areas all contain direction to increase pasture size. Increased pasture size is an objective for the Upton Osage and Broken Hills geographic areas. The Cellars Rosecrans Geographic Area direction contains a standard that precludes a net decrease in average pasture size. Increased pasture size may be difficult to achieve for the reasons described above for the Fall River Northeast Geographic Area.

Proposed Management Area Prescriptions. The proposed grassland plans redefine management areas for TBNG and BGNG. The management areas are defined as parts of the grassland that are managed for a particular emphasis or theme. Each management area has a prescription that outlines the theme, the desired conditions, and the standards and guidelines that apply to it. These management area standards and guidelines are applied in addition to the grassland wide and geographic area standards and guidelines discussed above.

The proposed grassland plans provide 8 major categories of management prescriptions based on a continuum from least evidence of human disturbance to most. The categories of management prescriptions which would be affected by the alternatives are listed below.

Prescription Category 1. Category 1 includes wilderness areas and the various prescriptions used within them, and the backcountry recreation settings. Ecological processes, such as fire, insects, and disease, are essentially allowed to operate relatively free from the influence of humans. Diversity resulting from natural succession and disturbances predominates, and non-native vegetation is rare. Users must be self-reliant and should expect little contact with other people. Few, if any, human-made facilities are present. With rare exceptions, travel is non-motorized.

Prescription Category 2. Category 2 areas are intended to conserve representative (or particularly rare and narrowly distributed) ecological settings or components.

They help protect ecosystems or ecosystem components that may have important functions, ensuring the overall sustainability of larger landscapes. Human influences on ecological processes are limited as much as possible, but are sometimes evident. Types of human use vary, but generally are not intensive. Travel is generally non-motorized. They help play an important role under an adaptive-management philosophy by serving as a "natural" reference for areas that are intensively managed for a particular objective.

Prescription Category 3. Ecological values in Category 3 areas are in balance with human occupancy, and consideration is given to both. Resource management activities may occur, but natural ecological processes and resulting patterns normally predominate. Although these areas are characterized by predominately natural-appearing landscapes, an array of management tools may be used to restore or maintain relatively natural patterns of ecological process. This results in some evidence of human activities. Users expect to experience some isolation from the sights and sounds of people, in a setting that offers some challenge and risk.

Prescription Category 4. The ecological values in Category 4 areas are managed to be compatible with recreation use, but are maintained within the levels necessary to maintain overall ecological systems. Resource use for other values is not emphasized and has little impact on ecological structure, function, or composition. Sights and sounds of people are expected, and may even be desired. Motorized transportation is common.

Prescription Category 5. Category 5 areas are forested areas managed for a mix of forest products, forage, and wildlife habitat, while protecting scenery and offering recreation opportunities. Ecological sustainability is protected, while selected biological structures and compositions which consider the range of natural variability are emphasized. These lands often display high levels of investment, use, and activity; density of facilities; and evidence of vegetative treatment. Users expect to see other people and evidence of human activities. Facilities supporting the various resource uses are common. Motorized transportation is common.

Prescription Category 6. Category 6 areas are primarily non-forested ecosystems that are managed to meet a variety of ecological and human needs. Ecological conditions will be maintained while emphasizing selected biological (grasses and other vegetation) structures and compositions which consider the range of natural variability. These lands often display high levels of investment, use, and activity; density of facilities; and evidence of vegetative manipulation. Users expect to see other people and evidence of human activities. Facilities supporting the various resource uses are common. Motorized transportation is common.

Prescription Category 8. Ecological conditions, including processes, within Category 8 areas are likely to be permanently altered by human activities, beyond the level needed to maintain natural-appearing landscapes and ecological processes. These areas are generally small. Ecological values are protected where they affect the health and welfare of humans. Human activities are generally commercial in nature, directly or indirectly providing jobs and income. Motorized transportation is common.

Table 1-2 lists the proposed management area prescriptions that would be crossed by the alternatives. The following describes the consistency of the alternatives with the proposed management prescription themes, desired conditions, goals and standards and guidelines.

Proposed Management Area Prescription 1.2 - Recommended for Wilderness

Only Alternative B would cross this management area prescription. This management area prescription includes RARE II and inventoried roadless areas on BGNG. These are areas that the Forest Service has or will recommend to Congress for inclusion in the Wilderness System. The areas are managed to protect wilderness characteristics until Congressional action is taken. Non-conforming activities may be limited or restricted. Alternative B would be inconsistent with both the goals and standards and guidelines proposed for this management prescription area (see Table 14 in Appendix A).

The management prescription contains a standard that allows uses and activities only if they do not degrade the characteristics for which the area was identified. The operating railroad would not be consistent with this standard. The railroad would degrade the wilderness characteristics of the areas. Direct impacts on NFS lands would be limited to Alternative B. However, Alternative C would introduce noise and potentially visual impacts to this proposed management area where it is routed on private lands adjacent to NFS lands on BGNG.

Motorized use in this management area is limited to administrative purposes such as grazing administration, noxious weed control, and fire suppression. Operation of locomotives in this management area and support traffic necessary for inspection, maintenance and repair of the railroad, would be inconsistent with this standard. The management prescription also prohibits a net gain in fences and prohibits new utilities and special use facilities. Alternative B would be inconsistent with these standards

and guidelines. Finally, the operating railroad would not be subordinate to the landscape which is a guideline for this management area.

Proposed Management Area Prescription 2.1 - Special Interest Areas

Alternatives B and C would cross the Thunder Basin Paleontological SIA on TBNG. The desired condition and standards and guidelines for this management area are listed on Table 15 in Appendix A. The Thunder Basin SIA is a 5,140-acre site that features a high concentration of fossil remains from the late Cretaceous Period ending about 65 million years ago. The site is within the Lance Formation, which is composed of 2,600 feet of dull-gray sandy shales alternating with lenticular, light-colored sandstones and thin lignite beds. The Lance Formation has a very good potential to produce a large variety of fossils of excellent research value. This is the most productive fossil-bearing site on TBNG. Management emphasis is on interpretation and education of geology and paleontology.

Construction of the railroad through this SIA would be consistent with the management emphasis. Construction of the railroad would offer a unique opportunity to discover geologic and paleontological resources. Important discoveries could be made as a result of excavation activities associated with construction of the alternatives. If Alternative B or C is selected, DM&E and the Forest Service will prepare a plan that addresses how impacts to this site would be mitigated and how the public can benefit from both education and interpretation of resources unearthed during construction of the alternatives. The alternatives are consistent with the desired conditions for this SIA.

Proposed Management Area Prescription 3.63 - Black-footed Ferret Reintroduction Habitat

Only Alternative B (on TBNG) would cross this proposed management prescription area. Under this proposed management prescription, black-tailed prairie dog colony complexes and intermingled public grasslands are actively and intensively managed for reintroduction of black-footed ferrets. Prairie dog colony complexes large enough for black-footed ferret reintroduction are established and maintained. Desired conditions and standards and guidelines for this management prescription area are listed on Table 16 in Appendix A.

The desired condition for this management area is to have prairie dog complexes and compatible land uses maintained for black-footed ferret reintroduction. However, without proper mitigation, Alternative B may preclude the successful reintroduction of ferrets into portions of this management area. The management prescription allows uses and activities (e.g. recreation, grazing, mineral leasing, road construction) only if they contribute to the protection or enhancement of the characteristics for which the area was designated. Alternative B would not contribute to the protection or enhancement of this site for black-footed ferret reintroduction. The railroad would fragment habitat (prairie dog towns) and could present a barrier to the ferret's ability to use large blocks of prairie dog towns. It is uncertain what impacts noise and ground vibrations may have on ferrets. These impacts could adversely affect the ability of ferrets to reproduce. Train traffic could result in direct mortality to ferrets. Alternative B would be inconsistent with this standard.

Proposed Management Area Prescription 3.64 - Special Plant and Wildlife Habitat

This management area would only be affected by Alternative C, although Alternative B would be constructed directly adjacent to the management area. The management area would be crossed on BGNG near Creston. The proposed management prescription requires the area to be managed to emphasize specific plant and wildlife species and communities (see Appendix A, Table 17).

The crossing of this management area would occur in the Fall River Northeast Geographic Area. The geographic area direction contains objectives that address only sharp-tailed grouse habitat. Those objectives include:

- provide diverse and quality grassland habitat at levels that, in combination with habitat on adjoining lands, helps support stable to increasing sharp-tailed grouse populations (long-term trends) across this geographic area;
- establish and maintain quality nesting and brooding habitat for sharp-tailed grouse and associated wildlife by meeting vegetation objectives for high structure within 10 years; and
- establish and maintain quality winter foraging habitat for sharp-tailed grouse and associated wildlife by enhancing and/or maintaining regeneration of shrub patches and the shrub component of wooded draws and riparian habitats.

Construction of Alternative C is not expected to adversely effect the habitats listed above. It is anticipated that Alternative C would be consistent with these objectives and the proposed management prescription.

Proposed Management Area Prescription 3.65 - Rangelands with Diverse Natural-Appearing Landscapes

Management emphasis is on maintaining or restoring a diversity of native plants and animals, and ecological processes and functions, while providing for a mix of other rangeland values and uses with limits on facilities to

support livestock grazing. Desired conditions and standards and guidelines are listed on Table 18 in Appendix A. All of the alternatives would cross this management area. The desired condition for this management area is a naturally-appearing landscape. Facilities are anticipated to be subordinate to the landscape. The alternatives would be inconsistent with this desired condition. Where the railroad alternatives are located, they would dominate the landscape. The operating railroad would not be subordinate to the landscape.

The management prescription contains a standard that requires the average size of fenced grazing units to be maintained or increased. The alternatives would not be consistent with this standard. The railroad would cross through a number of fenced grazing units on both TBNG and BGNG. The railroad would be fenced on both sides to prevent livestock from gaining access to the railroad right-of-way. In some cases, access will be installed to allow livestock to move under the tracks to access both sides of the grazing unit. However, where small remnants of the fenced grazing units remain, it is anticipated that tunnels would not be provided and the grazing unit size would be reduced. These isolated remnant grazing units may be combined with other grazing units on the same side of the track. However, the net effect would still result in reduced grazing unit size.

Proposed Management Area Prescription 3.68 - Big Game Range

These areas are managed to emphasize deer, elk and pronghorn habitat. All alternatives would cross this management area on TBNG. Table 19 in Appendix A lists the desired conditions and standards and guidelines proposed for this management area. Activities and uses are managed so that big game can effectively use the area. High levels of suitability and habitat effectiveness are maintained for big game. Conflicts that cannot be mitigated are resolved in favor of big game. Two seasonal restrictions are incorporated as guidelines into the management prescription for this area: 1) limit activities during big game wintering from December 15 through March 15 if they would reduce habitat effectiveness; and 2) limit activities during elk parturition from May 1 through June 30 if they would reduce habitat effectiveness. It would not be feasible to economically operate the alternatives and comply with these seasonal restrictions. The alternatives would not be consistent with the management prescription for this area.

Proposed Management Area Prescription 4.32 - Dispersed Recreation: High Use

Only Alternative D would cross this proposed management area. The entire route for Alternative D through this management area would be directly adjacent to the existing BNSF railroad. Table 20 in Appendix A lists the desired conditions and standards and guidelines contained in the proposed grassland plan for this management area. These areas are managed for recreational opportunities and scenic qualities and are usually adjacent to developed recreation sites and bodies of water. Visitors recreate in a relatively natural environment, while pursuing a variety of unstructured recreational activities, such as camping, picnicking, fishing, and off-highway vehicle use. Because the impact of an operating, heavy-haul railroad is already present and Alternative D would be constructed directly adjacent to the existing railroad, it was concluded that Alternative D would be consistent with the management area prescription.

Proposed Management Area Prescription 5.12 - General Forest and Rangelands: Range Vegetation Emphasis

These areas are managed for the sustainability of physical, biological and scenic values associated with woody vegetation and open grassland. Management emphasis is on a balance of resource uses and opportunities. All the alternatives, except Alternative D, would cross this proposed management area. Appendix A, Table 21 contains the goals for this proposed management area. The alternatives would be consistent with the proposed goals. The proposed grassland plans do not contain standards and guidelines for this management area.

Proposed Management Area Prescription 6.1 - Rangeland with Broad Resource Emphasis

Management emphasizes a diversity of native plants and animals and ecological functions and processes, while providing for livestock forage, a mix of other rangeland values and uses, minerals and energy development, and recreation opportunities. All alternatives, except Alternative D, would cross this proposed management area. The alternatives would be consistent with the theme and desired conditions (see Appendix A, Table 22) for this management area. The proposed grassland plans do not provide standards and guidelines for this prescription.

Proposed Management Area Prescription 8.4 - Mineral Production and Development

All the alternatives would cross this proposed management area. In addition, the Black Thunder North and South mine loop options would be constructed in this area. The management area's theme and desired conditions are listed on Table 23 in Appendix A. These areas are managed for solid mineral operations. Mineral operations of all types are emphasized to effectively and efficiently remove available commercial mineral resources, concurrent with other ongoing resource uses and activities. The alternatives would be consistent with the prescription.

CHAPTER TWO - PROJECT ALTERNATIVES

2.1 Introduction

This chapter describes the physical, spatial and temporal characteristics of alternatives for the new railroad which are considered in detail in the EIS[1] including their location, construction and operation. Information was selected for presentation in this chapter because it has some bearing on the nature and extent of environmental impacts which could result from implementation of the alternatives. Much of the information in this chapter provides detailed descriptions of the various alternative routes. It is important to recognize that some of the information used to predict impacts was preliminary in nature and is subject to change. Also, DM&E has not advanced design of Alternatives B and D to the level of Alternative C. Consequently, some information about Alternatives B and D is lacking. Where pertinent information is not known the text is so noted.

2.2 Alternatives

2.2.1 Alternative A. This alternative is the No Action Alternative. Under this alternative one or more of the Federal agencies with jurisdiction over construction or operation of all or part of the new railroad would choose not to issue permits or other approvals and the new railroad would not be constructed. STB could implement this alternative independently or in conjunction with similar decisions by other agencies. The Forest Service, BLM, BOR, USCG and COE could also independently invoke the No Action Alternative.

2.2.2 Alternative B. DM&E's original proposal, as defined by their February 20, 1998 application to the STB, comprises Alternative B. The alternative has been modified in response to operational constraints (grade) identified between Wall and Wasta[2].

2.2.2.1 Alternative B Route. This alternative would begin in the NE of Section 31, T. 1 N., R. 16 E. in Pennington County, South Dakota about 0.8 miles northeast of Wall (see Map Volume, Map 1). The alternative would originate on the west side of DM&E's existing main line crossing of the Wall Pedro Road. After crossing Wall Pedro Road, DM&E's existing main line turns south and passes through the Town of Wall. Alternative B would leave the existing main line where it turns south and would proceed west to the north of Wall and the Wall Landing Field. Northwest of the Wall Landing Field this alternative would turn to the southwest and cross over Interstate 90 (I-90) in the NE of Section 35, T. 1 N., R. 15 E. about 1.5 miles northwest of DM&E's existing main line crossing of I-90.

Once across I-90 Alternative B would continue southwest and cross Baseline Road approximately 0.4 miles southwest of the I-90 crossing in the SE of Section 35, T. 1 N., R. 15 E. Approximately 0.5 miles southwest of the Baseline Road crossing the alternative would cross DM&E's existing main line in the NE of Section 2, T. 1 S., R. 15 E. directly adjacent to Bull Creek (see Map Volume, Map 1). Approximately 1.4 miles southwest of the Bull Creek crossing Alternative B would turn to the west and then northwest and cross Sections 3 and 4 in T. 1 S., R. 15 E. along the south end of Lake Flat. The turn would occur about 1 mile north of Sage Creek Road. In this area several intermittent tributaries to Bull Creek would be crossed (see Map Volume, Maps 1 and 2). Alternative B would continue northwest parallel to and southwest of Bull Creek and DM&E's existing main line toward Wasta (see Map Volume, Map 2). In this area DM&E's existing railroad is located directly adjacent to and makes a number of crossings of Bull Creek. Alternative B would be routed between 0.5 and 1 mile southwest of the existing main line and Bull Creek. In the SE of Section 13, T. 1 N., R. 14 E. the alternative would be located approximately 0.8 miles southwest of I-90, DM&E's existing main line and Bull Creek (see Map Volume, Map 3). Jensen Road would be crossed in the center of Section 13.

In Section 10, T. 1 N., R. 14 E., about 1.7 miles southeast of Wasta, Alternative B would turn west and then southwest. In Section 10 the alternative would be about 0.5 miles south of I-90 and the Cheyenne River (see Map Volume, Map 4). Several intermittent streams that drain directly to the Cheyenne River would be crossed in the area south and southeast of Wasta. In the SW of Section 16, T. 1 N., R. 14 E. Crooked Creek would be crossed about 0.3 miles from its confluence with the Cheyenne River. In the SE of Section 17, T. 1 N., R. 14 E., about 2 miles south of Wasta, Alternative B would approach to within 750 feet of the Cheyenne River (see Map Volume, Map 4). Alternative B would drop into the Cheyenne River flood plain in the NE of Section 20, T. 1 N., R. 14 E. and would cross the river in the SW of Section 20 about 3 miles south of Wasta (see Map Volume, Map 5). About 0.4 miles southwest of the

[1] Information regarding alternatives which were determined not to be reasonable or feasible can be found in the EIS and in the study scope prepared by STB. The study scope can be found at http://www.stb.gov by searching under docket #33407.

[2] DM&E has determined that the grade between Wall and Wasta along the existing main line (known as Wall Hill) is too steep to allow efficient operation of the heavy haul railroad. DM&E modified their February 20, 1998 application to the STB and proposed a reroute around this area. The reroute is shown in the Map Volume, Maps 1 through 5.

Cheyenne River crossing Alternative B would cross Baseline Road approximately 3.2 miles south of Wasta and on the west side of the Cheyenne River flood plain. One the west side of Baseline Road the alternative would intersect DM&E's existing main line in the NE of Section 30, T. 1 N., R, 14 E. At the intersection Alternative B would turn to the south and follow the existing railroad through the south half of Section 30. In this area the alternative would be about 0.25 miles west of Baseline Road (see Map Volume, Map 5). In the SE of Section 30 DM&E's existing main line turns to the southwest and then west and proceeds up Boxelder Creek to Owanka and Rapid City, South Dakota (see Section 2.2.4). Alternative B would leave the existing DM&E main line in the SE of Section 30 and continue south along the west side of the Cheyenne River flood plain crossing Boxelder Creek in the NE of Section 31, T. 1 N., R. 14 E. about 0.5 miles southwest of its confluence with the river.

South of Boxelder Creek Alternative B would continue south along the west side of the Cheyenne River flood plain and east of Brennan Flat. In the NE of Section 31, T. 1 N., R. 14 E. (see Map Volume, Map 5) the alternative would again cross Baseline Road. The Cheyenne River is located about 600 feet east of the proposed Baseline Road crossing location. South of the Baseline Road crossing the Cheyenne River begins to meander toward the west side of the flood plain. In the south of Section 31 the alternative would turn to the southwest and encroach directly on the west bank of the Cheyenne River for approximately 0.5 miles in the SW of Section 6, T. 1 S., R. 14 E. (see Map Volume, Map 5). In this area Alternative B would be constructed on the east side of Brennan Flat and about 0.5 miles southeast of Baseline Road.

Beginning in the NE of Section 7, T. 1 S., R. 14 E. Alternative B would turn more to the southwest and proceed along the west edge of the Cheyenne River flood plain while the river meanders away from the alternative location to the east side of the flood plain (see Map Volume, Maps 5 and 6). For approximately 2.5 miles the Cheyenne River flows on the eastern side of the flood plain and Alternative B and the river would be separated by approximately 0.5 miles (see Map Volume, Map 6). In the NW of Section 23 and NE of Section 22, T. 1 S., R. 13 E. the river meanders back to the northwestern side of the flood plain. In this area, which includes the confluence with Timber Draw, Alternative B would be constructed directly adjacent to the west bank of the river for approximately 0.2 miles (see Map Volume, Maps 6 and 7). In the SE of Section 22 the river again turns south and Alternative B would continue in a southwest direction along the western edge of the flood plain. East of Holcomb Flat, in Section 28, T. 1 S., R. 13 E., the river turns to the northwest and parallels the west edge of the flood plain through Sections 28, 32 and 33 of T. 1 S., R. 13 E. and Section 6 of T. 2 S., R. 13 E. Alternative B would be constructed directly adjacent to the west or north bank of the river for approximately 1.5 miles in this area (see Map Volume, Maps 7 and 8).

Alternative B would continue in the Cheyenne River flood plain and turn to the west in Section 1, T. 2 S., R. 12 E. south of Holcomb Flat. The alternative would be constructed between 400 feet and 0.4 miles north of Rapid Creek in the north half of Section 2, T. 2 S., R. 12 E. In the NE of Section 3, T. 2 S., R. 12 E. Alternative B would turn to the southwest and cross Rapid Creek about 1.5 miles west of its confluence with the Cheyenne River (see Map Volume, Maps 8 and 9). South of the Rapid Creek crossing, in the SE of Section 3, Alternative B would cross State Highway 44 approximately 1.5 miles east of Creston, South Dakota (see Map Volume, Map 9). Southwest of the State Highway 44 crossing, Alternative B would leave the Rapid Creek drainage and would reenter the Cheyenne River flood plain. Approximately 0.6 miles southwest of the State Highway 44 crossing, after crossing Creston Road, Alternative B would begin paralleling (to the west) the abandoned Chicago, Milwaukee, St. Paul and Pacific Railroad (Old Milwaukee). The alternative would follow the abandoned railroad through the north half of Section 9, T. 2 S., R. 12 E. (see Map Volume, Map 9). In the middle of Section 9 the Old Milwaukee turns abruptly to the southeast and Alternative B would continue to the southwest (see Map Volume, Map 9).

In the NE of Section 17, T. 2 S., R. 12 E. Alternative B would cross Cole Draw approximately 0.9 miles upstream of its confluence with the Cheyenne River. South of Cole Draw the alternative would leave the Cheyenne River flood plain and proceed up the Spring Creek drainage, crossing from Pennington into Custer County in the south half of Section 20, T. 2 S., R. 12 E.(see Map Volume, Map 10). Spring Creek would be crossed in the south half of Section 20 and the alternative would continue along the east edge of the creek's flood plain through Section 29 and the north half of Section 32, T. 2 S., R. 12 E. Alternative B in this area would be constructed 0.25 miles or less from Spring Creek and west of Spring Creek Road. In some areas the alternative would be constructed directly adjacent to the creek (see Map Volume, Map 10). Spring Creek would again be crossed at several locations in Section 32, T. 2 S., R. 12 E. as Alternative B switches back to the west side of the Spring Creek flood plain. In this area Alternative B would be about 1 mile west of the north end of Phiney Flat. The alternative would be constructed directly adjacent to Spring Creek in a number of locations in Section 6, T. 3 S., R. 12 E. and Sections 1, 12, 14 and 15 of T. 3 S., R. 11 E. (see Map Volume, Map 11). Spring Creek would again be crossed in the SE of Section 15, T. 3 S., R. 11 E. About 0.3 miles southwest of Spring Creek Alternative B would cross Spring Creek Road. About 1.5 miles south of the road crossing the alternative would turn to the

south, traverse the southern portion of Phiney Flat (see Map Volume, Maps 12 and 65), and reenter the Cheyenne River flood plain in the NE of Section 9, T. 4 S., R. 11 E. about 2 miles north of the intersection of Pennington, Custer and Shannon counties (see Map Volume, Map 66). In the SE of Section 9 and the SW of Section 16, T. 4 S., R. 11 E, the alternative would be constructed directly adjacent to the Cheyenne River.

Battle Creek would be crossed in the NW of Section 21, T. 4 S., R. 11 E., approximately 1,000 feet upstream of its confluence with the Cheyenne River (see Map Volume, Map 66). From Battle Creek Alternative B would continue south between about 1,000 feet and 0.5 miles west of the Cheyenne River and Pine Ridge Indian Reservation. In the SW of Section 29, T. 4 S., R. 11 E. the alternative would turn west and run north of the river toward Red Shirt, South Dakota. Approximately 1.5 miles east of Red Shirt the alternative would cross State Highway 40 in Section 25, T. 4 S., R. 10 E. (see Map Volume, Map 67). Near the State Highway 40 crossing the alternative would be constructed within 800 feet of the Cheyenne River. West of State Highway 40 the alternative would continue for approximately 2 miles in a westerly direction to the middle of Section 27, T. 4 S., R. 10 E. At this point Alternative B would turn south and cross Red Shirt Creek. The alternative would continue south across French Creek paralleling the Cheyenne River to the west (between 500 feet and 0.5 miles). About 1.5 miles south of French Creek, in the SW of Section 9, T. 5 S., R. 10 E., Alternative B would turn to the west following the meanders of the Cheyenne River (see Map Volume, Map 68). In Section 8, T. 5 S., R. 10 E. the alternative would be constructed adjacent to the Cheyenne River and Pine Ridge Indian Reservation.

Alternative B would continue west approximately 6.5 miles on the north side of the Cheyenne River to Section 21, T. 5 S., R. 9 E. In Sections 13, 14 and 23, T. 5 S., R. 9 E. the alternative would be constructed on the northern edge of the flood plain. In this area the river and the alternative alignment would be separated by 600 feet to 0.5 miles. However, in Section 22, T. 5 S., R. 9 E. the river meanders to the north end of the flood plain and Alternative B would be constructed directly adjacent to the north bank of the river (see Map Volume, Map 69). In the middle of Section 22 the river swings back to the south and in Section 21 Alternative B would again be aligned over 0.5 miles from the river.

In Section 21 Alternative B would turn to the south and continue along the western edge of the river flood plain for about 2 miles to the SW of Section 33, T. 5 S., R. 9 E. In the SW of Section 33 the alternative would turn to the southwest and leave the Cheyenne River flood plain (see Map Volume, Map 18). At this point Alternative B would be routed up the Cottonwood Creek drainage to the west of Harrison Flat.

The alternative would be constructed along the north and western edges of Cottonwood Creek's flood plain. Alternative B would be constructed directly adjacent to the creek in the SW of Section 33, T. 5 S., R. 9 E. and 2 crossings would be made in the SE of Section 32. Two additional crossings of Cottonwood Creek would be made in the NE of Section 7, T. 6 S., R. 9 E. and Alternative B would encroach on the creek the SW of Section 7 (see Map Volume, Maps 18 and 19). After additional crossings in Section 18, T. 6 S., R. 9 E. and Section 13, T. 6 S., R. 8 E. Alternative B would leave the Cottonwood Creek drainage and traverse the southern portion of Harrison Flat and cross Lame Johnny Creek in the SW of Section 35, T. 6 S., R. 8 E. About 0.4 miles southwest of Lame Johnny Creek the alternative would cross from Custer into Fall River County (see Map Volume, Map 70).

In Section 8, T. 7 S., R. 8 E. Alternative B would descend back into the Cheyenne River flood plain and turn to the west (see Map Volume, Map 71). The location is approximately 7 miles southeast of Buffalo Gap, South Dakota. Alternative B would encroach on the north bank of the river in the SE of Section 7, T. 7 S., R. 8 E. (see Map Volume, Map 71). The alternative would continue in a southwest direction along the north edge of the river's flood plain to Section 22, T. 7 S., R. 7 E. In the NE of Section 22, about 1.8 miles north of Oral, South Dakota, Alternative B would cross Beaver Creek approximately 0.2 miles upstream of its confluence with the Cheyenne River. Approximately 0.4 miles south of the Beaver Creek crossing and 0.5 miles north of the Cheyenne River Alternative B would join DM&E's existing Black Hills Subdivision Branch Line (see Map Volume, Map 72) and would follow the existing railroad right-of-way for approximately 12.9 miles to the south.[3]

Approximately 1 mile south of the Beaver Creek crossing Alternative B would cross the Cheyenne River in the NE of Section 27, T. 7 S., R. 7 E. (see Map Volume, Map 72). Once across the Cheyenne River the alternative would proceed up the Sand Creek drainage using the Black Hills Subdivision Branch Line right-of-way toward Smithwick. In the SE of Section 27 the alternative would pass through the Town of Oral and cross County Road 2. Sand Creek would be crossed once in the SW of Section 34, T. 7 S., R. 7 E. and twice in the NE of Section 3, T. 8 S., R. 7 E. In Section 11, T. 8 S., R. 7 E. Alternative B would cross Sand Creek and switch to the east side of the flood plain (see Map Volume, Maps 72 and 73). In Sections 24 and 25, T. 8 S., R. 7 E., 5 crossings of Sand

[3] The existing Black Hills Subdivision Branch Line eventually connects with Chadron, Nebraska. Currently, DM&E hauls flour on this line. Traffic consists of approximately 2 trains weekly. Each train consists of about 50 cars. Longer trains are not feasible and the flour cars are not filled to capacity because of problems with the tracks including excessive grades and curves.

Creek would be required (see Map Volume, Map 73). Northwest of Smithwick (in the SW of Section 31, T. 8 S., R. 8 E.) Alternative B would turn to the southwest and follow the Black Hills Subdivision Branch Line for another 3 miles to the NE of Section 23, T. 9 S., R. 7 E. At this point the Black Hills Subdivision Branch Line turns to the south and continues to Oelrichs, South Dakota. Alternative B would leave the existing railroad at this point and turn to the west toward Heppner, South Dakota (see Map Volume, Map 24).

Approximately 2.2 miles west of its departure from the Black Hills Subdivision Branch Line Alternative B would cross Horsehead Creek. The crossing would occur in the SW of Section 21, T. 9 S., R. 7 E. (see Map Volume, Map 24) approximately 3.8 miles upstream of the creek's discharge to Angostura Reservoir. Approximately 0.3 miles west of the Horsehead Creek crossing Alternative B would cross U.S. Highway 18. The crossing would occur about 6 miles north of Oelrichs. After crossing U.S. Highway 18 the alternative would proceed west crossing south of Angostura Reservoir. About 2.1 miles west of U.S. Highway 18 Alternative B would cross County Road 79 in the SW of Section 19, T. 9 S., R. 7 E. Approximately 6.3 miles west of the U.S. Highway 18 crossing the alternative would cross Dry Creek (in the SE of Section 29, T. 9 S., R. 6 E.) 2.3 miles upstream of its discharge to Angostura Reservoir (see Map Volume, Map 25). At its closest Alternative B would be constructed approximately 1.8 miles south of Angostura Reservoir.

Once across Teepee Creek in the SE of Section 22, T. 9 S., R. 5 E. the alternative would proceed north of Heppner (see Map Volume, Map 26). Northwest of Heppner Alternative B would turn to the southwest and cross Bitter Creek in the SW of Section 29, T. 9 S., R. 5 E. One mile south of Bitter Creek the alternative would turn to the west and proceed across Ash and Hat creeks (in Section 36, T. 9 S., R. 4 E.). Approximately 4.2 miles southeast of Heppner the alternative would cross State Highway 71 in Section 34/35, T. 9 S., R. 4 E. (see Map Volume, Map 27). Once across the highway Alternative B would turn to the northwest and cross Plum Creek about 4.5 miles west of the highway crossing in the SW of Section 25, T. 9 S., R. 3 E. (see Map Volume, Map 28).

Once across Plum Creek Alternative B would continue to the northwest approximately 5.2 miles toward Edgemont. The alternative would proceed around the east and north end of Edgemont crossing Cottonwood Creek in the NW of Section 6, T. 9 S., R. 3 E. approximately 0.3 miles upstream from its confluence with the Cheyenne River (see Map Volume, Map 31). Northeast of the Cottonwood Creek crossing Alternative B would cross A Street and the Cheyenne River in the SE of Section 36, T. 8 S., R. 2 E. Approximately 0.3 miles north of A Street the alternative would cross U.S. Highway 18 between Edgemont and Dudley, South Dakota. Northwest of the U.S. Highway 18 crossing Alternative B would begin to parallel an existing BNSF railroad corridor. Alternative B would be constructed east of the BNSF corridor around the east side of Edgemont (see Map Volume, Map 31).

Once across U.S. Highway 18 Alternative B would proceed northwest for approximately 11 miles adjacent to the east side of the BNSF corridor which traverses along the eastern edge of the Cheyenne River flood plain. About 1 mile northwest of the U.S. Highway 18 crossing (in the SE of Section 26, T. 8 S., R. 2 E.) the Cheyenne River is located directly adjacent to west side of the BNSF corridor. However, in this area Alternative B would be constructed on the east side of the BNSF corridor and away from the river (see Map Volume, Map 31). Alternative B would continue to the northwest paralleling the BNSF corridor to the NW of Section 23, T. 7 S., R. 1 E. where the alternative would cross over the BNSF corridor (see Map Volume, Map 34). The crossing is about 1.8 miles southeast of Burdock, South Dakota. At this point Alternative B would turn to the west following the Cheyenne River flood plain into Wyoming and leave the BNSF corridor which continues to the northwest to Newcastle, Wyoming.

Approximately 1.8 miles west of the BNSF crossing the alternative would cross Beaver Creek (in the SW of Section 16, T. 7 S., R. 1 E.) about 1 mile upstream of its confluence with the Cheyenne River. Once across Beaver Creek Alternative B would proceed west running between 700 and 2,000 feet north of the Cheyenne River across Sections 17 and 18, T. 7 S., R. 1 E. (see Map Volume, Map 35). About 4.2 miles west of the BNSF crossing Alternative B would leave South Dakota and enter Niobrara County, Wyoming south of Twentyone Divide. Alternative B would continue west toward Riverview, Wyoming running parallel to and north of the Cheyenne River. In Section 20, T. 40 N., R. 60 W., just west of the Twentyone Draw confluence with the Cheyenne River, Alternative B would be constructed just north of the river for several hundred feet (see Map Volume, Map 35).

In the NW of Section 24, T. 40 N., R. 61 W. Alternative B would cross Old State Highway 85. Directly west of the highway crossing Alternative B would turn to the northwest and leave the Cheyenne River flood plain. Robbers Roost Creek would be crossed in the SW of Section 14, T. 40 N., R. 61 W. about 1.2 miles west of the Old State Highway 85 crossing (see Map Volume 36). The crossing would occur about 1 mile northwest of the creek's confluence with the Cheyenne River. About 2.5 miles west of Robbers Roost Creek the alternative would cross U.S. Highway 85 about 0.4 miles northwest of the intersection with Pipe Road (see Map Volume, Map 36). The crossing would occur approximately 2.5 miles north of Riverview.

Once across U.S. Highway 85 Alternative B would proceed northwest up the Bobcat Creek drainage. A number of crossings of the creek would be required in Sections 6, 7 and 8, T. 40 N., R. 61 W. and in Section 1, T. 40 N., R. 62 W. About 3.8 miles west of U.S. Highway 85 Alternative B would leave the Bobcat Creek drainage and proceed up the Alkali Creek drainage toward Morrisey, Wyoming. Alternative B would continue in a northwest direction up Alkali Creek to Section 30, T. 41 N., R. 62 W. where it would cross from Niobrara into Weston County (see Map Volume, Map 38). Approximately 0.5 miles northwest of the county line Alternative B would cross Morrisey Road. About 1.5 miles northwest of the county line the alternative would turn to the west and cross Roxson Road in the NE of Section 23, T. 41 N., R. 63 W. about 300 feet south of Morrisey Road and its intersection with the Cheyenne River Road (see Map Volume, Map 39).

West of Morrisey Alternative B would continue up the Alkali Creek drainage between the creek and the Cheyenne River Road. About 5 miles west of the Roxson Road crossing Alternative B would leave the Alkali Creek drainage and enter the headwaters of the Coyote Creek drainage. Coyote Creek would be crossed in the NE of Section 13, T. 41 N., R. 64 W. (see Map Volume, Map 40). About 1 mile west of the Coyote Creek crossing the alternative would turn to the northwest toward the Cheyenne River Road. In the NW of Section 5, T. 41 N., R. 64 W. the alternative would cross Lodgepole Creek (see Map Volume, Map 41). Directly west of the creek crossing the alternative would cross Grieves Road. Once across Grieves Road Alternative B would continue to the northwest running for approximately 7 miles between 0.5 and 1 mile north of Grieves Road up the Wildcat Creek drainage, crossing Wildcat Creek in the SW of Section 31, T. 42 N., R. 64 W. In Section 20, T. 42 N., R. 65 W. Alternative B would turn to the west and leave the Wildcat Creek drainage (see Map Volume, Map 43).

In the NW of Section 19, T. 42 N., R. 65 W. Alternative B would cross Dull Center Road and enter the Black Thunder Creek drainage (see Map Volume, Map 43). The crossing would occur about 1.7 miles north of Black Thunder Creek and the Grieves Road intersection. For approximately 5.5 miles west of Dull Center Road the alternative would be located north of Black Thunder Creek. Three crossings of Black Thunder Creek would occur in Section 7, T. 42 N., R. 66 W. upstream of the Horse Creek confluence (see Map Volume, Map 44).

At the confluence of Lion Creek with Black Thunder Creek, in the NW of Section 12, T. 42 N., R. 67 W., Alternative B would split into 2 legs (see Map Volume, Map 44). The split is known as the "Y". The southern leg would proceed southwest up Lion Creek to the southern SPRB coal mines. The northern leg would proceed north up Black Thunder Creek to the northern mines. The two legs are described below:

Southern Leg. From the Y the southern leg of Alternative B would proceed west, then southwest up the Lion Creek drainage. In the NE of Section 11, T. 42 N., R. 67 W. the southern leg would cross Lion Creek and would run southwest paralleling the east/south side of the creek for approximately 3 miles to Lynch Road which would be crossed in the SE of Section 21, T. 42 N., R. 67 W. (see Map Volume, Map 74). West of Lynch Road the southern leg would turn to the west and cross Lion Creek in the NE of Section 29, T. 42 N., R. 67 W. The southern leg would continue west and southwest roughly following Keyton Road between 1 and 1.5 miles to the north. In Section 30, T. 42 N., R. 67 W. the southern leg would cross Rochelle Road. In Section 26, T. 42 N., R. 68 W. the southern leg would leave the Lion Creek drainage and cross through the headwaters of the Frog Creek drainage.

In the NE of Section 34, T. 42 N., R. 68 W. the southern leg would cross Frog Creek and turn southwest. In Section 17, T. 41 N., R. 68 W. the southern leg would cross Keyton Creek and Rochelle Hills Road. About 1.6 miles southwest of the Rochelle Hills Road crossing the southern leg of Alternative B would cross from Weston into Campbell County (see Map Volume, Map 77). The southern leg would continue southwest for approximately 1.7 miles and pass from Campbell into Converse County. Once in Converse County the southern leg would turn to the west and cross a number of streams that are tributary to Antelope Creek. In Section 26, T. 41 N., R. 69 W. Wildcat Creek would be crossed approximately 3.5 miles north of its confluence with Antelope Creek. Approximately 1.8 miles to the west the southern leg would cross Beckwith Creek in the SE of Section 28, T. 41 N., R. 69 W. (see Map Volume, Map 52). In Section 31, T. 41 N., R. 69 W. the southern leg would enter the Antelope Creek drainage.

West of Porcupine Creek the southern leg of Alternative B would continue down the Antelope Creek drainage. Antelope Creek would be crossed in the SW of Section 32, T. 41 N., R. 70 W. After the crossing of Antelope Creek in the SE of Section 31, T. 41 N., R. 70 W., the route turns SW and proceeds to the Antelope Mine. The southern leg would terminate in the SE of Section 2, T. 40 N., R. 71 W. (see Map Volume, Map 54).

Northern Leg. From the Y in the NE of Section 12, T. 42 N., R. 67 W. (see Map Volume, Map 44) the northern leg of Alternative B would proceed northwest up the Black Thunder Creek drainage. About 2 miles northwest of the Y the northern leg would cross Little Thunder Creek in the NE of Section 3, T. 42 N., R. 67 W. about 0.4 miles southwest of its confluence with Black Thunder Creek. The crossing would be 2.2 miles east of

Darlington School. In the NE of Section 33, T. 43 N., R. 67 W. the northern leg would cross State Highway 450 and continue northwest up the Black Thunder Creek drainage (see Map Volume, Map 45). In Section 14, T. 43 N., R. 68 W. the northern leg would turn to the north and cross Buzzard Creek (see Map Volume, Map 78). In Section 4, T. 43 N., R. 68 W. the northern leg would turn to the west and cross Little Mike Creek. The northern leg would continue in a westerly direction south of Black Thunder Creek across the Weston-Campbell County line in Section 1, T. 43 N., R. 69 W. (see Map Volume, Map 80).

In the east half of Section 1, T. 43 N., R. 69 W., about 0.3 miles east of Keeline Road, a mine spur would originate from the northern leg to provide service to the Jacobs Ranch, North Rochelle and Black Thunder mines (see Map Volume, Map 80). The mine spur would proceed west up HA Creek around the north side of HA Divide (see Map Volume, Map 82) to Section 1, T. 43 N., R. 70 W. where it would enter the Jacobs Ranch Mine. On Jacobs Ranch the spur would turn south toward the North Prong Little Thunder Creek (see Map Volume, Map 55).

To service the North Rochelle Mine, this alternative would parallel the north side of State Highway 450 beginning in the NE of Section 23, T. 43 N., R. 70 W. The alternative would proceed east approximately 2.5 miles. In the NW of Section 29, T. 43 N., R. 69 W. the alignment would cross over State Highway 450 and curve south. From this point the alternative would proceed 1.5 miles to the NW of Section 6, T. 42 N., R. 69 W. The North Rochelle Mine Spur would depart from the alternative in the NW of Section 6, T. 42 N., R. 69 W. and proceed in a westerly direction for about 3.2 miles where it would join existing mine load out facilities in Section 9, T. 42 N., R. 70 W. School Creek Road would be crossed by this mine spur both in the NW and SW of Section 6, T. 42 N., R. 69 W. Reno Road would be crossed in the NE of Section 11, T. 42 N., R. 70 W.

The northern leg would continue up Black Thunder Creek on the south side for approximately 5 miles where it would cross to the north side of the creek in the SW of Section 20, T. 44 N., R. 69 W. (see Map Volume, Map 81). Once across Black Thunder Creek the northern fork would turn north up the Cottonwood Creek drainage and pass just east of Hay Lakes in Sections 14 and 23, T. 45 N., R. 70 W. (see Map Volume, Map 58). Approximately 6 miles north of Hay Lakes a mine spur would originate in Section 15, T. 46 N., R. 70 W. This spur would provide service to the Coal Creek Mine (see Map Volume, Map 60). The spur would extend approximately 3 miles to the west. A second mine spur would originate from the northern leg approximately 3 miles north of the Coal Creek Mine Spur (see Map Volume, Map 61). This spur would originate about 1.3 miles south of the Belle Fourche River and would provide service to the Cordero Mine. The spur would pass between the Belle Fourche River and Saddle Horse Butte in Section 31, T. 47 N., R. 70 W. The 2.2 mile long spur would terminate in the NE of Section 36, T. 47 N., R. 71 W. about 800 feet southeast of the Belle Fourche River.

The northern leg would cross the Belle Fourche River 3 times in the NW of Section 29, T. 47 N., R. 70 W. (see Map Volume, Map 62). On the north side of the river the northern leg would cross Kicken Draw in the NE of Section 19, T. 47 N., R. 70 W. and proceed north toward Caballo Creek. South of Caballo Creek, in Section 7, T. 47 N., R. 70 W., a mine spur would extend approximately 1.5 miles to the northwest (see Map Volume, Map 62) to provide service to the Rojo Mine (terminating in Section 1, T. 47 N., R. 71 W.).

The northern leg would continue north crossing Caballo Creek in the NE of Section 35, T. 48 N., R. 71 W. North of Caballo Creek the northern leg would provide service to the Belle Ayr and Caballo mines (see Map Volume, Map 63).

2.2.2.2 Alternative B Land Ownership. Figure 2-1 shows land ownership in the vicinity of the alternatives in South Dakota and Wyoming. A summary of land ownership for this alternative is provided in Table 2-1. The majority of the lands (nearly 80 percent) which would be crossed by Alternative B are private. Most of the Federal lands which would be crossed by this alternative are NFS lands which are associated with BGNG in South Dakota and TBNG in Wyoming.

Bureau of Land Management. Alternative B would cross the 5.7 miles of public lands in both South Dakota and Wyoming. The South Dakota public lands are managed by the BLM's South Dakota Field Office in Belle Fourche. Because of the complex history of homestead grants in western South Dakota, public lands are fragmented. The primary use is rangeland and management is primarily the responsibility of the lessee.

Wyoming public lands which would be affected by the alternative are managed by the Newcastle and Buffalo Field offices. The Newcastle Field Office manages public lands in Niobrara and Weston counties. Public lands within this field office are intermingled land surface ownership and overlapping mineral ownership. About 291,000 acres of public land surface and 1.4 million acres of subsurface Federal minerals are managed by the Newcastle Field Office. Principal land uses include grazing, oil and gas, and wildlife habitat. Public lands in Campbell County are managed by the Buffalo Field Office. The Buffalo Field Office manages nearly 800,000 acres of public surface and 4.7 million acres of Federal mineral estate. Very little public lands would be affected by the alternatives in the Buffalo Field Office. Affected

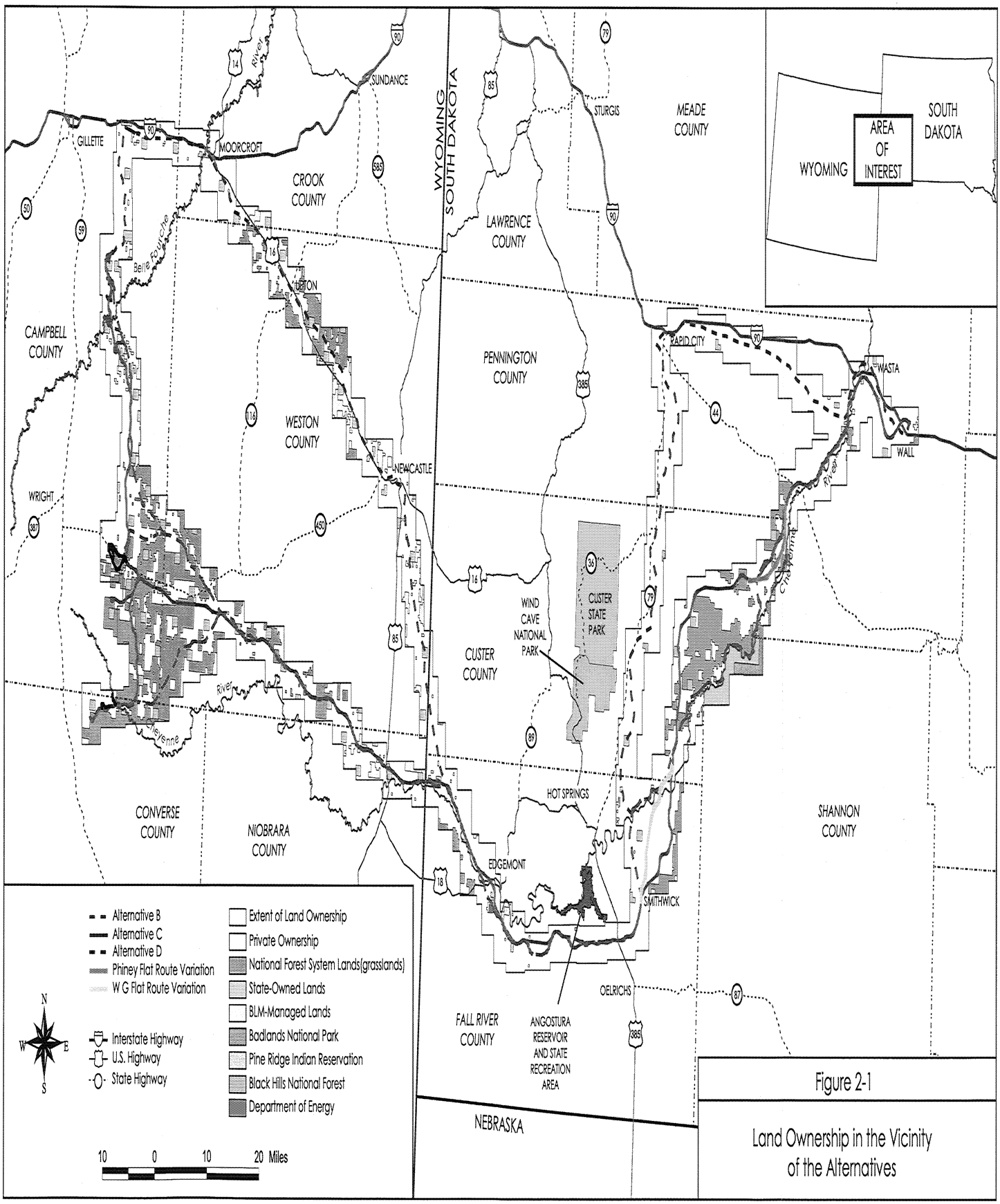

Figure 2-1

Land Ownership in the Vicinity of the Alternatives

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Table 2-1 Summary of Land Ownership (in Miles) for Alternative B						
Land Owner	South Dakota		Wyoming		Total	
	Miles	Percent of State	Miles	Percent of State	Miles	Percent of Total
BLM	3.3	2.3	2.4	1.6	5.7	2.0
DOE	0.3	0.2	0	0	0.3	0.1
Forest Service	16.3	11.2	35.6	23.5	51.9	17.5
State	2.7	1.9	7.4	4.9	10.1	3.4
Private	122.3	84.4	105.8	70.0	228.1	77.1
Total	144.9	100	151.2	100	296.1	100

public lands are located between Gillette and Wright, Wyoming.

In South Dakota Alternative B would cross 3.3 miles of public lands. These lands are scattered along the route and consist of small, isolated parcels. The first public land parcel which would be crossed consists of approximately 80 acres and is located in Section 19, T. 1 N., R. 15 E. in Pennington County between Wall and Wasta south of I-90 and Bull Creek (see Map Volume, Map 2). Another parcel of public lands would be crossed about 1.4 miles southeast of Wasta in Section 10, T. 1 N., R. 14 E. This 160-acre parcel is located about 0.4 miles south of I-90 (see Map Volume, Map 4).

A 200-acre public land parcel would be crossed just south of the proposed Boxelder Creek crossing in Section 31, T. 1 N., R. 14 E. on the north end of Brennan Flat (see Map Volume, Map 5). This crossing would occur about 4.7 miles south of Wasta in Pennington County. This parcel includes a portion of the Cheyenne River which is located approximately 800 feet east of the alternative through this public land parcel. South of Holcomb Flat a 70-acre public land parcel would be crossed in Section 1, T. 2 S., R. 12 E. (see Map Volume, Map 8). This parcel would be crossed about 2.5 miles east of the alternative's proposed crossing of State Highway 44 and about 0.5 miles east of the confluence of Rapid Creek with the Cheyenne River. A portion of this parcel is located in the Cheyenne River flood plain.

A 40-acre public land parcel is located at the crossing of State Highway 44 in Section 3, T. 2 S., R. 12 E. in Pennington County (see Map Volume, Map 9). This parcel is located southeast of the intersection of Creston Road and State Highway 44 and lies between Rapid Creek and the Cheyenne River.

A 160-acre public land parcel would be crossed west of Harrison Flat and about 2.2 miles west of the proposed Alternative B crossing from Custer into Fall River County (see Map Volume, Map 71). The parcel is located in Section 5, T. 7 S., R. 8 E. about 1.3 miles north of the Cheyenne River. About 5 miles southeast of Edgemont, public lands would be crossed in Sections 15 and 22, T. 9 S., R. 3 E. (see Map Volume, Map 29).

A 160-acre public land parcel would be crossed about 4 miles southeast of Edgemont in Section 22, T. 9 S., R. 3 E. A 40-acre public land parcel would also be crossed about 3.1 miles northwest of Edgemont within the BNSF corridor in Section 22, T. 8 S., R. 2 E. (see Map Volume, Map 32). These crossings would occur in Fall River County.

Alternative B would cross 2.4 miles of public lands in Wyoming. A public land parcel would be crossed by this alternative in Niobrara County at the point where the alternative would enter the Alkali Creek drainage in Section 4, T. 40 N., R. 62 W. and Section 32, T. 41 N., R. 62 W. (see Map Volume, Map 38) about 4.5 miles southeast of Morrisey. This parcel is managed by the BLM's Newcastle Field Office. All other public lands which would be crossed by Alternative B in Wyoming are located on the north end of the northern leg. These parcels are located west of Dry Creek in Section 33, T. 47 N., R. 70 W. and Sections 4, 5 and 23, T. 46 N., R. 70 W. (see Map Volume, Maps 59, 60 and 61). These lands are managed by the BLM's Buffalo Field Office and are located south of the proposed crossing of the Belle Fourche River in Campbell County.

Department of Energy. A 360-acre parcel of Department of Energy (DOE) managed lands would be crossed by this alternative in Fall River County in Section 8, T. 9 S., R. 3 E. (see Map Volume, Map 30). The parcel is about 2.5 miles southeast of Edgemont and about 1.3 miles west of the Cheyenne River. This parcel was used for uranium tailings disposal but has been cleaned up. No surface disturbing activities are allowed by DOE on this parcel. If this alternative is selected it may be necessary to reroute to avoid this parcel.

Forest Service. In South Dakota Alternative B would cross 16.3 miles of NFS lands on BGNG. These NFS lands are managed by the Fall River Ranger District which is headquartered in Hot Springs, South Dakota. Alternative B would cross 35.6 miles of NFS lands in

Wyoming. These lands are managed by the Douglas Ranger District which is headquartered in Douglas, Wyoming.

Buffalo Gap National Grassland. BGNG is located in southwestern South Dakota and includes more than 595,000 acres of land that borders and is intermingled with private, state, Indian reservation, and national park lands. Alternative B would affect the western unit of BGNG which extends from the Cheyenne River on the east to the Wyoming and Nebraska borders on the west and south, respectively. Principal land uses on the BGNG are grazing and recreation.

Alternative B would cross 16.3 miles of NFS lands on BGNG. These lands are primarily located in Custer and Pennington counties between U.S. Highway 44 and Oral. The first parcels which would be crossed are located in Pennington County on the south side of U.S. Highway 44 east of Creston (see Map Volume, Map 9). In the north half of Section 9, T. 2 S., R. 12 E. Alternative B would follow the abandoned Old Milwaukee Railroad across NFS lands.[4] In the middle of Section 9 the Old Milwaukee turns to the southeast and Alternative B proceeds to the southwest. In the SW of Section 9 and the NE of Section 17, T. 2 S., R. 12 E. NFS lands would be crossed.

A second parcel would be crossed just north of the Pennington-Custer County line as the alternative leaves the Cheyenne River flood plain and turns up the Spring Creek drainage west of the Creston Road. This includes portions of Sections 17 and 20 in T. 2 S., R. 12 E. Additional NFS lands would be crossed in the Spring Creek drainage in Sections 31 and 32, T. 2 S., R. 12 E.; Section 6, T. 3 S., R. 12 E.; and Section 1, T. 3 S., R. 11 E. (see Map Volume, Map 10).

Alternative B would again enter NFS lands about 0.3 miles north of the intersection of Pennington, Custer and Shannon counties in Section 21, T. 4 S., R. 11 E. (see Map Volume, Map 66). From the intersection of the counties the alternative would follow the north side of the Cheyenne River to the south to Red Shirt. In this area a contiguous stretch of approximately 7.6 miles of NFS lands would be crossed in the following sections: Sections 20, 21, 28, 29, 30, 31 and 32, T. 4 S., R. 11 E. and Sections 25, 26, 27, and 28, T. 4 S., R. 10 E. (see Map Volume, Maps 66 and 67). Once south of Red Shirt Alternative B would continue across private lands in the Cheyenne River flood plain to Section 9, T. 5 S., R. 10 E. where a small parcel (133 acres) of NFS lands would be crossed directly west of the Cheyenne River (see Map Volume, Map 68).

Alternative B would again enter BGNG northeast of Harrison Flat in Section 14, T. 5 S., R. 9 E. in Custer County (see Map Volume, Map 68). NFS lands, intermixed with private lands, would be crossed in the vicinity of Harrison Flat. NFS lands include portions of Sections 14, 22, 23, 32 and 33, T. 5 S., R. 9 E. and Sections 5 and 6, T. 6 S., R. 9 E. (see Map Volume, Maps 18 and 19). Some of these NFS lands are located in the Cottonwood Creek drainage.

Thunder Basin National Grassland. TBNG is located in northeastern Wyoming and occupies about 572,000 acres of land among a mosaic of state, Federal and private lands. NFS lands generally lie between Douglas on the south, to Newcastle on the east, to Gillette on the north, and to Wright on the west. A great deal of coal is mined on the grassland, including the largest coal strip-mine operation in the nation. Other important land uses include oil and gas, grazing and recreation.

Alternative B would cross 35.6 miles of NFS lands on TBNG. No NFS lands would be crossed by this alternative in Niobrara County. Alternative B would first enter NFS lands about 3.1 miles west of Morrisey in Weston County (see Map Volume, Map 40). These lands are located in the headwaters of Coyote Creek south of the Cheyenne River Road and include Sections 17 and 18, T. 41 N., R. 63 W. and Section 10, T. 41 N., R. 64 W. North of Grieves Road, in the Wildcat Creek drainage, Alternative B would cross NFS lands in Sections 22, 26 and 27, T. 42 N., R. 65 W. Lands west of Dull Center Road are NFS lands including portions of Sections 13, 14 and 24, T. 42 N., R. 66 W. (see Map Volume, Map 43).

Much of the southern leg of this alternative would cross NFS lands. From the headwaters of Lion Creek, around the south side of the Rochelle Hills, Alternative B would cross over 9 miles of contiguous NFS lands (see Map Volume, Map 74 to 77). This includes the headwaters of Frog, Keyton and Horse creeks. NFS lands which would be crossed in this area include: Section 29, T. 42 N., R. 67 W.; Sections 25, 26, 27, and 34, T. 42 N., R. 68 W.; Sections 3, 4, 8, 9, 17, 18, and 19, T. 41 N., R. 68 W.; and Sections 24 and 25, T. 41 N., R. 69 W. NFS lands would also be crossed by the southern leg of Alternative B immediately west of where Alternative B would cross into Converse County from Campbell County. This 560-acre parcel would be crossed in Section 27, T. 41 N., R. 69 W. (see Map Volume, Map 52).

NFS lands would also be crossed by the southern leg where it is aligned north of Antelope Creek from about Gibson Draw to Porcupine Creek. NFS lands in this area include Sections 29, 31 and 32, T. 41 N., R. 69 W. and Section 35, T. 41 N., R. 70 W. (see Map Volume, Maps

[4] The analysis assumes that disturbance adjacent to the Old Milwaukee Railroad would occur on NFS lands. However, the actual Old Milwaukee Railroad right-of-way is owned by the State of South Dakota. If this alternative is constructed entirely within the Old Milwaukee right-of-way NFS lands may not be affected.

52 and 53). The southern leg terminus on Antelope Mine would occur on NFS lands in Section 6, T. 40 N., R. 70 W. and Sections 1 and 12, T. 40 N., R. 71 W. (see Map Volume, Maps 53 and 54)

Much of the northern leg up the Black Thunder Creek drainage would cross NFS lands including the crossing of State Highway 450 and parts of Sections 19, 29, 30 and 33, T. 43 N., R. 67 W. and Sections 3 and 10, T. 43 N., R. 68 W. The NFS lands north of State Highway 450 are smaller in size and more checkerboard in nature than those which would be crossed by the southern leg. One mile west of the crossing from Weston into Campbell County NFS lands would be crossed in Sections 20, 27, 28 and 35, T. 44 N., R. 69 W. (see Map Volume, Maps 80 and 81). These lands are directly west and north of the confluence of HA Creek with Black Thunder Creek. Additional NFS lands would be crossed in Sections 1 and 12, T. 44 N., R. 70 W. and Section 7, T. 44 N., R. 69 W. as Alternative B leaves the Black Thunder Creek drainage and enters the Cottonwood Creek drainage (see Map Volume, Maps 57 and 81) .

NFS lands would be crossed by the spur to Jacobs Ranch Mine (see Map Volume, Map 55). These lands include portions of Sections 11, 12, 14 and 23, T. 43 N., R. 70 W. along the western edge of HA Divide. The North Rochelle Mine Spur would cross NFS lands in Section 24, T. 43 N., R. 70 W.; Sections 29, 30, 31 and 32, T. 43 N., R. 69 W.; Sections 1, 9 and 12, T. 42 N., R. 70 W.; as well as in Section 6, T. 42 N., R. 69 W.

State of South Dakota. About 2.7 miles of lands owned by the State of South Dakota would be crossed by Alternative B. The first parcel is located just south of Boxelder Creek on the east end of Brennan Flat adjacent to the Cheyenne River in Section 6, T. 1 S., R. 14 E. (see Map Volume, Map 5). The second parcel would be crossed just north of the intersection of Pennington, Custer and Shannon counties in Section 16, T. 4 S., R. 11 E. about 5 miles east of Red Shirt (see Map Volume, Map 66). A 320-acre state-owned parcel would be crossed in Fall River County in the Plum Creek drainage in the east half of Section 36, T. 9 S., R. 3 E. This parcel is about 7.3 miles southeast of Edgemont (see Map Volume, Map 28). The final state-owned parcel which would be crossed by Alternative B in South Dakota is located in western Fall River County approximately 1.5 miles southwest of Burdock. The parcel is located in the SW of Section 16, T. 7 S., R. 1 E. at the Beaver Creek crossing (see Map Volume, Map 35). State-owned parcels which would be crossed are used for grazing.

State of Wyoming. A total of 7.4 miles of lands owned by the State of Wyoming would be crossed by this alternative, all of which are used for grazing. The first parcel is just 0.5 miles west of the South Dakota-Wyoming State line in Section 16, T. 40 N., R. 60 W. (see Map Volume, Map 35). This parcel is in Niobrara County on the north side of the Cheyenne River but south of Twentyone Divide and east of the confluence of Twentyone Draw and the Cheyenne River. The area between Robbers Roost Creek and State Highway 18 in Niobrara County is state-owned lands (see Map Volume, Map 36). The state-owned parcels between the highway and the creek include the SW of Section 9 and Section 16, T. 41 N., R. 61 W. Two miles west of Morrisey Alternative B would cross state-owned Section 16, T. 41 N., R. 63 W. (see Map Volume, Map 40). This section is located in Weston County.

State-owned lands would be crossed north of Grieves Road in the Wildcat Creek drainage. This parcel (Section 36, T. 42 N., R. 65 W.) is located approximately 0.6 miles northeast of "the Nose" in Weston County (see Map Volume, Map 42). A state section would be crossed approximately 2.6 miles east of the Y in Section 16, T. 42 N., R. 66 W. (see Map Volume, Map 44). This section is located in the Black Thunder Creek drainage near the School Draw confluence in Weston County.

No state-owned lands would be crossed on the southern leg. Additional state-owned lands in Section 36, T. 44 N., R. 69 W. would be crossed by the northern leg just north of the spur to Black Thunder Mine. That section is located at the confluence of HA Creek and Black Thunder Creek in Campbell County. The section is bisected by Keeline Road. In the Cottonwood Creek drainage, in Section 36, T. 45 N., R. 70 W., a state-owned section would be crossed (see Map Volume, Map 57). This section is approximately 1.8 miles south of Hay Lakes. The spur to the Cordero Mine would terminate on state-owned lands in Section 36, T. 47 N., R. 71 W. This section is just south of the Belle Fourche River and west of Saddle Horse Butte in Campbell County (see Map Volume, Map 61). Finally, the north end of the northern leg, including the spur to the Belle Ayr Mine, would cross through a small portion of a state-owned section in Section 36, T. 48 N., R. 71 W. (see Map Volume, Map 63). This section is crossed by Caballo Creek.

Angostura Unit. All the alternatives would cross through the Angostura Unit. The Angostura Unit is located in Custer and Fall River counties in southwestern South Dakota. Angostura Dam and Reservoir, located on the Cheyenne River about 9 miles southeast of Hot Springs, provide multipurpose benefits, including irrigation, flood control, fish and wildlife conservation, recreation and sediment control.

The primary function of the Angostura Unit is to impound and deliver a full supply of irrigation water for production of forage and grain crops. The unit land, consisting of 12,218 acres extending along the Cheyenne River approximately 24 miles downstream from the dam, are served by the Angostura Canal.

In 1950 commissioners of Fall River and Custer counties approved the creation of the Angostura Irrigation District. The irrigation district and the United States agreed to a service and repayment contract in May 1951. Under the agreement the United States reimburses the district for 27.6 percent of the cost of operating and maintaining the supply works. That percentage reflects the portion applicable to benefits other than Angostura Unit irrigation. The irrigation district has operated and maintained the dam, reservoir and associated project irrigation facilities since January 1, 1968. Repayment toward construction of the distribution system totals $718,000, while annual water service charges amount to $3,650 over a 30-year period beginning in 1968. The annual payments are the result of a formula reflecting the farm parity ratio and the total irrigated crop value for the project each year.

In 1995 BOR began negotiations with the irrigation district for a new water supply contract. Traditional questions of silt, recreation, and irrigation were joined by Native American water rights, interstate water development, conservation, water rights, and water supply contracting.

Approximately 11.7 miles of Alternative B would cross through the Angostura Unit . This includes 5 miles of private land, 5.9 miles of NFS lands, and 0.8 miles of state lands.

2.2.3 Alternative C. This alternative was developed in response to comments received during scoping from Federal, state and local agencies as well as private land owners and the general public. The alternative was designed to minimize or eliminate several significant environmental impacts associated with Alternative B, particularly on NFS lands on BGNG and TBNG. DM&E has advanced the design for this alternative much further than the design for the other alternatives. Consequently, information regarding the location and extent of this alternative is more complete than for the other alternatives.

2.2.3.1 Alternative C Route. The following discussion is limited only to those portions of the Alternative C route which are materially different than those described above for Alternative B. In many places the alternative routes are identical or nearly the same. These areas are typically not described further.

This alternative would begin in the same location as Alternative B and follows the same route (see Section 2.2.2.1) for approximately 13 miles to the intersection with DM&E's existing main line west of Baseline Road in Section 30, T. 1 N., R. 14 E., Pennington County (see Map Volume, Maps 1 through 5). In the SE of Section 30, T. 1 N., R. 14 E. Alternative C would deviate slightly from Alternative B and run directly adjacent to DM&E's existing main line for about 0.5 miles (see Map Volume, Map 5).

Alternative C would continue south in the Cheyenne River flood plain and would parallel (mostly to the east) the route described for Alternative B for approximately 18 miles, crossing the same roads and streams as described in Section 2.2.2.1 (see Map Volume, Maps 5 to 11). In the SE of Section 17, T. 2 S., R. 12 E., just south of the Creston Road crossing, Alternative C would cross over Alternative B and proceed up the Spring Creek drainage (see Map Volume, Map 9). Like Alternative B, Alternative C would make a number of crossings of Spring Creek and in many areas it has been routed closer to the creek than Alternative B. In the north half of Section 14, T. 3 S., R. 11 E. Alternative C would cross to the east side of Spring Creek. In the SE of Section 21, T. 3 S., R. 11 E. Alternative C would again cross Alternative B and continue to the west, while Alternative B would turn in a southern direction (see Map Volume, Map 12).

Beginning in the SE of Section 21 Alternative C would run west for about 2.5 miles to Section 24, T. 3 S., R. 10 E. where it would turn to the southwest for 2 miles (see Map Volume, Map 12). In the SW of Section 27, T. 3 S., R. 10 E. Alternative C would cross Willow Creek. In the NE of Section 31, T. 3 S., R. 10 E. Alternative C would cross State Highway 40 about 0.3 miles east of the Battle Creek crossing (see Map Volume, Map 13). Battle Creek would be crossed in the NW of Section 31, T. 3 S., R. 10 E. and the alternative would be constructed directly adjacent to the south bank of Battle Creek in the NW of Section 31 and the NW of Section 36, T. 3 S., R. 9 E. (see Map Volume, Map 14).

About 1.5 miles west of the Battle Creek crossing Alternative C would turn toward the southwest, gradually heading in a southern direction. In the south half of Section 18, T. 4 S., R. 9 E. Dry Creek would be crossed. Approximately 3.2 miles south of the Dry Creek crossing Alternative C would cross East French Creek Road in the NW of Section 6, T. 5 S., R. 9 E. About 0.5 miles south of the East French Creek Road crossing the alternative would cross French Creek in the SW of Section 6, T. 5 S., R. 9 E. (see Map Volume, Map 16). Approximately 1.2 miles south of the French Creek crossing Alternative C would cross the South Fork of French Creek in the SW of Section 7, T. 5 S., R. 9 E.

Alternative C would continue south for about 6.5 miles across broken terrain west of the Cheyenne River and Squaw-Humper Table. In Section 18, T. 6 S., R. 9 E. Alternative C would rejoin the route for Alternative B. Alternative C would follow the Alternative B route for approximately 1.2 miles roughly between Cottonwood Cutoff Road and 268th Street. Alternative C would cross Cottonwood Creek in the NE of Section 13, T. 6 S., R. 8

E. (see Map Volume, Map 19) and 268th Street in the SE of Section 13. About 0.2 miles south of 268th Street Alternative C would leave the Alternative B route and turn south and proceed across Harrison Flat for about 1.6 miles.

Alternative C would continue south across the south end of Harrison Flat and pass from Custer County into Fall River County about 0.7 miles west of the Cheyenne River (see Map Volume, Map 20). One mile south of the county line Alternative C would cross the Cheyenne River in the SW of Section 1, T. 7 S., R. 8 E. Once across the river Alternative C would proceed south within the Hay Canyon flood plain, crossing Hay Canyon Creek many times while weaving across the flood plain for approximately 6 miles (see Map Volume, Map 20). In Section 1, T. 8 S., R. 8 E. Alternative C would turn to the southwest for about 1.2 miles, crossing County Road 2C in the NE of Section 11, T. 8 S., R. 8 E. West of County Road 2C Alternative C would continue along the Hay Canyon drainage and cross Hay Canyon Creek 2 more times in Section 10, T. 8 S., R. 8 E. (see Map Volume, Maps 21 and 22).

Alternative C would leave the Hay Canyon drainage in the SW of Section 20, T. 8 S., R. 8 E. and for the next 3.2 miles run in a southwest direction crossing several tributaries to Plumb Creek in Sections 20 and 29, T. 8 S., R. 8 E. (see Map Volume, Map 22). Approximately 0.6 miles north of Smithwick in the SW of Section 31, T. 8 S., R. 8 E. Alternative C would again join Alternative B. Both alternatives would be routed from this point to the south within DM&E's existing Black Hills Subdivision Branch Line right-of-way. The route for Alternative C from approximately Smithwick to the crossing of U.S. Highway 18 in Section 21, T. 9 S., R. 7 E. would be similar to the route for Alternative B described in Section 2.2.2.1 (see Map Volumes, Maps 23 and 24).

Beginning in the SW of Section 19, T. 9 S., R. 7 E. Alternative C would be routed parallel to Alternative B between 400 and 1,600 feet to the south. Alternative C would follow Alternative B in this manner for the next 4 miles. In Sections 28 and 29, T. 9 S., R. 6 E. Alternative C would cross Alternative B twice (see Map Volume, Map 25). For the next 3.5 miles Alternative C would be located between 300 and 5,000 feet south of Alternative B. In Section 23, T. 9 S., R. 5 E. Alternative C would cross to the north of Alternative B and proceed west to Heppner in the SE of Section 20, T. 9 S., R. 5 E. (see Map Volume, Map 26).

Alternative C would cross Hat Creek in the SE of Section 25, T. 9 S., R. 4 E. (see Map Volume, Map 27) about 1.2 miles north of the Alternative B crossing. In the SW of Section 26, T. 9 S., R. 4 E. Alternative C would cross State Highway 71. Beginning about 1.9 miles west of the State Highway 71 crossing Alternative C would follow the same route as Alternative B for approximately 1.7 miles. In the SE of Section 25, T. 9 S., R. 3 E. Alternative C would cross Plum Creek and then head northwest for the next 3 miles within about 0.25 miles of Alternative B. In the SW of Section 9, T. 9 S., R. 3 E. Alternative C would turn to the north for approximately 1.2 miles and then would turn northwest for about 3.5 miles around the east side of Edgemont. The north and northwestern directions followed by the Alternative C route would distance Alternative C from Edgemont by at least 1 mile (see Map Volume, Maps 30 and 31). Alternative C would cross the Cheyenne River about 1.5 miles east of Edgemont in NE of Section 31, T. 8 S., R. 3 E.

Northwest of Edgemont Alternative C would join the BNSF railroad corridor in the same manner as was described for Alternative B in Section 2.2.2.1. Similar to Alternative B, Alternative C would leave the BNSF railroad corridor in Section 15, T. 7 S., R. 1 E. and proceed west toward Wyoming (see Map Volume, Map 34).

Once in Wyoming Alternative C would parallel Alternative B, occasionally crossing. The alternatives would run roughly parallel to the west and northwest for approximately 35 miles. The alternatives would generally cross all the same roads and streams (see Section 2.2.2.1). However, in the NW of Section 4, T. 41 N., R. 64 W. in Weston County Alternative C would cross to the north side of Alternative B and cross Cheyenne River Road, which would not be crossed by Alternative B in this area (see Map Volume, Map 41).

Beginning in Section 24, T. 42 N., R. 66 W., just west of the Dull Center Road crossing, Alternative C would be constructed approximately 0.5 miles south and parallel to Alternative B for about 2 miles to the west. Alternative C would then turn to the northwest for approximately 4.5 miles, still parallel to Alternative B with the distance between the alternatives ranging from 330 feet to 0.5 miles. In this area Alternative C would cross Black Thunder Creek and Horse Creek.

In Section 12, T. 42 N., R. 67 W., east of the Lion Creek crossing, Alternative C would cross the southern leg of Alternative B. Alternative C would continue in a westerly direction and run between the northern and southern legs of Alternative B (see Map Volume, Map 44). From the Alternative B Y, Alternative C would run west approximately 8.6 miles to Section 4, T. 42 N., R. 68 W. Along this stretch Alternative C would cross 3 tributaries to Little Thunder Creek in Sections 5 and 6, T. 42 N., R. 67 W. Also, in the SE of Section 5, T. 42 N., R. 67 W., Alternative C would cross Lynch Road approximately 0.2 miles south of Darlington School. Approximately 3.2 miles west of the Lynch Road crossing Alternative C

would cross Piney Creek in the south half of Section 2, T. 42 N., R. 68 W. (see Map Volume, Map 46).

East of the Weston-Campbell County line (see Map Volume, Map 47) Alternative C would cross several tributaries to Little Thunder Creek in Sections 5 and 6, T. 42 N., R. 68 W. and Section 31, T. 43 N., R. 68 W. On the west side of the Weston-Campbell County line Alternative C would also cross several tributaries to Little Thunder Creek in Sections 36, 35, 34, 33, and 28, T. 43 N., R. 69 W. (see Map Volume, Maps 47 and 48).

In the SE of Section 29, T. 43 N., R. 69 W. Alternative C would form a "T" (see Map Volume, Map 48). The southern leg would proceed towards the southern coal mines and the northern leg would proceed to the northern mines. The routes for these legs are described below:

Southern Leg. From the T the southern leg of Alternative C would proceed to the southwest crossing School Creek in the NW of Section 32, T. 43 N., R. 69 W. (see Map Volume, Map 48). About 0.4 miles southwest of the School Creek crossing Alternative C would approach School Creek Road and run parallel to the road on the east side for approximately 0.8 miles. In the NE of Section 6, T. 42 N., R. 69 W. Alternative C would cross to the west side of the road and then immediately back to the east side (see Map Volume, Map 49). It is anticipated that School Creek Road would be relocated to the east in this area to avoid the multiple crossings. In the NW of Section 6 the southern leg would leave School Creek Road and proceed to the southwest. Approximately 0.2 miles southwest of the School Creek Road crossing Alternative C would cross School Creek and then continue southwest about 0.4 miles where it would cross Reno Road. The North Rochelle Mine spur would depart from the south leg of Alternative C in the NW of Section 6, T. 42 N., R. 69 W. From this point the spur would proceed in a westerly direction for about 3.2 miles where it would join existing mine load out facilities in Section 9, T. 42 N., R. 70 W. School Creek Road would be crossed by this spur both in the NW and SW of Section 6, T. 42 N., R. 69 W. and the Reno Road would be crossed in the NE of Section 11, T. 42 N., R. 70 W.

In Section 12, T. 42 N., R. 70 W. Alternative C would curve toward the southeast where, for the next 3.5 miles, it would cross 8 tributaries to School Creek (see Map Volume, Maps 49 and 50). In Section 29, T. 42 N., R. 69 W. Alternative C would turn south. In the north half of Section 32, T. 42 N., R. 69 W. Alternative C would cross Piney Canyon Road. Approximately 1.5 miles south of the Piney Canyon Road crossing, in Section 5, T. 41 N., R. 69 W., Alternative C would cross West Fork and then continue south on the west side of the West Fork drainage (see Map Volume, Map 51), crossing several tributaries to West Fork. In the SE of Section 17, T. 41 N., R. 69 W. Alternative C would cross Phillips Road.

Alternative C would continue south leaving the West Fork drainage and would cross several tributaries to Beckwith Creek in Section 20, T. 41 N., R. 69 W. (see Map Volume, Map 52). In Section 29, T. 41 N., R. 69 W. Alternative C would turn towards the west, leaving Campbell County and entering Converse County. In the north half of Section 36, T. 41 N., R. 70 W. Alternative C would join the Alternative B route and parallel it approximately 300 feet to the north. The southern leg would roughly parallel Alternative B, crossing back and forth to the north and south sides. The distance between Alternative C and Alternative B would range between 50 and 2,000 feet. Alternative C would follow the 5.6 mile route of Alternative B through the Antelope Creek drainage, ending in the Antelope Creek Mine area in the SE of Section 2, T. 40 N., R. 71 W. (see Map Volume, Map 54).

Northern Leg. From the T in SW of Section 28, T. 43 N., R. 69 W. (see Map Volume, Map 48) the northern leg of Alternative C would be constructed towards the northwest. State Highway 450 would be crossed in the NW of Section 29, T. 43 N., R. 69 W. Approximately 2.3 miles northwest of the State Highway 450 crossing, in Section 23, T. 43 N., R. 70 W., Alternative C would again fork (see Map Volume, Map 55). One branch would head north to the northern SPRB mines, while the other would proceed west to the Jacobs Ranch Mine. The west fork would meet with Alternative B in the NE of Section 23, T. 43 N., R. 70 W. and would follow the same route described in Section 2.2.2.1 to the Jacobs Ranch Mine in Section 14, T. 43 N., R. 70 W.

The northern leg would continue north, crossing Little Thunder Road in the SE of Section 35, T. 44 N., R. 70 W. Approximately 3.6 miles north of the Little Thunder Road crossing Alternative C would cross Black Thunder Creek in the NW of Section 14, T. 44 N., R. 70 W. (see Map Volume, Map 56). About 350 feet to the north of the Black Thunder Creek crossing Alternative C would cross Keeline Road in the SW of Section 11, T. 44 N., R. 70 W. Alternative C would continue north crossing 2 tributaries to Black Thunder Creek in Sections 11 and 2, T. 44 N., R. 70 W. In Section 35, T. 45 N., R. 70 W. Alternative C would cross 2 tributaries to Cottonwood Creek and then continue north to Section 23, T. 45 N., R. 70 W. where it would cross a tributary to Hay Lake (see Map Volume, Map 58). In the NE of Section 23, T. 45 N., R. 70 W. Alternative C would cross Alternative B running parallel on the east side for about 2 miles. In the south half of Section 2, T. 45 N., R. 70 W. Alternative C would cross Alternative B and parallel it on the west side for about 1.5 miles before turning to the northwest in Section 35, T. 46 N., R. 70 W.

In Section 8, T. 46 N., R. 70 W. a spur would be constructed to Coal Creek Mine (see Map Volume, Map 60) in the same location as Alternative B. In the NW of Section 31, T. 47 N., R. 70 W. a spur would originate and follow the same route around Saddle Horse Butte to the Cordero Mine as described for Alternative B (see Map Volume, Map 61).

Alternative C would continue north approximately 0.3 miles to the Belle Fourche River crossing in the NW of Section 31, T. 47 N., R. 70 W. (see Map Volume, Map 61). About 2.2 miles north of the Belle Fourche crossing Alternative C would cross Kicken Draw and one of its tributaries in the SE of Section 13, T. 47 N., R. 71 W. Approximately 1.8 miles north of the Kicken Draw crossing a spur would be constructed to the Rojo Mine (see Map Volume, Map 62). Alternative C would cross the east side of Alternative B about 0.5 miles north of the Rojo Mine Spur. About 1 mile north of the Rojo Mine Spur Alternative C would meet again with Alternative B and the 2 alternatives would parallel each other to the Belle Ayr and Caballo Mines (see Map Volume, Map 63).

2.2.3.2 Alternative C Land Ownership. Like Alternative B the majority of the lands (about 80 percent) which would be crossed by Alternative C are private. A summary of land ownership for this alternative is provided in Table 2-2. Most of the Federal lands which would be crossed by this alternative are NFS lands which are associated with BGNG in South Dakota and TBNG in Wyoming. A general land ownership map is provided on Figure 2-1. More detailed land ownership mapping is provided in the Map Volume.

Bureau of Land Management. In South Dakota Alternative C would cross 3.4 miles of public lands. These lands are scattered along the route and are small, isolated parcels. The first parcel which would be crossed consists of approximately 80 acres and is located in Section 19, T. 1 N., R. 15 E. in Pennington County between Wall and Wasta south of I-90, DM&E's existing main line and Bull Creek (see Map Volume, Map 3) and east of Jensen Road. Another parcel of public lands would be crossed about 1.4 miles southeast of Wasta in Section 10, T. 1 N., R. 14 E. This 160-acre parcel is located about 0.4 miles south of I-90 (see Map Volume, Map 4).

A 200-acre public land parcel would be crossed just south of the proposed Boxelder Creek crossing in Section 31, T.1 N., R. 14 E. on the north end of Brennan Flat (see Map Volume, Map 5). This crossing would occur about 4.7 miles south of Wasta in Pennington County. This parcel includes a portion of the Cheyenne River which is located approximately 1,000 feet east of the Alternative C route through this parcel. South of Holcomb Flat a public land parcel would be crossed in Section 1, T. 2 S., R.12 E. (see Map Volume, Map 8). This parcel would be crossed about 2.5 miles east of the alternative's proposed crossing of State Highway 44 and about 0.5 miles east of the confluence of Rapid Creek with the Cheyenne River. A portion of this parcel is located in the Cheyenne River flood plain.

A 40-acre public land parcel would be crossed about 0.1 miles south of the crossing of State Highway 44 in Section 3, T. 2 S., R. 12 E. in Pennington County (see Map Volume, Map 9). This parcel is located southeast of the intersection of Creston Road and State Highway 44 and northeast of Alternative C's intersection with the Old Milwaukee right-of-way.

About 5 miles southeast of Edgemont public lands would be crossed in Sections 15 and 22, T. 9 S., R. 3 E. (see Map Volume, Map 29). A 40-acre public land parcel would also be crossed about 3.1 miles northwest of Edgemont within the BNSF corridor in the SE of Section 22, T. 8 S., R.2 E. Alternative C would cross a 120-acre parcel of public lands in the south half of Section 17, T. 7 S., R. 1 E. about 450 feet west of the Beaver Creek crossing (see Map Volume, Map 35). These crossings would occur in Fall River County.

In Wyoming Alternative C would cross 1.5 miles of public lands. The first crossing would be in Niobrara County where Alternative C would cross a 120-acre parcel of public lands south of Bobcat Creek in the NW of Section 7, T. 40 N., R. 61 W. (see Map Volume, Map 37). The second public land parcel which would be crossed by Alternative C in Wyoming is in Section 4, T. 40 N., R. 62 W. and Section 32, T. 41 N., R. 62 W. just north of Alkali Creek in northern Niobrara County. This parcel is located about 4.5 miles southeast of Morrisey (see Map Volume, Map 38).

The final public land parcel which would be crossed by Alternative C is a 40-acre parcel located in the SW of Section 26, T. 46 N., R. 70 W. (see Map Volume, Map 59). This public land parcel is the only one which would be crossed by Alternative C which is managed by the Buffalo Field Office. The parcel is located south of the Belle Fourche River crossing in Campbell County.

Forest Service. Alternative C was partially developed to minimize/eliminate potential impacts to RARE II and inventoried roadless areas on BGNG (see Chapter 3). This avoidance was achieved by routing the alternative to the north and west up Battle Creek and away from the Cheyenne River near Red Shirt. Consequently, this alternative would reduce the amount of NFS lands crossed by over 10 miles.

Table 2-2 Summary of Land Ownership (in Miles) for Alternative C						
Land Owner	South Dakota		Wyoming		Total	
	Miles	Percent of State	Miles	Percent of State	Miles	Percent of Total
BLM	3.4	2.4	1.5	1.2	4.9	1.8
Forest Service	6.1	4.3	32.8	25.0	38.9	14.2
State	2.1	1.5	9.6	7.3	11.7	4.3
Private	131.0	91.8	87.3	66.5	218.3	79.7
Total	142.6	100	131.2	100	273.8	100

Buffalo Gap National Grassland. Alternative C would cross 6.1 miles of NFS lands on BGNG. These lands are primarily located in Custer and Pennington counties between U.S. Highway 44 and Oral. The first parcels which would be crossed are located in Pennington County south of Rapid Creek and U.S. Highway 44, east of Creston and directly north of the Pennington-Custer County line (see Map Volume, Map 9). These parcels are located In Sections 9, 17, and 20, T. 2 S., R. 12 E. Alternative C would follow the abandoned Old Milwaukee across NFS lands in Section 9.[5]

A second parcel of NFS lands would be crossed just south of the Pennington-Custer County line in the Spring Creek drainage in Section 1, T. 3 S., R. 11 E. and Section 6, T. 3 S., R. 12 E. (see Map Volume, Map 10). A 2,700-acre parcel would be crossed in Section 19, T. 3 S., R. 11 E. and Sections 24 and 26, T. 3 S., R. 10 E. (see Map Volume, Map 12) in Custer County. This parcel is about 3 miles west of the Spring Creek Road crossing. About 3 miles northeast of the Dry Creek crossing Alternative C would cross the northwest corner of a 38,000-acre tract of NFS lands in Section 4, T. 4 S., R. 9 E. (see Map Volume, Map 14). Alternative C would also cross through a 720-acre parcel of NFS land in Section 19, T. 5 S., R. 9 E. about 1.5 miles southeast of South Fork French Creek (see Map Volume, Map 17). The next crossing of NFS lands by Alternative C would be in Section 31, T. 5 S., R. 9 E. about 2 miles west of the Cheyenne River (see Map Volume, Map 18) and 2 to 3 miles north of the crossing of the Cottonwood Cutoff Road.

Alternative C avoids NFS lands through the remainder of its route through South Dakota. However, the alternative does approach within 0.25 miles of NFS lands in the upper reaches of Hay Canyon north of Smithwick (see Map Volume, Map 22).

[5] The analysis assumes that disturbance adjacent to the Old Milwaukee Railroad would occur on NFS lands. However, the actual Old Milwaukee Railroad right-of-way is owned by the State of South Dakota. If this alternative is constructed entirely within the Old Milwaukee right-of-way NFS lands would not be affected.

Thunder Basin National Grassland. Alternative C would cross 32.8 miles on NFS lands on TBNG. No NFS lands would be crossed in Niobrara County. Alternative C would first enter NFS lands on TBNG about 3.1 miles west of Morrisey and south of the Cheyenne River Road in Weston County (see Map Volume, Map 40). These lands are located in the headwaters of Coyote Creek and include Sections 9, 8, 17, and 18, T. 41 N., R. 63 W. and the east half of Section 10, T. 41 N., R. 64 W. North of Grieves Road, in the Wildcat Creek drainage, Alternative C would cross NFS lands in Sections 35, 26, 27, and 22, T. 42 N., R. 65 W. NFS lands, immediately west of Dull Center Road, would be crossed by Alternative C in Sections 23 and 24, T. 42 N., R. 66 W. (see Map Volume, Map 43).

North of Piney Canyon Road in Weston County Alternative C would cross NFS lands in Sections 1, 2, 3, and 4, T. 42 N., R. 68 W. (see Map Volume, Map 46). The crossing would occur about 0.7 miles south of Little Thunder Creek. Immediately east of the Weston-Campbell County line Alternative C would cross through NFS lands in Section 31, T. 43 N., R. 68 W. (see Map Volume, Map 47). East of the T Alternative C would cross through NFS land in Sections 33 and 34, T. 43 N., R. 96 W. (see Map Volume, Map 48) in the Little Thunder Creek drainage.

The majority of the southern leg of Alternative C is routed across NFS lands. The following sections contain Alternative C crossings of NFS lands in Campbell County: Sections 29, 30, 31, and 32, T. 43 N., R. 69 W.; Sections 6, 18, 19, 30, 29, and 32, T. 42 N., R. 69 W.; Sections 5, 8, 17, 21, 20, and 29, T. 41 N., R. 69 W; and Sections 11 and 12, T. 42 N., R. 70 W. The southern leg of Alternative C would cross NFS lands in Converse County in the following sections: Sections 30 and 31, T. 41 N., R. 69 W.; Section 35, T. 41 N., 70 W.; Section 6, T. 40 N., R. 70 W.; and Sections 1 and 12, T. 40 N., R. 71 W. (see Map Volume, Maps 48 through 54).

About 2.2 miles northwest of the T the northern leg of Alternative C would cross a 40-acre parcel of NFS land in the SW of Section 24, T. 43 N., R. 70 W. Approximately 2.7 miles northwest of the T the northern leg would cross

a 1,800-acre parcel of NFS land in Sections 11, 12, 14 and 23, T. 43 N., R. 70 W. (see Map Volume, Map 55). Also in Campbell County Alternative C would cross the northwest corner of a 500-acre parcel of NFS land in Section 2, T. 44 N., R. 70 W. (see Map Volume, Map 57). This crossing would be approximately 1.5 miles northeast of the Keeline Road crossing.

State of South Dakota. A total of 2.1 miles of land owned by the state of South Dakota would be crossed by Alternative C. The first crossing of state land would occur in the southern half of Section 6, T. 1 S., R. 14 E. in Pennington County on the eastern edge of Brennan Flat (see Map Volume, Map 6). The parcel is located about 1 mile south of the Boxelder Creek crossing. A second parcel would be crossed directly north of the East French Creek Road crossing in Section 36, T. 4 S., R. 8 E. This parcel is located in Custer County about 0.6 miles north of the French Creek crossing (see Map Volume, Map 16).

In Fall River County state lands would be crossed adjacent to Plum Creek crossing. The northeast corner of a 320-acre parcel of state land would be crossed in Section 36, T. 9 S., R. 3 E. (see Map Volume, Map 28). The next crossing in Fall River County would be a small 80-acre parcel of state land in Section 8, T. 9 S., R. 3 E. about 1.2 miles west of the Cheyenne River (see Map Volume, Map 30) and about 2 miles southeast of Edgemont. The most western crossing of state lands in South Dakota would be in Section 16, T. 7 S., R. 1 E. about 0.15 miles west of the Beaver Creek crossing and north of the Cheyenne River (see Map Volume, Map 35).

State of Wyoming. A total of 9.6 miles of lands owned by the State of Wyoming would be crossed by Alternative C. The first crossing would be just 0.5 miles west of the South Dakota-Wyoming State line in Section 16, T. 40 N., R. 60 W. (see Map Volume, Map 35). This parcel is in Niobrara County on the north side of the Cheyenne River but south of Twentyone Divide and east of the confluence of Twentyone Draw and the Cheyenne River. The area between Robbers Roost Creek and State Highway 18 in Niobrara County is state-owned lands. The state-owned parcels between the highway and the creek include the SW of Section 9 and Section 16, T. 40 N., R. 61 W. (see Map Volume, Map 36). Two miles west of Morrisey Alternative C would cross state-owned land in Section 16, T. 41 N., R. 63 W. This section is located in Weston County and south of the Cheyenne River Road (see Map Volume, Map 40).

State-owned lands would be crossed north of Grieves Road in the Wildcat Creek drainage. This parcel (Section 36, T. 42 N., R. 65 W.) is located approximately 0.6 miles northeast of "the Nose" in Weston County (see Map Volume, Maps 41 and 42). The next state-owned parcel that Alternative C would cross would be Section 16, T. 42 N., R. 66 W. This section is located in the Black Thunder Creek drainage near the School Draw confluence in Weston County about 0.3 miles north of Thunder Creek (see Map Volume, Map 43).

In Campbell County state-owned lands would be crossed about 3 miles east of the T in Section 36, T. 43 N., R. 69 W. (see Map Volume, Map 47) in the Little Thunder Creek drainage. The next crossing of state-owned land would be at the T of Alternative C in Sections 33, 28, and 29, T. 43 N., R. 69 W. (see Map Volume, Map 48). These parcels are located in the Little Thunder Creek drainage.

No state lands would be crossed by Alternative C on the southern leg. Section 36, T. 45 N., R. 70 W. is a state-owned section that would be crossed by the northern leg about 2 miles northeast of the Keeline Road crossing. About 0.5 miles southeast of the end of the spur to the Coal Creek Mine Alternative C would cross state-owned land in Section 16, T. 46 N., R. 70 W. (see Map Volume, Map 60). Also, the spur to the Cordero Mine would terminate on state-owned lands in Section 36, T. 47 N., R. 71 W. (see Map Volume, Map 61). This section is just south of the Belle Fourche River and west of Saddle Horse Butte in Campbell County. Finally, the north end of the northern leg, including the spur to the Belle Ayr Mine, would cross through a small portion of a state-owned section in Section 36, T. 48 N., R. 71 W. (see Map Volume, Map 63). This section is crossed by Caballo Creek.

Angostura Unit. Approximately 3.1 miles of Alternative C would cross through the Angostura Unit. All lands which would be crossed within the unit are privately-owned.

2.2.3.3. Alternative C Route Variations. During coordination and field inspections with Federal and state agencies it was suggested that 3 portions of Alternative C could result in unacceptable and perhaps irreplaceable impacts to wetland/riparian areas and important wildlife habitats in South Dakota. These 3 areas included:

- Cheyenne River pinch points on the SMS Ranch in Pennington County east of Holcomb Flats;
- Spring Creek drainage in Custer County west of Phiney Flat; and
- Hay Canyon in Fall River County northeast of Smithwick.

As a result of coordination with the agencies DM&E reevaluated the alignment for Alternative C to determine if there were variations in the route which were economically and technically feasible and which reduced impacts to wetland/riparian areas and wildlife habitats. DM&E was successful in identifying route variations which would avoid much of the impact within Spring Creek and

Hay Canyon. However, they could not identify an economically and technically feasible alternative that avoided the Cheyenne River pinch points on the SMS Ranch.

Two route variations are discussed below. The Phiney Flat Route Variation would avoid construction within the Spring Creek drainage while the W G Flat Route Variation would avoid construction within Hay Canyon. Figure 2-1 shows the general location of the route variations. More detailed maps are provided in the Map Volume.

Phiney Flat Route Variation. The Alternative C alignment through the Spring Creek drainage is shown in the Map Volume on Maps 10 and 11. This route variation would avoid construction within the Spring Creek drainage by routing the railroad onto Phiney Flat generally following the Spring Creek Road. Table 2-3 shows land ownership for Alternative C with the Phiney Flat Route Variation. The route variation would increase the length of Alternative C by about 0.8 miles.

The Phiney Flat Route Variation would deviate from Alternative C beginning in the SE of Section 17, T. 2 S., R. 12 E. in Pennington County just west of Creston Road (see Map Volume, Map 9). The variation would proceed south crossing Creston Road and Spring Creek in the SE of Section 20, T. 2 S., R. 12 E. South of Spring Creek the route variation would cross from Pennington into Custer County. On the east side of Spring Creek and Spring Creek Road the variation would proceed up an unnamed draw to the top of Phiney Flat (see Map Volume, Map 10). In Section 32, T. 2 S., R. 12 E. the variation would be located west of a small impoundment before turning to the southwest and running just east of Spring Creek Road in the NE of Section 5, T. 3 S., R. 12 E. (see Map Volume, Map 10). The variation would proceed south and then southwest across the top of Phiney Flat crossing River Road in the SW of Section 23, T. 3 S., R. 11 E. (see Map Volume, Map 11). In the middle of Section 23 the variation would turn to the west and cross the southern half of Sections 21 and 22 and the north half of Section 29, T. 3 S., R. 11 E. Spring Creek would be crossed in the SE of Section 21, T. 3 S., R. 11 E. The route variation would rejoin Alternative C in the NE of Section 29, T. 3 S., R. 11 E. (see Map Volume, Map 12).

The beginning of the route variation in Sections 17 and 20, T. 2 S., R. 12 E. (see Map Volume, Map 9) would be constructed on NFS lands. All other lands which would be crossed by the Phiney Flat Route Variation are privately-owned. On top of Phiney Flat the route variation would pass just west of NFS lands in the NW of Section 8, T. 3 S., R. 12 E. directly adjacent to Spring Creek Road. This route variation would not affect lands within the Angostura Unit.

W G Flat Route Variation. This route variation was designed to avoid Hay Canyon. The Alternative C route through Hay Canyon is shown in the Map Volume on Maps 20 through 22. Land ownership for Alternative C with the W G Flat Route Variation is provided on Table 2-4. Alternative C with the W G Flat Route Variation would be 1.2 miles shorter than Alternative C.

The W G Flat Route Variation would deviate from Alternative C in the SE of Section 25, T. 6 S., R. 8 E. in Custer County about 1.3 miles north of the Custer-Fall River County line (see Map Volume, Map 19). The origin would be located on the southern edge of Harrison Flat. From the origin the route variation would turn to the southwest and cross Lame Johnny Creek in the SW of Section 35, T. 6 S., R. 8 E. (see Map Volume, Map 70). The variation would cross from Custer into Fall River County in the NW of Section 2, T. 7 S., R. 8 E. and generally follow the route for Alternative B through the NE of Section 3, T. 7 S., R. 8 E. In the middle of Section 3 the route variation would deviate from the Alternative B route and turn south and cross the Cheyenne River in the NW of Section 10, T. 7 S., R. 8 E. (see Map Volume, Map 70). On the south side of the river the route variation would continue south then southwest across the Cheyenne River flood plain and climb up onto W G Flats in the NE of Section 16, T. 7 S., R. 8 E. Once on W G Flat the route variation would proceed south on the ridge line between W G Draw and Iron Draw (see Map Volume, Map 124). The route continues south on W G Flat running about 4 miles east of Oral. In the NE of Section 19, T. 8 S., R. 8 E. the route variation would cross the headwaters of Plumb Creek (see Map Volume, Map 22). The route follows the ridge line between Plumb Creek and the West Fork of Hay Canyon until it rejoins Alternative C in the SW of Section 31, T. 8 S., R. 8 E. just west of Smithwick (see Map Volume, Map 23).

Except for a portion of the north half of Section 10, T. 7 S., R. 8 E. which is public land (see Map Volume, Map 70), the entire route variation would cross only privately-owned lands. Approximately 7.1 miles of the Angostura Unit would be crossed by this route variation including 0.1 miles of public lands and 7 miles of private lands.

2.2.4 Alternative D. During public scoping for this project a number of comments were received that suggested DM&E construct the new railroad using existing railroad corridors in South Dakota and Wyoming. DM&E has stated that a route using existing railroad corridors is neither economically or technically feasible. If this alternative was selected by the agencies DM&E has stated it would abandon the project. Nonetheless, based on comments received from the public, the agencies have decided to evaluate in the EIS whether environmental benefits would be realized by using existing railroad corridors to implement the project.

Table 2-3 Summary of Land Ownership (in Miles) for Alternative C with the Phiney Flat Route Variation						
Land Owner	South Dakota		Wyoming		Total	
	Miles	Percent of State	Miles	Percent of State	Miles	Percent of Total
BLM	3.4	2.4	1.5	1.2	4.9	1.8
Forest Service	5.3	3.7	32.8	25.0	38.1	13.8
State	2.1	1.5	9.6	7.3	11.7	4.3
Private	132.6	92.4	87.3	66.5	219.9	80.1
Total	143.4	100	131.2	100	274.6	100

Table 2-4 Summary of Land Ownership (in Miles) for Alternative C with the W G Flat Route Variation						
Land Owner	South Dakota		Wyoming		Total	
	Miles	Percent of State	Miles	Percent of State	Miles	Percent of Total
BLM	3.5	2.5	1.5	1.2	5.0	1.8
Forest Service	6.1	4.3	32.8	25.0	38.9	14.3
State	2.1	1.5	9.6	7.3	11.7	4.3
Private	129.7	91.7	87.3	66.5	217.0	79.6
Total	141.4	100	131.2	100	272.6	100

In reviewing this section it is important to remember that the route selected for analysis as Alternative D was not provided by DM&E. Rather, the alternative was defined by the Forest Service. DM&E has not been able to identify an alternative using existing corridors that they believe is technically and economically feasible.

Instead of proceeding along the Cheyenne River valley toward Smithwick Alternative D would follow DM&E's existing main line from Wall to Rapid City. In Rapid City the alternative would turn south and follow the existing Black Hills Subdivision Branch Line to Smithwick. From Smithwick to the Wyoming border Alternative D would follow the same route as described for Alternative C in Section 2.2.3.1. However, instead of turning to the west into Wyoming near Burdock as described for Alternatives B and C, Alternative D would continue parallel to the BNSF railroad corridor through Newcastle and Moorcroft and on to Donkey Creek east of Gillette. At Donkey Creek the alternative would turn south and proceed to each of the SPRB mines using essentially the same route described for Alternative C.

It is generally agreed by the agencies that it would not be prudent to construct a heavy haul railroad through Rapid City. However, because a viable option around the city has not been identified, Alternative D utilizes the route of DM&E's existing main line and Black Hills Subdivision Branch Line, both of which pass directly through Rapid City. Similarly, it is recognized that it would be difficult to construct and operate a second heavy haul railroad directly adjacent to but outside of BNSF's existing railroad right-of-way through Upton, Osage, Moorcroft and Newcastle, Wyoming. If Alternative D was selected it would be likely that new routes around these communities would be required. However, because of the lack of identified route variations, Alternative D assumes construction parallel to BNSF's existing right-of-way through these communities.

2.2.4.1 Alternative D Route. This alternative would originate at the same point as Alternatives B and C. However, instead of proceeding north and west around Wall, this alternative would utilize DM&E's existing main line alignment which passes through the Town of Wall. West of the Wall Pedro Road crossing, the existing main line turns south and passes just north of Creighton Road and west of 1st Street. South of 1st Street the existing main line roughly parallels Main Street through town (see Map Volume, Map 1). The existing main line crosses 4th Avenue just west of Main Street. South of 4th Avenue the main line is aligned between Main Street and Crown Street directly west of Wall Drug. Loop 90 is crossed by the main line about 0.2 miles west of Main Street. South of the Loop 90 crossing, the main line crosses I-90 in the NE of Section 6, T. 1 S., R. 16 E.

South of the I-90 crossing the main line turns west and then northwest as it proceeds up the Bull Creek drainage toward Wasta (see Map Volume, Map 1). In the NE of Section 2, T. 1 S., R. 15 E. the existing main line would be crossed by Alternatives B and C. The existing main line continues northwest up the Bull Creek drainage making a number of crossings of the creek. In Section 20, T. 1 N., R. 15 E. the main line is aligned adjacent to I-90 (see Map Volume, Map 2). The main line runs

generally parallel to the interstate to the NW of Section 12, T. 1 N., R. 14 E. where it crosses (see Map Volume, Map 3). About 1 mile northwest of the I-90 crossing the main line turns to the west and crosses the Cheyenne River in the NW of Section 2, T. 1 N., R. 14 E. The main line continues west and parallels the north bank of the Cheyenne River through the NW of Section 3 before turning southwest still parallel to the river through the NE of Section 4, T. 1 N., R. 14 E. (see Map Volume, Map 4). In this area the main line is aligned between the river and Elm Springs Road and is northeast of Wasta.

As can be seen in the Map Volume on Map 4, DM&E's existing main line passes through the southern edge of the Town of Wasta - generally between the town and the Cheyenne River. The existing alignment is located on the southeast side of Baseline Road. I-90 is again crossed just east of the Wasta interchange. South of Wasta the main line continues in a southwestern direction between Baseline Road and the Cheyenne River flood plain. In the SE of Section 8, T. 1 N., R. 14 E. the main line is directly adjacent to the Cheyenne River (see Map Volume, Map 4). The main line continues on the western side of the Cheyenne River flood plain to the NE of Section 19, T. 1 N., R. 14 E. where Baseline Road is crossed. South of the crossing the main line turns to the south and continues along the western edge of the Cheyenne River flood plain to Boxelder Creek in the SE of Section 30, T. 1 N., R. 14 E. Near the confluence of the creek with the Cheyenne River the main line turns to the west, leaving the Cheyenne River flood plain and proceeds up the Boxelder Creek drainage.

Boxelder Creek is crossed in the NW of Section 31, T. 1 N., R. 14 E. and in the NW of Section 36, T. 1 N., R. 13 E. (see Map Volume, Maps 4 and 83). The main line continues to the west on the north side of Boxelder Creek to Owanka (see Map Volume, Map 83). The main line passes directly south of Owanka and crosses Owanka Road in the NW of Section 29, T. 1 N., R. 13 E. Boxelder Creek is again crossed on the west side of Owanka and the main line is aligned directly adjacent to the creek through the NE of Section 25, T. 1 N., R. 12 E. near the Owanka Cemetery (see Map Volume, Map 84). The main line turns to the northwest and continues on the south side of Boxelder Creek through the SE of Section 24, T. 1 N., R. 12 E. The creek is crossed by the main line in the NW of Section 24 and the main line is aligned directly adjacent to the north side of the creek through the NE of Section 25 and the SW of Section 14, T. 1 N., R. 12 E. The main line crosses back and forth across the creek in Sections 15 and 16, T. 1 N., R. 12 E. (see Map Volume, Map 84).

In the SW of Section 6, T. 1 N., R. 12 E. the main line crosses Sharpe Road. At this point DM&E's main line is approximately 3 miles south of I-90 Exit 84 (see Map Volume, Map 85). The main line continues to the west on the north side of the Boxelder Creek drainage to New Underwood, South Dakota. In the north half of Section 2, T. 1 N., R. 11 E. the main line crosses Libertine Road approximately 1.5 miles south of I-90. Knuppe Road is crossed about 1 mile east of New Underwood. In the NE of Section 31, T. 2 N., R. 11 E. the existing main line passes south of New Underwood. A Avenue is crossed on the south side of town and the main line runs between Elm Street and Orin Avenue and Boxelder Creek (see Map Volume, Map 86).

After passing south of New Underwood the main line continues to the west in the Boxelder Creek drainage crossing the creek in the NW of Section 31, T. 2 N., R. 11 E. and in the NE of Sections 35 and 34, T. 2 N., R. 10 E. At this point the main line is about 0.5 miles south of I-90 (see Map Volume, Map 87). Boxelder Creek is again crossed in the SW of Section 28, T. 2 N., R. 10 E. Spevak Road is crossed in the SW of Section 29, T. 2 N., R. 10 E. and McCain School Road is crossed in the SW of Section 30, T. 2 N., R. 10 E. Milke Road is crossed in the NW of Section 27, T. 2 N., R. 9 E. about 1.5 miles east of Box Elder, South Dakota. On the west side of Milke Road the main line is aligned directly adjacent to and on the south side of Old Highway 14-16 and crosses Spruce Drive and Cottonwood Drive on the east side of Box Elder. The main line crosses through Box Elder on the south side of Old Highway 14-16 and on the north side of Front Street. In town the main line crosses Oak Street and Cedar Street. West of town the main line crosses South Gate Drive and Cobble Road.

About 2 miles west of Box Elder the main line turns south and begins to parallel I-90 on the south side (see Map Volume, Map 89). Boxelder Creek is crossed in the SW of Section 23, T. 2 N., R. 8 E. The main line proceeds in a southwest direction leaving the Boxelder Creek drainage and crossing Elk Creek Road in the SW of Section 27, T. 2 N., R. 8 E. about 0.2 miles south of I-90 Exit 61. West of the Elk Creek Road crossing the main line continues west directly south of Elgin Street and crosses U.S. Highway 16 as the existing main line enters Rapid City (see Map Volume, Map 90).

The main line passes through Rapid City following the route shown in the Map Volume on Map 90. On the west side of U.S. Highway 16 the main line crosses Century Road and turns to the southwest. The main line passes north of Pheasant Drive and Meadowlark Road and crosses Lacrosse Street north of Monroe Street. The main line continues in a southwest direction through Rapid City crossing Milwaukee Street north of North Street and New York Street west of East Boulevard. The main line crosses Omaha Street on the east side of the downtown area and east of 5th Street.

At this point Alternative D departs the main line and follows DM&E's existing Black Hills Subdivision Branch

Line to Smithwick. On the south side of Omaha Street the branch line crosses 2nd and 1st streets and then East Boulevard. The crossings occur between Main Street and Omaha Street. On the east side of East Boulevard the branch line turns to the southwest and crosses Maple Street directly north of Main Street. On the east side of Maple Street the branch line parallels Main Street on the north side and crosses Steele Avenue. The branch line continues southwest between Saint Joseph Street and Cherry Avenue to the crossing of Saint Patrick Street. South of Saint Patrick Street the branch line is aligned between State Highway 79 and the service road to the Campbell Street crossing. Once across Campbell Street the branch line turns more to the south and follows State Highway 79 to the east to the intersection with County Road 217 where the branch line turns to the southeast and parallels the north side of the county road and leaves the Rapid City area.

The branch line follows County Road 217 to the NW of Section 28, T. 1 N., R. 8 E. where the branch line turns to the southeast and enters the Dry Creek drainage crossing Dry Creek in the SW of Section 27, T. 1 N., R. 8 E. (see Map Volume, Map 91). In the SE of Section 27 the branch line crosses Warren Lamb Road. South of the crossing the branch line continues to the south running about 1 mile east of Old Folsom Road. In the NW of Section 2, T. 1 S., R. 8 E. the branch line departs the Dry Creek drainage and turns south and then southwest crossing Antelope Creek Road in the SW of Section 11, T. 1 S., R. 8 E. (see Map Volume, Map 92). In the SE of Section 15, T. 1 S., R. 8 E., south of Coyote Draw, the branch line converges with Old Folsom Road. The branch line follows the east side of Old Folsom Road through Section 22, T. 1 S., R. 8 E. before turning west and crossing Spring Creek in the NW of Section 27, T. 1 S., R. 8 E.

Once across Spring Creek the branch line turns southeast and then southwest and proceeds toward Ajax, South Dakota (see Map Volume, Map 93). The branch line passes directly east of Ajax about 1 mile east of State Highway 79. Daughenbaugh Road is crossed at Ajax. The branch line proceeds in a southwest direction south of Ajax approaching within approximately 0.2 miles of State Highway 79 in the NW of Section 17, T. 2 S., R. 8 E. In the SW of Section 8, T. 2 S., R. 8 E. the branch line enters the headwaters of Billover Creek and follows the drainage south to Hermosa, South Dakota crossing from Pennington into Custer County.

The branch line passes on the east side of Hermosa (see Map Volume, Map 94). State Highway 40, the major thoroughfare through Hermosa, is crossed just east of 2nd Street. One mile south of Hermosa the branch line crosses State Highway 36 at its intersection with State Highway 79 (see Map Volume, Map 94). From this point the branch line begins to follow State Highway 79 to the south for about 3 miles. In the SW of Section 18, T. 3 S., R. 8 E., just north of the County Road 7 crossing, the branch line turns to the southeast and leaves State Highway 79. L7 Draw is crossed in the NE of Section 29, T 3 S., R. 8 E. and Dry Creek is crossed in the NE of Section 7, T. 4 S., R. 8 E. South of Dry Creek, County Road 18 is crossed in the SW of Section 7. About 1 mile south of County Road 18 the branch line turns to the southwest and passes through Fairburn, South Dakota on the north side of 1st Street. Just west of Fairburn the branch line crosses County Road 719.

On the west side of Fairburn the branch line enters the French Creek drainage and proceeds to the southwest on the north side of the creek to the center of Section 26, T. 4 S., R. 7 E. where the branch line turns to the south and leaves the drainage. South of French Creek the branch line intersects and begins to parallel State Highway 79 in the SW of Section 27, T. 4 S., R. 7 E. The branch line follows the highway for approximately 1.5 miles to the southwest. In the NE of Section 4, T. 5 S., R. 7 E. the branch line turns to the south and leaves State Highway 79. The branch line enters the Lame Johnny Creek drainage in the NW of Section 22, T. 5 S., R. 7 E. and follows the creek to the south making a number of crossings (see Map Volume, Map 98). In the SE of Section 3, T. 6 S., R. 7 E. the branch line crosses Dry Creek about 0.1 miles west of its confluence with Lame Johnny Creek. South of the Dry Creek crossing the branch line runs adjacent to County Road 17 through Sections 10 and 16, T. 6 S., R. 7 E. In the NW of Section 21, T. 6 S., R. 7 E. the branch line leaves the county road and proceeds south to Buffalo Gap, South Dakota (see Map Volume, Map 99). The branch line is aligned on the east side of Buffalo Gap between Beaver Creek and First Street. Beaver Creek is crossed on the north side of town. The branch line crosses Main Street just east of First Street. South of Main Street the branch line follows County Road 101 to the south in the Beaver Creek drainage. The branch line runs on the west side of Beaver Creek between County Roads 6291 and 17 to the NW of Section 16, T. 7 S., R. 7 E. where the branch line crosses Beaver Creek (see Map Volume, Map 100). As the branch line continues south it crosses Beaver Creek a number of times in Sections 16 and 22, T. 7 S., R. 7 E.

In the SE of Section 22, T. 7 S., R. 7 E. the branch line turns to the south and proceeds toward Oral. The branch line route from Oral to Smithwick is precisely the same as that described for Alternative B in Section 2.2.2.1 (see Map Volume, Map 72). Beginning at Smithwick (see Map Volume, Map 73) Alternative D would follow the route for Alternative C described in Section 2.2.3.1 to the South Dakota-Wyoming State line (see Map Volume, Maps 22 though 34).

Alternative D would again deviate from the Alternative C route beginning in the NE of Section 25, T. 7 S., R. 1 E.

in Fall River County (see Map Volume, Map 34). Rather than turning west at this point up the Cheyenne River, Alternative D would continue parallel to the BNSF and County Road 6463 to the northwest to Burdock. The alternative would cross Pass Creek in the NW of Section 10, T. 7 S., R. 1 E. (see Map Volume, Map 101). About 1.3 miles north of the Pass Creek crossing the alternative would leave Fall River and enter Custer County. In the NE of Section 33, T. 6 S., R. 1 E. the alternative would be about 0.4 miles west of the Black Hills National Forest and west of Beaver Creek. The alternative would continue to the northwest parallel to BNSF and County Road 769 to Dewey, South Dakota. About 2 miles north or Dewey the alternative would enter Weston County, Wyoming (See Map Volume, Map 102). In Wyoming the alternative would proceed next to the BNSF corridor up the Line Creek drainage to the center of Section 28, T. 42 N., R. 60 W. where the alternative turns to the north. In the north half of Section 16, T. 42 N., R. 60 W. the alternative turns to the northwest and continues parallel to the BNSF (see map Volume, Map 103) avoiding steep terrain to the west and the Black Hills National Forest.

In the south half of Section 30, T. 43 N., R. 60 W. the alternative would cross Whoopup Creek and Whoopup Canyon Road (see Map Volume, Map 104). North of Whoopup Canyon Road the alternative converges with Old U.S. Highway 85 on the east side of Stockade Beaver Creek. The alternative parallels the highway and BNSF through Section 13, T. 43 N., R. 61 W. but turns to the north and away from the highway in the SW of Section 12, T. 43 N., R. 61 W. From this point the alternative is routed up the Stockade Beaver Creek drainage crossing the creek in the SW of Section 1, T. 43 N., R. 61 W. (see Map Volume, Map 105). The alternative continues to the north on the west side of Stockade Beaver Creek to Section 15, T. 44 N., R. 61 W. At this point the creek turns to the east and the alternative continues next to the BNSF corridor to the north and crosses Old U.S. Highway 85 in the NE of Section 10, T. 44 N., R. 61 W. (see Map Volume, Map 106). The alternative follows Old U.S. Highway 85 and turns to the northwest as it approaches Newcastle. East of Newcastle the alternative crosses U.S. Highway 85 just south of Summit Avenue. West of the highway crossing the alternative would cross Faye Avenue and Divide Avenue north of Sheridan Street and adjacent to BNSF. West of Divide Avenue the alternative turns to the northwest and crosses the Highway 16 bypass east of Douglas Street. Main Street would be crossed just west of South Railway Avenue. North of Main Street the alternative would pass east of Pine Street before crossing Little Oil Creek and turning to the west, south of Cambria Street. The alternative would continue west parallel to BNSF and between Cambria Street and West Railroad Street. On the west side of Newcastle the alternative is located between Sunset Street and North Railroad Street. The alternative runs north of Main Street and U.S. Highway 16 as it leaves Newcastle.

West of Newcastle the alternative proceeds to the northwest roughly parallel to and on the north side of U.S. Highway 16 (see Map Volume, Map 108). In the NE of Section 22, T. 45 N., R. 62 W. the alternative would cross Fourmile Creek and Oil Creek would be crossed in the SW of Section 16, T. 45 N., R. 62 W. The alternative would continue northwest adjacent to BNSF and U.S. Highway 16 past the Newcastle Airport in Section 9, T. 45 N., R. 62 W. Beginning in Section 6, T. 45 N., R. 62 W. the alternative would follow BNSF up the Skull Creek drainage passing east of the Pedro Oil Field (see Map Volume, Map 109). In Section 9, T. 46 N., R. 63 W. the alternative would follow the BNSF through Osage (see Map Volume, Map 110). The alternative would be aligned to the east of town between Taylor Avenue and Nefsey Avenue. Skull Creek Road would be crossed in the middle of Osage. North of Skull Creek Road Alternative D would follow the BNSF on the east side of Nefsey Avenue. North of Osage the alternative turns to the northwest crossing the headwaters of Turner Creek in the NW of Section 4, T. 46 N., R. 63 W. (see Map Volume, Map 110).

Northwest of Osage the alternative is routed up Turner Creek and crosses Iron Creek in the NE of Section 25, T. 47 N., R. 64 W. Pump Creek would be crossed in the NW of Section 23, T. 47 N., R. 64 W. (see Map Volume, Map 111). Jerome Creek and Spring Creek would be crossed upstream of their confluences with Pine Creek northwest of Pine Ridge and southeast of Upton. U.S. Highway 16 would be crossed by Alternative D in the NE of Section 7, T. 47 N., R. 64 W. about 2.5 miles southeast of Upton (see Map Volume, Map 113). The alternative would cross through Upton adjacent to BNSF on the south side of the town between Second Street and Nester Road. Hay Creek Road would be crossed south of Second Street. Northwest of Hay Creek Road the alternative is aligned between Lincoln Street and First Street. Pine Street would be crossed just north of South Railroad Avenue and Iron Creek would be crossed on the northwest side of town.

The alternative continues to the northwest parallel to the south of U.S. Highway 16. In the SW of Section 21, T. 48 N., R. 65 W. the alternative would cross Haul Road. North of the Haul Road crossing the alternative would continue on the south side of U.S. Highway 16, crossing Patrick Creek and Wind Creek before entering Crook County in the SW of Section 33, T. 49 N., R. 66 W. (see Map Volume, Map 116).

Alternative D would continue northwest adjacent to BNSF toward Moorcroft. In the NW of Section 23, T. 49 N., R. 67 W. the alternative would cross Buffalo Creek Road about 1 mile southwest of U.S. Highway 16. In the SE of Section 9, T. 49 N., R. 67 W. the alternative would approach U.S. Highway 16 and run between the highway and Rush Creek. The alternative would continue

northwest up the Rush Creek drainage to Moorcroft (see Map Volume, Map 118). Warbonnet Road would be crossed in the NE of Section 8, T. 49 N., R. 67 W. The alternative would continue toward Moorcroft running between Rush Creek Road and U.S. Highway 16. The alternative would pass south of East Railroad Avenue and cross Bighorn Avenue southeast of town. The alternative would continue west parallel to BNSF on the south side of U.S. Highway 16. In the SE of Section 36, T. 50 N., R. 68 W. Alternative D would be approximately 0.1 miles of the intersection of State Highway 16/14 and I-90 at Exit 153.

West of Moorcroft the alternative is aligned on the south side of I-90 and State Highway 51 (see Map Volume, Map 118). The alternative would cross the Belle Fourche River in the NW of Section 36, T. 50 N., R. 68 W. and Shipwheel Road in the NE of Section 35, T. 50 N., R. 68 W. Both crossings would occur directly adjacent to I-90.

The alternative would enter the Donkey Creek drainage in the NE of Section 35, T. 50 N., R. 68 W. The first crossing of Donkey Creek would occur within this quarter section directly adjacent to and south of I-90. After the Donkey Creek crossing the alternative turns to the west and continues up the Donkey Creek drainage adjacent to the BNSF toward Gillette. The alternative is located on the north side of Donkey Creek and directly south of I-90 to the SW of Section 30, T. 50 N., R. 49 N. where the alternative leaves Crook and enters Campbell County (see Map Volume, Map 119). In Section 27, T. 50 N., R. 69 W. I-90 turns to the northwest and the alternative continues west adjacent to the BNSF and State Highway 51. In the SE of Section 28, T. 50 N., R. 69 W. the alternative would cross Stewart Road and Donkey Creek. On the west side of Donkey Creek the route is aligned on the south side of the creek and north of State Highway 51 toward Rozet, Wyoming.

The alternative would cross Adon Road in the SW of Section 30, T. 50 N., R. 69 W. about 0.1 miles north of Rozet (see Map Volume, Map 120). West of the Adon Road crossing the alternative continues in a western direction and crosses to the south of State Highway 51 in the SW of Section 26, T. 50 N., R. 70 W. The alternative continues west on the south side of State Highway 51 and adjacent to BNSF to the NE of Section 29, T. 50 N., R. 70 W. In this quarter section the BNSF and the Alternative D route would turn to the south and proceed up Dry Donkey Creek on the west side of the Rochelle Hills (see Map Volume, Map 121). The alternative would follow the existing BNSF route up Dry Donkey Creek for about 12 miles to the south to the Belle Ayr Mine (see Map Volume, Map 63). From the Belle Ayr Mine Alternative D would continue to the south providing service to the same mines described for Alternatives B and C. For the northern mines the route varies from that described above for Alternatives B and C. The route to these mines is shown in th Map Volume on Maps 61 through 63. However, the southern SPRB mines would be serviced by this alternative using the same route described above for Alternative C.

2.2.4.2 Alternative D Land Ownership. Table 2-5 shows land ownership for Alternative D. As can be seen from the table, Alternative D is about 86 miles longer than Alternative C and 70 miles longer than Alternative B. Nearly 90 percent of the route is privately-owned. Crossing of NFS lands would be reduced by over 20 and 10 miles, respectively, when compared with Alternatives B and C.

Bureau of Land Management. Alternative D would cross only 1.3 miles of public lands in South Dakota. No public lands would be crossed on DM&E's existing main line or the Black Hills Subdivision Branch Line. Public lands would be crossed near Edgemont. The first parcel is located in the NW of Section 22, T. 9 S., R. 3 E. (see Map Volume, Map 29) southeast of Edgemont. A second parcel of public lands would be crossed in the SE of Section 22, T. 8 S., R. 2 E. adjacent to the BNSF northwest of Edgemont (see Map Volume, Map 32). A third public land parcel would be crossed just south of the Fall River-Custer County line in the SW of Section 4, T. 7 S., R. 1 E. (see Map Volume, Map 101).

About 1.7 miles of public lands would be crossed in Wyoming. The first parcel is located in the NE of Section 13, T. 43 N., R. 61 W. just east of Stockade Beaver Creek in Weston County (see Map Volume, Map 105). Public lands would also be crossed in the Stockade Beaver Creek drainage in the SW of Section 23, T. 44 N., R. 61 W. (see Map Volume, Map 106). Just after the alternative crosses from Weston into Crook County, public lands would be crossed. These lands are shown in the Map Volume on Map 116 and include the SW of Section 33 and the SE of Section 32, T. 49 N., R. 66 W. A 40-acre parcel of public lands would be crossed in the SE of Section 15, T. 49 N., R. 67 W. in the headwaters of Rush Creek southeast of Moorcroft. A second 40-acre isolated parcel would be crossed in the headwaters of the Timber Creek drainage in the SW of Section 33, T. 49 N., R. 70 W. (see Map Volume, Map 123). Similar to Alternative C this alternative would cross a 40-acre parcel of public lands north of Hay Lakes in Campbell County (see Map Volume, Map 59). The parcel is located in the SW of Section 26, T. 46 N., R. 70 W.

Forest Service. No NFS lands would be crossed by Alternative D on BGNG. However, 26.7 miles would be crossed on TBNG in Wyoming. Alternative D would first cross NFS lands about 1 mile north of Osage (see Map Volume, Maps 110, 111 and 112). These NFS lands include the crossing of Turner Creek, Little Turner Creek, Pump Creek, and Spring Creek south of Upton. This block of NFS lands is located west of Pine Ridge.

Table 2-5 Summary of Land Ownership (in Miles) for Alternative D						
Land Owner	South Dakota		Wyoming		Total	
	Miles	Percent of State	Miles	Percent of State	Miles	Percent of Total
BLM	1.3	0.7	1.7	0.9	3.0	0.8
Forest Service	0	0	26.7	14.8	26.7	7.4
State	2.0	1.1	8.8	4.9	10.8	3.0
Private	176.0	98.2	143.5	79.4	319.5	88.8
Total	179.3	100	180.7	100	360.0	100

Additional NFS lands would be crossed in northern Weston County in Sections 3, 4 and 12, T. 48 N., R. 66 W., just south of the Patrick Creek crossing and at the West Fork of Wind Creek crossing (see Map Volume, Maps 115 and 116). The remainder of the NFS lands which would be crossed by this alternative are the same as those described for the northern and southern legs of Alternative C in Section 2.2.3.2 above.

State of South Dakota. Alternative D would cross 2 miles of state lands in South Dakota. The first parcel is located on the Black Hills Subdivision Branch Line. The parcel is located about 2 miles north of Buffalo Gap and includes Section 16, T. 6 S., R. 7 E. (see Map Volume, Map 99). A second 160-acre parcel would be crossed about 2 miles south of Buffalo Gap in the Beaver Creek drainage (see Map Volume, Map 100). This parcel includes the NE of Section 8, T. 7 S., R. 7 E. However, DM&E owns the right-of-way through both of these parcels. If construction could be confined entirely to DM&E's property, state lands would not be affected at these locations.

Similar to Alternative C this alternative would cross state lands southeast of Edgemont. The crossings include the east half of Section 36, T. 9 S., R. 3 E. in the Plum Creek drainage and the NE of Section 8 in T. 9 S., R. 3 E. about 2.5 miles southeast of Edgemont (see Map Volume, Maps 28 and 30).

State of Wyoming. Alternative D would cross nearly 9 miles of state-owned lands in Wyoming. The first parcel, Section 16, T. 42 N., R. 60 W., would be crossed in Weston County about 3.5 miles south of the Whoopup Creek crossing (see Map Volume, Map 103). The second parcel includes the crossing of Jerome Creek west of Pine Ridge and southeast of Upton (see Map Volume, Map 112). This parcel includes all of Section 16, T. 47 N., R. 64 W. A parcel of state lands would be crossed in the Rush Creek drainage where the alternative converges with U. S. Highway 16 in the SW of Section 9, T. 49 N., R. 67 W. about 2 miles southeast of Moorcroft. The west side of Moorcroft (Section 36, T, 50 N., R. 68 W.) is also state lands. This parcel includes the crossing of the Belle Fourche River (see Map Volume, Map 118). State lands would be crossed in the Piney Creek drainage in Section 16, T. 48 N., R. 70 W. north of the Belle Ayr Mine (see Map Volume, Map 123). The remainder of the state lands which would be crossed by Alternative D are the same as those described in Section 2.2.3.2 for the northern and southern legs of Alternative C.

Angostura Unit. Approximately 2.6 miles of Alternative D would cross through the unit. Only private lands would be affected by the alternative in the unit.

2.3 Mine Loop Options

2.3.1 North Antelope West Mine Loop Option. This mine spur option would take off from the southern leg to provide service to the North Antelope and Rochelle mines (see Map Volume, Map 53). The North Antelope West Mine Loop option would depart from Alternative C's south leg in the SW of Section 32, T. 41 N., R. 70 W. This spur would loop north and around to the east paralleling the south side of the existing UP/BNSF mine tracks in the NW of Section 32, T. 41 N., R. 70 W. This loop continues east for about 1.5 miles staying immediately south of the UP/BNSF track and would merge with this track in the NE of Section 33, T. 41 N., R. 70 W. This mine loop option would cross 2.4 miles of private lands.

2.3.2 North Antelope East Mine Loop Option. The exact location of this spur is currently unknown. For purposes of this report it was assumed that the spur would follow existing rail service (see Map Volume, Map 53) up the Porcupine Creek drainage and terminate in the NW of Section 27, T. 41 N., R. 70 W. This mine loop would cross 1.5 miles of private lands.

2.3.3 Black Thunder South Mine Loop Option. The Black Thunder South Mine Loop would being in the NE of Section 23, T. 43 N., R. 70 W. where it would depart from Alternative C. At this point the loop would curve to the northwest for about 0.5 miles. In the NW of Section 23, T. 43 N., R. 70 W. the loop would proceed in a southwest direction where it would cross State Highway 450 and North Prong Little Thunder Creek. In the NW of Section 27, T. 43 N., R. 70 W. the loop would curve to the northwest and proceed in this direction for approximately

2 miles where it would join the existing load out facilities at the Black Thunder Mine. This mine loop option is DM&E's preferred route. This mine loop would cross 3.1 miles on TBNG, 0.7 miles of State of Wyoming lands and 3.3 miles of private land.

2.3.4 Black Thunder North Mine Loop Option. In the NE of Section 23, T. 43 N., R. 70 W. this mine loop option would turn to the northwest and parallel the north side of North Prong Little Thunder Creek for approximately 1.5 miles to the Black Thunder Mine in Section 17, T. 43 N., R. 70 W. (See Map Volume, Map 14). This option could conflict with the Black Thunder Mine's development plans for their Thunder Cloud lease located on the north side of State Highway 450. This mine loop would cross 3.1 miles on TBNG, 2.7 miles of State of Wyoming land and 1.2 miles of private land.

2.4 Proposed Yard Sites

DM&E has identified 3 yard sites which are essential for efficient operation of Alternative C. Although required, similar yard sites have not been identified for Alternatives B and D. Impacts from yards necessary for operation of Alternatives B and D are not analyzed in this report.

2.4.1 Wall Yard. The proposed location of this 70-acre yard is shown in the Map Volume on Map 1. The yard site is located in Pennington County and extends from the west side of Wall Pedro Road to just north of the proposed crossing of I-90. The yard site is north of the Town of Wall and the Wall Land Field and would be located in Section 31, T. 1 N., R. 16 E. and Sections 35 and 36, T. 1 N., R. 15 E. Only private lands would be affected by this yard.

2.4.2 Edgemont Interchange Yard. The interchange yard would be located in Fall River County northeast of Edgemont (see Map Volume, Map 31). The yard would originate in the NE of Section 31, T. 8 S., R. 3 E. and extend to the northeast adjacent to BNSF to the SW of Section 20, T. 8 S., R. 3 E. The yard would cross Red Canyon Creek south of Bell Ranch. Only private lands would be affected by the 70-acre yard.

2.4.3 Western Yard. An approximately 250-acre yard is proposed for the west end of Alternative C in Wyoming. The yard would straddle the Campbell and Weston County line. The location of the yard is shown in the Map Volume on Map 47. The yard spans (east to west) from Section 4, T. 42 N., R. 68 W. to Section 35, T. 43 N., R. 69 W. and includes approximately 71 acres of NFS lands, 78 acres of state lands and 101 acres of private lands. The yard site is located south of the Little Thunder Creek. Several intermittent tributaries to the creek are located within the yard site including Hansen Draw. The yard site is about 0.5 miles south of State Highway 450.

2.5 Construction

2.5.1 Assumptions Regarding Construction Disturbance. The new railroad would be constructed according to current main line railroad standards and would be comprised of continuously-welded rail on hardwood or concrete ties. Typical cross-sections of the construction and operation rights-of-way are included as Figures 2-2 and 2-3. Figure 2-2 provides a cross section for single track and Figure 2-3 shows how double track for sidings would be configured.

The track would be supported on approximately 12 inches of ballast and 12 inches of sub-ballast. The area disturbed during construction would range from 200 to 1,000 feet in width, depending primarily on the need to cut and fill to obtain the desired grade. An area exceeding 600 feet in width would be rare.

2.5.2 Construction Techniques and Schedule. Construction of the new railroad would be a 3 year project. Assuming regulatory approvals are issued in a timely manner, the work would be initiated in the Spring of 2001 and continue through 2003. Some activities would occur year-round while others would be seasonally restricted by weather.

The first step in construction of the new railroad would be the purchase of the right-of-way or issuance of a right-of-way from the land management agency. Where necessary the right-of-way would be fenced in advance of construction. The major steps in completing construction of the new railroad are as follows:

- establish the Edgemont Interchange Yard to allow a connection with BNSF for delivery of construction materials;
- bridge construction (including highway overpasses, cattle passes, required drainage, etc.);
- construction of railroad grade;
- track construction; and
- clean up and restoration.

The Edgemont Interchange Yard would serve construction activities working in both directions. From this centralized location work crews would proceed both east toward Wall and west toward the SPRB mines in Wyoming. The yard would be the receipt point for much of the materials used to construct the railroad which would be shipped to Edgemont by rail. The yard may contain a pre-cast plant for fabrication of concrete rail ties, concrete box culverts, etc.

It would take approximately 6 months to get the pre-cast plant and yard up and running. Work is anticipated to begin setting up the yard and pre-cast plant in early 2001 as soon as regulatory approvals for the project and financing are secured.

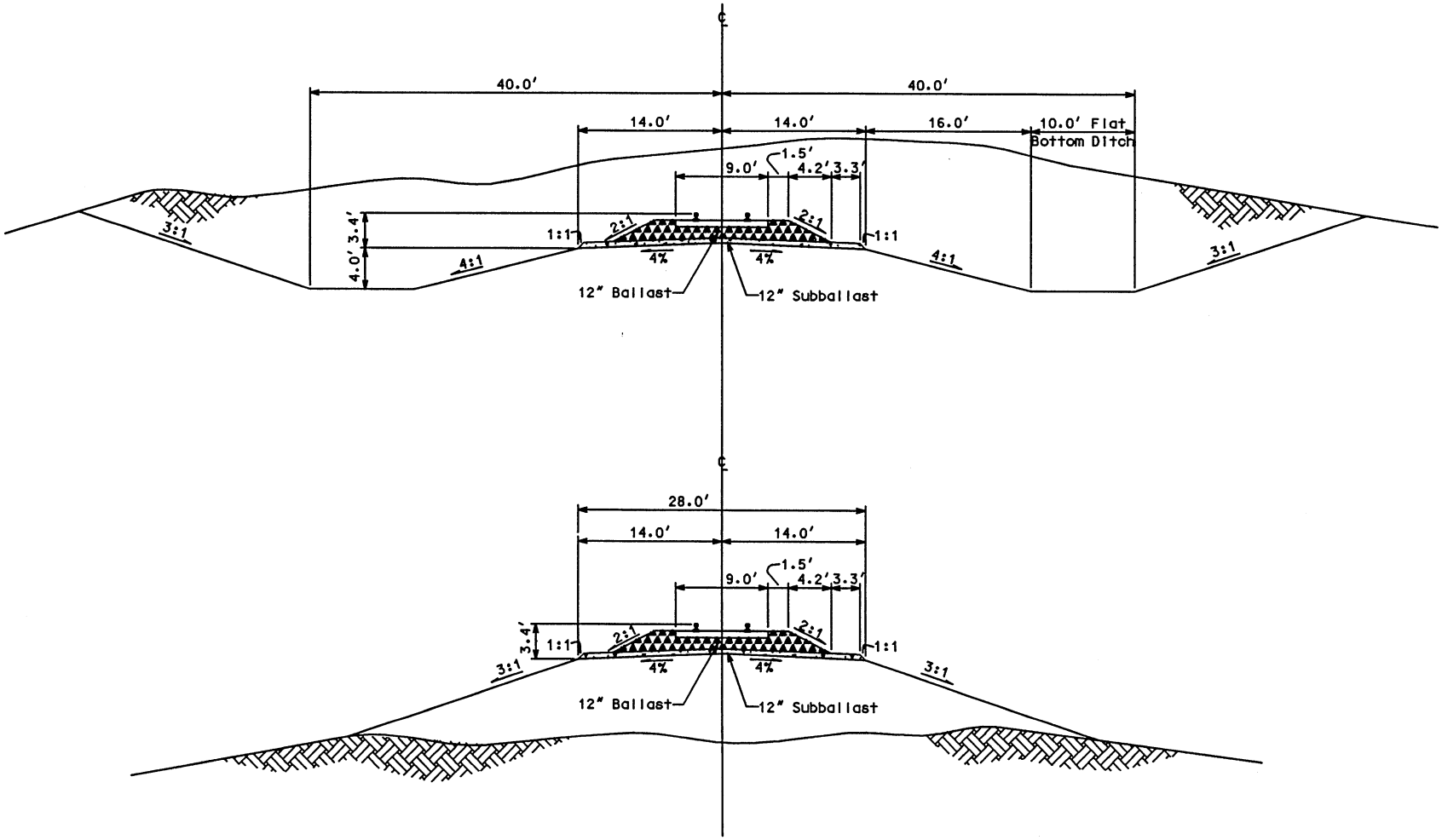

Figure 2-2
Typical Cross-section of Single Track Configuration

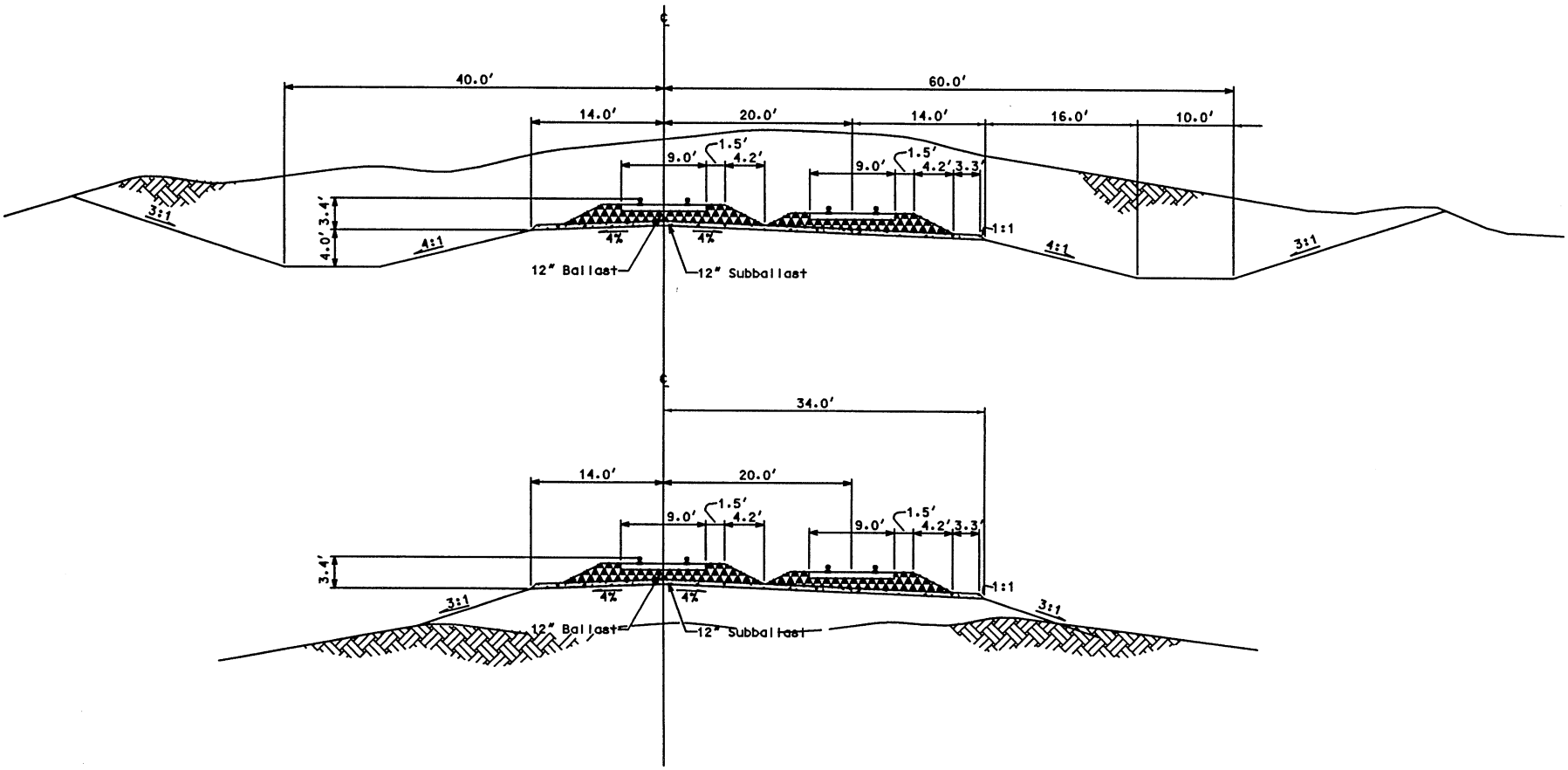

Figure 2-3
Typical Cross-section of Siding Track Configuration

Bridge construction would begin at various locations along the new railroad both east and west of Edgemont in about May, 2001. These crews precede all other construction activities and are responsible for installing bridges, major road crossings, livestock crossings and culverts. This is the only activity associated with construction that is anticipated to occur all year long. Other activities would occur only when weather conditions permit. Five to seven bridge crews may be working at any time. However, these crews would be spread over the entire new railroad and only 1 crew is expected to be working in an area at any time. These crews use a variety of equipment including cranes, dozers, loaders, etc. Much of their work involves concrete so generators powering heaters and lights would be located at most of the construction sites.

The bridge crews would work double shifts from about 7 a.m. to midnight. Work would occur 6 days weekly. Although construction would typically stop after midnight, equipment maintenance crews would be working between midnight and 7 a.m. Lights could be used at construction sites throughout the night.

The construction of the railroad subgrade would occur separately from the bridge construction crews. Earthwork would not occur when the ground is frozen so this construction activity is anticipated to be limited to about mid-April to mid-November. Seasonal conditions may change these dates. Between 5 and 7 construction spreads would be required to complete the earthwork. Construction spreads would be working both east and west of Edgemont simultaneously. Each spread would consist of scrapers, front-end loaders, power shovels or draglines, trucks, and other equipment. Belly dumps would be used to transport material between cut and distant fill areas. The spreads would work double shifts starting at 7 a.m. and ending at midnight. Maintenance of equipment would occur after midnight. Work would occur 6 days weekly. Lights would be required all night in areas where maintenance is occurring and from dark to midnight in other areas where equipment and crews are working.

Grading of the subgrade would begin with clearing and grubbing of the right-of-way followed by the removal and storage of topsoil. The entire right-of-way would be cleared and grubbed so that no organic material or vegetation is hauled to embankments. Disposal of vegetation would be determined on a case-by-case basis after consultation with landowners and appropriate county, state and Federal officials. Blasting within the right-of-way may be required to fracture material if ripping with a dozer is not possible. Throughout construction, water trucks would distribute water along the graded area for dust control and soil compaction.

The goal of designing the right-of-way is to have the "cut and fill" balance, as near as practicable. However, excess material can only be economically transported so far which results in the requirement for waste and borrow. Also, excavated cut material may be unsuitable for use as fill and may require disposal. DM&E has refined the alignments to reduce the need to haul borrow or waste material making for more cost-effective construction. However, it is likely that borrow and disposal sites will be necessary. Borrow areas, averaging 5 acres in size, would be established only when fill material is needed in addition to that provided during excavation of the track bed. The locations of borrow and disposal sites are currently unknown. However, the construction contractors would not locate borrow or disposal sites in environmentally sensitive areas including sites with significant cultural or historical resources, wetlands, sensitive species, etc. After grading is complete, reclamation work would commence beginning with the placement of topsoil on side slopes. Disturbed areas would be seeded and mulched.

Assuming timely issuance of approvals, actual construction of the rail would commence in May, 2002 from Edgemont heading west and August, 2002 from Edgemont heading east. Completion of the track is anticipated in October, 2003. The ties, rail and ballast used in construction would be shipped from the Edgemont Interchange Yard on material trains. Work crews would lay welded rail and initial ballast would be installed. When rail laying work is completed, signal and communication facilities would be installed. Final ballast placement and clean-up would complete the construction activity.

2.5.3 Construction Water Use. The primary needs for water during construction would be for compaction and dust control. No estimate is currently available on total water need. However, water sources have been tentatively identified. In Wyoming water would come primarily from private sources and the mines. Additional water may be withdrawn from the Cheyenne River, if available, under temporary use agreements. In South Dakota water sources would include private sources and possibly the Cheyenne River, if available, under temporary use agreements.

Most of the water for the project is expected to come from private sources. Private water sources include existing wells, stock ponds, etc. DM&E would reimburse landowners for use of their water and would use the water only in compliance with state law. Water would be moved along the construction right-of-way using standard irrigation piping. Temporary water storage pits would be excavated at a number of locations within the construction right-of-way. With the possible exception of the Cheyenne River, water would not be withdrawn from streams or rivers.

2.5.4 Estimated Work Force and Construction Housing. Between 600 and 1,000 workers would be

employed during construction of the new railroad. However, this workforce would be spread over the entire length of the new alignment. A typical spread would employ about 50 workers, including truck drivers, equipment operators and laborers. DM&E would take steps to maximize the use of local labor resources. Local labor pools in Edgemont, Rapid City, Douglas, Gillette and tribal labor sources would be utilized to the maximum extent practicable. Housing is not available locally to accommodate the expected inmigrant work force. Therefore, the contractors expect that it will be necessary to install temporary mancamps to house the workers. The locations of these camps cannot be currently predicted. However, they would not be located in environmentally sensitive areas such as at wetlands, cultural sites, etc.

2.5.5 Surface Drainage. Precast and cast in place concrete box culverts or corrugated metal pipe may be used to provide drainage under the railroad. Drainage of natural flow under the railroad would be designed based on the 100-year storm event where headwater does not exceed either 1 foot above top of pipe or above the subgrade shoulder point. Corrugated metal pipe under the railroad would be a minimum of 36 inch diameter.

2.5.6 Utility Crossings. The new railroad would cross a number of utilities including powerlines, telephone cables, oil flow lines, water lines, gas lines, miscellaneous buried conduits, etc. DM&E will be responsible for identifying these crossings prior to construction. Once the exact location of the utilities are known, DM&E will contact the utility owner and develop a plan as to how the crossing would be constructed. Various options exist including relocating the utility, burying the utility deeper, changing the utility from buried to overhead, raising an overhead utility, etc. If the affected utility is on NFS or public lands, the Forest Service and BLM would be involved in developing the crossing plan. Appropriate approvals, such as special use permits, Sundry Notice, etc., may be required.

2.6 Operations

2.6.1 Analysis Assumptions Regarding Operational Traffic. DM&E estimates that trains will consist of 115 to 135 cars with either three 6,000 hp locomotives or four 4,000 hp locomotives. Combined, the trains would be approximately 6,400 to 7,740 feet long. Speeds will be 45 mph for loaded east bound trains and 49 mph for empty west bound trains. Market factors will determine the train traffic on the new railroad. Therefore, the analysis considers 3 levels of operations:

- 8 total trains daily, 4 loaded and 4 empty, 5 running during daylight hours and 3 at night;
- 18 total trains daily, 9 loaded and 9 empty, 11 running during daylight hours and 7 at night; and
- 34 total trains daily, 17 loaded and 17 empty, 21 running during daylight hours and 13 at night.

2.6.2 Analysis Assumptions Regarding Noise Area of Influence. Noise from operation of the new railroad will vary in intensity based on areas where the whistle would be used. Estimates of instantaneous noise levels at specific distances from the railroad are provided on Table 2-6. The estimated noise levels were provided by Burns & McDonnell (STB's third-party EIS contractor) and are based on monitored noise levels from Conrail and other railroads.

2.6.3 Fence/Cattle Guard Maintenance. Fences would be maintained on an as-needed basis and would be inspected annually except in areas where more frequent inspection is warranted (i.e., near yards). Cattleguard maintenance would occur during the regular track maintenance program. Track maintenance would occur in compliance with the Federal Railroad Administration's Safety Standards. Those requirements include daily, weekly or monthly inspection depending on the level of traffic in each segment.

2.6.4 Permanent Road Access Needs/Maintenance Responsibilities. At sidings it is anticipated that access along the track will be required. At these locations switches would be installed that would require maintenance and fuel (electric and propane). DM&E would be responsible for maintaining access to these sites and access is anticipated to occur wholly within the right-of-way.

2.6.5 Noxious Weed Control. Following revegetation DM&E would implement a noxious weed control program. This program would be designed to control all state-declared noxious weeds. DM&E would spray herbicide annually on its right-of-way in order to prevent the spread of any noxious weeds to adjoining lands, taking into account the appropriate spraying sequence and formulations with respect to the terrain and site characteristics. Use of herbicides would comply with appropriate Federal, state and local laws and only certified applicators would be employed in use of herbicides on railroad property or easement.

2.6.6 Fire Control Plan/Responsibilities. Fire control is an integral part of DM&E's Emergency Response Plan and Safety Plan. Fire control includes maintenance of locomotives and maintenance of fire breaks on both sides of the track pursuant to DM&E's Fire Prevention and Control Plan.

Table 2-6 Whistle and Non-Whistle Noise Estimates		
Predicted Noise Level	**Distance From Centerline with Whistle (feet/miles)**	**Distance From Centerline without Whistle (feet/miles)**
60 dBA	16,000/3.0	5,700/1.08
50 dBA	27,000/5.1	13,000/2.46
40 dBA	39,000/7.4	23,000/4.36
32 dBA	49,000/9.3	32,000/6.06

CHAPTER THREE - AFFECTED ENVIRONMENT

3.1 Introduction

This chapter describes those components of the existing environment that could be affected by construction, operation and maintenance of the alternatives. Emphasis is provided for those resources which could be significantly impacted. Where practicable, information is provided in tabular format for ease of comparison between the alternatives. Numerous maps are provided to show the relationship between the alternatives and sensitive natural resources in the impact analysis areas.

Information in this section was gathered from a number of sources including Federal and state agencies in South Dakota and Wyoming. Where information is readily available in other documents prepared to address environmental impacts from DM&E's proposed project, it is not typically repeated here. Rather, a reference to the information source is provided.

Each of the natural resource descriptions in this chapter attempts to provide the same level of detail for each of the alternatives. For instance, this chapter contains gross-scale wetland crossing impact estimates for each of the alternatives based on National Wetland Inventory (NWI) mapping. Much more precise mapping of wetlands has been completed by DM&E for Alternative C and the route variations to support the COE 404 permit application. However, detailed wetland mapping has not been completed for Alternatives B and D - thus the need for the more general NWI-based comparison of wetland impacts contained in this report.

3.2 Climate

Tables 3-1 and 3-2 show average (1961-1990) monthly precipitation and temperature from 7 monitoring stations located in the general vicinity of the alternatives (4 in South Dakota and 3 in Wyoming). In the eastern portion of the project area, the climate is variable and unpredictable with temperatures ranging from -40 °F to 116 °F in Badlands National Park in Pennington County. At Wasta, average monthly temperature is lowest during December (23.2 °F) and January (21 °F). Most of the 15 to 17 inches of annual precipitation fall just before and during the warmer months, often in the form of torrential thunderstorms. May (2.61 inches) and June (2.83 inches) are typically the wettest months in Wasta while December (0.39 inches), January (0.31 inches) and February (0.4 inches) are the driest.

Wind Cave National Park is located in Custer County about 7 miles north of Hot Springs and about 12 miles northwest of Alternatives B and C and 2.5 miles west of Alternative D. An extensive climate description for the park is available from the National Park Service (NPS).[1] In the park, snowfall averages 30 inches annually (November through March). January is usually the coldest month, but March often brings the most snow. Occasional high winds can make for extra chilly weather during spring (April and May). Consistent spring-like weather generally occurs in late April, but some snow is possible. May usually brings the most precipitation - about 3 inches. Like May, June can be a rainy month. Severe thunderstorms are common in June and July and occur occasionally in August. Fall (September and October) days are warm and nights are cool. Snow is common in late fall.

A monthly weather summary for Wind Cave National Park is provided below:

- January is the coldest month. The average high and low are 37.4 °F and 10.7 °F, respectively. Temperatures below zero are common. Average snowfall for January is 6.6 inches.
- February brings an average of 5.9 inches of snow. The average high is 41.8 °F and the average low is 14.5 °F.
- March brings the warmest winter temperatures, but the most snow. The average high and low are 49.7 °F and 21.4 °F. Snowfall averages 7.4 inches.
- April is a variable time. There is warm weather mixed with cold and snowy days. Precipitation increases with an average of 1.78 inches. The average high and low are 61 °F and 32 °F.
- May can be a wet month with an average of 2.95 inches of rain. Temperatures are often pleasant - average high and low are 70.7 °F and 41.7 °F.
- June is characterized by dramatic thunderstorms. June is slightly wetter than May with an average precipitation of 3.05 inches. The average high is 81 °F and the average low is 51 °F.
- July is the warmest month of the year with an average high of 89.3 °F and average low of 57.2 °F. Hail and thunderstorms are common.
- August is similar to July, but drier, and there are fewer thunderstorms. The average high and low are 88.1 °F and 54.9 °F.
- September weather is often very pleasant with an average high of 78.4 °F and an average low of 44.6 °F. September is a little drier than the summer months.

[1] Additional information can be found at http://www.nps.gov/wica

Table 3-1
Average Monthly Precipitation (1961-1990) in Inches at Climate Stations Near the Alternatives

Station	January	February	March	April	May	June	July	August	September	October	November	December	Annual Average
South Dakota													
Rapid City	0.28	0.4	0.92	2.01	3.02	2.75	2.49	2.21	1.21	1.22	0.54	0.37	17.42
Hot Springs	0.3	0.4	0.79	1.63	2.82	2.8	2.62	1.34	1.36	0.97	0.44	0.36	15.83
Oelrichs	0.4	0.48	1.04	1.95	2.98	2.91	2.21	1.59	1.26	1.03	0.55	0.47	16.87
Wasta	0.31	0.4	0.96	1.88	2.61	2.83	1.96	1.61	1.19	1.18	0.52	0.39	15.84
Wyoming													
Douglas Aviation	0.4	0.4	0.77	1.59	2.32	1.66	1.53	0.74	1.07	0.71	0.62	0.39	12.2
Lusk	0.58	0.52	1.21	2.23	2.7	2.19	1.91	1.15	1.26	1.02	0.63	0.58	15.98
Newcastle	0.39	0.51	0.6	1.54	2.4	2.49	1.88	1.55	1.15	0.91	0.57	0.56	14.55

Source: High Plains Climate Center at http://hpccsun.unl.edu/home.html

Table 3-2
Average Monthly Temperature (1961-1990) in °F at Climate Stations Near the Alternatives

Station	January	February	March	April	May	June	July	August	September	October	November	December	Annual Average
South Dakota													
Rapid City	22.9	26.1	34.1	44.6	55.3	65.5	72.5	69.8	59	47.8	33.7	24.6	46.3
Hot Springs	25.2	29.7	36.8	47.4	56.9	66.6	73.5	71.7	61.7	50.6	36.6	27.0	48.6
Oelrichs	22.7	28.2	36.2	47.3	57.2	67.1	74.8	73.0	62.5	50.3	35.5	24.8	48.3
Wasta	21.0	26.6	35.5	47.8	58.3	68.1	75.3	73.2	61.9	49.8	35.0	23.2	48.0
Wyoming													
Douglas Aviation	22.9	27.6	34.3	43.3	52.7	63.0	70.6	68.3	57.7	46.3	33.6	24.4	45.4
Lusk	21.7	26.4	32.9	42.9	52.1	62.5	69.7	67.3	56.7	46.1	32.3	23.4	44.5
Newcastle	22.0	26.5	34.9	45.7	55.9	66.1	73.5	71.1	59.9	48.1	34.1	23.7	46.8

Source: High Plains Climate Center at http://hpccsun.unl.edu/home.html

- October is often a mixture of warm and cold days. The average high is 65.8 °F and the average low is 33.6 °F. Precipitation is light although some snow can occur, especially late in the month.
- November often brings snow. The average high temperature is 49.5 °F and the average low temperature is 22.5 °F.
- December is generally a dry month. Snow averages 6 inches. It is the second coldest month with an average high of 39.8 °F and an average low of 14.1 °F.

In eastern Wyoming, the climate is generally dry and temperate. Typically, the days are dry and sunny with weather fronts coming from the Pacific Ocean. Higher elevations experience lower average temperatures and higher average precipitation.

Average annual precipitation ranges from a low of 10.59 inches at Keeline to nearly 23 inches in the Black Hills at Alva. In this part of the state, about 20 percent of the precipitation generally occurs as snow from November through March. About 60 percent is received as rain from April through July. Temperatures can be extreme in both summer and winter. According to the BLM (1998), the lowest recorded temperature in the region is -30 °F and the highest is 105 °F. Average temperature in the region is 46 °F.

At Newcastle, average annual precipitation is 14.55 inches. The driest month is January (0.39 inches) and the wettest months are May (2.4 inches) and June (2.49 inches). The coldest months are December (23.7 °F) and January (22 °F). The warmest months are July (73.5 °F) and August (71.1 °F).

3.3 Socioeconomic Resources

3.3.1 Impact Analysis Area. The area evaluated for socioeconomic impacts includes the 8 counties which could be crossed by the alternatives, including Pennington, Custer and Fall River counties, South Dakota and Niobrara, Weston, Converse, Campbell and Crook counties, Wyoming. In addition, information is provided for Shannon County, South Dakota (Pine Ridge Indian Reservation) because of its close proximity to the alternatives. Data presented in this section is primarily from the Bureau of the Census (BOC). Additional information was provided by the states.

3.3.2 Population. The information presented in this section was obtained from the BOC's Population Estimates Program. The information was made available on July 10, 1999 and can be reviewed at http://www.census.gov. Table 3-3 summarizes July 1, 1998 estimated population, and population change between July 1, 1997 and July 1, 1998, for the counties in the impact analysis area.

South Dakota and Wyoming are very sparsely populated and the state's populations changed very little between 1997 and 1998. According to BOC estimates, just over 100,000 people reside in the 3 counties in the impact analysis area in South Dakota while almost 60,000 people reside in the 5 counties in the Wyoming impact analysis area. Pennington County, which includes Rapid City, has the largest population. In fact, more people reside in Pennington County than in all of the other counties in the impact analysis area, combined.

Between 1997 and 1998, all the South Dakota counties in the impact analysis area had above state-average growth. Fall River County grew by 1.8 percent during the period and was the 6th fastest growing county in the state. However, in absolute terms, total Fall River County population increased by only 124 individuals. Shannon County showed the second largest growth rate at 1.2 percent.

Wyoming counties in the impact analysis area are generally less populated than those in South Dakota. Campbell County, with about 32,000 residents, has the highest population. Niobrara County is the least populated with only about 2,700 people. Weston County lost population between 1997 and 1998 while Niobrara, Campbell and Crook counties experienced population growth. Converse County population between 1997 and 1998 was essentially unchanged.

As can be seen on Table 3-4, except for Shannon County, the population in the impact analysis area is predominantly white non-hispanic. Custer, Niobrara, Weston and Crook counties are over 95 percent white non-hispanic. Fall River, Converse and Campbell counties are over 90 percent white non-hispanic and Pennington County is about 86 percent white non-hispanic. Only 4.8 percent of Shannon County is white non-hispanic.

Hispanics and American Indians are the next most common races found in the impact analysis area. The largest hispanic populations are found in Pennington and Campbell counties. Nearly 94 percent of the population in Shannon County is American Indian. Shannon County is home to the Pine Ridge Indian Reservation. American Indians comprise nearly 8 percent of the population of Pennington County but a relatively small portion (3.3 percent) of Custer County's population even though the county is adjacent to the reservation. Fall River County has a higher percentage (about 6 percent) of American Indians. Very few blacks are found in any of the counties. Blacks comprise only about 2 percent of the population in Pennington County.

3.3.3 Employment. The size of the labor force varies significantly across the counties in the impact analysis area (see Table 3-5). The largest labor force is located in Pennington and Campbell counties. The smallest labor force is in Niobrara County. For most of the counties, the labor force increases somewhat in the summer and decreases during the winter months. However, the magnitude of the labor force change between months varies considerably. Custer County shows the most change in the labor force from month-to-month. In 1998, the difference between the peak and low monthly total labor force in Custer County was 1,407 workers. This is significant considering that average monthly total labor force in Custer County is only 3,274 workers. On-the-other-hand, Campbell County demonstrated the most stable monthly total labor force between months. Monthly total employment over the year fluctuated by less than 1,000 workers. This is a relatively small change considering that county average monthly employment was over 18,500 workers.

Unemployment for 1998 for each of the counties in the impact analysis area is provided on Table 3-6. As can be seen on the table, unemployment is seasonally dependent with the highest unemployment rate occurring in all the counties, except Shannon County, during the winter months and then dropping sharply during the summer months.

In 1998 in the South Dakota counties, average annual unemployment ranged from a low of 2.6 percent to a high of 12.1 percent. The highest unemployment was in Shannon County and the lowest was Pennington County. All counties, except Shannon County, experienced the highest unemployment during the winter months, typically January through March.

Table 3-3 County Population Estimates for July 1, 1998 and Population Change from July 1, 1997 to July 1, 1998				
State/County	**July 1, 1998 Estimate**	**July 1, 1997 Estimate**	**Population Change 1997-1998**	**Percent Population Change 1997-1998**
South Dakota	**738,171**	**737,755**	**416**	**<0.1**
Pennington County	87,702	87,071	631	0.7
Custer County	6,930	6,896	34	0.5
Shannon County	12,183	12,040	143	1.2
Fall River County	7,133	7,009	124	1.8
Wyoming	**480,907**	**480,043**	**864**	**0.2**
Niobrara County	2,706	2,645	61	2.3
Weston County	6,472	6,508	-36	-0.6
Converse County	12,337	12,332	5	0.0
Campbell County	32,465	32,071	394	1.2
Crook County	5,829	5,820	9	0.2

Table 3-4 1997 Population Estimate by Age, Sex and Race for Counties in the Impact Analysis Area									
	South Dakota				**Wyoming**				
	Pennington	**Custer**	**Shannon**	**Fall River**	**Niobrara**	**Weston**	**Crook**	**Converse**	**Campbell**
White Non-Hispanic Male	37,299	3,380	324	3,420	1,242	3,183	2,899	5,659	15,593
Percent of county total	42.6	48.5	2.7	47.9	47.4	48.9	49.7	45.9	48.3
White Non-Hispanic Female	37,813	3,246	264	3,088	1,315	3,108	2,825	5,804	14,855
Percent of county total	43.1	46.6	2.2	43.2	50.2	47.7	48.5	47.1	46.1
Hispanic (of any race) Male	1,399	38	71	71	25	59	31	319	570
Percent of county total	1.6	0.6	0.6	1.0	1.0	0.9	0.5	2.6	1.8
Hispanic (of any race) Female	1,215	48	82	89	13	46	33	322	543
Percent of county total	1.4	0.7	0.7	1.2	0.5	0.7	0.6	2.6	1.7
Black Male	1,112	10	4	15	2	8	1	14	52
Percent of county total	1.3	0.1	<0.1	0.2	<0.1	0.1	<0.1	0.1	0.2
Black Female	782	6	4	20	6	0	1	11	39
Percent of county total	0.9	<0.1	<0.1	0.3	0.2	<0.1	<0.1	<0.1	0.1
Amer. Indian, Eskimo, & Aleut Male	3,095	110	5,619	182	7	39	17	72	220
Percent of county total	3.5	1.6	46.3	2.5	0.3	0.6	0.3	0.6	0.7
Amer. Indian, Eskimo, & Aleut Female	3,624	119	5,765	226	8	54	18	62	208
Percent of county total	4.1	1.7	47.5	3.2	0.3	0.8	0.3	0.5	0.6
Asian and Pacific Islander Male	521	4	4	13	1	3	1	30	95
Percent of county total	0.6	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	0.2	0.3
Asian and Pacific Islander Female	791	11	3	20	2	9	2	25	82
Percent of county total	0.9	0.2	<0.1	0.3	<0.1	0.1	<0.1	0.2	0.3
Total 1997 Population	87,651	6,972	12,140	7,144	2,621	6,509	5,828	12,318	32,257

Table 3-5 Total 1998 Labor Force by Month for Counties in the Impact Analysis Area									
Sector	South Dakota				Wyoming				
	Pennington	Custer	Shannon	Fall River	Niobrara	Weston	Converse	Crook	Campbell
January	45,577	2,792	3,281	3,364	1,126	3,202	6,241	2,716	18,706
February	45,595	2,737	3,291	3,295	1,146	3,264	6,365	2,748	19,019
March	46,034	2,781	3,388	3,392	1,169	3,253	6,393	2,789	19,236
April	46,462	2,876	3,173	3,398	1,293	3,278	6,474	2,890	19,066
May	47,664	3,477	3,263	3,534	1,309	3,287	6,476	3,042	18,942
June	48,780	4,032	3,523	3,758	1,291	3,360	6,571	3,214	19,530
July	49,260	4,144	3,390	3,894	1,262	3,274	6,834	3,157	19,311
August	48,490	4,044	3,490	3,768	1,305	3,292	6,958	3,086	19,336
September	47,807	3,631	3,459	3,677	1,319	3,408	6,662	3,114	18,883
October	47,554	3,095	3,546	3,618	1,374	3,454	6,648	3,097	19,353
November	47,426	2,934	3,519	3,600	1,413	3,513	6,673	3,171	19,377
December	46,511	2,742	3,425	3,453	1,320	3,446	6,458	2,971	19,326
Annual Average	47,254	3,274	3,394	3,562	1,278	3,336	6,563	2,999	19,174

South Dakota data were provided by Labor Market Information Center, South Dakota Department of Labor, Aberdeen, South Dakota. Wyoming data can be obtained at http://lmi.state.wy.us/

Table 3-6 1998 Unemployment Rate by Month for Counties in the Impact Analysis Area									
Month	South Dakota				Wyoming				
	Pennington	Custer	Shannon	Fall River	Niobrara	Weston	Converse	Crook	Campbell
January	4.0	8.9	8.8	6.4	3.5	6.9	6.0	8.0	5.7
February	3.5	7.5	7.9	4.2	3.1	7.0	6.3	8.6	6.2
March	3.3	7.4	8.3	5.4	2.9	6.5	6.7	8.5	6.1
April	2.9	5.0	8.4	3.1	3.4	5.3	5.9	5.6	4.8
May	2.4	4.1	7.9	2.2	2.8	4.4	4.5	4.6	4.6
June	2.4	2.7	19.5	2.2	2.5	4.8	5.3	4.5	4.8
July	2.0	2.1	22.1	2.3	2.9	3.6	5.2	4.2	4.5
August	1.8	2.2	21.5	1.8	2.5	4.1	4.5	3.7	4.1
September	2.0	2.3	11.0	1.7	1.6	3.6	4.2	3.8	4.3
October	2.0	2.7	9.8	2.2	2.8	3.8	4.4	4.1	4.3
November	2.5	5.2	10.0	3.0	2.8	4.1	5.3	4.6	4.6
December	2.3	6.3	9.5	2.5	2.8	3.8	5.1	5.0	4.2
Annual Average	2.6	4.4	12.1	3.0	2.8	4.8	5.3	5.3	4.8

South Dakota data were provided by Labor Market Information Center, South Dakota Department of Labor, Aberdeen, South Dakota. Wyoming data can be obtained at http://lmi.state.wy.us/

For example, even though annual average unemployment in Fall River County was only 3 percent, during January, February and March, unemployment was 6.4, 4.2 and 5.4 percent, respectively. Summer unemployment during 1998 in Fall River County was less than 2 percent in August and September. The same trend applies in Custer County. However, in 1998 Custer County experienced relatively high unemployment rates from early winter through early spring. Unemployment in Custer County exceeded 5 percent from January through April and in November and December, 1998. Peak unemployment reached 8.9 percent. The unemployment

pattern in Shannon County is the exact opposite of that in other South Dakota counties in the impact analysis area. In Shannon County, annual unemployment averaged 12.1 percent in 1998 (see Table 3-6). However, peak unemployment was during the summer months, particularly June through August, when unemployment reached about 20 percent. Unemployment rate peaked in July at 22.1 percent. In 1998, the lowest unemployment rate was reached in February and May at 7.9 percent.

Unemployment in the 5 Wyoming counties in the impact analysis area also varies by season. In 1998, Converse and Crook counties had the highest unemployment rate of all the Wyoming counties in the impact analysis area (see Table 3-6), but the rate was very similar to Weston and Campbell counties. Average unemployment for the year in Converse and Crook counties was 5.3 percent. In March, Converse County's unemployment rate peaked at 6.7 percent, however, the rate was below 5 percent in May through October. Crook County had the highest unemployment rate in any month (8.6 percent in February). However, the rate was below 5 percent in May through November. Campbell County's unemployment rate exceeded 5 percent in January through March, 1998 but was below 5 percent from April through December. The 1998 annual average unemployment rate for Campbell County was 4.8 percent. Weston County unemployment exceeded 5 percent for January through April, 1998 but was below 5 percent from May through December. Niobrara County had the lowest unemployment rate. Unemployment in 1998 did not exceed 3.5 percent in any month and averaged only 2.8 percent for the year.

Employment by sector for each county in the impact analysis area is provided on Table 3-7. South Dakota data is provided for 1997.[2] In Pennington County, the largest employment sector is services followed by retail trade. Services sector employment includes lodging, personal services (such as laundry, beauty shops, funeral homes, etc.), auto and appliance repair, entertainment (bowling, theaters, etc.), health services (clinics, hospital, etc.), legal services, etc. These sectors provide approximately 55 percent of all the jobs in Pennington County. Government is the third largest source of employment in Pennington County representing about 14 percent of total employment. Services, government and retail trade are also the largest employment sectors in Custer County. These 3 sectors provide nearly 85 percent of the county's total employment. Nearly 35 percent of the county's total employment is in the government sector which is the largest employment sector.

Services and government provide 84 percent of total employment in Shannon County (note: estimated employment for the agriculture and wholesale trade sectors are not available for Shannon County and have been excluded from the total employment estimate). Government, particularly the Federal government, is the largest employment sector in Fall River County, providing nearly 44 percent of total county employment. The Federal government employed 580 workers (23 percent of the total county employment) in Fall River County during 1997. Retail trade is also an important source of employment in the county.

Sector employment during 1998 for Wyoming counties in the impact analysis area is presented on Table 3-7.[3] Government is the largest employer in Niobrara County and provides about 49 percent of total county employment. Retail trade and services are also important employment sectors. Combined, these sectors provide about 31 percent of total county employment. Government is also the largest employment sector in Weston County, representing 32 percent of total county employment. Services and retail trade combined represent about 32 percent. Mining and manufacturing are also important sources of employment in Weston County, providing about 13 and 10 percent, respectively, of total county employment.

Government, mining and retail trade are the principal employment sectors in Converse County. Combined, these sectors provide over 60 percent of total county employment. Services is also important, providing nearly 12 percent of the county's total employment. Mining is the largest employment sector in Campbell County - 25 percent of Campbell County employment is directly related to mining. Services, retail trade, construction and government are also large employers. Combined, these sectors provide 60 percent of total county employment.

3.3.4 Income. Table 3-8 provides estimates of median household income for each county in the impact analysis area. Median household income in South Dakota is estimated at $29,426. Wyoming median household income is estimated to be slightly higher than South Dakota at $30,673. Median household income in Pennington and Custer counties exceed the state average by 14.8 and 2 percent, respectively. Fall River County median household income is about 10 percent less than the state average, whereas, Shannon County is about 39 percent less than the state average. Pennington County median household income is nearly twice that of Shannon County.

[2] South Dakota employment data is available from the South Dakota Labor Market Information Center's homepage at http://www.state.sd.us/dol/lmic

[3] This information is available from the State of Wyoming at http://eadiv.state.wy.us/almanac

Table 3-7 Employment by Sector for Counties in the Impact Analysis Area									
Sector	South Dakota 1997				Wyoming 1998				
	Pennington	Custer	Shannon	Fall River	Niobrara	Weston	Converse	Crook	Campbell
Agriculture and Forestry	276	7	(1)	56	11	10	74	18	92
Mining	241	19	0	32	36	269	687	301	4,133
Construction	2,798	96	86	33	34	51	329	83	1,583
Manufacturing	4,428	48	0	100	0	207	81	223	416
TCPU	1,878	73	22	67	30	163	380	117	762
Wholesale Trade	2,583	12	(1)	19	29	15	115	28	767
Retail Trade	11,334	511	215	579	163	388	820	283	2,798
FIRE	1,785	52	140	70	22	67	112	46	375
Services	13,079	502	1,639	458	76	281	500	157	2,391
Government	6,273	710	829	1,097	378	671	1,140	631	3,037
Total	44,675	2,029	2,934	2,511	779	2,122	4,238	1,887	16,354

TCPU = Transportation, Communications and Public Utilities
FIRE = Finance, Insurance and Real Estate
1 = Data is confidential and not available to the public

Table 3-8 Income Estimates for Counties in the Impact Analysis Area									
	South Dakota				Wyoming				
	Pennington	Custer	Shannon	Fall River	Niobrara	Weston	Converse	Crook	Campbell
Median household income	$33,779	$30,112	$18,070	$26,501	$25,682	$33,003	$34,464	$31,645	$45,852
Difference from State Average	+$4,353	+$686	-$11,356	-$2,925	-$4,991	+$2,330	+$3,791	+$972	+$15,179

Source: BOC's Small Area Income and Poverty Estimates Program. Released February, 1999. Data is available on BOC's web site at http://www.census.gov

All the counties in Wyoming, except Niobrara County, exceed the state median household income. Weston County is nearly 8 percent higher than the state average while Campbell County is almost 50 percent higher. Niobrara County median household income is nearly 16 percent less than the state average and median income in Campbell County is almost twice that of Niobrara County. Crook County is similar to the state average.

3.3.5 Poverty. Table 3-9 summarizes BOC's 1995 model-based poverty estimates for the counties in the impact analysis area. The estimates were released in February, 1999. To put these estimates in perspective, they are compared to state averages for South Dakota and Wyoming.

In South Dakota, the state average for people of all ages in poverty is 13.7 percent. Except for Shannon County, all counties in the impact analysis area in South Dakota are within 2 percentage points of the state average for people of all ages in poverty. Shannon County has 46.7 percent of all ages and nearly 60 percent of people under 18 and children in poverty.

For Shannon County, the estimate for people of all ages in poverty is nearly 3.5 times higher than the state average. Because of poverty and a county minority population exceeding 50 percent (American Indian), the U.S. Environmental Protection Agency (EPA) has listed Shannon County as an Environmental Justice Focus Area.[4]

The Wyoming state average for people of all ages in poverty is 11.5 percent. Although Niobrara County is 5 percentage points higher than the state average, all other Wyoming counties in the impact analysis area are below the state average. Niobrara County is also 8 percentage points higher than the state average of 15.7 percent for people under age 18 in poverty.

[4] See map at http://www.epa.gov/region08/gif/ej.gif

Table 3-9 1995 Model-Based Poverty Estimates for Counties in the Impact Analysis Area									
	South Dakota				Wyoming				
	Pennington	Custer	Shannon	Fall River	Niobrara	Weston	Converse	Crook	Campbell
People of all ages in poverty/Percent of county population	11,962 13.6%	819 12.1%	5,527 46.7%	1,004 14.9%	423 16.5%	630 9.6%	1,394 11.4%	564 9.7%	2,557 7.9%
People under age 18 in poverty/ Percent of county population	5,246 21.3%	311 17.4%	3,134 57.1%	355 20.9%	143 23.7%	225 12.1%	568 15%	219 12.6%	1,133 10.2%
Related children age 5-17 in families in poverty/Percent of county population	3,252 19.5%	209 15.3%	2,199 59.6%	227 17.4%	88 18.8%	145 10%	345 11.9%	136 10.4%	668 8%
Poverty estimates are available at the BOC's web site at http://www.census.gov									

Even though the Wyoming county poverty estimates are well below the 30 percent poverty level used by EPA to identify Environmental Justice Focus Areas, EPA did identify a portion of northeastern Converse County as a focus area. This area consists of the BOC's Block Numbering Area (BNA) 9561 which is shown on Figure 3-1.

BNA 9561 is made up of 6 individual block groups. According to the 1990 Census of Population and Housing, Block Groups 5 and 6 exceed 30 percent of the population below the poverty level. These block groups are also shown on Figure 3-1. Even though neither below poverty level block group would be crossed by the alternatives, BNA 9561 would be crossed by all the alternatives.

According to the 1990 Census of Population and Housing, Block Group 5 had a median household income of $11,250 and a per capita income of $2,965. All 51 people in 14 families in the block group for whom poverty status was determined by the census were determined to be below the poverty level. This included 29 persons 18 years and over but younger than 65 years and 22 children under 5 years of age.

Median household income for Block Group 6 was only $4,999 but per capita income was $3,500. Poverty status was determined for 2 people in this block group. Both were determined by the census to be below the poverty level. Both were determined to be older than 18 but less than 65 years of age.

The alternatives would be constructed through BNA 9561 in Block Group 1 (see Figure 3-1). Median household income in 1989 for this block group was $18,750 and per capita income was $9,527. No segment of the population in Block Group 1 was determined to be below the poverty level.

3.4 Transportation

3.4.1 Impact Analysis Area. The impact analysis area for transportation resources includes all public roads which would be crossed by the alternatives.

3.4.2 Affected Environment. Tables 3-10 through 3-14 provide lists of the major Federal, state, county and city highways, roads and streets which would be crossed by the alternatives. In addition to these major roads, the alternatives would also cross a number of less-traveled public roads. The Forest Service provides access for a number of uses on NFS lands, including hunting, recreation, livestock operations, oil and gas operations, mining, etc. Roads maintained by the Forest Service (grassland roads) which would be crossed by the alternatives are listed on Tables 3-15 through 3-17.

The grassland road crossings listed for Alternative C in Table 3-16 are the same as those which would be crossed by the Phiney Flat and W G Flat Route variations. However, the Phiney Flat Route Variation would cross Grassland Road 7060 (County Road 121) in 4 locations and the W G Flat Route Variation would not cross Grassland Road 7049 at all.

The mine loop options are excluded from the crossing tables. The Black Thunder South Mine Loop would cross State Highway 450 in Section 23, T. 43 N., R. 70 W. in Campbell County, Wyoming. No other state, county or grassland roads would be crossed by this option. The Black Thunder North option would not cross any state, county or grassland roads.

The North Antelope West Mine Loop would cross one major road, Irwin Road, in the Section 33, T. 41 N., R. 70 W. in Converse County. No state, county or grassland roads would be crossed by the North Antelope East Mine Loop.

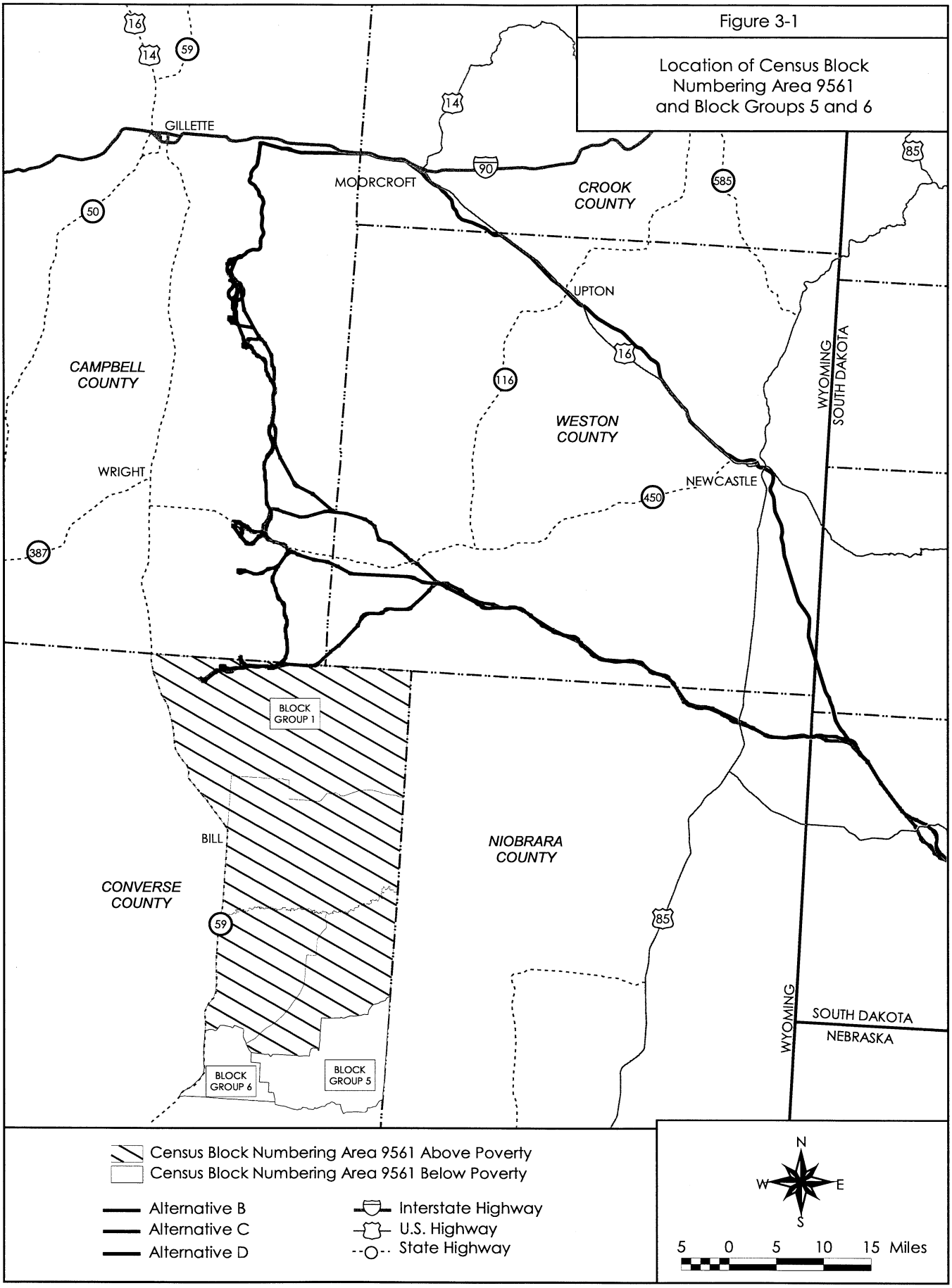
Figure 3-1
Location of Census Block Numbering Area 9561 and Block Groups 5 and 6
GILLETTE
MOORCROFT
CROOK COUNTY
UPTON
CAMPBELL COUNTY
WESTON COUNTY
WRIGHT
NEWCASTLE
WYOMING
SOUTH DAKOTA
BLOCK GROUP 1
BILL
NIOBRARA COUNTY
CONVERSE COUNTY
BLOCK GROUP 6
BLOCK GROUP 5
SOUTH DAKOTA
NEBRASKA
Census Block Numbering Area 9561 Above Poverty
Census Block Numbering Area 9561 Below Poverty
Alternative B
Alternative C
Alternative D
Interstate Highway
U.S. Highway
State Highway
N
W
E
S
5 0 5 10 15 Miles

Table 3-10
Major Roads Which Would be Crossed by Alternative B

Road Name	Legal Location
South Dakota	
Pennington County	
Township Road	NW/NW Section 31, T. 1 N., R. 16 E.
I-90	SE/NE Section 35, T 1 N., R. 15 E.
Baseline Road	NW/SE Section 35, T 1 N., R. 15 E.
Jensen Road	NE/NE Section 13, T. 1 N., R. 14 E.
Baseline Road	SE/SE Section 19, T. 1 N., R. 14 E.
Baseline Road	SW/NE Section 31, T. 1 N., R. 14 E.
State Highway 44	NW/SW Section 3, T. 2 S., R. 12 E.
Creston Road	SE/SE Section 4, T. 2 S., R. 12 E.
Custer County	
County Road 121 (Spring Creek Road)	SE/SW Section 15, T. 3 S., R. 11 E.
State Highway 40	NE Section 25, T. 4 S., R. 10 E.
County Road 21 (Cottonwood Cutoff)	SE/SW Section 7, T. 6 S., R. 9 E.
County Road 719 (148th Ave.)	NW/SW Section 18, T. 6 S., R. 9 E.
County Road 719 (268th Street)	SW/SE Section 13, T. 6 S., R. 9 E.
County Road 656 (Riverside Road)	SW/SW Section 24, T. 6 S., R. 8 E.
Fall River County	
County Road 2G	NW/NW Section 2, T. 7 S., R. 8 E.
County Road 2	SW/SE Section 27, T. 7 S., R. 7 E.
County Road 14	SW/SE Section 11, T. 8 S., R. 7 E.
County Road 2	SE/SE Section 25, T. 8 S., R. 7 E.
County Road 2	NW/SW Section 31, T. 8 S., R. 8 E.
County Road 1	SW/SW Section 31, T. 8 S., R. 8 E.
County Road 19	SW/NW Section 23, T. 9 S., R. 7 E.
U.S. Highway 18	SW/SW Section 21, T. 9 S., R. 7 E.
County Road 79	SW/SW Section 19, T. 9 S., R. 7 E.
County Road 6	NW/NE Section 30, T. 9 S., R. 6 E.
County Road 6	SW/SW Section 22, T. 9 S., R. 5 E.
County Road 6	SW/SE Section 20, T. 9 S., R. 5 E.
County Road 6C	NE/SW Section 29, T.9 S., R. 5 E.
State Highway 71	SW/SW Section 35, T. 9 S., R. 4 E.
County Road 3292	SW/SW Section 23, T. 9 S., R. 3 E.
County Road 6E	SW/SE Section 6, T. 9 S., R. 3 E.
Old U.S. Highway 18 (A Street)	SE/SE Section 36, T. 8 S., R. 2 E.
U.S. Highway 18	NW/SE Section 36, T. 8 S., R. 2 E.
Fall River County (continued)	
County Road 6463	SW/SW Section 25, T. 8 S., R. 2 E.
County Road 6463	SE/ NW Section 31, T. 7 S., R. 2 E.
County Road 6463	NE/NW Section 23, T. 7 S., R.1 E.
Wyoming	
Niobrara County	
Old Highway 85	NW/NW Section 24, T. 40 N., R. 61 W.
Township Road/Pipe Road	SW/SE Section 9, T. 40 N., R. 61 W.
U.S. Highway 85	NE/SE Section 8, T. 40 N., R. 61 W.
Weston County	
Morrisey Road	NW/NE Section 30, T. 41 N., R. 62 W.
Cheyenne River Road (Morrisey Road)	NE/NE Section 23, T. 41 N., R. 63 W.
Grieves Road (Cheyenne River Road)	NE/NE Section 5, T. 41 N., R. 64 W.
Dull Center Road (Bruce Road)	SW/NW Section 19, T. 42 N., R. 65 W.
Lynch Road	NE/SE Section 21, T. 42 N., R. 67 W.
State Highway 450	NW/NE Section 33, T. 43 N., R. 67 W.
Rochelle Road	NW/NW Section 30, T. 42 N., R. 67 W.
Rochelle Hills Road	SW/NW Section 17, T. 41 N., R. 68 W.
Campbell County	
Keeline Road	SW/NE Section 1, T. 43 N., R. 69 W.
Keeline Road	NE/NW Section 1, T. 43 N., R. 69 W.
Little Thunder Road	SW/NW Section 1, T. 43 N., R. 70 W.
Keeline Road	SW/NW Section 20, T. 44 N., R. 69 W.
T-7 Road	SW/SE Section 4, T. 46 N., R. 70 W.
T-7 Road	SE/NE Section 31, T. 47 N., R. 70 W.
Bishop Road	SE/SE Section 26, T. 48 N., R. 71 W.
Bishop Road	SW/SW Section 25, T. 48 N., R. 71 W.
Bishop Road	SE/SW Section 25, T. 48 N., R. 71 W.
State Highway 450	SW/NW Section 29, T. 43 N., R. 69 W.
Little Thunder Road	NW/NE Section 30, T. 43., R. 69 W.
School Creek Road	SE/NW Section 6, T. 42 N., R. 69 W.
School Creek Road	SW/NW Section 6, T. 42 N., R. 69 W.
Reno County Road	NE/NE Section 11, T. 42 N., R. 70 W.
Converse County	
Irwin Road	NW/SE Section 33, T. 41 N., R. 70 W.

Table 3-11
Major Roads Which Would be Crossed by Alternative C

Road Name	Legal Location
South Dakota	
Pennington County	
Township Road	NW/NW Section 31, T. 1 N., R. 16 E.
I-90	SE/NE Section 35, T 1 N., R. 15 E.
Baseline Road	NW/SE Section 35, T 1 N., R. 15 E.
Jensen Road	NE/NE Section 13, T. 1 N., R. 14 E.
Baseline Road	SE/SE Section 19, T. 1 N., R. 14 E.
Baseline Road	SW/NE Section 31, T. 1 N., R. 14 E.
State Highway 44	NE/SW Section 3, T. 2 S., R. 12 E.
Creston Road	SE/SE Section 4, T. 2 S., R. 12 E.
Creston Road	NE/SW Section 9, T. 2 S., R. 12 E.
Creston Road	NW/NW Section 16, T. 2 S., R. 12 E.
Custer County	
County Road 121 (Spring Creek Road)	SW/SE Section 15, T. 3 S., R. 11 E.
State Highway 40	NW/NE Section 31, T. 3 S., R.10 E.
County Road 18 (French Creek Road)	NE/NW Section 6, T. 5 S., R. 9 E.
County Road 21 (Cottonwood Cuttoff)	SW/SW Section 7, T. 6 S., R. 9 E.
County Road 719 (148th Ave.)	SW/NW Section 18, T. 6 S., R. 9 E.
County Road 719 (268th Ave.)	SW/SE Section 13, T. 6 S., R. 9 E.
County Road 656 (Riverside Road)	SW/SE Section 24, T. 6 S., R. 8 E.
Fall River County	
County Road 2C	NW/NE Section 11, T. 8 S., R. 8 E.
County Road 2	NW/SW Section 31, T. 8 S., R. 8 E.
County Road 1	SW/SW Section 31, T. 8 S., R. 8 E.
County Road 19	SW/NW Section 23, T. 9 S., R. 7 E.
U.S. Highway 18	SW/SW Section 21, T. 9 S., R. 7 E.
County Road 79	NW/NW Section 30, T. 9 S., R. 7 E.
County Road 6	NE/SE Section 30, T.9 S., R. 6 E.
County Road 6	SW/SW Section 22, T. 9 S., R. 5 E.
County Road 6	SW/SE Section 20, T. 9 S., R. 5 E.
County Road 6C	SE/NW Section 29, T.9 S., R. 5 E.
State Highway 71	SW/SW Section 26, T. 9 S., R. 4 E.
County Road 3292	SE/SW Section 23, T. 9 S., R. 3 E.
Old U.S. Highway 18 (County Road - 6463)	SE/NE Section 31, T. 8 S., R. 3 E.
U.S. Highway 18	NE/NW Section 31, T. 8 S., R. 3 E.
Fall River County (continued)	
County Road 6463	NW/SW Section 25, T. 8 S., R. 2 E.
County Road 6463	SE/NW Section 31, T. 7 S., R. 2 E.
County Road 6463	SE/SE Section 15, T.7 S., R. 1 E.
Wyoming	
Niobrara County	
Old Highway 85	NW/NW Section 24, T. 40 N., R. 61 W.
Township Road/Pipe Road	SE/SW Section 9, T. 40 N., R. 61 W.
U.S. Highway 85	SE/SE Section 8, T. 40 N., R. 61 W.
Weston County	
Morrisey Road	NW/NE Section 30, T. 41 N., R. 62 W.
Cheyenne River Road (Morrisey Road)	NE/NE Section 23, T. 41 N., R. 63 W.
Cheyenne River Road	NE/NW Section 4, T. 41 N., R. 64 W.
Cheyenne River Road (Grieves Road)	SE/SE Section 32, T. 42 N., R. 64 W.
Dull Center Road (Bruce Road)	SW/NW Section 19, T. 42 N., R. 65 W.
Lynch Road	NE/SE Section 6, T. 42 N., R. 67 W.
Piney Creek Road	NW/SW Section 6, T. 42 N., R. 67 W.
Campbell County	
State Highway 450	SW/NW Section 29, T. 43 N., R. 69 W.
Little Thunder Road	NW/NE Section 30, T. 43 N., R. 69 W.
Little Thunder Road	SW/SE Section 35, T. 44 N., R. 70 W.
Keeline Road	SW/SW Section 11, T. 44 N., R. 70 W.
T-7 Road	SW/NW Section 30, T. 47 N., R. 70 W.
Bishop Road	SE/SE Section 26, T. 48 N., R. 71 W.
Bishop Road	SW/SW Section 25, T. 48 N., R. 71 W.
School Creek Road	SE/NW Section 6, T. 42 N., R. 69 W.
Reno County Road	SW/SW Section 6, T. 42 N., R. 69 W.
Piney Creek Road (Mackey Road)	SE/NW Section 32, T. 42 N., R. 69 W.
School Creek Road	SW/NW Section 6, T. 42 N, R. 69 W.
Reno County Road	NE/NE Section 11, T. 42 N., R. 70 W.
Converse County	
Irwin Road	NE/SW Section 32, T. 41 N., R. 70 W.
Irwin Road	NW/SW Section 33, T. 41 N., R. 70 W.
Irwin Road	NE/SW Section 33, T. 41 N., R. 70 W.

Table 3-12
Major Roads Which Would be Crossed by Alternative C With the Phiney Flat Route Variation

Road Name	Legal Location
South Dakota	
Pennington County	
Township Road	NW/NW Section 31, T. 1 N., R. 16 E.
I-90	SE/NE Section 35, T 1 N., R. 15 E.
Baseline Road	NW/SE Section 35, T 1 N., R. 15 E.
Jensen Road	NE/NE Section 13, T. 1 N., R. 14 E.
Baseline Road	SE/SE Section 19, T. 1 N., R. 14 E.
Baseline Road	SW/NE Section 31, T. 1 N., R. 14 E.
State Highway 44	NE/SW Section 3, T. 2 S., R. 12 E.
Creston Road	SE/SE Section 4, T. 2 S., R. 12 E.
Creston Road	NE/SW Section 9, T. 2 S., R. 12 E.
Creston Road	NW/NW Section 16, T. 2 S., R. 12 E.
Creston Road	NW/NW Section 20, T. 2 S., R. 12 E.
Custer County	
County Road 121	NE/NE Section 7, T. 3 S., R. 12 E.
County Road 121	SE/SW Section 7, T. 3 S., R. 12 E.
County Road 121	SE/NE Section 13, T. 3 S., R. 11 E.
County Road 121	SW/SW Section 13, T. 3 S., R. 11 E.
State Highway 40	NW/NE Section 31, T. 3 S., R.10 E.
County Road 18	NE/NW Section 6, T. 5 S., R. 9 E.
County Road 21	SW/SW Section 7, T. 6 S., R. 9 E.
County Road 719	SW/NW Section 18, T. 6 S., R. 9 E.
County Road 719	SW/SE Section 13, T. 6 S., R. 9 E.
County Road 656	SW/SE Section 24, T. 6 S., R. 8 E.
Fall River County	
County Road 2C	NW/NE Section 11, T. 8 S., R. 8 E.
County Road 2	NW/SW Section 31, T. 8 S., R. 8 E.
County Road 1	SW/SW Section 31, T. 8 S., R. 8 E.
County Road 19	SW/NW Section 23, T. 9 S., R. 7 E.
U.S. Highway 18	SW/SW Section 21, T. 9 S., R. 7 E.
County Road 79	NW/NW Section 30, T. 9 S., R. 7 E.
County Road 6	NE/SE Section 30, T.9 S., R. 6 E.
County Road 6	SW/SW Section 22, T. 9 S., R. 5 E.
County Road 6	SW/SE Section 20, T. 9 S., R. 5 E.
County Road 6C	SE/NW Section 29, T.9 S., R. 5 E.
State Highway 71	SW/SW Section 26, T. 9 S., R. 4 E.
County Road 3292	SE/SW Section 23, T. 9 S., R. 3 E.
Old U.S. Highway 18	SE/NE Section 31, T. 8 S., R. 3 E.
Fall River County (continued)	
U.S. Highway 18	NE/NW Section 31, T. 8 S., R. 3 E.
County Road 6463	NW/SW Section 25, T. 8 S., R. 2 E.
County Road 6463	SE/NW Section 31, T. 7 S., R. 2 E.
County Road 6463	SE/SE Section 15, T.7 S., R. 1 E.
Wyoming	
Niobrara County	
Old Highway 85	NW/NW Section 24, T. 40 N., R. 61 W.
Township Road/Pipe Road	SE/SW Section 9, T. 40 N., R. 61 W.
U.S. Highway 85	SE/SE Section 8, T. 40 N., R. 61 W.
Weston County	
Morrisey Road	NW/NE Section 30, T. 41 N., R. 62 W.
Morrisey Road	NE/NE Section 23, T. 41 N., R. 63 W.
Cheyenne River Road	NE/NW Section 4, T. 41 N., R. 64 W.
Grieves Road	SE/SE Section 32, T. 42 N., R. 64 W.
Dull Center Road	SW/NW Section 19, T. 42 N., R. 65 W.
Lynch Road	NE/SE Section 6, T. 42 N., R. 67 W.
Piney Creek Road	NW/SW Section 6, T. 42 N., R. 67 W.
Campbell County	
State Highway 450	SW/NW Section 29, T. 43 N., R. 69 W.
Little Thunder Road	NW/NE Section 30, T. 43 N., R. 69 W.
Little Thunder Road	SW/SE Section 35, T. 44 N., R. 70 W.
Keeline Road	SW/SW Section 11, T. 44 N., R. 70 W.
T-7 Road	SW/NW Section 30, T. 47 N., R. 70 W.
Bishop Road	SE/SE Section 26, T. 48 N., R. 71 W.
Bishop Road	SW/SW Section 25, T. 48 N., R. 71 W.
School Creek Road	SE/NW Section 6, T. 42 N., R. 69 W.
Reno County Road	SW/SW Section 6, T. 42 N., R. 69 W.
Piney Creek Road	SE/NW Section 32, T. 42 N., R. 69 W.
School Creek Road	SW/NW Section 6, T. 42 N., R. 69 W.
Reno County Road	NE/NE Section 11, T. 42 N., R. 70 W.
Converse County	
Irwin Road	NE/SW Section 32, T. 41 N., R. 70 W.
Irwin Road	NW/SW Section 33, T. 41 W., R. 70 W.
Irwin Road	NE/SW Section 33, T. 41 W., R. 70 W.

Table 3-13
Major Roads Which Would be Crossed by Alternative C With the W G Route Variation

Road Name	Legal Location
South Dakota	
Pennington County	
Township Road	NW/NW Section 31, T. 1 N., R. 16 E.
I-90	SE/NE Section 35, T 1 N., R. 15 E.
Baseline Road	NW/SE Section 35, T 1 N., R. 15 E.
Jensen Road	NE/NE Section 13, T. 1 N., R. 14 E.
Baseline Road	SE/SE Section 19, T. 1 N., R. 14 E.
Baseline Road	SW/NE Section 31, T. 1 N., R. 14 E.
State Highway 44	NE/SW Section 3, T. 2 S., R. 12 E.
Creston Road	SE/SE Section 4, T. 2 S., R. 12 E.
Creston Road	NE/SW Section 9, T. 2 S., R. 12 E.
Creston Road	NW/NW Section 16, T. 2 S., R. 12 E.
Custer County	
County Road 121	SW/SE Section 15, T. 3 S., R. 11 E.
State Highway 40	NW/NE Section 31, T. 3 S., R.10 E.
County Road 18	NE/NW Section 6, T. 5 S., R. 9 E.
County Road 21	SW/SW Section 7, T. 6 S., R. 9 E.
County Road 719	SW/NW Section 18, T. 6 S., R. 9 E.
County Road 719	SW/SE Section 13, T. 6 S., R. 9 E.
County Road 656	SW/SE Section 24, T. 6 S., R. 8 E.
Fall River County	
County Road 2G	NW/NW Section 2, T. 7 S., R. 8 E.
County Road 2B	SW/SW Section 10, T. 7 S., R. 8 E.
County Road 2B	NW/NW Section 15, T. 7 S., R. 8 E.
County Road 2B	SW/SW Section 16, T. 7 S., R. 8 E.
County Road 2A	SW/SE Section 20, T. 7 S., R. 8 E.
County Road 2D	SE/SW Section 29, T. 7 S., R. 8 E.
County Road 2E	SE/SE Section 6, T. 8 S., R. 8 E.
County Road 2C	SE/SE Section 7, T. 8 S., R. 8 E.
County Road 2F	SE/SW Section 19, T. 8 S., R. 8 E.
County Road 2	NW/SW Section 31, T. 8 S., R. 8 E.
County Road 1	SW/SW Section 31, T. 8 S., R. 8 E.
County Road 19	SW/NW Section 23, T. 9 S., R. 7 E.
U.S. Highway 18	SW/SW Section 21, T. 9 S., R. 7 E.
County Road 79	NW/NW Section 30, T. 9 S., R. 7 E.
County Road 6	NE/SE Section 30, T.9 S., R. 6 E.
County Road 6	SW/SW Section 22, T. 9 S., R. 5 E.
County Road 6	SW/SE Section 20, T. 9 S., R. 5 E.
County Road 6C	SE/NW Section 29, T.9 S., R. 5 E.
State Highway 71	SW/SW Section 26, T. 9 S., R. 4 E.

Road Name	Legal Location
Fall River County (continued)	
County Road 3292	SE/SW Section 23, T. 9 S., R. 3 E.
Old U.S. Highway 18 (County Road - 6463)	SE/NE Section 31, T. 8 S., R. 3 E.
U.S. Highway 18	NE/NW Section 31, T. 8 S., R. 3 E.
County Road 6463	NW/SW Section 25, T. 8 S., R. 2 E.
County Road 6463	SE/NW Section 31, T. 7 S., R. 2 E.
County Road 6463	SE/SE Section 15, T.7 S., R. 1 E.
Wyoming	
Niobrara County	
Old Highway 85	NW/NW Section 24, T. 40 N., R. 61 W.
Township Road/Pipe Road	SE/SW Section 9, T. 40 N., R. 61 W.
U.S. Highway 85	SE/SE Section 8, T. 40 N., R. 61 W.
Weston County	
Morrisey Road	NW/NE Section 30, T. 41 N., R. 62 W.
Morrisey Road	NE/NE Section 23, T. 41 N., R. 63 W.
Cheyenne River Road	NE/NW Section 4, T. 41 N., R. 64 W.
Grieves Road	SE/SE Section 32, T. 42 N., R. 64 W.
Dull Center Road	SW/NW Section 19, T. 42 N., R. 65 W.
Lynch Road	NE/SE Section 6, T. 42 N., R. 67 W.
Piney Creek Road	NW/SW Section 6, T. 42 N., R. 67 W.
Campbell County	
State Highway 450	SW/NW Section 29, T. 43 N., R. 69 W.
Little Thunder Road	NW/NE Section 30, T. 43 N., R. 69 W.
Little Thunder Road	SW/SE Section 35, T. 44 N., R. 70 W.
Keeline Road	SW/SW Section 11, T. 44 N., R. 70 W.
T-7 Road	SW/NW Section 30, T. 47 N., R. 70 W.
Bishop Road	SE/SE Section 26, T. 48 N., R. 71 W.
Bishop Road	SW/SW Section 25, T. 48 N., R. 71 W.
School Creek Road	SE/NW Section 6, T. 42 N., R. 69 W.
Reno County Road	SW/SW Section 6, T. 42 N., R. 69 W.
Piney Creek Road	SE/NW Section 32, T. 42 N., R. 69 W.
School Creek Road	SW/NW Section 6, T. 42 N., R. 69 W.
Reno County Road	NE/NE Section 11, T. 42 N., R. 70 W.
Converse County	
Irwin Road	NE/SW Section 32, T. 41 N., R. 70 W.
Irwin Road	NW/SW Section 33, T. 41 N., R. 70 W.
Irwin Road	NE/SW Section 33, T. 41 N., R. 70 W.

Table 3-14 Major Roads Which Would be Crossed by Alternative D			
Road Name	**Legal Location**	**Road Name**	**Legal Location**
South Dakota		**Pennington County (continued)**	
Pennington County		Warren Lamb Road	NW/NE Section 27, T. 1 S., R. 8 E.
Baseline Road	NE/NE Section 6, T. 1 S., R. 16 E.	Antelope Creek Road	SE/SW Section 11, T. 1 S., R. 8 E.
I-90 Loop (South Blvd.)	SW/NW Section 6, T. 15 S., R. 16 E	Lower Spring Creek Road	NW/NE Section 27, T. 1 S., R. 8 E.
I-90	SW/NE Section 6, T. 1 S., R. 16 E.	Daughenbaugh Road	SE/SE Section 5, T. 2 S., R. 8 E.
I-90	SE/SW Section 1, T. 1 N., R. 14 E.	**Custer County**	
Jensen Road	SW/NW Section 1, T. 1 N., R. 14 E.	U.S. Highway 40 (Main)	NW/NE Section 32, T. 2 S., R. 8 E.
I-90	NE/NE Section 8, T. 1 N., R. 14 E.	Vilas Road	NE/NW Section 32, T. 2 S., R. 8 E.
Baseline Road	SE/NE Section 19, T. 1 N., R. 14 E.	County Road - 6	SW/SW Section 32, T. 2 S., R. 8 E.
173rd Avenue (Owanka Road)	NW/NW Section 29, T. 1 N., R. 13 E.	County Road - 7	NW/NW Section 19, T. 3 S., R. 8 E.
Sharpe Road	NE/SE Section 6, T. 1 N., R. 12 E.	County Road -18	SE/SW Section 7, T. 4 S., R. 8 E.
Libertine Road	NW/NE Section 2, T. 1 N., R. 12 E	French Creek Road (County Road -719)	NW/SW Section 19, T. 4 S., R. 8 E.
Knuppe Road	NW/SW Section 33, T. 2 N., R. 11 E.	County Road - 656	NW/SE Section 29, T. 6 S., R. 7 E.
161st Avenue (A. Ave.)	SW/NE Section 31, T. 2 N., R. 11 E.	Dewey Road	SE/NE Section 18, T. 6 S., R. 1 E.
Garrett Road	SW/NW Section 36, T. 2 N., R. 10 E.	**Fall River County**	
Spevak Road	NW/SW Section 29, T. 2 N., R. 10 E.	County Road -2	SW/SE Section 27, T. 7 S., R. 7 E.
Melke Road	NW/NW Section 27, T. 2 N., R. 9 E.	County Road - 14	SW/SE Section 11, T. 8 S., R. 7 E.
Spruce Drive	SW/SW Section 21, T. 2 N., R. 9 E.	County Road - 2	NW/NW Section 31, T. 8 S., R. 8 E.
Cottonwood Drive	SW/SE Section 20, T. 2 N., R. 9 E.	County Road - 2	NW/SW Section 31, T. 8 S., R. 8 E.
Cedar Street	SW/SW Section 20, T. 2 N., R. 9 E.	County Road - 1	SW/SW Section 31, T. 8 S., R. 8 E.
Cobler Road	SW/SW Section 19, T. 2 N., R. 9 E.	County Road - 19	SW/NW Section 23, T. 9 S., R. 7 E.
Elk Creek Road	SW/SW Section 27, T. 2 N., R. 8 E.	U. S. Highway 18	SW/SW Section 21, T. 9 S., R. 7 E.
Eglin Street	NW/SE Section 32, T. 2 N., R. 8 E.	County Road - 79	NW/NW Section 30, T. 9 S., R. 7 E.
I-16t	NW/NE Section 32, T. 2 N., R. 8 E.	County Road - 6	NE/SE Section 30, T. 9 S., R. 6 E.
Century Road	NW/NW Section 32, T. 2 N., R. 8 E.	County Road - 6	SW/SW Section 22, T. 9 S., R. 5 E.
North Lacrosse Street	SW/NE Section 31, T. 2 N., R. 8 E.	County Road - 6	SW/SE Section 20, T. 9 S., R. 5 E.
Milwaukee Street	NE/SW Section 31, T. 2 N., R. 8 E.	County Road - 6c	SE/NW Section 29, T. 9 S., R. 5 E.
Maple Avenue	SW/NW Section 31, T. 2 N., R. 8 E.	State Highway 71	SW/SW, Section 26, T. 9 S., R. 4 E.
East Blvd. North	NE/SE Section 36, T. 2 N., R. 7 E.	County Road 3292	SE/SW, Section 23, T. 9 S., R. 3 E.
New York Street	SE/SE Section 36, T. 2 N., R. 7 E.	County Road 6463 (Old Highway 18)	SE/NE, Section 31, T. 8 S., R. 3 E.
Omaha Street	SW/SE Section 36, T. 2 N., R. 7 E.	U.S. Highway 18	NE/NW Section 31, T. 8 S., R. 3 E.
2nd Street	NW/NE Section 1, T. 1 N., R. 7 E.	County 6463	NW/SW Section 25, T. 8 S., R. 2 E.
1st Street	NW/NE Section 1, T. 1 N., R. 7 E.	County 6463	SE/NW Section 31, T. 7 S., R. 2 E.
East Blvd.	NE/NE Section 1, T. 1 N., R. 7 E.	County 6463	SW/SE Section 4, T. 7 S., R. 1 E.
Maple Avenue	NW/NW Section 6, T. 1 N., R. 8 E.	**Wyoming**	
Steele Ave.	NW/SE Section 6, T. 1 N., R. 8 E.	**Weston County**	
E. Saint Charles Street	SE/SE Section 6, T. 1 N., R. 8 E.	Whoopup Canyon Road	NE/SW Section 30, T. 43 N., R. 60 W.
E. Saint Patrick Street	SE/SE Section 6, T. 1 N., R. 8 E.	Old Highway 85	SW/NE Section 10, T. 44 N., R. 61 W.
Campbell Street	SW/NE Section 8, T. 1 N., R. 8 E.	U. S. Highway 85	SW/SE Section 28, T 45 N., R. 61 W.

Table 3-14
Concluded

Road Name	Legal Location
Weston County (continued)	
Faye Ave.	SE/SW Section 28, T 45 N., R. 61 W.
U. S. Highway 16 By Pass	NE/SE Section 29, T. 45 N., R. 61 W.
West Main Street	SW/NE Section 29, T. 45 N., R. 61 W.
Walker Ave.	NE/NW Section 29, T. 45 N., R. 61 W.
Williams Ave.	NE/NW Section 29, T. 45 N., R. 61 W.
Grove Ave.	NE/NE Section 30, T. 45 N., R. 61 W.
Oil Creek Road	NE/NW Section 16, T. 45 N., R. 62 W.
E. Rail Road Street	NE/NE Section 16, T. 46 N., R. 63 W.
Skull Creek Rd.	SE/NE Section 9, T. 46 N., R. 63 W.
Baroid Road	SW/SW Section 30, T. 47 N., R. 63 W.
Highway 16	NE/NW Section 7, T. 47 N., R. 64 W.
Highway 116	SW/SE Section 35, T. 48 N., R. 65 W.
Pine Street	NE/SW Section 35, T. 48 N., R. 65 W.
Thorn Road	SE/NW Section 11, T. 48 N., R. 66 W.
Crook County	
Buffalo Creek Road (King Road)	NW/NW Section 23, T. 49 N., R. 67 W.
Warbonnet Road	NW/NE Section 8, T. 49 N., R. 67 W.
South Big Horn Ave.	NE/NW Section 6, T. 49 N., R. 67 W.
Donkey Creek Road	NE/SE Section 30, T. 50 N., R. 68 W.
Wessex Road	NW/SW Section 30, T. 50 N., R. 68 W.
Campbell County	
State Highway 51 (14/16)	SW/SE Section 27, T. 50 N., R. 69 W.
Stewart Road	SW/SW Section 27, T. 50 N., R. 69 W.
Adon Road	SW/SW Section 30, T. 50 N., R. 70 W.
Svaling Road	NE/SW Section 26, T. 50 N., R. 70 W.
State Highway 51 (14/16)	NE/SE Section 27, T. 50 N., R. 70 W.
Timber Creek Road	SW/SW Section 5, T. 49 N., R. 70 W.
Timber Creek Road	SW/SE Section 7, T. 49 N., R. 70 W.
Bishop Road	SE/SW Section 25, T. 48 N., R. 71 W.
Bishop Road	SE/SE Section 26, T. 48 N., R. 71 W.
Bishop Road	SW/SW Section 25, T. 48 N., R. 71 W.
Bishop Road	SW/SW Section 25, T. 48 N., R. 71 W.
T-7 Road	SE/SE Section 24, T. 47 N., R. 71 W.
Keeline Road	SW/SW Section 11, T. 44 N., R. 70 W.
Little Thunder Road	SW/SE Section 35, T. 44 N., R. 70 W.
State Highway 450	SW/NW Section 29, T. 43 N., R. 69 W.
Little Thunder Road	NW/NE Section 30, T. 43 N., R. 69 W.

Road Name	Legal Location
Campbell County (continued)	
School Creek Road	SE/NW Section 6, T. 42 N., R. 69 W.
Reno County Road	SW/SW Section 6, T. 42 N., R. 69 W.
Piney Creek Road (Mackey Road)	SE/NW Section 32, T. 42 N., R. 69 W.
School Creek Road	SW/NW Section 6, T. 42 N., R. 69 W.
Reno County Road	NE/NE Section 11, T. 42 N., R. 70 W.
Converse County	
Irwin Road	NE/SW Section 32, T. 41 N., R. 70 W.
Irwin Road	NW/SW Section 33, T. 41 N., R. 70 W.
Irwin Road	NE/SW Section 33, T. 41 N., R. 70 W.

Table 3-15 National Forest System (Grassland) Roads Which Would be Crossed by Alternative B		
Grassland Road Number	**County**	**Legal Location**
Buffalo Gap National Grassland		
Grassland Road 7068	Pennington	NE/SW Section 9, T. 2 S., R. 12 E.
Grassland Road 7067	Pennington	NE/SE Section 17, T. 2 S., R. 12 E.
Grassland Road 7060/Custer County Road 121	Custer	SE/SW Section 15, T. 3 S., R. 11 E.
Grassland Road 7053	Custer	SE/NW Section 27, T. 4 S., R. 10 E.
Grassland Road 7053	Custer	NE/NE Section 33, T. 4 S., R. 10 E.
Grassland Road 7053	Custer	SW/SE Section 33, T. 4 S., R. 10 E
Grassland Road 7042	Custer	NE/NE Section 13, T. 5 S., R. 9 E.
Grassland Road 7042	Custer	SW/NE Section 13, T. 5 S., R. 9 E.
Grassland Road 7042	Custer	NE/SE Section 14, T. 5 S., R. 9 E.
Grassland Road 7046/Custer County Road 719	Custer	NW/SW Section 18, T. 6 S., R. 8 E.
Grassland Road 7046/Custer County Road 656	Custer	SW/SW Section 24, T. 6 S., R. 9 E.
Thunder Basin National Grassland		
Grassland Road 937/Lynch Road	Weston	NE/SE Section 21, T. 42 N., R. 67 W.
Grassland Road 933	Weston	SW/NW Section 17, T. 41 N., R. 68 W.
Grassland Road 973	Campbell	SE/SW Section 29, T. 41 N., R. 69 W.
Grassland Road 930/Keeline Road	Campbell	SW/NE Section 1, T. 43 N., R. 69 W.
Grassland Road 930/Keeline Road	Campbell	NE/NW Section 1, T. 43 N., R. 69 W.
Grassland Road 930/Keeline Road	Campbell	SW/NW Section 20, T. 44 N., R. 69 W.
Grassland Road 968/School Creek	Campbell	SE/NW Section 6, T., 42 N., R. 69 W.
Grassland Road 968/School Creek	Campbell	SW/NW Section 6, T., 42 N., R. 69 W.

Table 3-16 National Forest System (Grassland) Roads Which Would be Crossed by Alternative C and the Route Variations		
Grassland Road Number	**County**	**Legal Location**
Buffalo Gap National Grassland		
Grassland Road 7068	Pennington	NE/SW Section 9, T. 2 S., R. 12 E.
Grassland Road 7067	Pennington	NE/SE Section 17, T. 2 S., R. 12 E.
Grassland Road 7060/Custer County Road 221	Custer	SW/SE Section 15, T. 3 S., R. 11 E.
Grassland Road 2048	Custer	SE/SE Section 27, T. 3 S., R. 10 E.
Grassland Road 7064	Custer	NE/NW Section 7, T. 5 S., R. 9 E.
Grassland Road 7046/Custer County Road 719	Custer	SW/NW Section 18, T. 6 S., R. 8 E.
Grassland Road 7046/Custer County Road 656	Custer	SW/SE Section 24, T. 6 S., R. 9 E.
Grassland Road 7049	Fall River	NW/NW Section 24, T. 7 S., R. 8 E.
Grassland Road 7049	Fall River	SW/NW Section 24, T. 7 S., R. 8 E.
Grassland Road 7049	Fall River	SW/NW Section 24, T. 7 S., R. 8 E.
Thunder Basin National Grassland		
Grassland Road 937/ Lynch Road	Weston	NE/SE Section 5, T. 42 N., R. 67 W.
Grassland Road 973	Campbell	SE/SE Section 17, T. 41 N., R. 69 W.
Grassland Road 1618	Campbell	NW/NE Section 8, T. 41 N., R. 69 W.
Grassland Road 968/School Creek	Campbell	SE/NW Section 6, T. 42 N., R. 69 W.
Grassland Road 930/Keeline Road	Campbell	SW/SW Section 11, T. 44 N., R. 70 W.
Grassland Road 968/School Creek	Campbell	SW/NW Section 6, T., 42 N., R. 69 W.

Table 3-17 National Forest System (Grassland) Roads Which Would be Crossed by Alternative D		
Grassland Road Number	**County**	**Legal Location**
Thunder Basin National Grassland		
Grassland Road 914/Baroid Road	Weston	SW/SW Section 30, T. 47 N., R. 63 W.
Grassland Road 973	Campbell	SE/SE Section 17, T. 41 N., R. 69 W.
Grassland Road 1618	Campbell	NW/NE Section 8, T. 41 N., R. 69 W.
Grassland Road 968/School Creek	Campbell	SE/NW Section 6, T. 42 N., R. 69 W.
Grassland Road 930/Keeline Road	Campbell	SW/SW Section 11, T. 44 N., R. 70 W.
Grassland Road 968/School Creek	Campbell	SW/NW Section 6, T., 42 N., R. 69 W.

3.5 Land Use

3.5.1 Impact Analysis Area. The USGS's National Cartographic Information Center distributes cartographic/geographic data files as part of the national mapping program. Part of that data includes land use and land cover. The basic source of land use and land cover compilation data are National Aeronautics & Space Administration (NASA) high-altitude aerial photographs and national high-altitude photography program photographs, usually at scales smaller than 1:60,000. For purposes of analyzing land uses potentially affected by the alternatives, 1:250,000 scale land use and land cover data were used.[5]

3.5.2 Affected Environment. USGS land use and land cover types in the vicinity of the alternatives are shown on Figures 3-2 (South Dakota) and 3-3 (Wyoming). Table 3-18 provides a summary of land use and land cover types which would be affected by Alternative B including the miles which would be crossed within each type. Tables 3-19 through 3-21 provide the same information for Alternative C and Alternative C with the Phiney Flat and W G Flat Route variations, respectively. Land use and land cover is summarized for Alternative D on Table 3-22.

The Black Thunder North Mine Loop would cross 3 land use and land cover types: herbaceous rangeland; industrial; and strip mines, quarries and gravel pits. The Black Thunder South Mine Loop would cross the same land use and land cover types but would also affect nonforested wetlands (see discussion of problems associated with the accuracy of this classification on page 3-26). The North Antelope East Mine Loop would cross cropland and pasture, herbaceous rangeland and shrub and brush rangeland. The North Antelope West Mine Loop would cross cropland and pasture and herbaceous rangeland.

[5] 1:250,000 and limited 1:100,000 scale land use and land cover data can be downloaded from the USGS's GeoData web site at http://edc.usgs.gov/doc/edchome/ndcdb/ndcdb.html

The Wall Yard would occupy 3 land use and land cover types: residential; mixed urban or built-up land; and cropland and pasture. The Edgemont Interchange Yard would be constructed within a herbaceous rangeland land use and land cover type. The Western Yard site consists of a mixture of herbaceous rangeland and small amounts of cropland and pasture.

Affected land use and land cover types are briefly described below:

Residential. Residential land uses range from high density, represented by the multiple-unit structures of urban cores, to low density, where homes are on lots of more than an acre and on the periphery of urban expansion. Areas of sparse residential land use, such as farmsteads, are typically included in categories to which they are related.

All alternatives would cross areas with residential land uses. Alternatives B and C (including the route variations) would only cross approximately 0.3 miles of residential areas in South Dakota. Neither alternative would cross areas classified by the USGS as residential in Wyoming. Alternative D would cross almost 6 miles of residential areas - mostly along DM&E's existing main line through Rapid City and adjacent to the BNSF through Newcastle and Moorcroft.

All the alternatives (including the route variations) would cross an area classified as residential at Smithwick in Fall River County in Section 31, T. 8 S., R. 8 E. and Section 6, T. 9 S., R. 8 E. Through the Smithwick area, the alternatives would be constructed on DM&E's existing Black Hills Subdivision Branch Line. The new railroad would replace the existing branch line adjacent to Smithwick.

Alternative B is routed directly adjacent to an area classified by USGS as residential in Fall River County east of Edgemont in Section 36, T. 8 S., R. 2 E. and Section 6, T. 9 S., R. 3 E. A number of residences are located within 0.1 miles or less of Alternative B at this location.

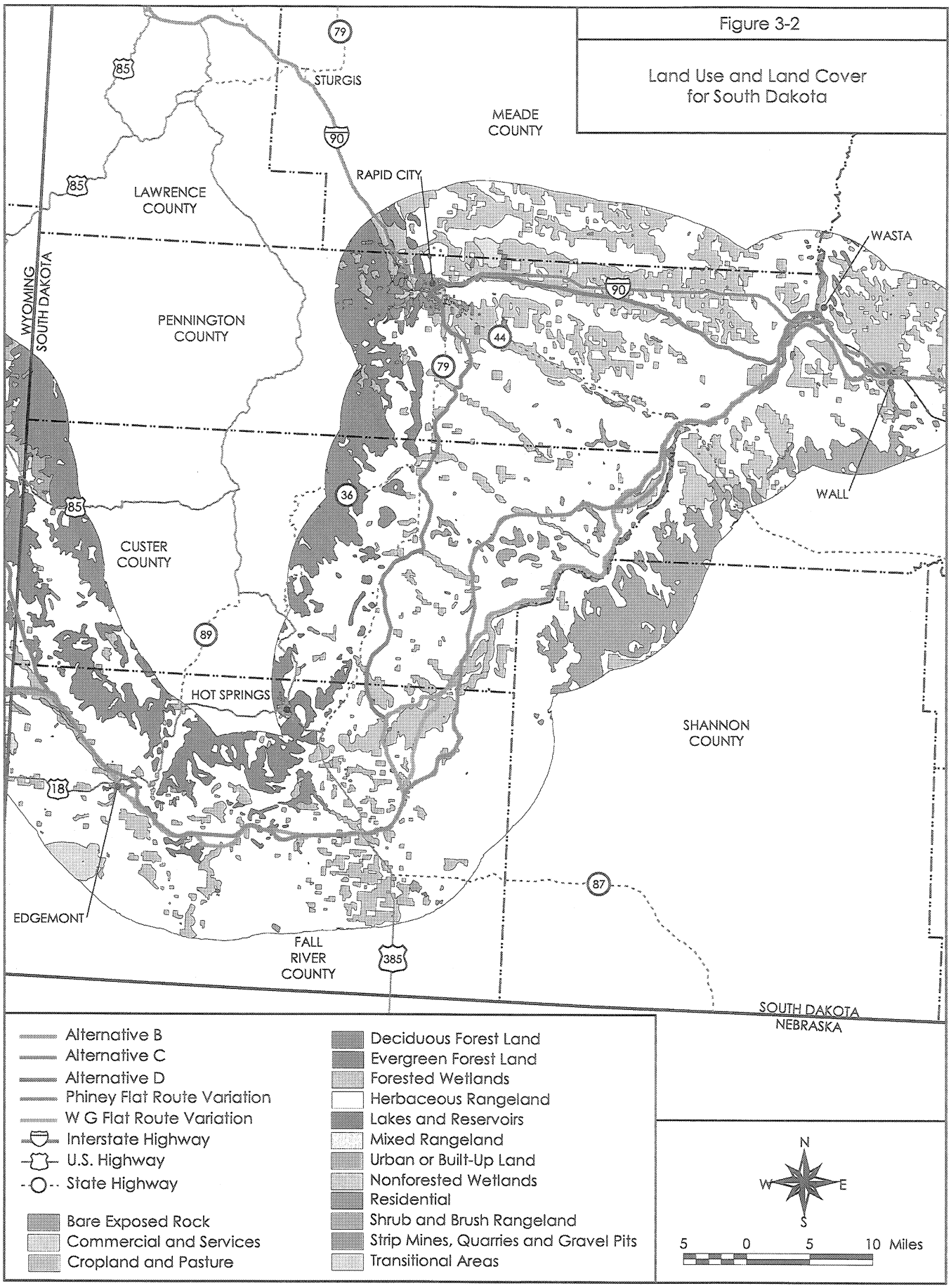
Figure 3-2
Land Use and Land Cover for South Dakota
STURGIS
MEADE COUNTY
RAPID CITY
LAWRENCE COUNTY
WASTA
WYOMING
SOUTH DAKOTA
PENNINGTON COUNTY
WALL
CUSTER COUNTY
HOT SPRINGS
SHANNON COUNTY
EDGEMONT
FALL RIVER COUNTY
SOUTH DAKOTA
NEBRASKA
Alternative B
Alternative C
Alternative D
Phiney Flat Route Variation
W G Flat Route Variation
Interstate Highway
U.S. Highway
State Highway
Bare Exposed Rock
Commercial and Services
Cropland and Pasture
Deciduous Forest Land
Evergreen Forest Land
Forested Wetlands
Herbaceous Rangeland
Lakes and Reservoirs
Mixed Rangeland
Urban or Built-Up Land
Nonforested Wetlands
Residential
Shrub and Brush Rangeland
Strip Mines, Quarries and Gravel Pits
Transitional Areas
N
W
E
S
5 0 5 10 Miles

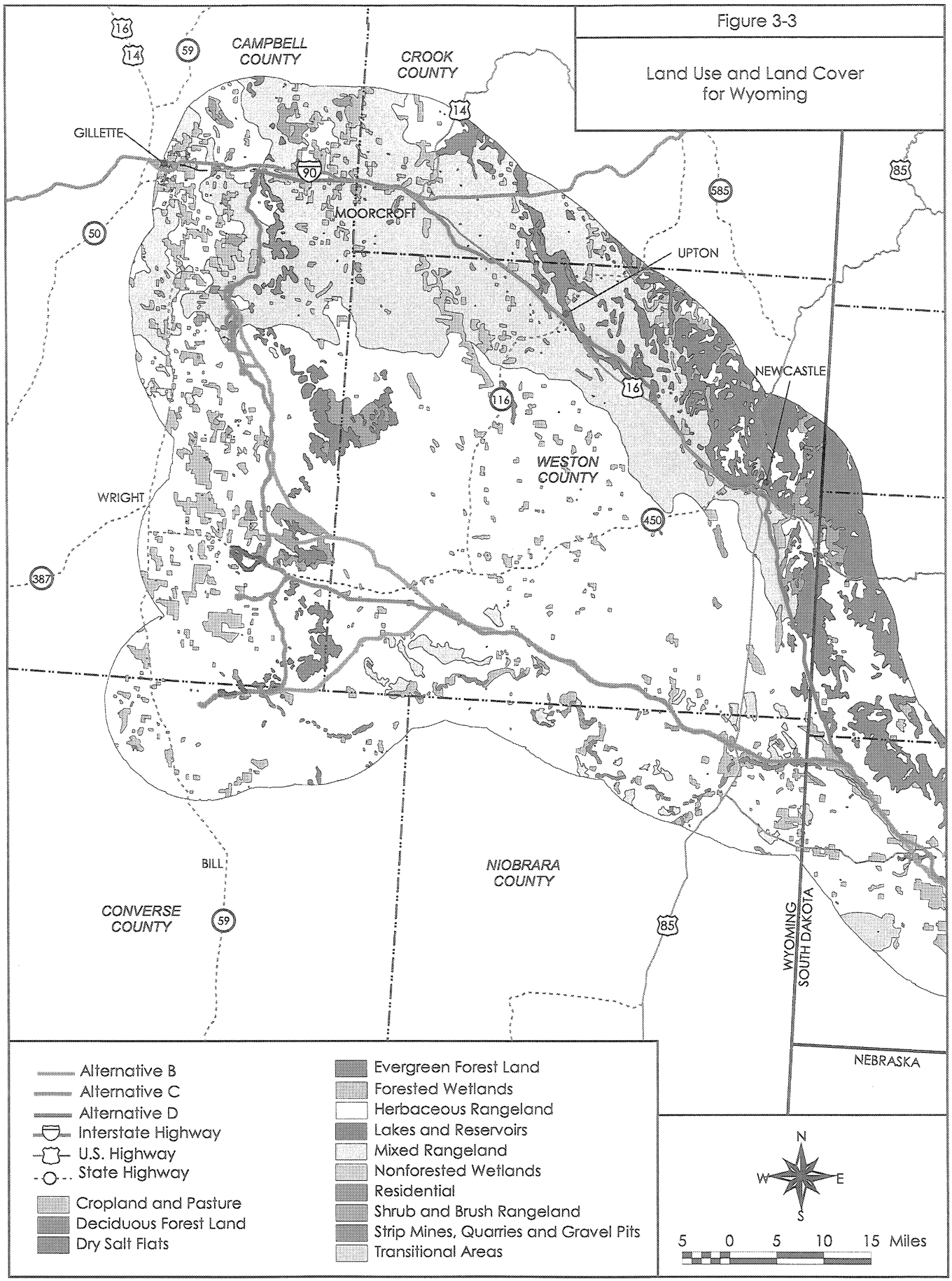
Figure 3-3
Land Use and Land Cover for Wyoming
CAMPBELL COUNTY
CROOK COUNTY
GILLETTE
MOORCROFT
UPTON
NEWCASTLE
WESTON COUNTY
WRIGHT
BILL
CONVERSE COUNTY
NIOBRARA COUNTY
WYOMING
SOUTH DAKOTA
NEBRASKA
16
14
59
90
50
585
85
116
450
387
Alternative B
Alternative C
Alternative D
Interstate Highway
U.S. Highway
State Highway
Cropland and Pasture
Deciduous Forest Land
Dry Salt Flats
Evergreen Forest Land
Forested Wetlands
Herbaceous Rangeland
Lakes and Reservoirs
Mixed Rangeland
Nonforested Wetlands
Residential
Shrub and Brush Rangeland
Strip Mines, Quarries and Gravel Pits
Transitional Areas
N
W
E
S
5 0 5 10 15 Miles

Table 3-18 Land Use and Land Cover Classifications Which Would be Crossed by Alternative B							
	Miles Crossed by Land Ownership					State Total (miles)	Percent of State
	Forest Service	DOE (1)	BLM	State	Private		
South Dakota							
Residential					0.3	0.3	0.2
Transportation, Communications and Utilities					0.1	0.1	0.1
Mixed Urban or Built-Up Land					0.2	0.2	0.1
Cropland and Pasture	<0.1			0.2	20.3	20.5	14.1
Other Agricultural Land					0.1	0.1	0.1
Herbaceous Rangeland	15.3	0.3	3.2	2.5	92.3	113.6	78.4
Evergreen Forest Land			0.1		2.3	2.4	1.7
Forested Wetlands	0.8				2.6	3.4	2.3
Nonforested Wetlands	0.2				3.3	3.5	2.4
Strip Mines, Quarries, and Gravel Pits					0.8	0.8	0.6
Total	16.3	0.3	3.3	2.7	122.3	144.9	100
Wyoming							
Industrial							
Cropland and Pasture	0.7				7.0	7.7	5.1
Herbaceous Rangeland	34.5		2.4	6.6	84.5	128.0	84.7
Shrub and Brush Rangeland	0.1			0.8	3.7	4.6	3.0
Mixed Rangeland	0.2		<0.1		9.8	10.0	6.6
Deciduous Forest Land					0.5	0.5	0.3
Strip Mines, Quarries, and Gravel Pits	0.1				0.3	0.4	0.3
Total	35.6		2.4	7.4	105.8	151.2	100
1 = DOE lands would only be crossed in South Dakota							

Alternative D would, by far, have the largest impact on residential areas. The alternative would cross through residential areas at its origin in Wall. Residential areas are located on both sides of DM&E's existing main line through the town. Residences are located adjacent to the track along Main Street and on the north and south sides of 4th Avenue. Additional residential areas are located next to the existing track along Myrtle Avenue and adjacent to the north and west sides of 7th Avenue west of Main Street.

Through Wasta DM&E's existing track crosses just south of town between Baseline Road and the Cheyenne River and the town's sewage lagoon. Residential areas are located north of the existing track, generally on the north side of Baseline Road. The existing main line also passes directly south of New Underwood between Elm Street and Boxelder Creek. Residences are located adjacent to Elm Street and Pine Street to the north of the existing main line. In addition, scattered residences are located south of the existing main line along A Avenue both north and south of Boxelder Creek.

West of Melke Road, Alternative D approaches the Town of Box Elder. On the east side of town a number of residences have been constructed south of Old Highway 14-16 and DM&E's existing main line. Residences are located south of Line Road adjacent to Willow Drive, Pine Drive, Spruce Drive, Circle Drive, Cottonwood Drive and Aspen Drive. All these residences are less than 0.1 miles south of the existing main line.

DM&E's existing main line passes north of the Town of Box Elder on the north side of Front Street. Residences are located in close proximity to the existing main line south of Front Street between Ash Street and Cedar Street. West of the town, residential areas are located north of the existing main line and south of I-90 and Ellsworth Air Force Base. These residential areas are located on the north side of Box Elder Road from about South Gate Road on the east to approximately Exit 63 on I-90 to the west. Throughout this area, DM&E's existing main line is located on the south side of Old Highway 14-16 whereas the majority of the residences are north of the highway.

Table 3-19 Land Use and Land Cover Classifications Which Would be Crossed by Alternative C						
	Miles Crossed by Land Ownership				State Total (miles)	Percent of State
	Forest Service	BLM	State	Private		
South Dakota						
Residential				0.3	0.3	0.2
Transportation, Communications and Utilities				0.1	0.1	0.1
Mixed Urban or Built-Up Land				0.1	0.1	0.1
Cropland and Pasture			0.5	19.9	20.4	14.3
Other Agricultural Land				0.2	0.2	0.1
Herbaceous Rangeland	5.2	2.7	1.5	100.6	110.0	77.1
Shrub and Brush Rangeland				<0.1		
Deciduous Forest Land		0.3	0.1	0.3	0.7	0.5
Evergreen Forest Land		0.4		2.6	3.0	2.1
Forested Wetlands				1.8	1.8	1.3
Nonforested Wetlands				4.3	4.3	3.0
Bare Exposed Rock	0.9			0.8	1.7	1.2
Total	6.1	3.4	2.1	131.0	142.6	100
Wyoming						
Industrial						
Cropland and Pasture	0.7			8.6	9.3	7.1
Herbaceous Rangeland	31.8	1.5	8.8	68.2	110.3	84.1
Shrub and Brush Rangeland			0.7	1.2	1.9	1.4
Mixed Rangeland			0.1	9.3	9.4	7.2
Evergreen Forest Land	0.3				0.3	0.2
Total	32.8	1.5	9.6	87.3	131.2	100

As was discussed previously, this alternative assumes that DM&E's existing main line and the Black Hills Subdivision Branch Line through Rapid City are rebuilt as a heavy haul railroad. Much of these existing routes cross through or adjacent to residential areas. In reality, if these lines were to be rebuilt, an alternative alignment around Rapid City would be required.

On the northeast side of Rapid City, DM&E's existing main line passes directly north of Mockingbird Lane and Meadowlark Road. A number of additional residences are located south of the alternative east of LaCrosse Street and north of Adams Street including along Pheasant Drive. West of LaCrosse Street and east of Milwaukee Street, residential areas are located adjacent to the existing main line along Monroe Street, Racine Street and Waterloo Street. North of North Street the existing main line is aligned adjacent to residences along Herman Street, Maple Avenue and Watertown Street.

On the south side of Rapid City, along the Black Hills Subdivision Branch Line and adjacent to Saint Joseph Street and State Highway 79, residential areas are located directly east of the existing branch line along Cherry Avenue, Saint James Street, Saint Cloud Street and Franklin Street. Generally, these areas are located north of Saint Patrick Street. Additional residential areas are in close proximity to the branch line east of Campbell Street and north of Saint Francis Street.

Residential areas are located east and west of the existing branch line through Hermosa. The closest residences are located east of 2nd Street and south of Main Street (State Highway 40). All of Hermosa is located within about 0.5 miles of the branch line. Around Fairburn, the existing branch line runs north of 1st and 2nd streets. Residences are located along both streets with most of the town located to the south of the branch line. All of the town is within about 0.3 miles of the branch line.

No residential areas would be affected by Alternative D between south of Smithwick and where the alternative deviates from Alternative C near the South Dakota-Wyoming State line. However, north of the alternative's

Table 3-20 Land Use and Land Cover Classifications Which Would be Crossed by Alternative C With the Phiney Flat Route Variation						
	Miles Crossed by Land Ownership				State Total (miles)	Percent of State
	Forest Service	BLM	State	Private		
South Dakota						
Residential				0.3	0.3	0.2
Transportation, Communications and Utilities				0.1	0.1	0.1
Mixed Urban or Built-Up Land				0.1	0.1	0.1
Cropland and Pasture			0.5	25.1	25.6	17.9
Other Agricultural Land				0.2	0.2	0.1
Herbaceous Rangeland	4.4	2.7	1.5	97.2	105.8	73.7
Shrub and Brush Rangeland				<0.1	<0.1	<0.1
Deciduous Forest Land		0.3	0.1	0.3	0.7	0.5
Evergreen Forest Land		0.4		2.6	3.0	2.1
Forested Wetlands				1.6	1.6	1.1
Nonforested Wetlands				4.3	4.3	3.0
Bare Exposed Rock	0.9			0.8	1.7	1.2
Total	5.3	3.4	2.1	132.6	143.4	100
Wyoming						
Industrial						
Cropland and Pasture	0.7			8.6	9.3	7.1
Herbaceous Rangeland	31.8	1.5	8.8	68.2	110.3	84.1
Shrub and Brush Rangeland			0.7	1.2	1.9	1.4
Mixed Rangeland			0.1	9.3	9.4	7.2
Evergreen Forest Land	0.3				0.3	0.2
Total	32.8	1.5	9.6	87.3	131.2	100

departure from Alternative C, the USGS has mapped the area crossed near Dewey as residential. In this area, Alternative D would be constructed directly adjacent to the BNSF. All the residences around Dewey would be located within 0.2 miles of the alternative.

Alternative D would cross through residential areas in Newcastle. On the east side of town, the alternative would be constructed adjacent to the BNSF and south of Old Highway 85. Residential areas are located on the north side of Old Highway 85 in this area along Oak Street, Gray Boulevard, Cedar Street and Ash Street. The alternative would again approach residential areas on the west side of the Highway 16 bypass near Seneca Avenue. North of Main Street, residential areas are located on both sides of the alternative including areas north of Cambria Street and Railroad Street and south of Sunset Street and Railroad Street. In fact, it may be difficult to route the alternative on the north side of the BNSF through Newcastle north of the Highway 16 bypass without impacting residences along Cambria Street and Timber Avenue/Railroad Street.

If the alternative was routed on the south side of BNSF through Newcastle, equally severe impacts would occur to residences located on Sunset Street. Consequently, unless DM&E could find a way to construct the alternative within BNSF's existing right-of-way, the route evaluated through Newcastle for this alternative may not be feasible.

Through Osage the alternative is routed on the east side of BNSF. Osage is located west of the BNSF. However, the entire town is situated within 0.5 miles of the alternative. The closest residences are located along Nefsy Avenue between McGrew Street and Sheridan Street on the south end of town.

Upton is located east of the BNSF. Alternative D is routed between the BNSF and the town and the entire town is located within about 0.5 miles of the alternative. The alternative would pass on the southwest side of Upton southwest of First Street adjacent to BNSF. Most of the residences in Upton are located northeast of Second Street.

Table 3-21 Land Use and Land Cover Classifications Which Would be Crossed by Alternative C With the W G Flat Route Variation						
	Miles Crossed by Land Ownership				State Total (miles)	Percent of State
	Forest Service	BLM	State	Private		
South Dakota						
Residential				0.3	0.3	0.2
Transportation, Communications and Utilities				0.1	0.1	0.1
Mixed Urban or Built-Up Land				0.1	0.1	0.1
Cropland and Pasture		0.1	0.5	24.3	24.9	17.6
Other Agricultural Land				0.2	0.2	0.1
Herbaceous Rangeland	5.2	2.7	1.5	97.7	107.1	75.7
Shrub and Brush Rangeland				<0.1	<0.1	<0.1
Deciduous Forest Land		0.3	0.1	0.3	0.7	0.5
Evergreen Forest Land		0.4		2.6	3.0	2.1
Forested Wetlands				1.8	1.8	1.3
Nonforested Wetlands				1.5	1.5	1.1
Bare Exposed Rock	0.9			0.8	1.7	1.2
Total	6.1	3.5	2.1	129.7	141.4	100
Wyoming						
Industrial						
Cropland and Pasture	0.7			8.6	9.3	7.1
Herbaceous Rangeland	31.8	1.5	8.8	68.2	110.3	84.1
Shrub and Brush Rangeland			0.7	1.2	1.9	1.4
Mixed Rangeland			0.1	9.3	9.4	7.2
Evergreen Forest Land	0.3				0.3	0.2
Total	32.8	1.5	9.6	87.3	131.2	100

Alternative D would pass on the southwest side of Moorcroft between Rush Creek and Railroad Avenue. A number of residences are located north of Railroad Street, east and west of Yellowstone Avenue. These residences may preclude construction of the alternative on the north side of the BNSF through town. For Alternative D to be feasible, it may be necessary to cross to the south side of BNSF east of Moorcroft. The area near the intersection of Big Horn Avenue and Railroad Street is particularly tight.

Industrial. This category includes a wide array of land uses from light manufacturing to heavy manufacturing plants. Light industrial areas may be directly in contact with urban areas; many are found at airports or in relatively open country. Heavy industries use raw materials such as iron ore, timber or coal. Included are steel mills, pulp and lumber mills, electric power generating stations, oil refineries and tank farms, chemical plants, and brick making plants. Stockpiles of raw materials and waste-product disposal areas are usually visible, along with transportation facilities capable of handling heavy materials. In South Dakota, Alternative D would cross 2 areas classified as industrial in and adjacent to Rapid City (0.5 miles, combined).

Transportation, Communications and Utilities. These land uses occur to some degree within all of the other urban or built-up categories and actually can be found within many other categories. Unless they can be mapped separately by the USGS, they usually are considered an integral part of the land use within which they occur. According to the USGS, any statistical summary of the area of land uses in this category typically represents only a partial data set. Major transportation routes and areas greatly influence other land uses, and many land use boundaries are outlined by them. The types and extent of transportation facilities in a locality determine the degree of access and influence both the present and potential use of the area. Highways and railways are characterized by areas of activity connected in linear patterns.

Table 3-22 Land Use and Land Cover Classifications Which Would be Crossed by Alternative D						
	Miles Crossed by Land Ownership				State Total (miles)	Percent of State
	Forest Service	BLM	State	Private		
South Dakota						
Residential				3.8	3.8	2.1
Commercial and Services				3.3	3.3	1.8
Industrial				0.5	0.5	0.3
Transportation, Communications and Utilities				0.5	0.5	0.3
Mixed Urban or Build-Up Land				1.8	1.8	1.0
Cropland and Pasture				42.3	42.3	23.6
Other Agricultural Land				0.2	0.2	0.1
Herbaceous Rangeland		0.9	2.0	116.2	119.1	66.4
Deciduous Forest Land				0.5	0.5	0.3
Evergreen Forest Land		0.4		1.9	2.3	1.3
Forested Wetlands				1.3	1.3	0.7
Nonforested Wetlands				3.3	3.3	1.8
Bare Exposed Rock				0.1	0.1	0.1
Strip Mines, Quarries, and Gravel Pits				0.3	0.3	0.2
Total		1.3	2.0	176.0	179.3	100
Wyoming						
Residential				2.1	2.1	1.2
Commercial and Services				0.5	0.5	0.3
Industrial				0.6	0.6	0.3
Transportation, Communications and Utilities			0.9	9.9	10.8	6.0
Mixed Urban or Built-Up Land				0.1	0.1	0.1
Cropland and Pasture	<0.1		0.2	8.2	8.4	4.6
Other Agricultural Land				0.1	0.1	0.1
Herbaceous Rangeland	20.0	0.1	4.3	44.4	68.8	38.0
Shrub and Brush Rangeland		<0.1		1.4	1.4	0.8
Mixed Rangeland	5.5	1.6	3.4	68.8	79.3	43.8
Evergreen Forest Land	1.1			5.9	7.0	3.9
Strip Mines, Quarries, and Gravel Pits	0.1			1.5	1.6	0.9
Total	26.7	1.7	8.8	143.5	180.7	100

The highways include rights-of-way, areas used for interchanges, and service and terminal facilities. Rail facilities include stations, parking lots, roundhouses, repair and switching yards, and related areas, as well as overland track and spur connections of sufficient width for delineation at mapping scale. Communications and utilities areas (such as those involved in processing, treatment and transportation of water, gas, oil and electricity) and areas used for airwave communications are also included in this category. Pumping stations, electric substations, and areas used for radio, radar, or television antennas are the major types. Small facilities, such as those associated with an industrial or commercial land use, are included within the larger category with which they are associated. Long-distance gas, oil, electric, telephone, water, or other transmission facilities rarely constitute the dominant land use of the lands with which they are associated.

Alternatives B and C (including the route variations) would cross 0.1 miles of this category in Pennington County at the crossing of I-90 west of Wall in Section 35, T. 1 N., R. 15 E. Alternative D would cross 0.5 miles of this category in the I-90 corridor at Wall and near Wasta.

In Wyoming, 10.8 miles of this category would be crossed by Alternative D in the Donkey Creek drainage near Rozet. The area includes the joint BNSF/State Highway 51 corridor. The area containing the Newcastle airport also contains lands of this classification.

Mixed Urban or Built-Up Land. This category includes developments along transportation routes and in cities, towns, and built-up areas where land uses cannot be mapped individually. Residential, commercial, industrial, and occasionally other land uses may be included. Farmsteads, intermixed with strip or cluster settlements, are included within the built-up land, but other agricultural land uses are excluded. All the alternatives would cross this category north of Wall just west of Pedro Wall Road in Section 31, T. 1 N., R. 16 E. Alternatives B and D would cross approximately 0.2 miles of this category at Oral in Sections 27 and 34, T. 7 S., R. 7 E. within DM&E's Black Hills Subdivision Branch Line. Alternative D would cross this category east of Rapid City and in downtown Rapid City generally on the north side of Rapid Creek between Omaha Street and North Street. In Wyoming, this land use and land cover category would be crossed in Upton and Moorcroft by Alternative D.

Cropland and Pasture. This category includes cropland harvested, including bush fruits; cultivated summer-fallow and idle cropland; land on which crop failure occurs; cropland in soil-improvement grasses and legumes; cropland used only for pasture in rotation with crops; and pasture on land more or less permanently used for that purpose. Both Alternatives B and C would cross about 20 miles of the cropland and pasture category in South Dakota. Both the Phiney Flat and W G Flat route variations would cross an additional 5 miles of this land use and land cover category. Alternative D would cross over 42 miles of this category in South Dakota. In Wyoming, approximately 7 to 10 miles of this category would be crossed by all of the alternatives.

Other Agricultural Land. This land use includes farmsteads, holding areas for livestock such as corrals, breeding and training facilities on horse farms, farm lanes and roads, ditches and canals, small farm ponds, and similar uses associated with other agricultural land uses. Small amounts (0.1 mile for Alternative B and 0.2 mile for all of the other alternatives) of this category would be crossed in South Dakota. Alternative D would cross a small amount of this category (0.1 mile) in Wyoming.

Herbaceous Rangeland. The herbaceous rangeland category encompasses lands dominated by naturally occurring grasses and forbs as well as those areas of actual rangeland which have been modified to include grasses and forbs as their principal cover, when the land is managed for rangeland purposes and not managed using practices typical of pastureland. It includes the tall grass, short grass, bunch grass and other grass regions. Typical occurrences of grasslands include such species as bluestems, grama grasses, wheatgrasses, needle-grasses and fescues. This is the dominant land use category crossed in both states by Alternatives B and C (including the route variations). It compromises approximately 70 to 80 percent of these alternatives. It is also the dominant land use land cover which would be crossed by Alternative D in South Dakota. However, in Wyoming, mixed range is more common than herbaceous range along Alternative D.

Shrub and Brush Rangeland. This type includes shrubs found in arid and semiarid regions characterized by xerophytic vegetation types with woody stems such as big sagebrush, shadscale and greasewood. Where highly alkaline soils are present, halophytes such as saltbush may occur. Also included in this category are areas with mountain mahogany and scrub oaks. This category would be mostly crossed in Wyoming and becomes more prevalent as the alternatives move toward the west.

Mixed Rangeland. When more than one-third of either herbaceous or shrub and brush rangeland species occur in an area, it is classified by the USGS as mixed rangeland. This type is more common in the northern portions of the project area in northern Campbell and Weston counties. Alternatives B and C would cross this category north of the Belle Fourche River crossing on the northern legs of the alternatives. Alternative D would cross a much larger amount of this category (approximately 80 miles) - mixed rangeland is the predominant land use and land cover type which would be affected by this alternative in Wyoming.

Deciduous Forest Land. This forest type includes all forested areas having a predominance of trees that lose their leaves at the end of the frost-free season or at the beginning of the dry season. Oaks and aspen stands are included in this category. Cottonwoods, which are more typical of wetlands, are not included in this type. This type is associated primarily with the Cheyenne River drainage. About 0.7 and 0.5 miles of this type would be crossed by Alternative C (including the route variations) and D, respectively, in South Dakota and about 0.5 miles would be crossed by Alternative B in Wyoming.

Evergreen Forest Land. In the impact analysis area, this type includes all forested areas in which the trees are predominantly coniferous. All alternatives would cross this category In Fall River County southeast of Edgemont on the south side of the Black Hills. Seven miles of this category would be crossed by Alternative D in Wyoming. Most of these areas are located on the western edge of the Black Hills near Clifton, Newcastle and Osage,

Wyoming. Also included is the area known as Pine Ridge near Upton.

Nonforested Wetlands. These wetlands are dominated by wetland herbaceous vegetation or are nonvegetated. These wetlands include wet meadows and wet prairies. Due to the scale of the USGS land use and land cover mapping, the estimates for this category are considered unreliable. Refer to Section 3.16 for a better estimate of potential wetland impacts by type. Detailed descriptions of wetlands that are located adjacent to Alternative C (including the route variations) can be found in the COE 404 application wetland delineation reports prepared by DM&E.

Forested Wetlands. These wetlands are dominated by woody vegetation. In the project area, forested wetlands are typically dominated by cottonwood and willow. Due to the scale of the USGS mapping, the estimates for this category are considered unreliable. Refer to Section 3.16 for a better estimate of potential wetland impacts by type.

Bare Exposed Rock. This category includes areas of bedrock exposure, scarps, talus, slides and other accumulations of rock without vegetative cover. Much of Badlands National Park is characterized as this type. About 1.7 miles of this category would be crossed by Alternative C (including the route variations) in South Dakota northwest of Badlands National Park and west of Horsehead Creek and south of Angostura Reservoir. Alternative D would also cross this category west of Horsehead Creek.

Strip Mines, Quarries and Gravel Pits. Those extractive mining activities that have significant surface expression are identified in this category. Vegetative cover and overburden are removed to expose minerals. Current mining activity is not always distinguishable, and inactive, unreclaimed, and active strip mines, quarries, borrow pits, and gravel pits are included in this category until other cover or use has been established. Unused pits or quarries that have been flooded are placed in the appropriate water category.

Alternative D would cross through clay pits near Colloid and Bentley, Wyoming which are identified by USGS as this category. Clay pits would also be crossed by this alternative southeast of Upton near the Little Turner Creek crossing. In South Dakota, Alternative D would cross through gravel pits on the Cheyenne River east of Wasta that are included in this category. Immediately east of Edgemont, Alternative B would cross through an area which contains uranium tailings and ponds being reclaimed by DOE.

3.6 Recreation Resources

3.6.1 Impact Analysis Area. Any area directly impacted or potentially affected by operating noise from the alternatives is included in the recreation impact analysis area.

3.6.2 Recreation Activities. The eastern portion of the project area contains recreation resources of national significance (see Figure 1-1). Included are well-known and heavily visited national parks such as Badlands and Wind Cave. Many tourists are initially attracted to the Black Hills by Mount Rushmore. However, other area recreation destinations, such as Custer State Park, Black Hills National Forest and Angostura Reservoir State Recreation Area, also attract large numbers of visitors. Consequently, recreation is very important to the economy of western South Dakota.

3.6.2.1 National Forest System Lands. Many of the recreation opportunities in the general project area are located on NFS lands. In most cases, recreation activities on NFS lands are unstructured and dispersed. Except as noted below, there are few developed recreation sites in close proximity to any of the alternatives.

Many of the recreation amenities TBNG and BGNG offer are unquantifiable and unmeasurable. Because of the vastness of the lands and predominantly dispersed types of recreation that occur, it is difficult to determine actual use numbers for any particular activity and area. Although the majority of the use occurs during the big game hunting seasons in the fall, recreation use occurs year-round due to the limited snowfall on the grasslands. The recent Northern Great Plains Land and Resource Management Plan Revision effort has publicized the values of these lands to the attention of the general public. This new public interest in the grasslands will undoubtably result in increased visitation over the next decade by those seeking grassland types of experiences, as these types of public lands are few and unique.

Two of the greatest attractions to dispersed recreationist on the national grasslands are the vastness and undeveloped character of these areas. What sights and sounds of humankind that currently exist are generally diminished and become mostly insignificant across the landscape due to the expansiveness of the areas. These areas offer an escape from the constant barrage of human caused noise that most people in their everyday lives experience. The largeness and primitive appearing landscapes on the grasslands also offer an escape from the sights of human developments that most people live with on a daily basis.

Another recreation related experience the grasslands offer is a night sky that is not diminished by ambient night light pollution. The horizon to horizon sky during the numerous clear nights on these lands provides brilliantly clear views of the stars and other celestial objects. Again, these areas offer this experience that is not available in rural and urban areas.

BGNG provides excellent backcountry opportunities including the Cheyenne River and Redshirt RARE II areas. One non-motorized area, Indian Creek, is also a good backcountry area. Fishing opportunities are rapidly declining as many small reservoirs age and become more shallow due to siltation. Railroad Buttes provides an excellent off-highway vehicle area, but concerns have been expressed about resource damage and conflicts with other uses. Agate hunting, birdwatching and wildlife viewing are popular on BGNG. Big game and upland bird hunting are popular, as is shooting prairie dogs. The National Grasslands Visitor Center in Wall draws thousands of visitors to interpretive displays. The Black Hills and Badlands National Park are within driving distances of BGNG. As such, highways that cross BGNG carry tens of thousands of visitors into the area every year. State Highways 240 and 44 provide a scenic loop through the BGNG and Badlands National Park.

The Forest Service, as part of its Northern Great Plans Management Plans Revision, estimated recreation use on BGNG. This area receives more recreation use than any other national grassland evaluated in the plans revision. Annual mean visitor days by recreation use on BGNG is listed on Table 3-23. Motorized travel/viewing scenery is the most popular recreation use comprising nearly 94 percent of all recreation visitor days on BGNG. Picnicking and big game hunting are the second most frequent recreation uses on the grassland - combined, however, these 2 uses represent only about 3.2 percent of the total recreation visitor days. Camping and small game hunting are relatively small uses and individually represent less than 1 percent of the total recreation visitor days.

Similar recreational opportunities are found on TBNG, although few developed sites exist. BGNG receives over 2.5 times more recreational visitor days than TBNG. Scattered ownership patterns and limited legal public access across private lands hinders some recreational opportunities on NFS lands on TBNG. Over half (51.5 percent) of the recreation use on TBNG is associated with motorized travel and viewing scenery (see Table 3-23). Roads constructed to service oil and gas production facilities provide improved motorized access for recreationists. TBNG contains some of the largest coal deposits in the nation, much of it being strip mined on sites within the grassland. Many people drive to these mines to view the mining process.

Big game hunting (primarily for mule deer and pronghorn) is a very important recreation use on TBNG. Considering the short season of use associated with big game hunting, the use still accounts for nearly 15 percent of all recreation visitor days on the grassland. Prairie dog shooting is popular and attracts participants from across the nation. Camping is a relatively important use and represents 8 percent of total recreation visitor days. Largemouth bass and trout fishing are available at several sites on the grassland.

During the past 10 years, the Douglas Ranger District has undertaken an aggressive land exchange program to dispose of isolated tracts of the TBNG and consolidate the public land base. This effort has resulted in almost 100,000 acres being exchanged. The intent of this effort has been to improve public access to these lands, provide more contiguous public lands for recreation uses, improve overall land management efficiency, and consolidate large areas of these lands to provide expansive public grassland settings.

Recreation on NFS lands is currently managed to provide desired experiences to visitors using the Recreation Opportunity Spectrum (ROS). The key to providing most recreational experiences and opportunities is the setting and how the setting is managed. ROS is a system for planning and managing recreation resources that categorizes recreation opportunities into 6 classes. Each class is defined in terms of the degree to which it satisfies certain recreation experience needs based on: 1) the extent to which the natural environment has been modified; 2) the type of facilities provided; 3) the degree of outdoor skills needed to enjoy the area; and 4) the relative density of recreation use. ROS classification for BGNG and TBNG are summarized on Table 3-24. The current ROS classifications for NFS lands, in relation to the alternatives, are shown on Figures 3-4 (BGNG) and 3-5 (TBNG).

Table 3-25 lists current ROS classification for NFS lands which would be crossed by the alternatives. As is indicated on the table, several ROS classifications are not crossed by the alternative centerline but are located in close proximity (within 500 feet). Only the Western Yard would affect NFS lands. The ROS classification for the 71 acres of NFS lands located within the proposed Western Yard site is roaded natural.

The following is a description of ROS classes which are located within the impact analysis area for the alternatives:

Semi-Primitive Nonmotorized. These lands provide the most primitive recreation opportunities offered on NFS lands in the impact analysis area and are found only on BGNG. This ROS classification consists of approximately

Table 3-23 Annual Mean Recreation Use on Buffalo Gap and Thunder Basin National Grasslands (1)				
Recreation Use	BGNG		TBNG	
	Thousands of Recreation Visitor Days	Percent of Total Recreation Visitor Days	Thousands of Recreation Visitor Days	Percent of Total Recreation Visitor Days
Camping	1.4	0.8	5.1	8.0
Motorized travel/viewing scenery	155.6	93.9	33.0	51.5
Picnicking	2.7	1.6	0.0	0
Hiking/horseback riding	0.9	0.5	1.4	2.2
Big game hunting	2.7	1.6	9.4	14.7
Upland game hunting	0.3	0.2	2.9	4.5
Small game hunting	1.3	0.8	4.5	7.0
Waterfowl hunting	0.4	0.2	3.3	5.1
Fishing	0.4	0.2	4.5	7.0
Total	165.7		64.1	
1 = five-year annual mean (1992-1996)				

Table 3-24 Acres of National Forest System Lands by ROS Classification for Buffalo Gap and Thunder Basin National Grasslands (1)				
ROS Classification	BGNG		TBNG	
	Acres	Percent of Total Grassland	Acres	Percent of Total Grassland
Semi-Primitive Nonmotorized	18,720	3.2	0	0
Semi-Primitive Motorized	124,860	21.2	27,070	4.9
Roaded Natural	405,310	68.8	444,620	79.9
Primitive	0	0	0	0
Rural	40,220	6.8	70,690	12.7
Urban	0	0	14,050	2.5
Total	589,110	100	556,430	100
1 = Acres provided are for the current Medicine Bow and Nebraska National Forest Plans (Forest Service, 1984 and 1995).				

18,720 acres on BGNG and comprises about 3 percent of the total grassland acres (see Table 3-24). These lands, although not crossed directly by any of the alternative centerline, are within 500 feet of Alternative B. The Indian Creek Rare II Area, located in Sections 9, 16 and 21, T. 4 S., R. 11 E. in Pennington County on the north boundary of the Pine Ridge Indian Reservation (see Figure 3-6), is designated as semi-primitive nonmotorized. The semi-primitive nonmotorized area is separated from Alternative B by the Cheyenne River. These lands are located on the east side of the river just north of the Pennington-Shannon County line. Alternative B in this area is routed west of the river across Battle Creek on NFS lands in Custer County.

Semi-primitive non-motorized lands are characterized by a predominantly natural or natural-appearing environment of moderate to large size. Interaction between recreational users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but would be subtle. Motorized recreation is not permitted, but local roads used for other resource management activities may be present on a limited basis. Use of such roads is restricted to minimize impacts on recreational opportunities.

Semi-Primitive Motorized. This ROS classification is characterized by a predominantly natural or natural-appearing environment of moderate to large size. The concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but would be subtle. Motorized use of local primitive or collector roads with predominantly natural surfaces and trails suitable for motor bikes is permitted.

Both BGNG and TBNG contain areas that have been classified as semi-primitive motorized, although these lands are much more prevalent on BGNG - over 21

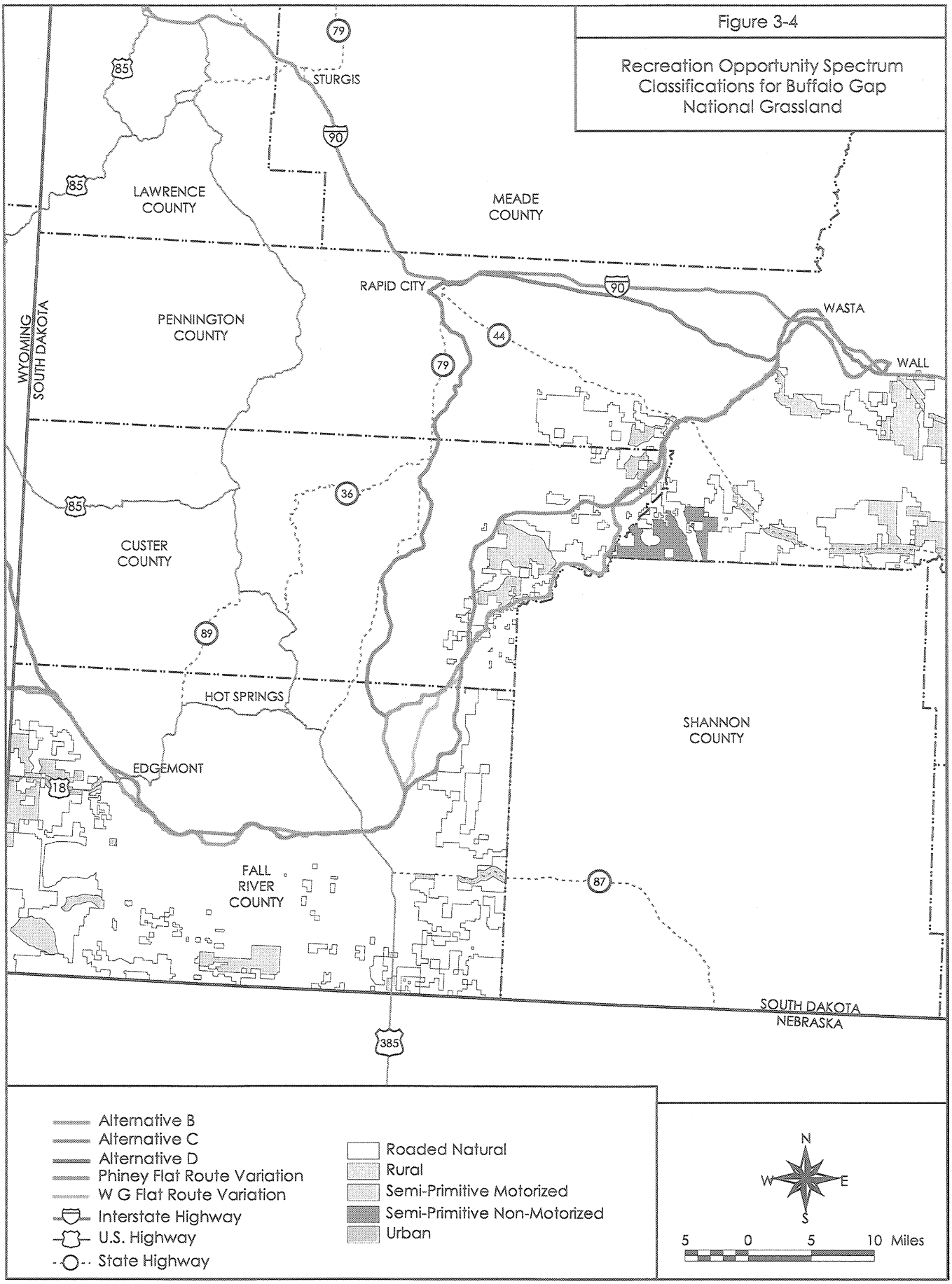
Figure 3-4
Recreation Opportunity Spectrum Classifications for Buffalo Gap National Grassland
STURGIS
LAWRENCE COUNTY
MEADE COUNTY
RAPID CITY
WASTA
WALL
PENNINGTON COUNTY
WYOMING
SOUTH DAKOTA
CUSTER COUNTY
HOT SPRINGS
EDGEMONT
SHANNON COUNTY
FALL RIVER COUNTY
SOUTH DAKOTA
NEBRASKA
Alternative B
Alternative C
Alternative D
Phiney Flat Route Variation
W G Flat Route Variation
Interstate Highway
U.S. Highway
State Highway
Roaded Natural
Rural
Semi-Primitive Motorized
Semi-Primitive Non-Motorized
Urban
N
W
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S
5 0 5 10 Miles

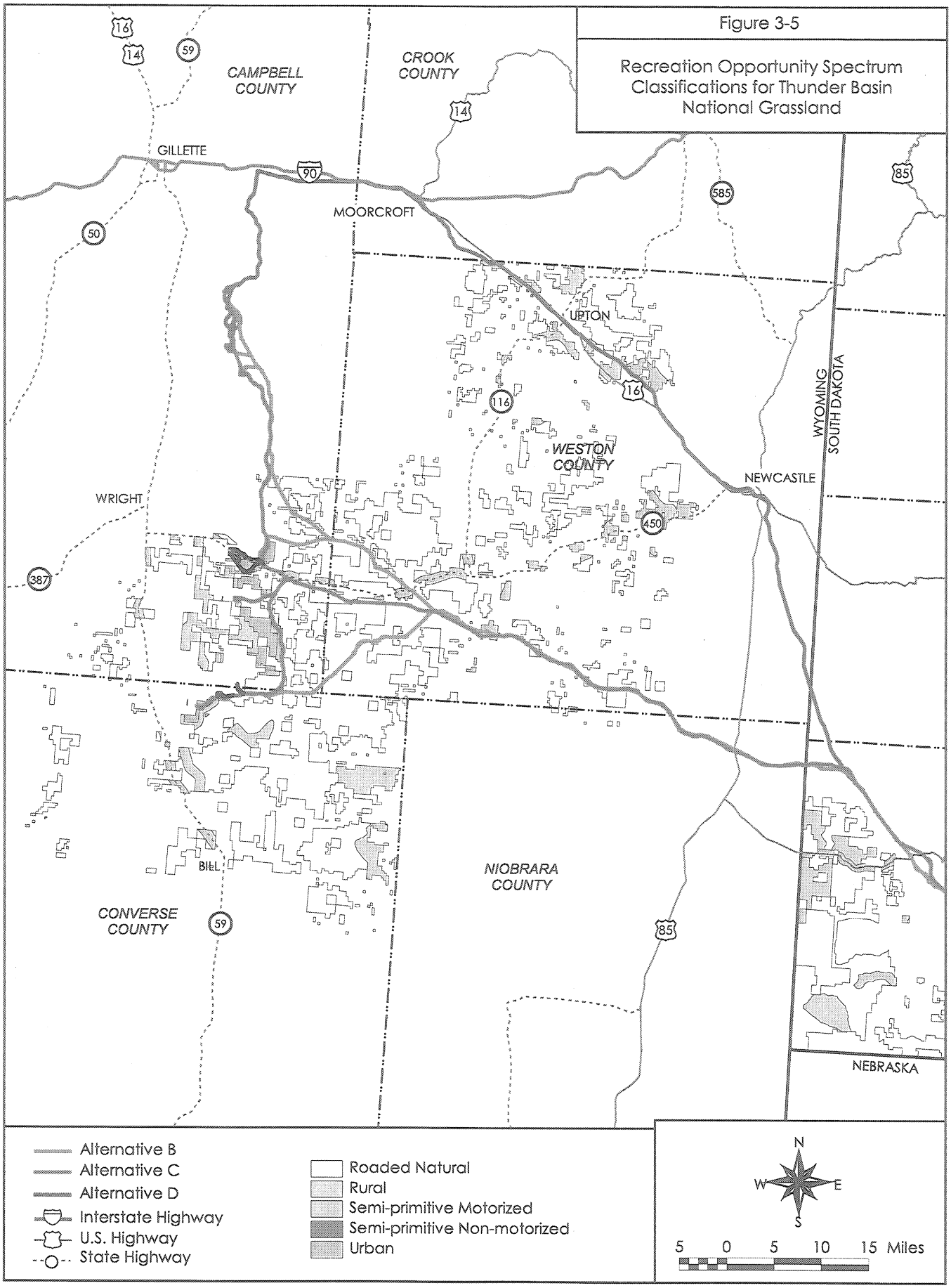


Figure 3-5
Recreation Opportunity Spectrum Classifications for Thunder Basin National Grassland
CAMPBELL COUNTY
CROOK COUNTY
GILLETTE
MOORCROFT
UPTON
WESTON COUNTY
NEWCASTLE
WYOMING
SOUTH DAKOTA
WRIGHT
BILL
CONVERSE COUNTY
NIOBRARA COUNTY
NEBRASKA
Alternative B
Alternative C
Alternative D
Interstate Highway
U.S. Highway
State Highway
Roaded Natural
Rural
Semi-primitive Motorized
Semi-primitive Non-motorized
Urban
N
W
E
S
5 0 5 10 15 Miles

Figure 3-6

Location of Semi-Primitive Non-Motorized Classified Lands on Buffalo Gap National Grassland in the Vicinity of Alternative B

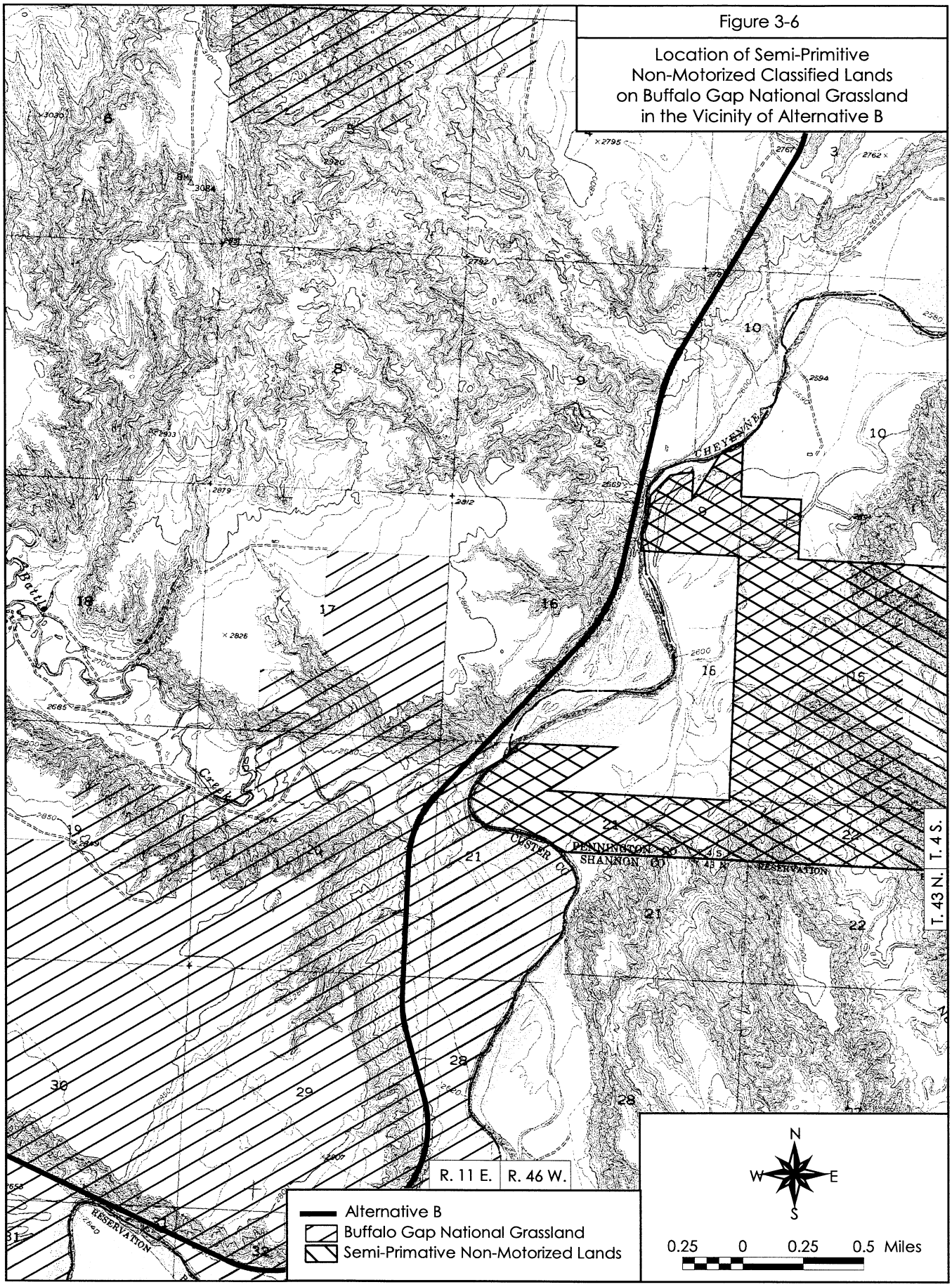


Table 3-25 Recreation Opportunity Spectrum Rating for National Forest System Lands Which Would be Crossed by the Alternatives												
	Alternative B		Alternative C (1)		Alternative C With the Phiney Flat Route Variation		Alternative D		Black Thunder North Mine Loop		Black Thunder South Mine Loop	
	Miles	Percent	Miles	Percent	Miles	Percent	Miles	Percent	Miles	Percent	Miles	Percent
Buffalo Gap National Grasslands												
Semi-Primitive Nonmotorized	(2)	0	0	0	0	0	0	0	0	0	0	0
Semi-Primitive Motorized	1.6	9.8	0.8	13.1	0.4	7.5	0	0	0	0	0	0
Roaded Natural	14.7	90.2	5.3	86.9	4.9	92.5	0	0	0	0	0	0
Rural	(2)	0	(2)	0	(2)	0	0	0	0	0	0	0
Total	16.3	100	6.1	100	5.3	100	0	0	0	0	0	0
Thunder Basin National Grasslands												
Roaded Natural	26.4	74.1	20.3	61.9	20.3	61.9	9.6	35.9	0	0	0	0
Rural	3.8	10.7	6.0	18.3	6.0	18.3	10.6	39.7	0	0	0.1	3.2
Urban	5.4	15.2	6.5	19.8	6.5	19.8	6.5	24.4	0.6	100	3.0	96.8
Total	35.6	100	32.8	100	32.8	100	26.7	100	0.6	100	3.1	100

1 = Alternative C with the W G Flat Route Variation would be the same as Alternative C.
2 = Although this ROS designation is not crossed by the alternative centerline, it does occur within 500 feet of the alternative centerline.
3 = Note the North Antelope Mine Loop options do not cross NFS lands.

percent of BGNG has been classified as semi-primitive motorized (see Table 3-24). These areas include all NFS lands north and northeast of the Sage Creek Wilderness Area in the vicinity of Anderson Draw; the area east of Railroad Buttes and south of Creston; areas in northern Custer County just east of Phiney Flat and Spring Creek; the Red Shirt area east of the Cheyenne River in Custer County; and NFS lands west of Edgemont and north of U.S. Highway 18 in Fall River County. Alternatives B and C (including the W G Flat Route Variation) would cross 1.6 and 0.8 miles of semi-primitive motorized lands on BGNG, respectively (see Table 3-25).

Alternatives B and C would cross this ROS classification on the west side of Phiney Flat in the Spring Creek drainage in Section 6, T. 3 S., R. 12 E. and Section 1, T. 3 S., R. 11 E. in Custer County. Alternative C (including both route variations) would cross additional lands classified as semi-primitive motorized northeast of the Dry Creek crossing in Custer County in Section 4, T. 4 S., R. 9 E. about 1 mile northwest of the Redshirt RARE II Area. Alternative B also would cross this ROS classification on the southern end of the Cheyenne River RARE II Area in Section 22, T. 5 S., R. 9 E. adjacent to the Cheyenne River. Alternative C with the Phiney Flat Route Variation would only cross 0.4 miles of semi-primitive motorized lands (0.4 miles less than Alternative C and Alternative C with only the W G Flat Route Variation). Semi-primitive motorized lands within the Spring Creek drainage would be avoided by this route variation. However, this ROS classification would still be crossed in the vicinity of Dry Creek, as noted above.

On TBNG, about 27,000 acres (4.9 percent) of the grasslands have been designated as semi-primitive motorized. This ROS classification has been applied to lands in and east of the Red Hills roadless area east of Fiddleback Ranch and the Miller Hills south of North Lance Creek Road in Converse County (see Figure 3-5). These lands would not be directly affected by the alternatives on TBNG - at their closest the alternatives would approach within 2.5 miles of semi-primitive motorized ROS classified lands southeast of the Antelope Mine.

Roaded Natural. The majority of the lands on BGNG (69 percent) and TBNG (80 percent) are classified as roaded natural. These areas are characterized by predominantly natural-appearing environments with moderate evidence of the sights and sounds of people. Such evidence usually harmonizes with the natural environment. Interaction between users may be moderate to high with evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized use is allowed and incorporated into construction standards and design of facilities. About 90 percent of Alternative B and 87 percent of Alternative C (including the W G Flat Route Variation) on BGNG would cross lands classified as roaded natural (see Table

3-25). Nearly 93 percent of Alternative C with the Phiney Flat Route Variation would cross this ROS classification. On TBNG, about 74 percent of the lands which would be crossed by Alternative B; about 62 percent of the lands which would be crossed by Alternative C; and about 36 percent of the lands which would be crossed by Alternative D are classified as roaded natural.

Rural. This ROS classification would not be affected directly by the alternatives on BGNG, but would be crossed by all alternatives on TBNG. Alternative B would cross 3.8 miles of these lands; Alternative C would cross 6.0 miles; and Alternative D would cross 10.6 miles. The rural classification is characterized by a natural environment that has been substantially modified by development of structures, vegetative manipulation or pastoral agricultural development. Resource modification and utilization practices may be used to enhance specific recreational activities and to maintain vegetative cover and soil. Sights and sounds of humans are readily evident and the interaction between users is often moderate to high. A considerable number of facilities are designed for use by a large number of people. Facilities are often provided for special activities. Moderate user densities are present away from developed sites. Facilities for intensified motorized use and parking are available. The Black Thunder North Mine Loop would cross 0.1 mile of these lands.

Urban. The area is characterized by a substantially urbanized environment, although the background may have natural-appearing elements. Renewable resource modification and utilization practices are often used to enhance specific recreational opportunities. Vegetative cover is often exotic and manicured. Sights and sounds of humans are predominant on the site. Large numbers of users can be expected both on the site and in nearby areas. Facilities for highly intensified motor use and parking are available with forms of mass transit often available to carry people throughout the site. This ROS classification does not occur in close proximity to the alternatives on BGNG. However, on TBNG, areas associated with active coal mining are classified as urban. Alternatives B, C, and D would cross 5.4, 6.5 and 6.5 miles, respectively, of this ROS classification on TBNG. The Black Thunder North Mine Loop would cross 0.6 miles of these lands and the Black Thunder South Mine Loop would cross 3.0 miles.

3.6.2.2 Public Lands. The BLM has not identified any significant recreation sites or opportunities in the general vicinity of the alternatives on public lands. In South Dakota, public lands are in a scattered and isolated pattern, thus, this land has a supplemental role in the overall recreational activities. The BLM has 2 recreation sites in South Dakota - one near Sturgis and the other near Belle Fourche. Neither is near the alternatives.

In the Newcastle Field Office area, recreation is unstructured and dispersed in nature. There are no developed recreation sites on public lands in the area administered by the field office. The primary recreational activity is big game hunting for mule deer and pronghorn. Prairie dog shooting is increasing in popularity. Additional recreation use of public lands is made through sightseeing, camping (generally associated with hunting), photography, and other casual uses such as rock-hounding. The draft EIS for the Newcastle RMP (BLM, 1998) identifies the main emphasis in the recreation program as acquisition of access to existing public land with higher recreation potential through exchanges or purchases of access agreements. According to the draft EIS, of the public land in the area managed by the field office, 60 percent has legal access; however, only 38 percent has practical vehicle access.

The area managed by the Buffalo Field Office offers diverse opportunities for several types of recreation including hunting, fishing, ORV use, sightseeing and wildlife observation. Most of the recreation use is focused on the southern Big Horn Mountains and in the Powder River Breaks country (BLM, 1984). Public lands in the Buffalo Field Office which would be affected by the alternatives are located on the northern legs and consists of small, isolated parcels adjacent to the coal mines. Consequently, they provide only insignificant recreation opportunity.

3.6.3 Parks, Recreation Sites and Facilities. In South Dakota, the alternatives would be constructed in the general vicinity of a number of recreation sites and facilities. Alternative B is routed less than a mile from Badlands National Park in Pennington County. Alternative D would be constructed about 2.7 miles east of Custer State Park and 2.5 miles east of Wind Cave National Park between Fairbairn and Buffalo Gap. Alternative D would approach within 1 mile of Black Hills National Forest near the South Dakota-Wyoming State line. Angostura State Recreation Area is located approximately 2 miles north of all the alternative routes near the crossing of U.S. Highway 385 near Horsehead Creek west of Smithwick. Recreation sites, parks and facilities in the vicinity of the alternatives in South Dakota are shown on Figure 3-7.

Badlands National Park. Figure 3-8 shows the proximity of Alternative B to the boundary of Badlands National Park. At its closest point, Alternative B would be constructed about 3,700 feet north of the park in Section 32, T. 43 N., R. 4 S. The Cheyenne River separates the park from the alternative at this location.

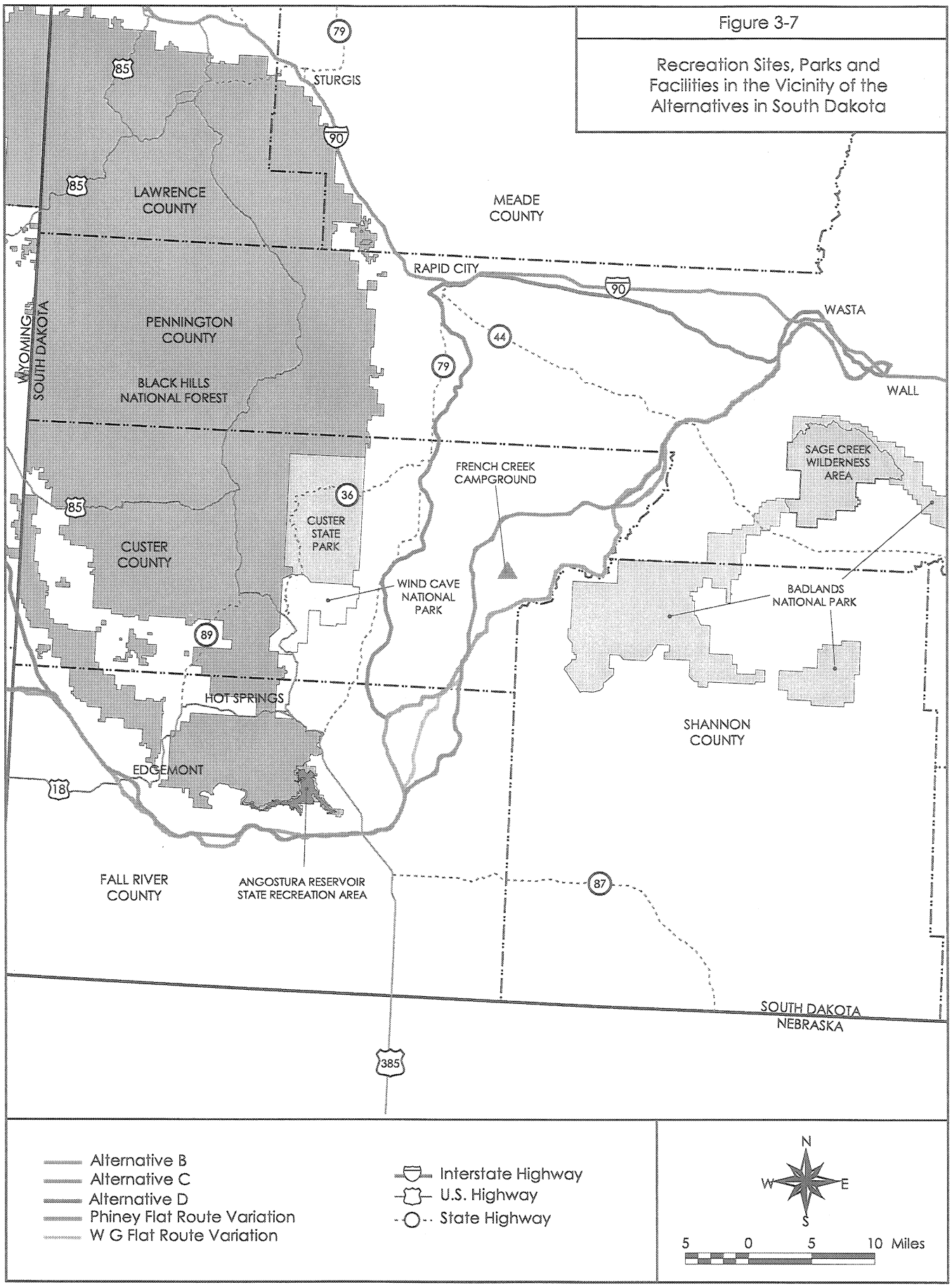


Figure 3-7
Recreation Sites, Parks and Facilities in the Vicinity of the Alternatives in South Dakota
STURGIS
LAWRENCE COUNTY
MEADE COUNTY
RAPID CITY
WASTA
WALL
PENNINGTON COUNTY
BLACK HILLS NATIONAL FOREST
WYOMING
SOUTH DAKOTA
FRENCH CREEK CAMPGROUND
SAGE CREEK WILDERNESS AREA
CUSTER STATE PARK
CUSTER COUNTY
WIND CAVE NATIONAL PARK
BADLANDS NATIONAL PARK
HOT SPRINGS
SHANNON COUNTY
EDGEMONT
FALL RIVER COUNTY
ANGOSTURA RESERVOIR STATE RECREATION AREA
SOUTH DAKOTA
NEBRASKA
Alternative B
Alternative C
Alternative D
Phiney Flat Route Variation
W G Flat Route Variation
Interstate Highway
U.S. Highway
State Highway
N
W
E
S
5 0 5 10 Miles

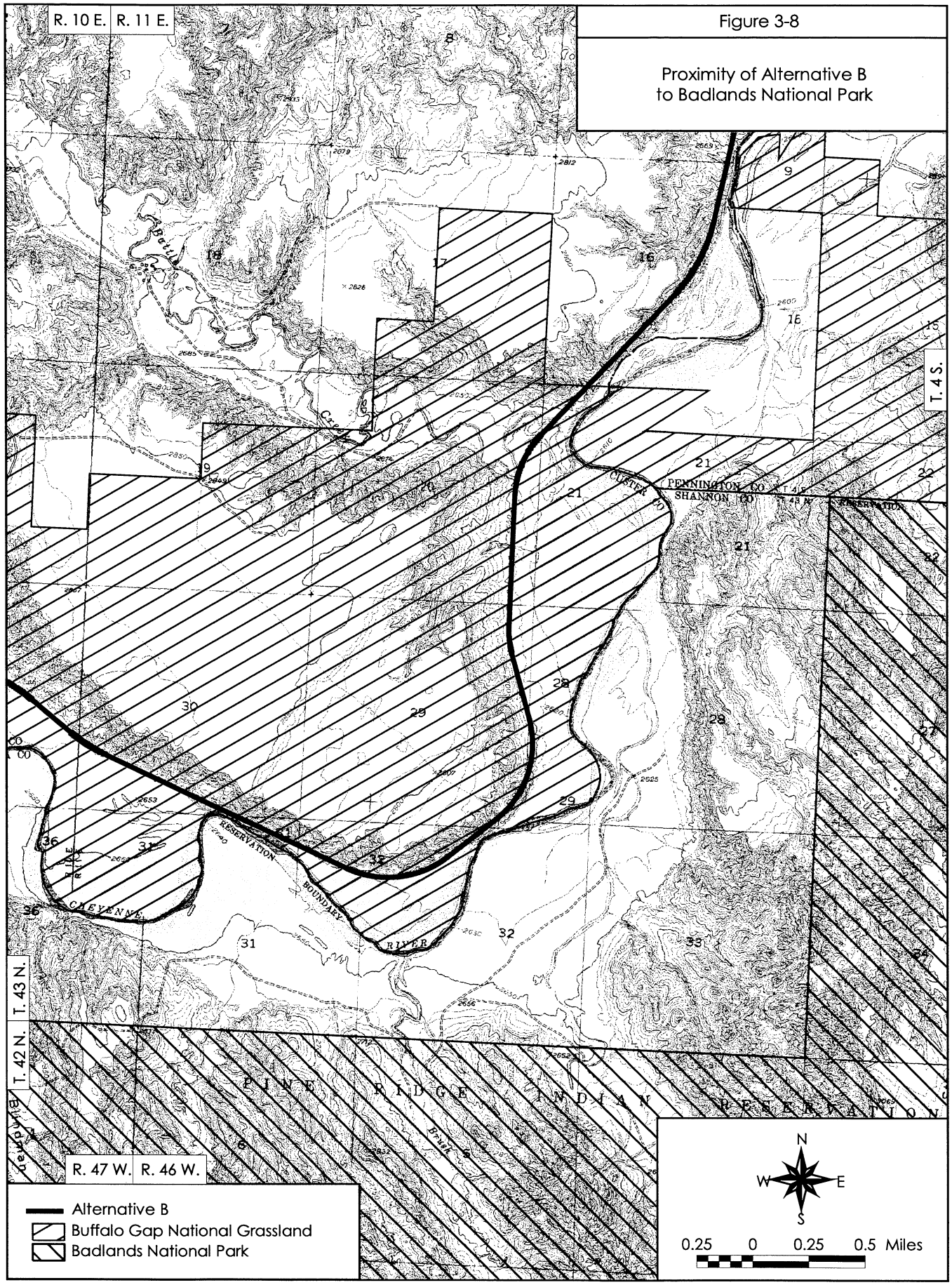


Figure 3-8

Proximity of Alternative B to Badlands National Park

The park was designated a national monument in 1939 and redesignated a national park in 1978. A portion of the park (Sage Creek) was designated as wilderness in 1976. Badlands National Park preserves a diversity of significant resources. These resources include the best known Oligocene fossil deposits contained within archetypical Big Badlands formations, a rich and varied cultural history spanning from paleo-Indian occupation through the early twentieth century homesteading period, and an expansive mixed-grass prairie ecosystem. Other qualities, most notably the wilderness character, quiet, solitude, vastness, and natural processes, provide visitors with a setting for exploration and appreciation through experiences such as hiking, camping, wildlife viewing, scenic drives and vistas, research and educational opportunities, and quiet contemplation.

There are approximately 1.3 million visitors per year. Highest visitation is from mid-June through September; lowest from mid-November through March.

Wind Cave National Park. The general location of Wind Cave National Park is shown on Figure 3-7. In the general vicinity of the park, Alternative D would be constructed within DM&E's existing Black Hills Subdivision Branch Line. At its closest, the existing branch line is about 2.5 miles from the park (see Figure 3-9). State Highway 79 separates the alternative from the park.

Wind Cave National Park was created on January 3, 1903. It was the 7th national park and the first created to protect a cave. The park at that time was small and there were no bison, elk, or pronghorn. They came later as the park boundaries expanded. One of the world's longest and most complex caves and 28,295 acres of mixed-grass prairie, ponderosa pine forest and associated wildlife are the main features of the park. The cave is well known for its outstanding display of box work, an unusual cave formation composed of thin calcite fins resembling honeycombs. The park's mixed-grass prairie is home to native wildlife such as bison, elk, pronghorn, mule deer, coyotes and prairie dogs.

Custer State Park. Located directly north of Wind Cave National Park (see Figure 3-9), Custer State Park encompasses 73,000 acres of the Black Hills. The state park is known for its spectacular terrain and abundant wildlife. Favorite outdoor activities include hiking 7,242-foot Harley Peak, mountain biking, horseback riding, rock climbing, fishing, chuck wagon suppers and jeep rides to view bison. Th park contains a significant bison population. The park includes scenic drives such as the Needles Highway. Alternative D would approach within 2.7 miles of the park. In the vicinity of the park, the alternative would be constructed within DM&E's existing Black Hills Subdivision Branch Line.

Angostura Reservoir State Recreation Area. As can be seen on Figure 3-7, the alternatives would pass south of Angostura Reservoir State Recreation Area. At their closest, the alternatives would be located about 1.8 miles south of the recreation area (see Figure 3-10). The warmwater springs found near Angostura have drawn visitors for more than 10,000 years. Legends describe a fierce battle between the Dakota and Cheyenne people to control the area's health restoring springs. White immigrants who came to the area quickly realized the benefits of the mineral-laden springs and settled in the area.

This recreation area is managed by the SDGFP. It is located along the shoreline of Angostura Reservoir. In 1949, the BOR completed an earth-filled and concrete dam across the Cheyenne River. The dam was built for irrigation purposes, but paved the way for recreation. The reservoir is well known for its walleye, smallmouth bass and crappie fishing. The lake also supports northern pike, largemouth bass, perch and bluegill. The state recreation area features a 78-slip marina, beach club and floating convenience store. Four campgrounds provide 163 campsites.

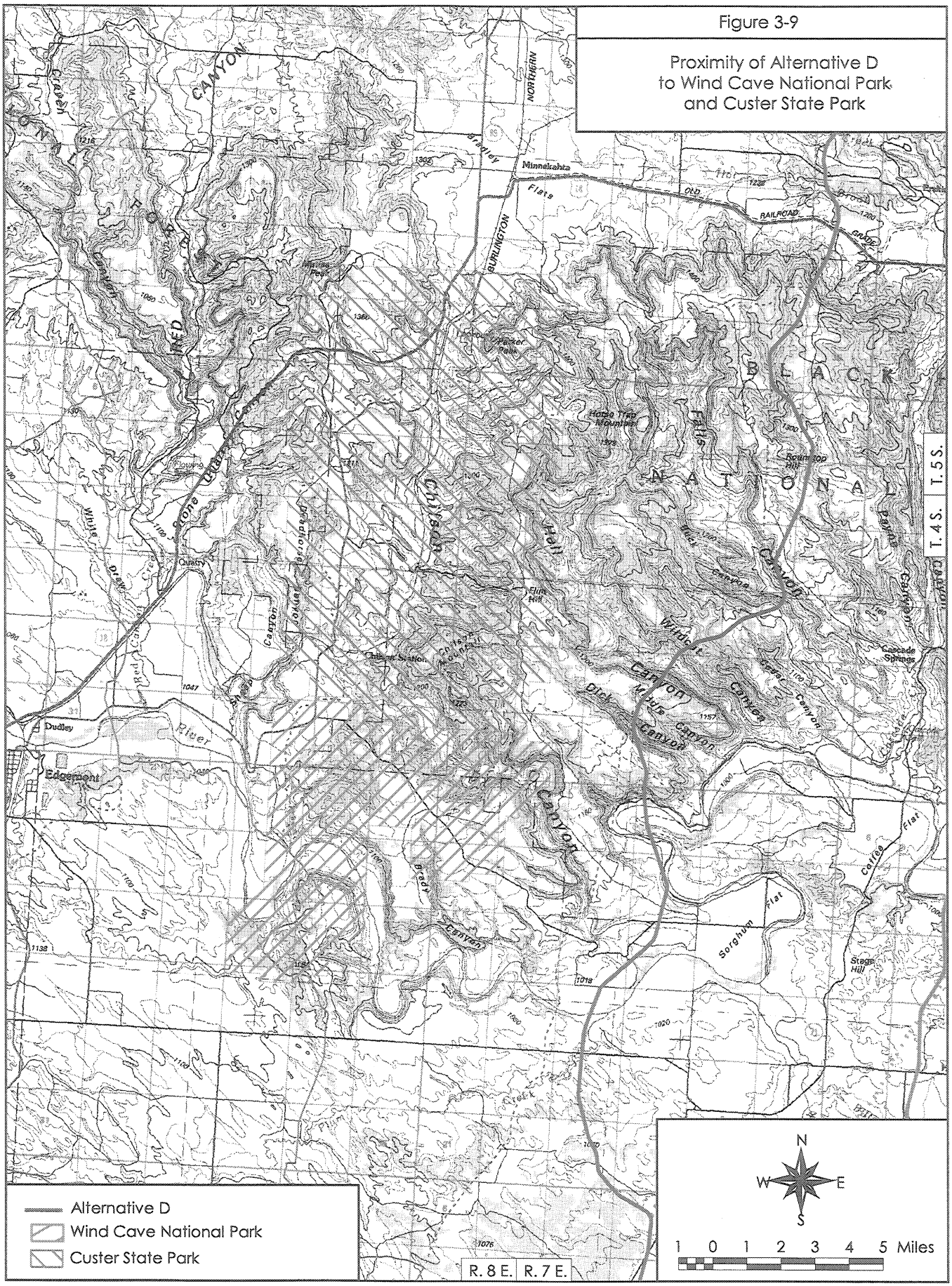
Black Hills National Forest. Northwest of Edgemont, in Section 25, T. 7 S., R. 1 E., all the alternatives would approach within 2 miles of the national forest boundary. In this area, the alternatives are routed directly adjacent to BNSF's existing railroad. Near Dewey, Alternative D would approach within 1 mile of the national forest. The alternative would also be constructed adjacent to BNSF in this area. Recreation opportunities abound on the more than 1.2 million acres of the Black Hills National Forest. Summer is the most popular vacation season in the Black Hills. The national forest provides over 100 developed recreation sites, including camp and picnic grounds, swimming beaches, boat launches and scenic overlooks.

According to the forest plan for the national forest (Forest Service, 1996), the "Southern Hills Forest and Grassland Areas" is managed as Category 5.1A. These areas are managed for sustainability of the physical, biological and visual values associated with areas of woody vegetation and open grassland. Habitat and vegetation are managed to achieve and maintain the desired conditions for wildlife, livestock and vegetation. The area has a ROS classification of roaded natural (see Section 3.6.2.1). Recreation in the area is dispersed and there are no developed recreation sites.

French Creek Campground. In Custer County, about 9.5 miles east of Fairbairn off County Road 18, the Forest Service has established a campground (see Figure 3-7). The campground is located in Section 34, T. 4 S., R. 9 E. At its closest, Alternative B would be located

Figure 3-9

Proximity of Alternative D to Wind Cave National Park and Custer State Park



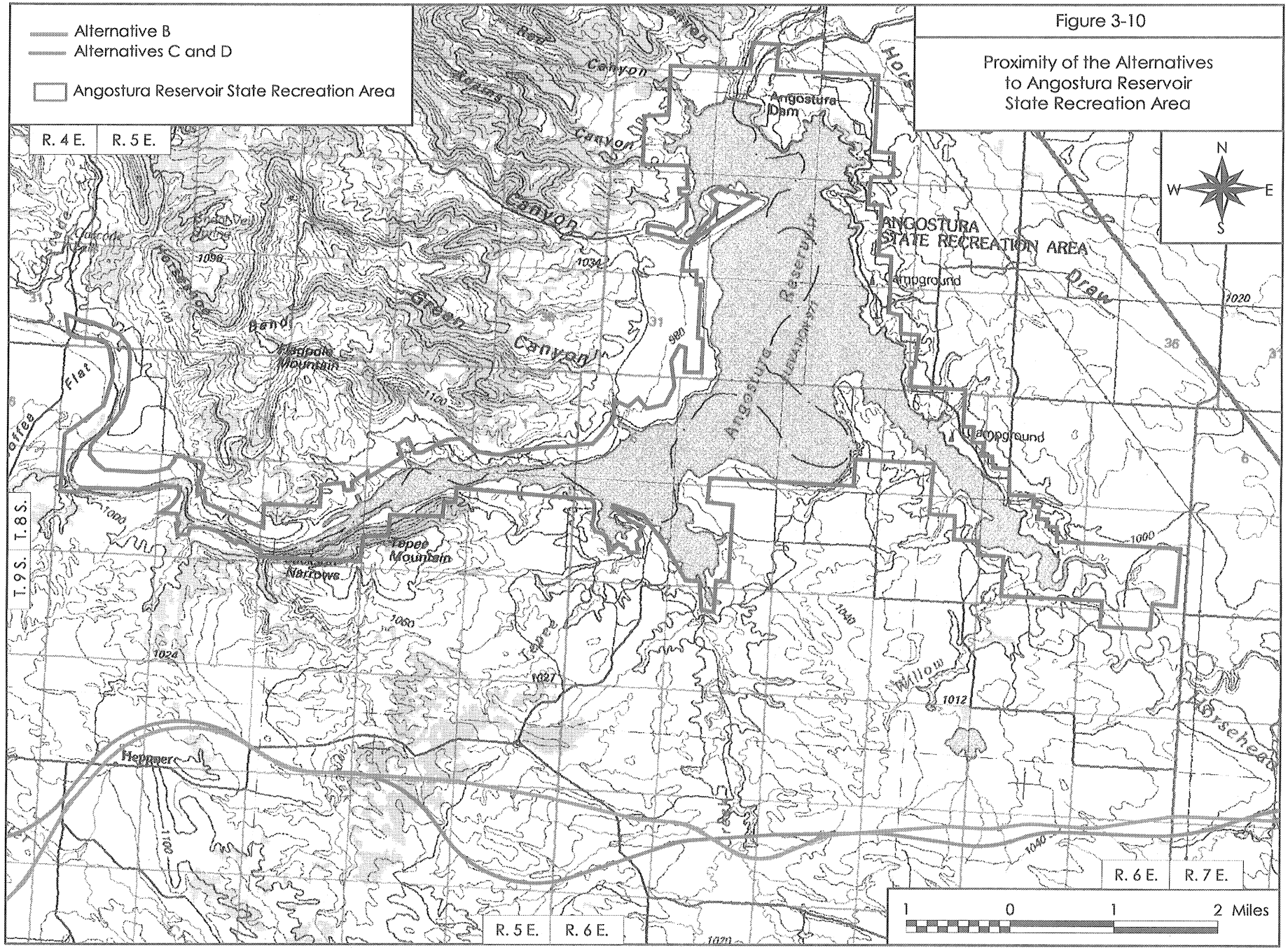


Figure 3-10

Proximity of the Alternatives to Angostura Reservoir State Recreation Area

approximately 3.5 miles from the campground. Alternative C is routed about 4 miles from the campground.

Historic Dorr Homestead. No parks, recreation sites or facilities occur in close proximity to any of the alternatives in Wyoming. However, the Forest Service recently acquired the historic Dorr Homestead in a land acquisition. The homestead is located approximately 7 miles south of the southern legs of the alternatives in Section 6, T. 39 N., R. 69 W. The homestead includes a turn of the century home and period school house, outbuildings, corals and windmill. The Forest Service intends to stabilize and improve the buildings located on the site. The Forest Service is currently proposing to restore the main building for public use under a fee system to provide a developed recreation opportunity on TBNG.

3.6.4 Wilderness and Inventoried Roadless Areas.

3.6.4.1 Wilderness Areas. There are no areas designated as wilderness or wilderness study areas in the general vicinity of the alternatives in Wyoming. However, Alternatives B and C would be constructed approximately 6.2 miles north of the Sage Creek Wilderness Area located inside Badlands National Park. The location of the wilderness area in relation to the alternatives is shown on Figure 3-11.

3.6.4.2. Inventoried Roadless Areas. The Forest Service is required by 36 CFR ¶ 219 to inventory, evaluate and consider all roadless areas for possible inclusion in the national Wilderness Preservation System. In June, 1977 the Forest Service initiated a comprehensive process to identify roadless and undeveloped land areas in the national forest system. The purpose of identifying these roadless areas was to evaluate their suitability as wilderness and for inclusion in the National Wilderness Preservation System. The comprehensive process was titled the "Roadless Area Review and Evaluation II" and is most commonly known as RARE II. To be considered a roadless area, the following criteria had to be present:

- the area had to be larger than 5,000 acres or, if smaller, contiguous to a designated wilderness or primitive area;
- the area could not contain improved roads maintained for travel by standard passenger-type vehicles; and
- the area had to be inventoried by the Forest Service for possible inclusion in the National Wilderness Preservation System.

No roadless areas were identified on TBNG during RARE II or during the 1980s planning effort (Forest Service, 1999c - see Appendix C). Three RARE II areas were identified on BGNG in South Dakota during preparation of the 1984 forest plan: Indian Creek (24,670 acres), Red Shirt (9,700 acres) and Cheyenne River (7,570 acres). The locations of these RARE II areas are shown on Figure 3-12.

As part of the National Great Plains Management Plans Revision, the Forest Service completed an updated inventory of areas which are essentially undeveloped in character and roadless. Areas identified with undeveloped character became part of the roadless inventory for evaluation as potential wilderness. The plans revision inventory process identified several roadless areas that were not identified in previous analyses. In total, 5 areas on BGNG and 3 on TBNG were identified that meet the Forest Service's roadless inventory criteria (Forest Service, 1999c). In addition, in the Wall Ranger District, the Indian Creek Area (24,670 acres) was identified as meeting the Forest Service's roadless inventory criteria. RARE II and inventoried roadless areas that occur in the vicinity of the alternatives are listed on Table 3-26. Recently inventoried roadless areas located on BGNG are shown on Figure 3-12. Roadless areas on TBNG are shown on Figure 3-13.

Of the inventoried roadless areas identified on TBNG, the Forest Service's proposed grassland plan (Forest Service, 1999b) recommends 8,460 acres of Cow Creek Buttes as wilderness. On BGNG, the Forest Service's proposed grassland plan recommends the Red Shirt Area (15,970 acres) as wilderness (Forest Service, 1999a).

Alternative B would be located in or adjacent to 3 inventoried roadless areas in Custer County on BGNG: Indian Creek; Red Shirt; and Cheyenne River (see Figure 3-12). Alternative B would pass approximately 650 feet to the west of the Indian Creek RARE II Area in Section 9, T. 4 S., R. 11 E. (see Figure 3-14). The alternative is located west of the Cheyenne River whereas the RARE II area is located to the east.

The Indian Creek RARE II Area is located about 5 miles west of Scenic, South Dakota and 37 miles southeast of Rapid City. The area is by far the most remote, rugged and inaccessible on the entire Wall Ranger District. Topography consists of intermingled badlands and grassland table terrain, with drainages off of the tables deeply incised and eroded, exposing cliffs of multi-colored clays. Large flat flood plains lie below the tables. This area does not exhibit the sharp, serrated pinnacles of nearby Badlands National Park. Rather, badlands terrain is more rounded in shape and very sparsely vegetated. Three ridge lines, which create distinctive landmarks, cross the area north to south. Two of them exhibit tabletop characteristics - Heutmacher and Zebell Tables. The third isn't named and is not generally flat on top. The 2 main drainages are Indian Creek and

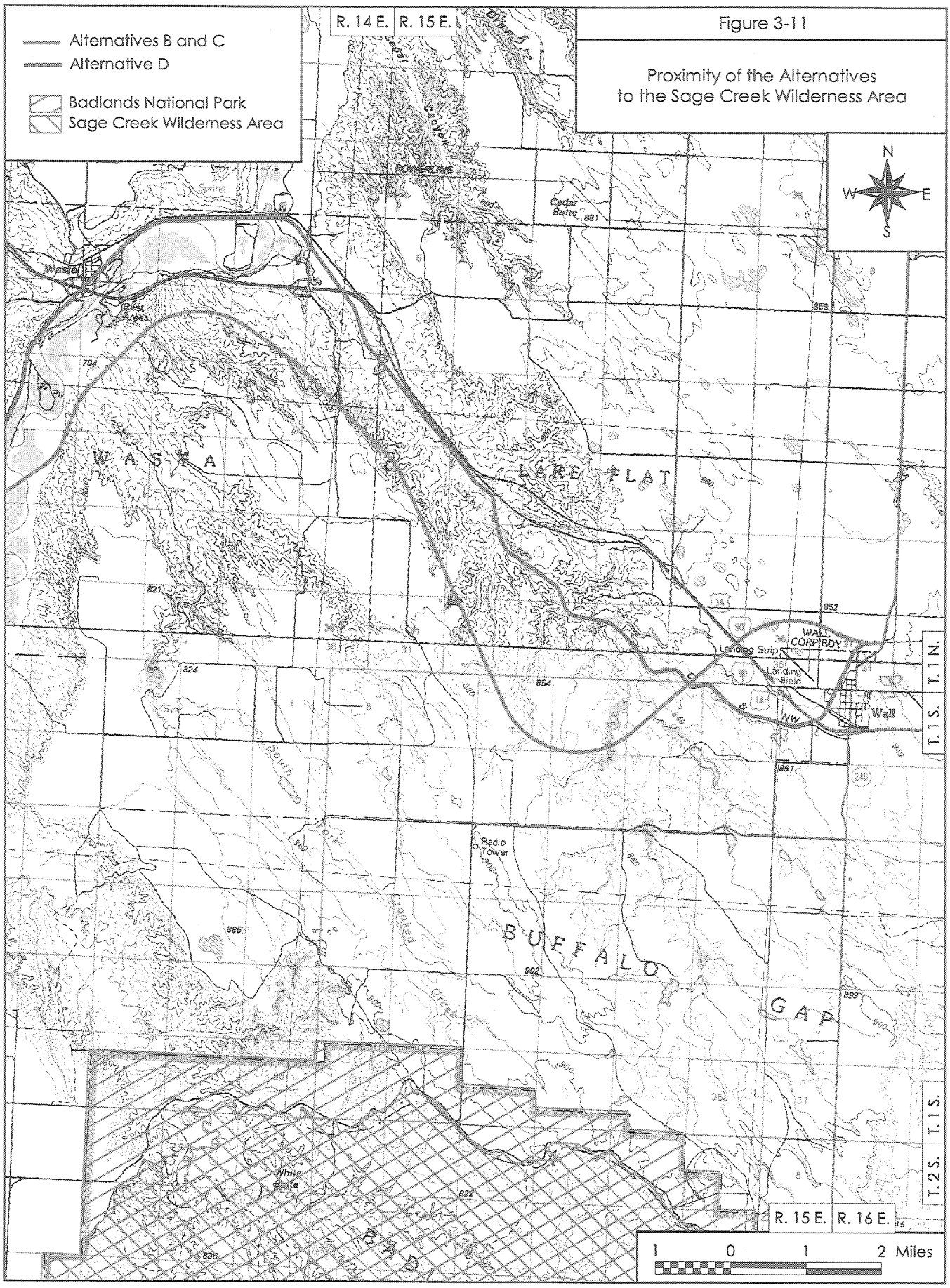


Figure 3-11

Proximity of the Alternatives to the Sage Creek Wilderness Area

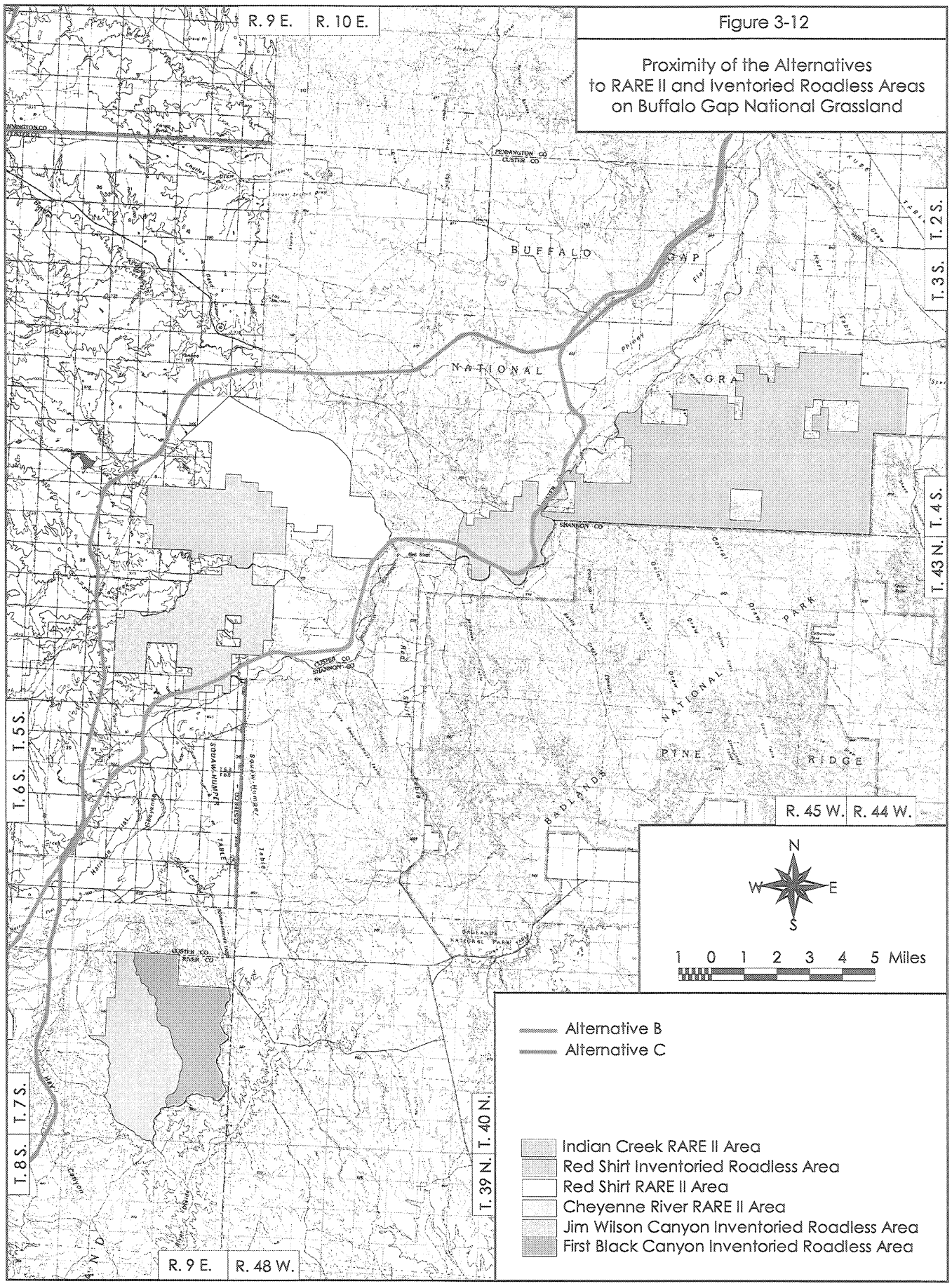


Figure 3-12

Proximity of the Alternatives to RARE II and Iventoried Roadless Areas on Buffalo Gap National Grassland

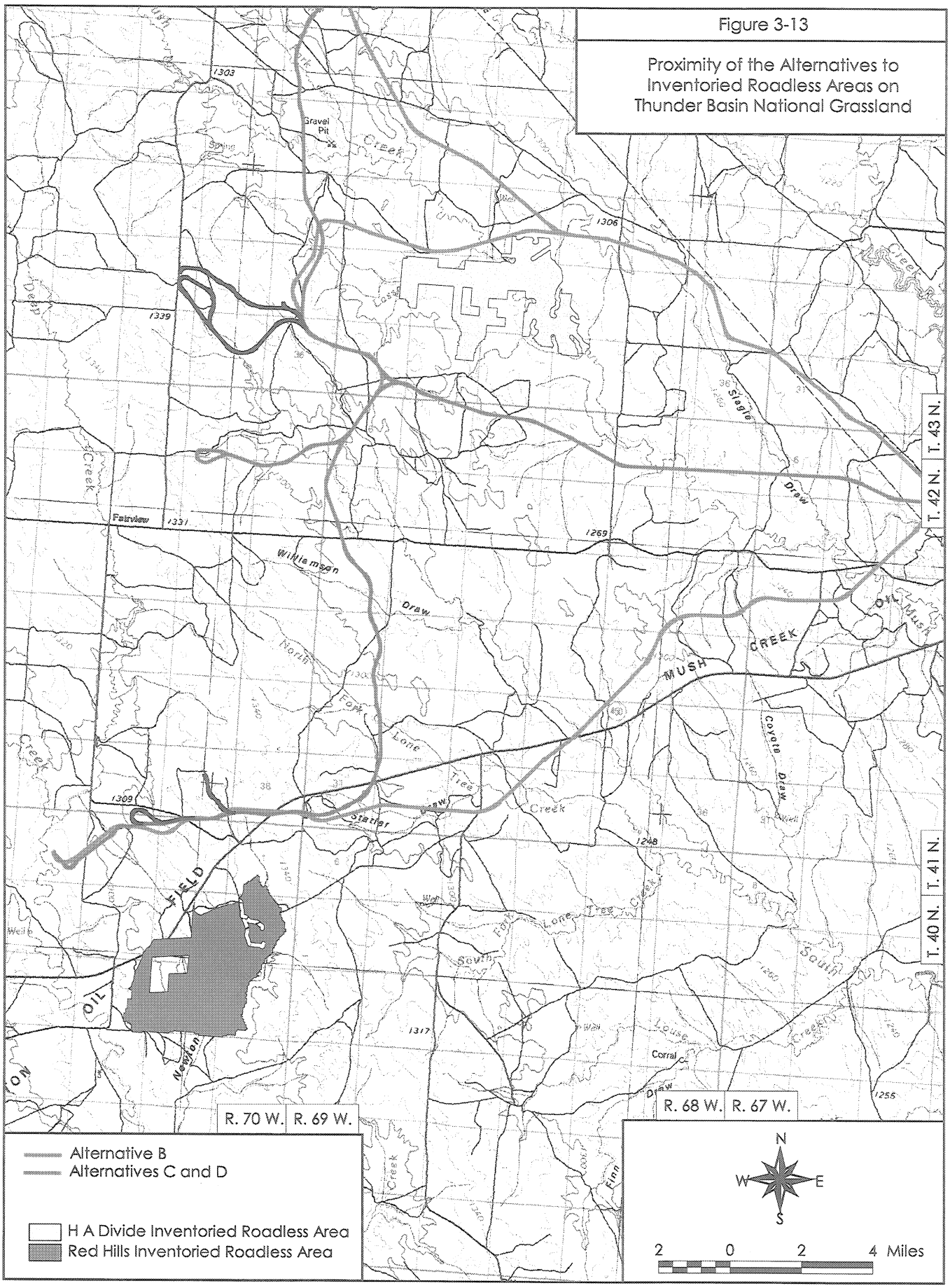


Figure 3-13

Proximity of the Alternatives to Inventoried Roadless Areas on Thunder Basin National Grassland

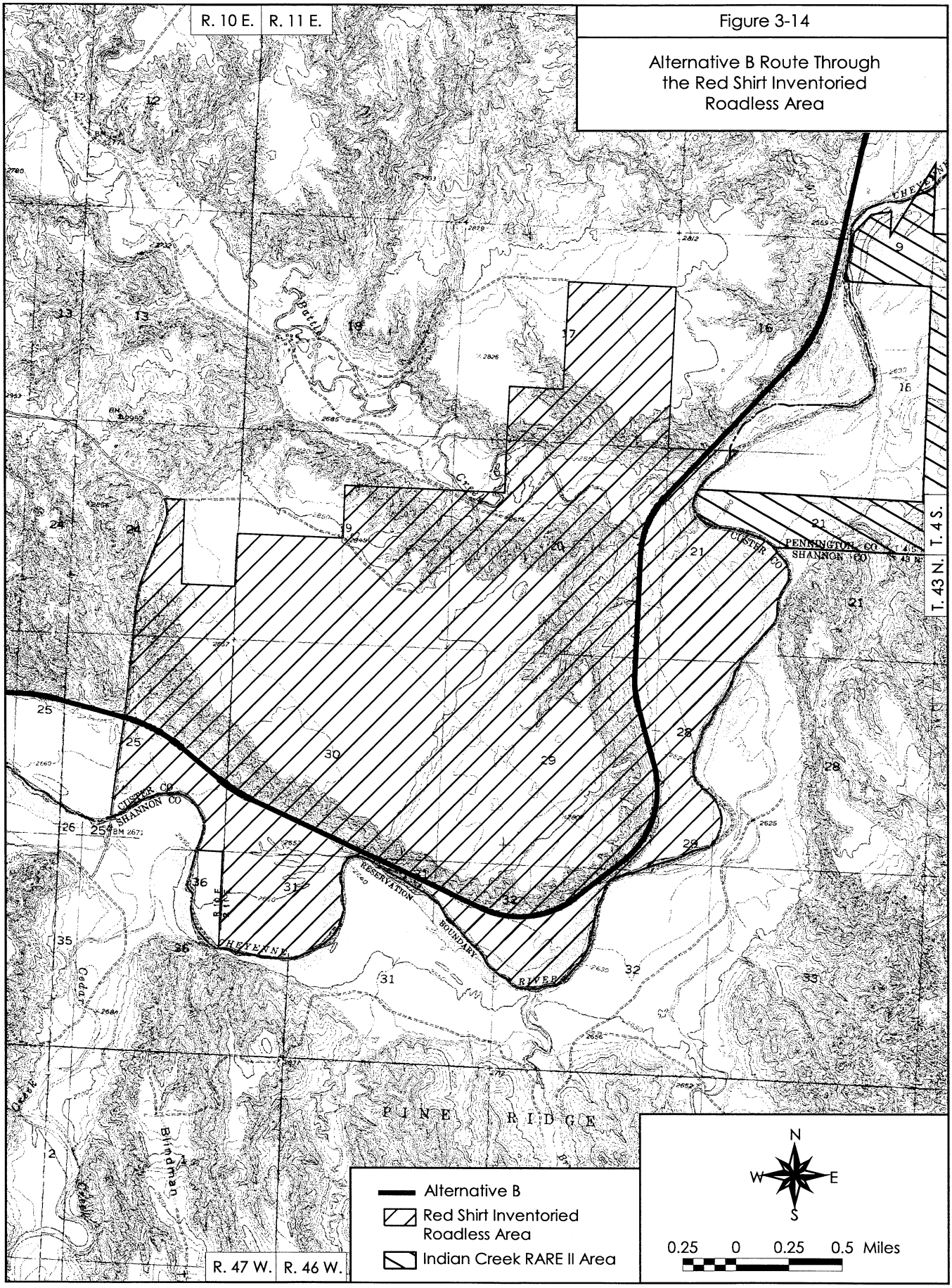


Figure 3-14

Alternative B Route Through the Red Shirt Inventoried Roadless Area

Table 3-26 RARE II and Inventoried Roadless Areas Which are Adjacent to or Which Would be Crossed by the Alternatives								
	Alternative B		Alternative C (1)		Alternative C W G Flat Route Variation		Alternative D	
	Miles Crossed	Approaches Within (miles)	Miles Crossed	Approaches Within (miles)	Miles Crossed	Approaches Within (miles)	Miles Crossed	Approaches Within (miles)
Buffalo Gap National Grasslands								
Red Shirt Inventoried Roadless Area	4.8			0.7		0.7		6.8
Red Shirt RARE II Area	0.6			0.4		0.4		7.5
Cheyenne River RARE II Area	1.9			0.3		0.3		7.2
Jim Wilson Canyon Inventoried Roadless Area		3.0		1.5		2.3		8.8
First Black Canyon Inventoried Roadless Area		3.5		2.7		2.8		10.7
Indian Creek RARE II Area		0.1		1.1		0.4		14.3
Thunder Basin National Grasslands								
H A Divide Inventoried Roadless Area		<0.1		1.2		1.2		1.8
Red Hills Inventoried Roadless Area		1.8		1.7		1.7		1.7
Cow Creek Buttes Inventoried Roadless Area		15.7		16.4		16.4		16.4
1 = Includes Phiney Flat Route Variation.								

Big Corral Draw which flow north and west into the Cheyenne River. Elevation ranges from 3,000 feet along the ridge lines to 2,600 feet along the Cheyenne River, which intermittently forms the western boundary of the area. Agate beds can be found in the area as can significant fossil deposits. The well known Sheep Mountain Table lies outside of the area to the east.

Alternative B would enter the Red Shirt Inventoried Roadless Area in Section 21, T. 4 S., R. 11 E. at the intersection of Shannon, Pennington and Custer counties and north of the Battle Creek confluence with the Cheyenne River. The alternative would continue through the roadless area for approximately 4.8 miles (see Figure 3-14). The alternative would leave the roadless area in Section 25, T. 4 S., R. 10 E. Alternative B would continue west approximately 2.2 miles, running north of the Cheyenne River, and would then enter the Red Shirt RARE II Area about 4,200 feet northwest of the Village of Red Shirt (see Figure 3-15). The alternative would proceed southwest on the west side of the Cheyenne River through the RARE II area through Sections 27 and 28, T. 4 S., R. 10 E.

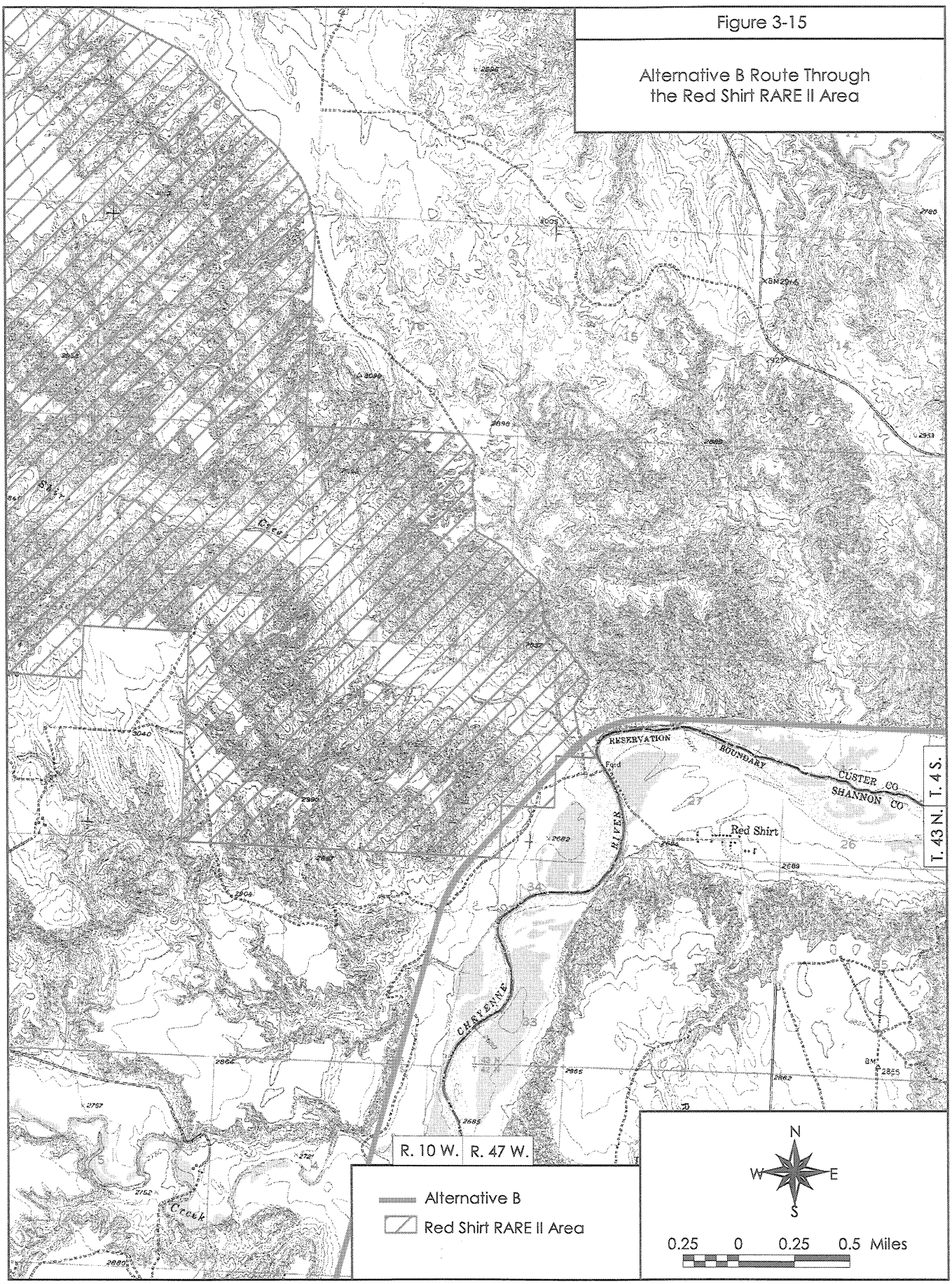
The 18,320-acre Red Shirt Area lies about 16 miles southeast of Hermosa and about 13 miles east of Fairbairn. The Red Shirt Area consists of the Red Shirt RARE II Area identified during development of the Nebraska National Forest Plan (Forest Service, 1984) and the inventoried roadless area identified in the recent draft plans revision (Forest Service, 1999c). The Forest Service's proposed grassland plan for BGNG (Forest Service, 1999a) recommends a portion of the RARE II area, a portion of the inventoried roadless area, and the area between the RARE II and inventoried roadless areas (not identified as roadless in the inventory) as wilderness (see Figure 3-16).

The topography of the Red Shirt Area is varied, consisting of gently rolling grasslands or highly vegetated tabletop buttes with steep, dissected slopes exposing layers of color-banded clays of reds and shades of white and gray. Elsewhere, sparsely vegetated, mounded, clay badlands terrain and beds of agates exist. Natural seeps frequently occur along some of the hillsides. The elevation of the area ranges from between 2,700 to 3,200 feet. This area is the most western extension of the White River Badlands on BGNG. Recreational opportunities include rock hounding, hunting, horseback riding and hiking. Other uses include livestock grazing and the gathering of sacred and medicinal plants and herbs by American Indians. One permittee currently grazes bison.

Northeast of Harrison Flat, Alternative B would cross the Cheyenne River RARE II Area (see Figure 3-12). The alternative would enter the RARE II area in Section 14, T. 5 S., R. 9 E. (see Figure 3-17). The alternative would proceed west nearly 2 miles through the RARE II area and north of the Cheyenne River. The alternative would exit the RARE II area in Section 2, T. 5. S., R. 9 E.

Figure 3-15

Alternative B Route Through the Red Shirt RARE II Area



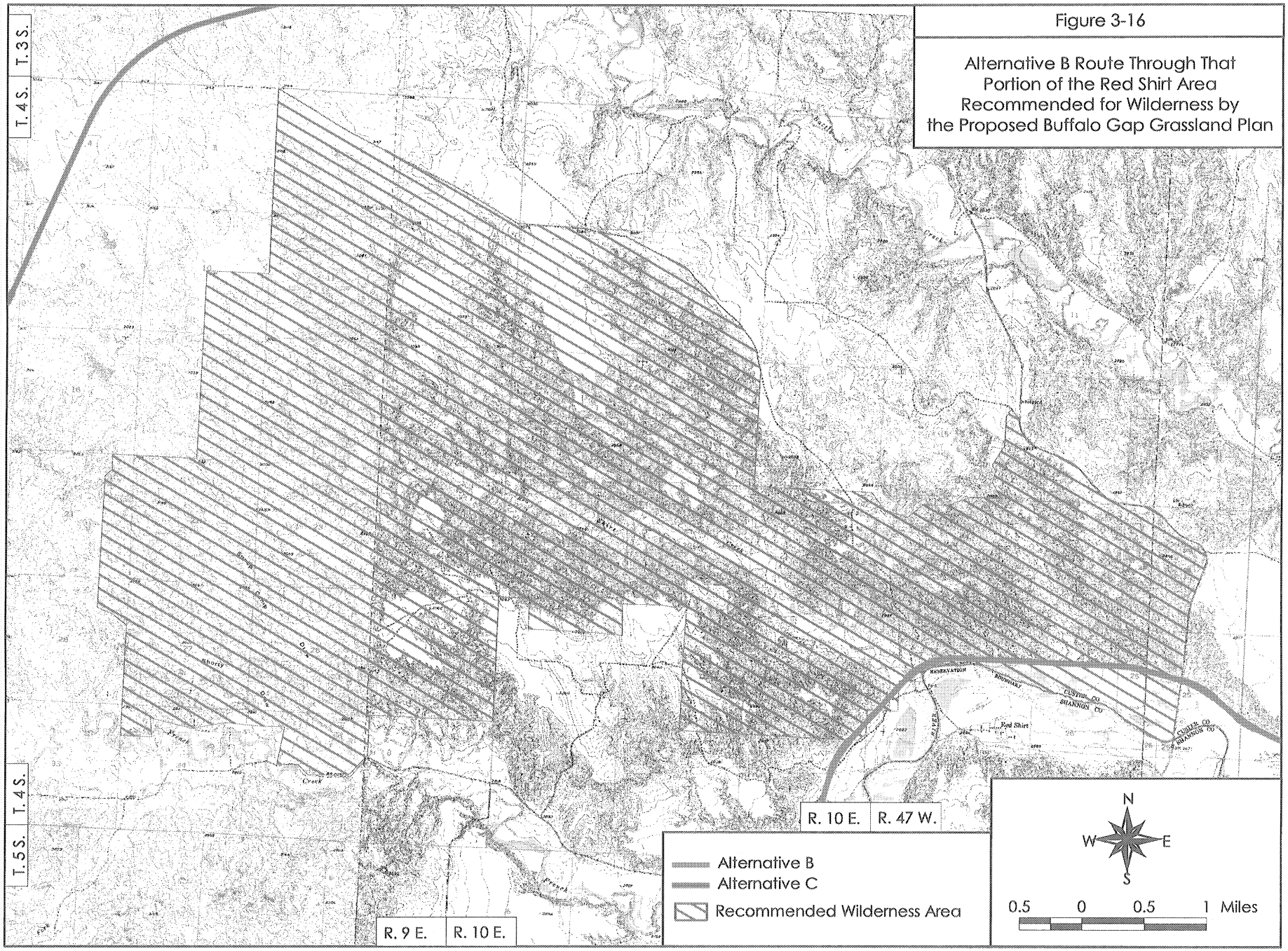
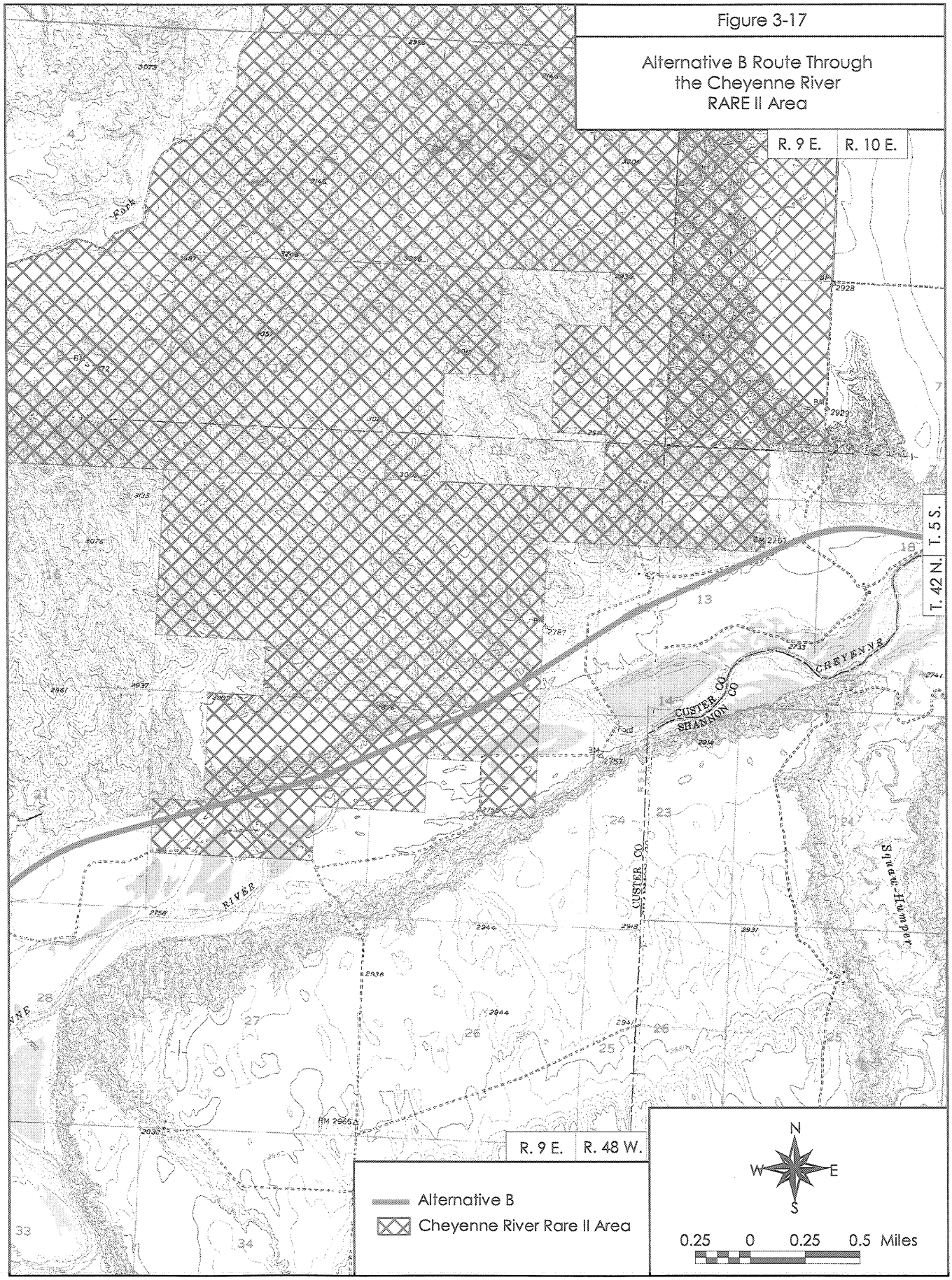


Figure 3-16

Alternative B Route Through That Portion of the Red Shirt Area Recommended for Wilderness by the Proposed Buffalo Gap Grassland Plan

Figure 3-17

Alternative B Route Through the Cheyenne River RARE II Area



The 7,570-acre Cheyenne River RARE II Area lies about 15 miles southeast of Hermosa and about 6 miles southeast of Fairburn. The topography of the area consists of gently rolling grasslands or highly vegetated tabletop buttes with steep, dissected slopes exposing layers of color-banded clays of reds and shades of white and gray. Sparsely vegetated, mounded, clay badlands terrain and beds of agates are also present. The elevation of the area ranges from between 2,750 and 3,300 feet. The dominate feature in the northern portion of the area is the Chalk Hills Ridge, exhibiting side slopes of white shale clays. This ridge runs in a northeasterly or southwesterly direction and is the most visible landmark in the northern portion of the area. The dominant feature in the southern portion is the Cheyenne River itself. Between the Chalk Hills and Cheyenne River are rolling grasslands dominated by western wheatgrass. Recreational opportunities include rock hounding, hunting, horseback riding, canoeing, prairie dog shooting and hiking. Livestock are grazed in the area.

Three inventoried roadless areas were identified on TBNG. These include HA Divide (5,060 acres); Red Hills (6,840 acres); and Cow Creek Buttes (10,450 acres). Figure 3-13 shows the locations of these inventoried roadless areas. None would be crossed by the alternatives.

Alternative B would approach within 1,400 feet of the H A Divide Inventoried Roadless Area as the northern leg enters Campbell County in Section 1, T. 42 N., R. 69 W. (see Figure 3-18). In addition, the spur to Jacobs Ranch Mine would pass directly north of the area as it traverses up H A Creek. In Section 2, T. 42 N., R. 69 W., the spur would approach within 150 feet of the roadless area. The spur would be located less than 1,000 feet of the north boundary of the roadless area in Section 9, T. 42 N., R. 43 N.

The H A Divide is located about 37 miles southeast of Gillette and about 16 miles east of Wright. H A Divide is characterized by a single, large mesa with color-banded buttes tapering away from the mesa. Side slopes on the mesa and area buttes display shale and limestone escarpments. The elevation of the area is around 4,500 feet. The top of the mesa is vegetated with ponderosa pine and Rocky Mountain juniper. Side slopes are partially barren. In general, H A Divide is a mixed-grass prairie, blended with sagebrush, limited cottonwood, some greasewood, ponderosa pine and Rocky Mountain juniper. Wildlife includes prairie dogs, pronghorn antelope, mule and white-tailed deer, grassland birds, raptors (including the bald eagle and peregrine falcon), reptiles and amphibians. Livestock grazing and hunting are frequent activities in the area.

At their closest, the southern legs of the alternatives would be routed about 1.7 miles north of the Red Hills Inventoried Roadless Area (see Figure 3-19). The Red Hills are located south of Antelope Creek in this area and the alternatives would be constructed north of or within the Antelope Creek drainage. The Red Hills Inventoried Roadless Area is located about 42 miles north of Douglas and about 10 miles north of Bill.

The area is characterized by rolling sage- and grass-covered hills, red scoria escarpments and buttes, dissected by mostly easterly flowing drainages. The area's elevation is between about 4,800 feet and 5,000 feet. The Red Hills Area is a visible landmark on TBNG. This area is a mixed-grass prairie, blended with sagebrush, cottonwood, greasewood, ponderosa pine and Rocky Mountain juniper. Wildlife includes prairie dogs, pronghorn antelope, mule and white-tailed deer, grassland birds, raptors, reptiles and amphibians.

Miller Hills Public Proposed Wilderness Area is about 8 miles south of the southern leg of the alternatives. The Cow Creek Buttes Inventoried Roadless Area is at least 15 miles south of the southern leg.

3.6.5 National Natural Landmarks. No areas designated or proposed as national natural landmarks occur in close proximity to any of the alternatives. In South Dakota, Cathedral Spires and Limber Pine Natural Area are located in Custer State Park in Fall River County. Both are more than 10 miles from the closest alternative (Alternative D). Mammoth Site of Hot Springs is located in the City of Hot Springs which, at its closest point, is more than 10 miles from any of the alternatives. In Wyoming, Lance Creek Fossil Area is located over 25 miles from the alternatives in Niobrara County.

3.6.6 Wild and Scenic Rivers. The National Wild and Scenic Rivers Act of 1968 (P.L. 90-542; 16 U.S.C. 1271-1287, as amended) is designed to preserve certain rivers and streams with outstanding natural, heritage, or recreational features in a free-flowing condition for the enjoyment of current and future generations. At the end of 1997, the national Wild and Scenic Rivers System included 154 streams totaling 10,759 miles. However, to date, no streams or rivers in western South Dakota or eastern Wyoming have been included in the system.[6]

Designated rivers and streams are classified as wild, scenic, or recreational. The Wild and Scenic Rivers Act defines these terms as follows:

- wild rivers - rivers or sections of rivers free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.

[6] A list of wild and scenic rivers can be found at http://www.nps.gov/rivers/wildriverslist.html

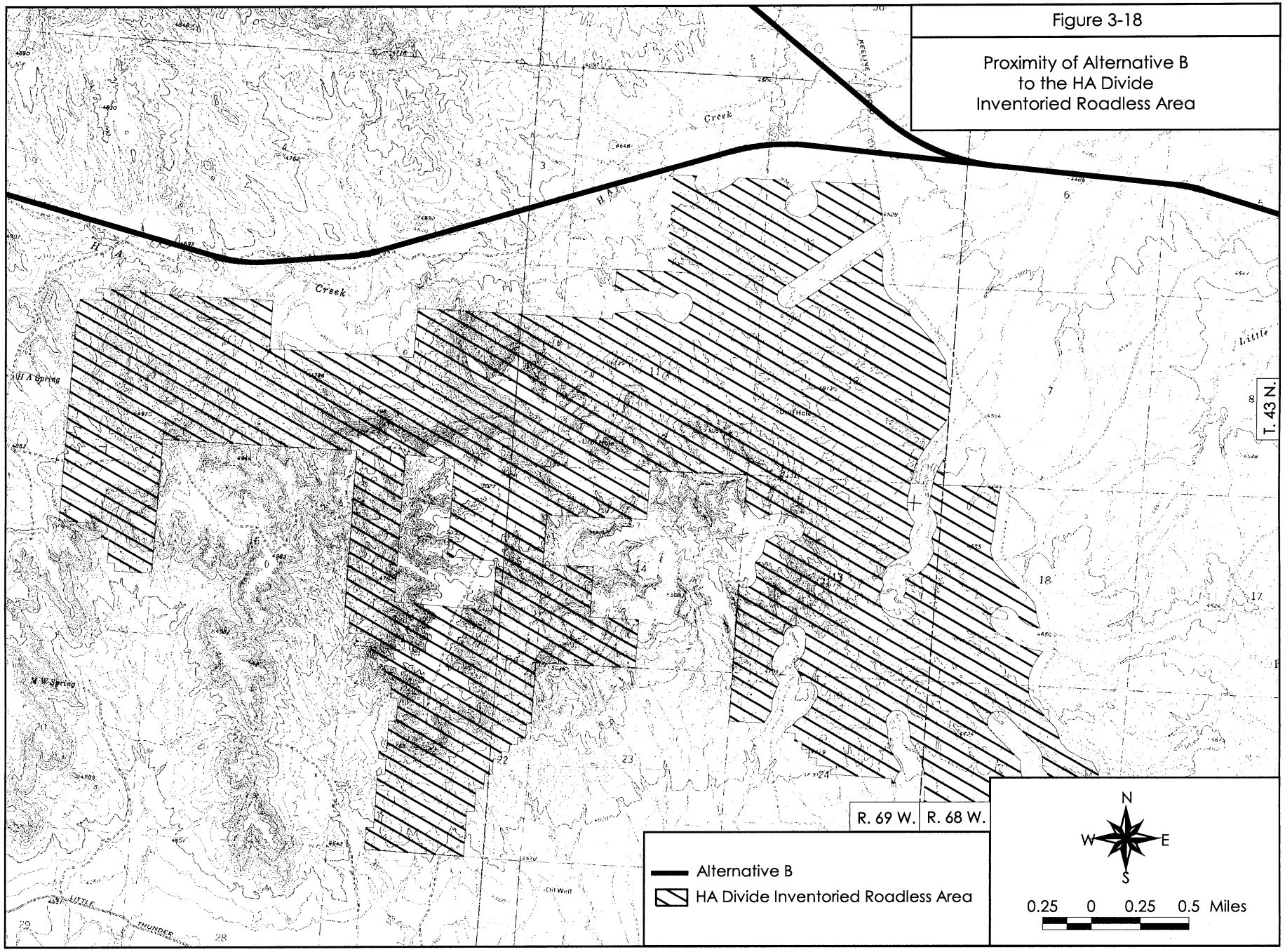


Figure 3-18

Proximity of Alternative B to the HA Divide Inventoried Roadless Area

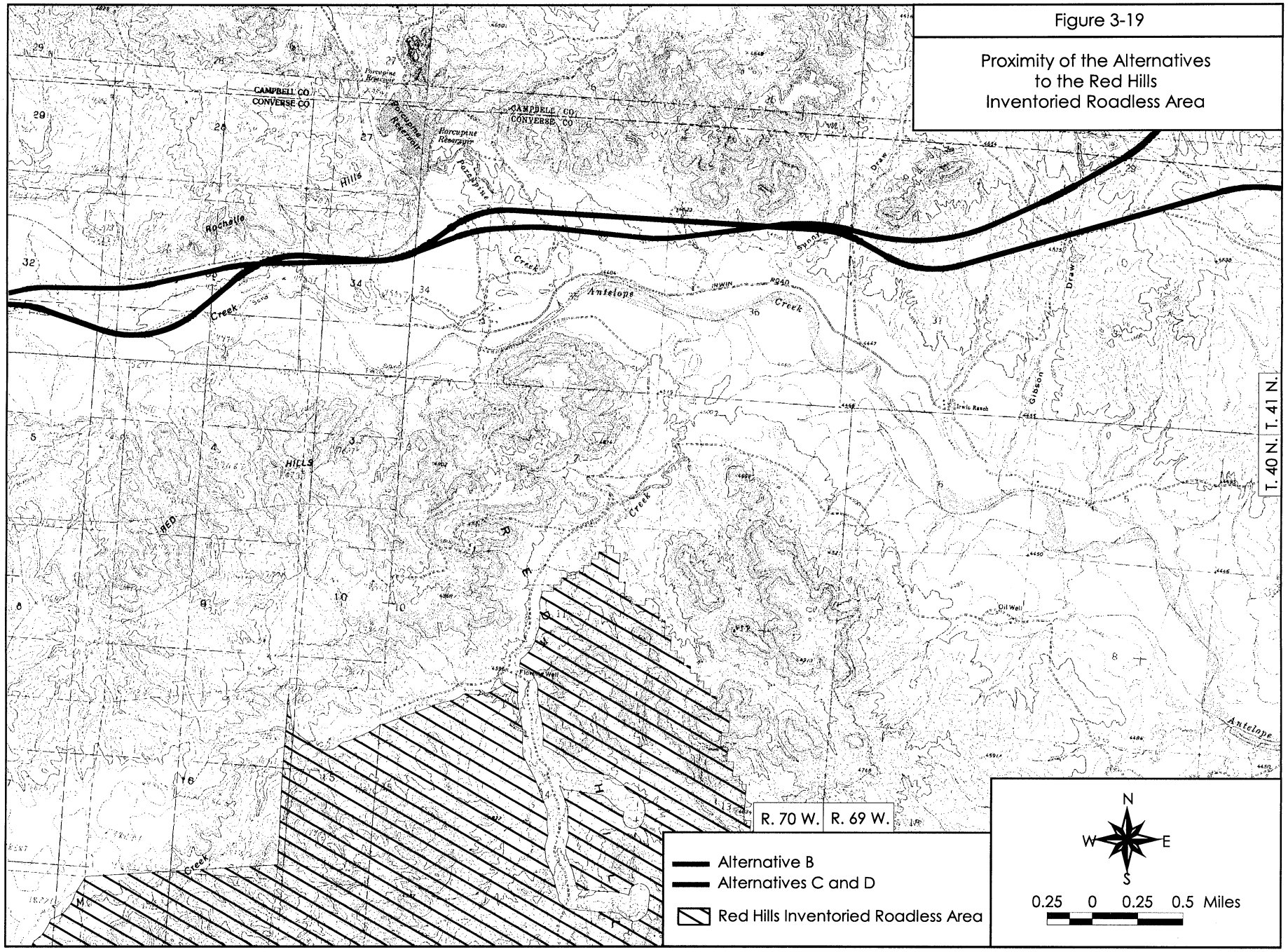


Figure 3-19

Proximity of the Alternatives to the Red Hills Inventoried Roadless Area

- scenic rivers - rivers or sections of rivers free of impoundments, with shorelines or watersheds still largely undeveloped, but accessible in places.
- recreational rivers - rivers or sections of rivers readily accessible by road or railroad, that may have some development along their shoreline and that may have undergone some impoundments or diversions in the past.

A 4-step process is required before a river can be included in the system. The first step is an evaluation of a river's "eligibility." This evaluation must consider the area within 0.25 miles of the high water mark on both sides of a river and other features outside the corridor, if their inclusion is essential for the protection of the river's outstandingly remarkable values. The second step is to classify eligible stretches of the river as potential wild, scenic, or recreational segments based on specific criteria that help determine the appropriate potential classification. The third step is to evaluate the eligible river for "suitability." This evaluation considers possible Congressional inclusion of the river in the National Wild and Scenic River System in terms of social and economic values, effects on other resources and effects on private lands and other uses of the area. Finally, an evaluation is made as to whether or not a recommendation for inclusion of segments of the river should be made to Congress. When Congress does designate a river for inclusion, a final boundary for the corridor is established and a management plan is developed.

As part of the plans revision, the Forest Service conducted a systematic review of all 6th level watersheds on the grasslands. The GIS computer program mapped all the 6th level watersheds on a scale of 1:126,720. An interdisciplinary team on each ranger district then reviewed the major streams within each 6th level watershed for free-flowing characteristics and evaluated the free-flowing segments using Forest Service Region 2 criteria to determine if segments had any outstandingly remarkable characteristics. Eligibility determination criteria indicating an outstanding rating could include scenic, recreation, geology, fisheries, wildlife, prehistoric, historic and ecological/vegetative. No streams or rivers on TBNG were determined to have outstandingly remarkable features. However, both the Cheyenne River and Rapid Creek on BGNG were determined to have outstandingly remarkable features.

The Forest Service has determined that about 8 miles of the Cheyenne River is eligible under the scenic classification on BGNG. The eligible section of this river is located from Section 27, T. 4 S., R. 10 E. to Section 21, T. 4 S., R. 11 E. This includes the entire portion of the river generally south of Battle Creek to Red Shirt (see Figure 3-20). This river section holds the potential for classification as scenic. Outstandingly remarkable features include significant fisheries and wildlife resources, scenic qualities and recreational values.

The inventory found the river to be highly scenic. A number of visually appealing habitats are visible from the river, including juniper breaks, cottonwood flood plains, and badlands topography. There is opportunity for increased recreational use of the river, including canoeing in a relatively pristine setting. The stream flow is somewhat controlled by Angostura Reservoir and some fences cross the river corridor, as does State Highway 44 in Section 26, T. 4 S., R. 10 E. The Old Highway 44 bridge also crosses the river corridor and, although it no longer transports traffic, it does have some historic and scenic value. Some utility lines and the Village of Red Shirt may be visible from some locations along the river.

However, the preferred alternative presented in the plans revision draft EIS (Alternative 3) does not propose designating this section of the Cheyenne River as wild and scenic. In fact, the draft EIS (Forest Service, 1999c) recognizes that railroad Alternative B may cut across this stretch of the Cheyenne River. The Draft EIS states "*degradation of the scenic and recreational backcountry characteristics of this stretch of the river could occur in lieu of designation should the proposed railway go through this National Forest Service river corridor.*"

The portion of Rapid Creek determined to be eligible is located in Section 35, T. 1 S., R. 11 E. well west or south of the alternatives.

3.7 Research Natural Areas

3.7.1 Impact Analysis Area. Any research natural areas (RNA) directly impacted or potentially affected by operating noise from the alternatives is included in the impact analysis area.

3.7.2 Affected Environment. The Forest Service defines RNAs as follows:

> *A physical or biological unit in which current natural conditions are maintained insofar as possible. These conditions are ordinarily achieved by allowing natural physical and biological processes to prevail without human intervention.*

RNAs are NFS lands that are permanently protected for the purposes of maintaining biological diversity, conducting non-manipulative research, monitoring to determine the effects of management on similar ecosystems and fostering education. They may also assist in implementing provisions of special acts such as the Endangered Species Act and the National Forest Management Act. RNAs are established on NFS lands as part of the continuing land and resource

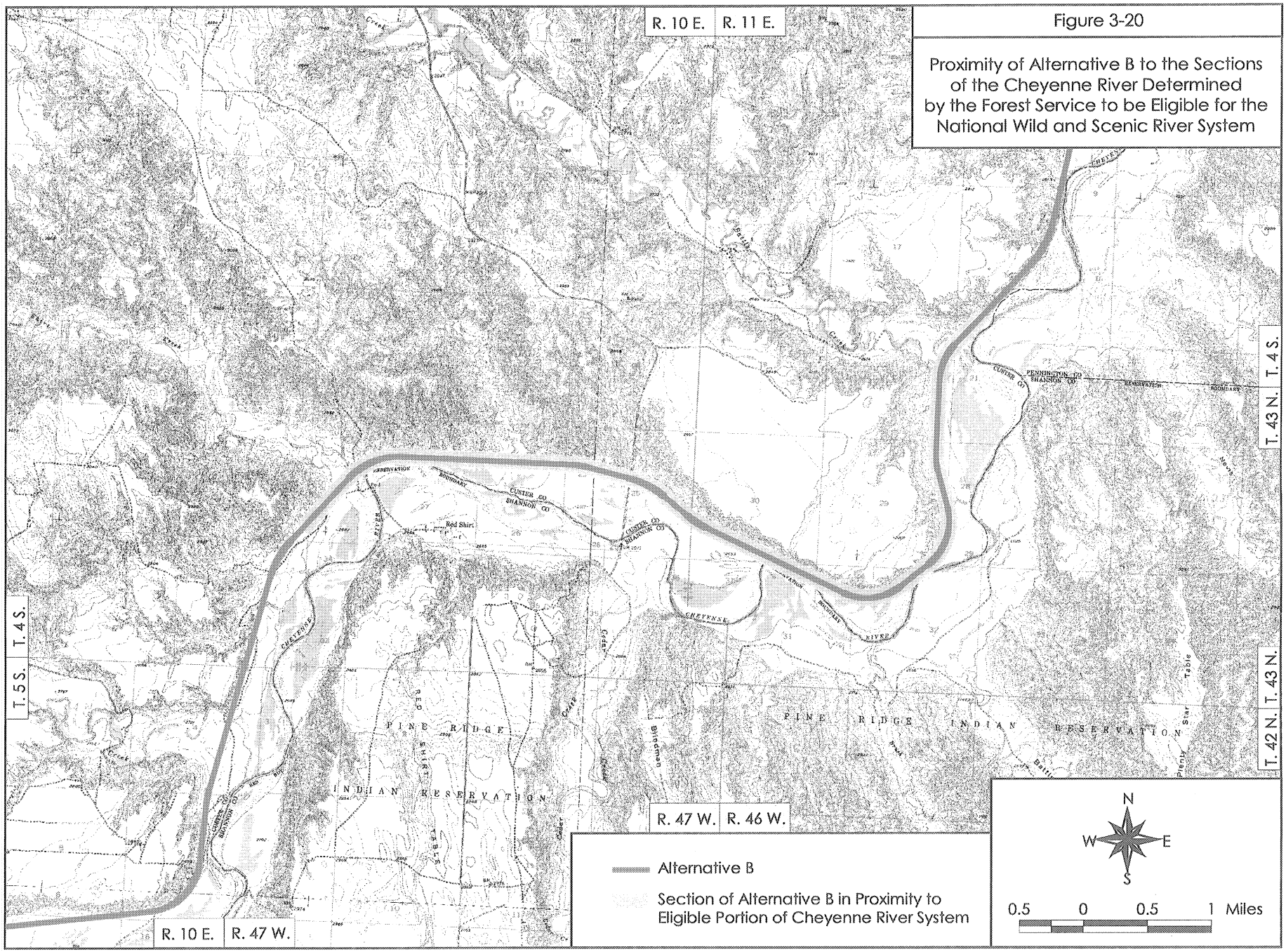


Figure 3-20

Proximity of Alternative B to the Sections of the Cheyenne River Determined by the Forest Service to be Eligible for the National Wild and Scenic River System

management planning process.[7] The objectives of RNAs are to:

- Preserve a wide spectrum of pristine representative areas that typify important forest, shrubland, grassland, alpine, aquatic, geological, and similar natural situations that have special or unique characteristics of scientific interest and importance that, in combination, form a network of ecological areas for research, education and maintenance of biological diversity.
- Preserve and maintain genetic diversity.
- Protect against serious environmental disruptions.
- Serve as reference areas for the study of succession.
- Provide on-site and extensive educational activities.
- Serve as baseline areas for measuring long-term ecological changes.
- Serve as control areas for comparing results from manipulative research.
- Monitor the effects of resource management techniques and practices.

There are currently no RNAs on TBNG nor in the vicinity of the alternatives on BGNG. However, during the plans revision, the Forest Service identified additional potential RNAs based on potential community types that exist on the grasslands. On both BGNG and TBNG, the Forest Service worked with The Nature Conservancy to develop ecological field evaluations to arrive at establishment protocols. The *Rare Plant Communities of the Northern Great Plains* assessment and *Northern Great Plains Assessment Map*, both prepared by The Nature Conservancy, were used to aid in the determination of potential RNAs. All RNAs were nominated regardless of current management practices occurring in the area; that is, current management did not diminish the conditions to a point that the areas could not meet the established RNA criteria. These include:

- quality - how well a site represents the targeted ecosystem type or projected biodiversity elements.
- condition - how much the site has been degraded or altered from natural or optimal conditions.
- viability - the likelihood of long-term survival for the ecosystem and its protected biodiversity.
- defensibility - extent to which the ecosystem and biodiversity elements can be protected from extrinsic human factors.

The plans revision inventory identified a potential RNA about 2.8 miles south of the southern leg of Alternative B on TBNG. The Antelope Creek Potential RNA contains 1,090 acres and was considered based on its botanical value. The location of the potential RNA in relation to the alternative is shown on Figure 3-21. Under the Forest Service's preferred alternative (Alternative 3) for the proposed TBNG Grassland Plan, the Antelope Creek Area is not nominated as an RNA.

The Antelope Creek area is located about 16 miles northwest of Bill. According to the Forest Service (1999c), the area is in reasonably good ecological condition and contains a high quality example of a plains stream ecosystem. The area includes Antelope Creek and the Dry Fork of the Cheyenne River. Vegetation includes plains cottonwood woodlands, shrub vegetation of plains silver sagebrush and black greasewood, grasslands of prairie sandreed and needle-and-thread, and wet meadows of leafy bulrush and alkali cordgrass.

The proposed BGNG Grassland Plan identified a potential RNA in the Hay Canyon Area. However, like Antelope Creek on TBNG, the area is not nominated as an RNA under the Forest Service's draft EIS preferred alternative. The Hay Canyon Pasture Potential RNA is located about 7 miles northeast of Smithwick and about 1.1 miles southeast of Alternative C (see Figure 3-22). It was also considered because of its botanical value. In the area's drier uplands, short and mixed-grass communities are prevalent. The lower drainage ways exhibit more vegetative growth and a few isolated cottonwood trees. Wetlands in the potential RNA are in reasonable condition and a healthy prairie dog population is scattered across the area.

The South Pasture RNA (777 Allotment) was proposed and nominated on the BGNG under the preferred grassland plan alternative because of its botanical value. The RNA is located about 7 miles east of Fairburn and approximately 0.7 miles southeast of Alternative C (see Figure 3-22). This 1,570 acre RNA is characterized by nearly level to rolling hills to very steep badlands and gently sloping alluvial fans. Dominate vegetation includes western wheatgrass and needle-and-thread. Juniper breaks and shrub patches are also present, as well as deciduous riparian woodlands along French Creek. Current use of the area includes short-duration grazing by bison.

3.8 Visual Resources

3.8.1 Impact Analysis Area. Generally, the impact analysis area for visual resources includes areas from which the operating railroad would be visible. In most cases, specific descriptions are limited to NFS lands because these are the only areas which would be directly affected by the alternatives which have established visual management objectives.

As discussed under the recreation resources section, the national grasslands offer vast and undeveloped appearing landscapes. Although the VQO system attempts to quantify and provide management direction

[7] Pursuant to 36 CFR ¶ 219.25.

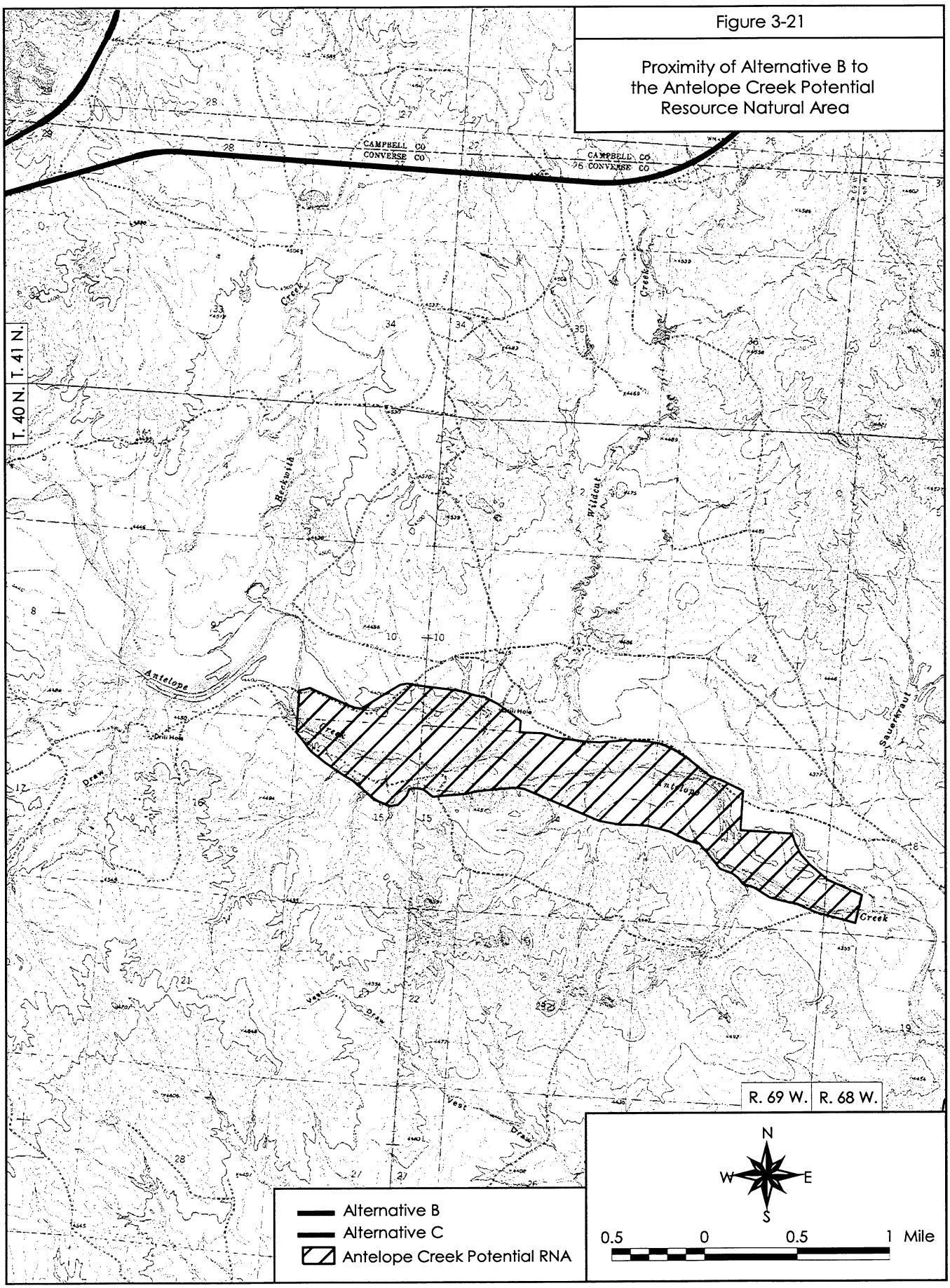
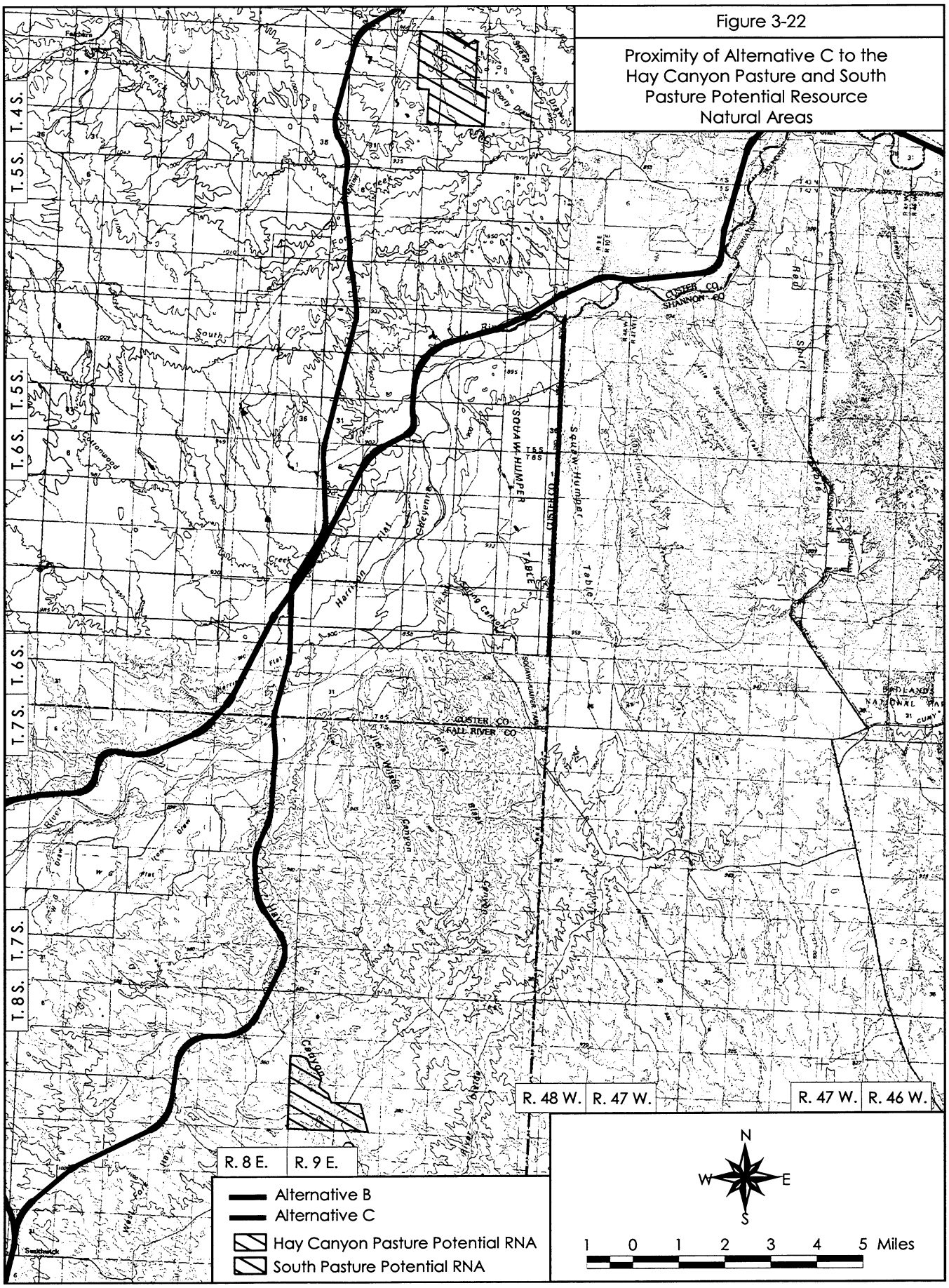


Figure 3-21

Proximity of Alternative B to the Antelope Creek Potential Resource Natural Area

Figure 3-22

Proximity of Alternative C to the Hay Canyon Pasture and South Pasture Potential Resource Natural Areas



for the visual resources, the expansiveness of these lands tend to diminish much of the existing human developments when viewed on a landscape or background level. Other than in the vicinity of the existing coal mines on the western flank of the grassland, this diminishing effect of developments is due in part to the relatively small scale developments that exist, such as windmills and oil wells. The primitive appearing landscapes on the grasslands offer a valuable, yet diminishing resource on these lands.

3.8.2 Affected Environment. The visual setting of the impact analysis area is quite variable. Some areas are very remote and show little or no human intrusions. Other areas, such as the route for Alternative D through Rapid City, are metropolitan in nature and existing visual impacts dominate the landscape. Natural landscapes range from dry desert-like areas to evergreen forests.

Many portions of the alternatives would be constructed adjacent to or would replace existing railroads, including the majority of Alternative D and, for the most part, the northern and southern legs of all the alternatives. In these areas, human activities are obvious - an operating railroad already exists at the site. The general types of visual intrusions from the project would be very similar to those that are currently occurring. It is recognized that the frequency of the visual intrusions may increase.

Only NFS lands in the impact analysis area have visual quality management objects. NFS lands on both BGNG and TBNG have been assigned VQOs. Historically, the Forest Service has used VQOs to define acceptable degrees of alteration of the natural landscape. The degree of alteration permitted using the VQO system is measured in terms of the changes in visual contrast with the surrounding landscape. The 5 VQOs used by the Forest Service, in descending order of allowable contrast, are:

- preservation
- retention
- partial retention
- modification
- maximum modification

Landscapes with a preservation designation have the highest scenic quality and are most sensitive to change. Small changes in visual contrast are generally considered unacceptable within this VQO. Maximum modification is assigned to areas which have the lowest scenic quality and which are not typically sensitive to change. Major changes in visual contract are acceptable within this VQO. Two VQOs would be affected on NFS lands by the alternatives - modification and partial retention. The miles of each of the VQOs which would be crossed by the alternatives are summarized on Table 3-27.

As can be seen on the table, between 80 and 90 percent of the lands which would be crossed by the alternatives on BGNG currently have a modification VQO. Relatively large changes in visual contrast are allowed in this VQO. In fact, changes in visual contrast to the degree that management activities dominate the landscape are allowed in this VQO. However, facilities, buildings, roads, signs, etc., are still required to borrow from the adjacent environment in terms of the materials, textures and colors used. For example, large clear cuts and powerlines may dominate the landscape but their visual impact should still be minimized in places using mitigation measures such as dulling metal surfaces, reseeding, leaving scattered tree groups, etc.

The partial retention VQO has been applied to only between 10 and 20 percent of the NFS lands which would be crossed by the alternatives. These areas are typically restricted to riparian corridors and other waterbodies. Less change in visual contrast is allowed in this VQO than in modification. While management activities are allowed to dominate the landscape under the modification VQO, in partial retention areas management activities are expected to be subordinate to the natural environment. Management activities are not anticipated to attract the attention of the casual observer in this VQO.

For the plans revision, the Forest Service inventoried BGNG and TBNG under a new scenic management system. Unlike the VQOs currently in place, mapping under the new system incorporates viewing distance zones, concern level, scenic attractiveness (indicator of intrinsic scenic beauty of a landscape), scenic class (determined by combining the scenic attractiveness with distance zone and concern levels) and existing scenic integrity (state of naturalness).

In the proposed BGNG and TBNG grassland plans, scenic integrity levels (SIL) were assigned to each of the proposed management prescription areas (see Section 1.4.1.3). The miles which would be crossed by the alternatives in each of the SILs are listed on Table 3-27. The SILs which would be crossed by the alternatives are described below:

- High - human activity is not scenically evident;
- Moderate - valued landscape character appears slightly altered;
- Low - valued landscape character appears moderately altered.

Under the proposed grassland plans, the SILs are predominately moderate or low for lands which would be crossed by the alternatives. In fact, for Alternative B only about 10 percent of the NFS lands which would be crossed have a high SIL. The percentage of high SIL is even lower for Alternative C and the route variations (about 6 percent). No NFS lands classified with a high

Table 3-27 Miles of Visual Quality Objective Which Would be Crossed by the Alternatives on National Forest System Lands							
Visual Quality Objective/SIL Class	Alternative B	Alternative C	Alternative C with Phiney Flat Route Variation	Alternative C with W G Flat Route Variation	Alternative D	Black Thunder North Mine Loop	Black Thunder South Mine Loop
Buffalo Gap National Grassland							
Modification VQO	13.7	5.4	4.9	5.4	0	0	0
Partial Retention VQO	2.6	0.7	0.4	0.7	0	0	0
Thunder Basin National Grassland							
Modification VQO	30.7	28.4	28.4	28.4	22.7	0.6	2.7
Partial Retention VQO	4.9	4.4	4.4	4.4	4.0	<0.1	0.4
1999 Proposed National Grasslands Plan for Thunder Basin and Buffalo Gap National Grasslands							
High SIL	4.7	2.4	2.4	2.4	0	0	0
Moderate SIL	0	0.6	0.6	0.6	4.7	0	0
Moderate SIL in foreground and middleground, Low SIL in background of scenic classes 1-2; Low SIL in all areas scenic classes 3-7	16.6	12.4	12.4	12.4	7.9	0	0
Low SIL	30.6	23.5	22.7	23.5	14.1	0.6	3.1

SIL would be crossed by Alternative D or by any of the mine loop options.

3.9 Cultural and Historic Resources

The EIS for this project will contain a complete analysis of potential impacts to cultural resources. The reader is referred to that document for information regarding this resource.

3.10 Air Quality

3.10.1 Impact Analysis Area. The impact analysis area for air quality includes eastern Wyoming and western South Dakota.

3.10.2 Affected Environment. Very detailed information describing existing air quality in eastern Wyoming and western South Dakota is being developed to support modeling of potential impacts from the project. This modeling is being conducted by STB for the EIS. This section provides a general overview of existing air quality in the area. For more detail, please refer to the technical report prepared to support the modeling results presented in the EIS.

Background Air Quality. Air quality in the vicinity of the alternatives is generally considered excellent. Air quality programs are managed by the Wyoming Department of Environmental Quality (WDEQ), Air Quality Division in Wyoming and by the SDENR, Air Quality Program in South Dakota. Both agencies have primacy from the EPA to implement regulatory provisions of the Clean Air Act.

The EPA has established National Ambient Air Quality Standards (NAAQS) which are absolute nationwide limits on the amounts of certain pollutants that may be present in the air. The State of Wyoming has developed its own standards (Wyoming Ambient Air Quality Standards - WAAQS) for the national pollutants and others. WAAQS are at least as stringent as the EPA standards. The State of South Dakota has not developed standards in addition to the NAAQS - therefore, the NAAQS apply in South Dakota. Standards for criteria pollutants currently in effect for both states are listed on Table 3-28. The air quality impact analysis area is in attainment for all NAAQS and WAAQS.

Very little background ambient air quality data is available for the counties which would be crossed by the alternatives. According to the BLM (1998), in the Newcastle Field Office area measured background concentrations of NO_2 were 2 $\mu g/m^3$. For SO_2, the 24-hour measured background concentration was 9 $\mu g/m^3$, while the annual average was 1 $\mu g/m^3$. TSP was less than half the WAAQS at 62.5 $\mu g/m^3$ and the 24-hour average PM_{10} concentration was only 10 $\mu g/m^3$. The 1- and 8-hour background concentrations for CO were 3,500 and 1,500 $\mu g/m^3$, respectively.

Table 3-28 Criteria Pollutants and Applicable Ambient Air Quality Standards in μg/m³ for South Dakota and Wyoming			
Criteria Pollutant	**Averaging Period**	**NAAQS and South Dakota**	**WAAQS**
Nitrogen dioxide (NO_2)	annual	100	100
Sulfur dioxide (SO_2)	3-hour 24-hour annual	1,300 365 80	1,300 260 60
Total suspended particulates (TSP)	24-hour	N/A	150
Particulate matter less than 10 micrometers in diameter (PM_{10})	24-hour annual	150 50	150 50
Carbon monoxide (CO)	1-hour 8-hour	40,000 10,000	40,000 10,000
Ozone (O_3)	1-hour	235	160

WDEQ began a NO_2 monitoring program at Gillette in March, 1996 and discontinued it in May,1997 (BLM, 1999). The average for the entire period was 16.5 μg/m³. Data for NO_2 was also collected at the Belle Ayr Mine and the Black Thunder Mine (see Figure 1-1). The average for the entire period at the Black Thunder Mine was 15.6 μg/m³, while the Belle Ayr data showed an average of 19.4 μg/m³.

In EPA's Aerobatic Information Retrieval System (AIRS) database,[8] additional PM_{10} background concentrations are provided for Campbell and Converse counties. Between 1993 and 1998 in Campbell County, the maximum 24-hour average PM_{10} was typically below 70 μg/m³. However, in 1995 (112 μg/m³) and 1996 (101 μg/m³), the maximum 24-hour background concentration exceeded 100 μg/m³ but did not exceed the WAAQS. Annual average PM_{10} during the monitoring period never exceeded 30 μg/m³. Converse County data is available from AIRS for 1997 and 1998. Like Campbell County, during these years annual average PM_{10} concentration did not exceed 30 μg/m³. Maximum 24-hour concentration was below 60 μg/m³ for both years.

The only current air quality monitoring station in South Dakota in the vicinity of the alternatives is in Rapid City.[9] The AIRS database includes PM_{10} for 1993 through 1998 for this site. In all years, except 1998, the maximum 24-hour PM_{10} concentration exceeded 100 μg/m³. The peak maximum 24-hour concentration was reached during 1994 at 144 μg/m³ which is just below the NAAQS. The peak annual average was also recorded during 1994 at 46 μg/m³. Over the years for which data is available, the annual average background concentration varied between 37 and 46 μg/m³.

Class I Airsheds. Prevention of significant deterioration (PSD) standards have been established which serve to keep areas which have very good air quality from being degraded to NAAQS by allowing only certain increments (increases) above existing background air quality conditions. PSD allowable increments are not the same for all areas of the country. For purposes of allowable increments, areas of the country have been designated as either Class I or Class II. Examples of Class I areas are national parks and wilderness areas larger than 5,000 acres and other areas designated by the states or Indian tribes. Class I areas are designed to have the best air quality and, therefore, have the smallest allowable increments. Class II areas have larger allowable increments. All the alternatives would be constructed through PSD Class II areas. However, air pollutants disperse from sources (such as locomotive engines) and affect air quality away from the source. Concerns have been raised about the potential for pollutants generated by the locomotives to affect nearby Class I areas where the increment is lower.

Two Class I areas, Wind Cave National Park and the Sage Creek Wilderness Area (within Badlands National Park), exist in relatively close proximity to the alternatives. Both Class I areas are located in South Dakota and are shown on Figure 2-1. Alternative D would be constructed less than 3 miles east of Wind Cave National Park in Custer County. The Sage Creek Wilderness Area is located approximately 6.2 miles south of Alternatives B and C west of Wall in Pennington County.

Air Quality Related Values (AQRVs), which include the potential air pollutant effects on visibility and the acidification of surface waterbodies, are of concern for PSD Class I areas and some PSD Class II areas. Visibility impairment occurs as a result of the scattering and absorption of light by air pollution. This decreases the distance of what we see in addition to degrading the color, clarity, and contrast of the various scenes. Primary particles, such as soot/elemental carbon from wood combustion, and primary gaseous emissions [for example

[8] The AIRS data base can be accessed through http://www.epa.gov

[9] A map of air quality monitoring stations in South Dakota can be found at http://www.state.sd.us/denr/DES/AirQuality/airmap.htm

nitrous oxides (NOx) from engines], reduce visibility. Humidity can also significantly increase the effect of pollution on visibility.

Since 1987, EPA has supported the Interagency Monitoring of Protected Visual Environments (IMPROVE) network in cooperation with the NPS, Forest Service, BLM, USFWS, and state agencies. One of the principal purposes of the IMPROVE network is to gather data that can be used to identify sources of impairment on an individual site, regional and national scale. This network began with 20 long-term monitoring sites in 1987 and now includes over 40 sites in parks and wilderness areas across the nation.

There is an IMPROVE monitoring site in Badlands National Park. The Badlands IMPROVE monitoring site ranks nearly in the middle of the range from cleanest to dirtiest monitoring sites in the nation (ranked 22 out of 42 total sites). The visibility degradation, like many rural western areas, is largely due to sulfate, organic and soot aerosols. Visibility at the Badlands National Park IMPROVE site is generally considered to be only average.

Atmospheric deposition (acid rain) is monitored as part of the National Acid Deposition Program/National Trends Network near Newcastle. Data from this site shows that current deposition rates are well below those that are considered potentially damaging to vegetation (BLM, 1998).

State and Federal Regulatory Programs. South Dakota and Wyoming do not currently regulate emissions from locomotives. However, the 1990 Clean Air Act amendments included a specific mandate for EPA to regulate these emissions. According to the EPA, unregulated locomotives are estimated to contribute almost 5 percent of the total nationwide emissions of nitrous oxides (NOx), which is more than 10 percent of the nationwide mobile sources of NOx emissions. EPA has determined that locomotives are one of the largest remaining unregulated sources of NOx emissions in the nation.

EPA is finalizing emission standards for NOx, hydrocarbons, carbon monoxide, particulate matter, and smoke for newly manufactured and remanufactured diesel-powered locomotives and locomotive engines. EPA has predicted that these new standards, which take effect in 2000, will achieve approximately a 66 percent reduction in NOx emissions. Hydrocarbon and particulate matter will be reduced by about 50 percent.

3.11 Geology and Paleontological Resources

3.11.1 Impact Analysis Area. For purposes of assessing impacts to geology and paleontological resources, an area including 500 feet on both sides of the alternative centerlines was evaluated.

3.11.2 Geology Affected Environment. The alternatives would be constructed entirely within the Upper Missouri Basin Broken Lands of the Interior physical subdivision (Radbruch-Hall *et al.*, 1976). Tables 3-29 through 3-33 list the formations which would be crossed by the alternatives. A brief description of each formation is provided in Table 3-34 (Love and Christiansen, 1985).

In South Dakota, 30 to 42 percent of the alternative routes would cross the Pierre Shale which was deposited during middle Cretaceous times. A large percentage of Alternatives B (44 percent) and C (35 percent) would cross quaternary alluvium where they are adjacent to and within the Cheyenne River flood plain. Alternative D follows the Cheyenne River flood plain to a lesser degree (10 percent of the route). Most of the other formations which would be crossed in South Dakota consist of Cretaceous shales with a lesser amount of limestone. Near the Wyoming-South Dakota State line, the alternatives are aligned to the southwest of the Black Hills which are a domed uplift with the oldest rocks exposed in the center and both sides having progressively younger strata outward. All of the alternatives would cross a portion of the domal uplift, although on the outer edge. At the outer edge of the dome, the alternatives would cross through the Greenhorn limestone where there may be karst terrain present. In western South Dakota and adjacent parts of Wyoming, Paleozoic and Cretaceous carbonate rocks, arched steeply upwards, encircle the structural dome that forms the Black Hills. Caves and open fissures are common and a few caves contain many miles of passages. However, most of the cave passages and fissures in the Black Hills area only extend up to 3,000 feet in length and are generally less than 150 feet in depth (Davies *et. al.*, 1984).

In Wyoming, the principal formation which would be crossed by the alternatives is the Fort Union. The Fort Union consists of the Lebo, Tullock and Tongue River members and was deposited during early Tertiary times. More than 60 percent of Alternatives B and C and approximately 45 percent of Alternative D would cross this formation through Wyoming. The Lance Formation, deposited in late cretaceous times, is the second most frequently crossed formation for Alternatives B and C.

The second most frequently crossed formation for Alternative D is the Greenhorn Formation and Belle Fourche Shales. Other formations existing to a lesser degree on the alternatives consist of early to middle cretaceous deposits such as the Pierre Shale and Mowry Shale.

Table 3-29 Miles of Formations Which Would be Crossed by Alternative B							
Formation	Miles Crossed by Land Ownership					State Total (miles)	Percent of State
	Forest Service	DOE	BLM	State	Private		
South Dakota							
Alluvium and Colluvium	16.3		0.9	2.1	44.4	63.7	44.1
White River Group					1.2	1.2	0.8
Pierre Shale	<0.1		1.3		46.9	48.2	33.3
Niobrara Formation, Carlile Shales and Greenhorn Limestone					6.8	6.8	4.7
Carlile Shale					0.7	0.7	0.5
Greenhorn Formation					0.2	0.2	0.1
Belle Fourche Shale		0.3	1.1	0.6	14.0	16.0	11.0
Belle Fourche and Mowry Shales					0.9	0.9	0.6
Mowry Shales					1.3	1.3	0.9
Skull Creek Shale and Inyan Kara Group					1.8	1.8	1.2
Unknown					4.1	4.1	2.8
South Dakota Total	16.3	0.3	3.3	2.7	122.3	144.9	100
Wyoming							
Alluvium and Colluvium					1.2	1.2	0.8
Wasatch Formation, Main Body	1.6				4.1	5.7	3.8
Fort Union: Tongue River and Lebo Members				0.1	2.0	2.1	1.4
Fort Union: Lebo Member	24.7		1.4	2.2	56.2	84.5	55.8
Fort Union: Tullock Member	3.6			1.1	14.8	19.5	12.9
Lance Formation	5.7			2.1	13.0	20.8	13.8
Fox Hills Sandstone			1.0		6.4	7.4	4.9
Pierre Shale				0.9	2.8	3.7	2.4
Niobrara Formation and Carlile Shale					1.5	1.5	1.0
Greenhorn Formation and Belle Fourche Shale				1.0	3.8	4.8	3.2
Wyoming Total	35.6		2.4	7.4	105.8	151.2	100

The Black Thunder North Mine Loop would cross 3.6 miles of the Fort Union Lebo member and 0.90 miles of the main body of the Wasatch Formation. The Black Thunder South Mine Loop would cross 3.9 miles of the Lebo member of the Fort Union Formation and 3.2 miles of the main body of the Wasatch Formation. The North Antelope East and West mine loops would cross 1.5 and 2.4 miles of the Fort Union Lebo member, respectively.

No earthquake epicenters have been mapped in the immediate vicinity of Alternatives B and C (Hammond, 1993 and Case *et. al*, 1995). According to Case *et. al.* (1995), the Alternative D route passes adjacent to (within 5 miles) 2 earthquake epicenters between Newcastle and Gillette. The first earthquake was in May, 1926 and has been given an intensity of IV on the Modified Mercalli Intensity Scale (see below for definition). The second earthquake occurred in February, 1972 and had a body wave magnitude of 4.3 (on a scale of 2.0 to 7.5) for relative earthquake size.

Seismic risk maps have been developed to define zones of maximum expected damage in an attempt to show the relative earthquake hazards to people and structures. All alternatives are located well within Seismic Risk Zone 1 which predicts "minor damage, Intensity V and VI on the Modified Mercalli Scale". The Modified Mercalli (MM) scale is defined below as:

MM IV — Felt indoors by many during the day, outdoors by few. At night, some persons are awakened. Dishes, windows and doors are disturbed; walls make cracking sound. Sensation like heavy truck striking building; standing vehicles are rocked noticeably.

Table 3-30 Miles of Formations Which Would be Crossed by Alternative C						
Formation	Miles Crossed by Land Ownership				State Total (miles)	Percent of State
	Forest Service	BLM	State	Private		
South Dakota						
Alluvium and Colluvium	2.8	1.2	1.1	44.2	49.3	34.6
White River Group	1.4			9.4	10.8	7.6
Pierre Shale	1.9	0.7	0.8	49.4	52.8	37.0
Niobrara Formation, Carlile Shales and Greenhorn Limestone				6.2	6.2	4.3
Carlile Shale				0.9	0.9	0.6
Greenhorn Formation				0.2	0.2	0.1
Belle Fourche Shale		1.5	0.2	10.5	12.2	8.6
Belle Fourche and Mowry Shales				3.1	3.1	2.2
Mowry Shales				1.2	1.2	0.8
Skull Creek Shale and Inyan Kara Group				1.8	1.8	1.3
Unknown				4.1	4.1	2.9
South Dakota Total	6.1	3.4	2.1	131.0	142.6	100
Wyoming						
Alluvium and Colluvium			0.5	1.2	1.7	1.3
Wasatch Formation, Main Body	1.6		0.1	6.7	8.4	6.4
Fort Union: Tongue River and Lebo Members			0.1	2.0	2.1	1.6
Fort Union: Lebo Member	22.1	0.1	4.6	41.5	68.3	52.2
Fort Union: Tullock Member	2.7		1.1	8.0	11.8	9.0
Lance Formation	6.4		1.7	14.1	22.2	16.8
Fox Hills Sandstone		1.3		6.2	7.5	5.7
Pierre Shale		0.1	1.0	2.4	3.5	2.7
Niobrara Formation and Carlile Shale				1.5	1.5	1.1
Greenhorn Formation and Belle Fourche Shale			0.5	3.7	4.2	3.2
Wyoming Total	32.8	1.5	9.6	87.3	131.2	100

MM V Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.

MM VI Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.

Nearly all of the earthquakes in Wyoming have been due to movements of faults. None of the alternatives would not cross any suspected active faults (Case, 1997). All the alternatives would cross inactive faults identified by Love and Christiansen (1985) south of Newcastle near Morrisey.

In both Wyoming and South Dakota, significant portions of the alternatives would cross the Pierre Shale Formation which has high landslide susceptibility (Radbruch-Hall *et. al*, 1976). In these areas, cutting or loading of slopes or anomalously high precipitation may cause landsliding involving more than 15 percent of the rock or soil.

3.11.3 Paleontological Resources Affected Environment. In the vicinity of the alternatives are world-famous paleontological deposits. In fact, the Badlands of South Dakota are considered to be the birthplace of the science of vertebrate paleontology. Badlands National Park formations date from the late Eocene and Oligocene epochs, the Age of Mammals. Ancestors of the modern day rhinoceros, horse, pig, cat, and many other species are present. There are also early birds, reptiles, and invertebrates found in various strata.

The fossil fauna on BGNG is very diverse because it contains both marine vertebrate and invertebrates. Most

Table 3-31 Miles of Formations Which Would be Crossed by Alternative C With the Phiney Flat Route Variation						
Formation	Miles Crossed by Land Ownership				State Total (miles)	Percent of State
	Forest Service	BLM	State	Private		
South Dakota						
Alluvium and Colluvium	2.0	1.3	1.1	38.9	43.2	30.2
White River Group	1.4			9.4	10.8	7.5
Pierre Shale	1.9	0.7	0.8	56.3	59.8	41.7
Niobrara Formation, Carlile Shales and Greenhorn Limestone				6.2	6.2	4.3
Carlile Shale				0.9	0.9	0.6
Greenhorn Formation				0.2	0.2	0.1
Belle Fourche Shale		1.4	0.2	10.5	12.1	8.4
Belle Fourche and Mowry Shales				3.1	3.1	2.2
Mowry Shales				1.2	1.2	0.8
Skull Creek Shale and Inyan Kara Group				1.8	1.8	1.3
Unknown				4.1	4.1	2.9
South Dakota Total	5.3	3.4	2.1	132.6	143.4	100
Wyoming						
Alluvium and Colluvium			0.5	1.2	1.7	1.3
Wasatch Formation, Main Body	1.6		0.1	6.7	8.4	6.4
Fort Union: Tongue River and Lebo Members			0.1	2.0	2.1	1.6
Fort Union: Lebo Member	22.1	0.1	4.6	41.5	68.3	52.2
Fort Union: Tullock Member	2.7		1.1	8.0	11.8	9.0
Lance Formation	6.4		1.7	14.1	22.2	16.8
Fox Hills Sandstone		1.3		6.2	7.5	5.7
Pierre Shale		0.1	1.0	2.4	3.5	2.7
Niobrara Formation and Carlile Shale				1.5	1.5	1.1
Greenhorn Formation and Belle Fourche Shale			0.5	3.7	4.2	3.2
Wyoming Total	32.8	1.5	9.6	87.3	131.2	100

of the rocks exposed within BGNG contain the remnants of ancient marine animals, such as plesiosaurs, mosasaurs, toothed diving birds, large sea turtles, sharks, sting rays, a wide variety of fish, and a myriad of invertebrates such as clams, oysters, ammonites, coral, and barnacles. Inventories concentrating on the Late Cretaceous marine sediments, primarily exposed on the western portion of BGNG, located 63 paleontological localities that are primarily marine vertebrates. Another inventory concentrating on the Tertiary units on BGNG located 25 fossil localities on the Fall River Ranger District.

About 1 mile southwest of Hot Springs, on the U.S. Highway 18 Bypass, is the Mammoth Site which has one of the largest concentrations of Columbian mammoth bones found to date in the western hemisphere. The site is approximately 26,000 years old and is believed to have been a sinkhole fed by springs. Mammoths, giant short-faced bears, and other mammals entered the pond, became trapped by the slippery, steep banks and died of starvation.

The investigation of paleontological resources on TBNG is relatively recent; however, the Lance Formation, primarily to the south of the grassland, has been heavily investigated since at least 1888. Approximately 25 miles south of the alternatives in Niobrara County is the Lance Creek Fossil Area which was nominated as a National Natural Landmark in 1966. The Lance Formation in the Lance Creek area has produced skulls and skeletons of horned dinosaurs, duckbilled dinosaurs, and primitive mammals. The American Museum of Natural History and the University of California Museum of Paleontology have collected and identified many specimens of fish, amphibians, turtles, lizards, snail, crocodiles, birds and

Table 3-32 Miles of Formations Which Would be Crossed by Alternative C With the W G Flat Route Variation						
Formation	Miles Crossed by Land Ownership				State Total (miles)	Percent of State
	Forest Service	BLM	State	Private		
South Dakota						
Alluvium and Colluvium	2.8	1.4	1.1	43.5	48.8	34.5
White River Group	1.4			9.4	10.8	7.6
Pierre Shale	1.9	0.7	0.8	48.8	52.2	36.9
Niobrara Formation, Carlile Shales and Greenhorn Limestone				6.2	6.2	4.4
Carlile Shale				0.9	0.9	0.6
Greenhorn Formation				0.2	0.2	0.1
Belle Fourche Shale		1.4	0.2	10.5	12.1	8.6
Belle Fourche and Mowry Shales				3.1	3.1	2.2
Mowry Shales				1.2	1.2	0.9
Skull Creek Shale and Inyan Kara Group				1.8	1.8	1.3
Unknown				4.1	4.1	2.9
South Dakota Total	6.1	3.5	2.1	129.7	141.4	100
Wyoming						
Alluvium and Colluvium			0.5	1.2	1.7	1.3
Wasatch Formation, Main Body	1.6		0.1	6.7	8.4	6.4
Fort Union: Tongue River and Lebo Members			0.1	2.0	2.1	1.6
Fort Union: Lebo Member	22.1	0.1	4.6	41.5	68.3	52.2
Fort Union: Tullock Member	2.7		1.1	8.0	11.8	9.0
Lance Formation	6.4		1.7	14.1	22.2	16.8
Fox Hills Sandstone		1.3		6.2	7.5	5.7
Pierre Shale		0.1	1.0	2.4	3.5	2.7
Niobrara Formation and Carlile Shale				1.5	1.5	1.1
Greenhorn Formation and Belle Fourche Shale			0.5	3.7	4.2	3.2
Wyoming Total	32.8	1.5	9.6	87.3	131.2	100

mammals, but little dinosaur material. Additional localities and specimens are still being discovered and described.

The Lance Formation may also provide important information about how and why dinosaurs became extinct. Sites have been identified in eastern Wyoming with rock layers that are believed to contain material from a comet or meteorite that hit the earth about 65 million years ago.

Marine reptiles and fish are found in deposits of Mesozoic age throughout the area managed by the BLM's Newcastle Field Office (BLM, 1998). Jurassic dinosaurs (giant sauropods, the carnivore Allosaurus, and early duckbills) along with primitive mammals and other animals occur in the Morrison Formation where it outcrops around the Black Hills.

Table 3-34 contains a column which identifies the Probable Fossil Yield Classification (PFYC) for each formation which would be crossed by the alternatives. PFYC is a planning tool developed by the Forest Service wherein geological units, usually at the formation or member level, are classified according to the probability of yielding paleontological resources that are of concern. The classification is based largely on how likely a geologic unit is to produce vertebrate fossils of terrestrial (i.e. nonmarine) origin. As is shown on Table 3-34, 2 PFYCs would be crossed by the alternatives. These PFYCs are described below:

Class 3. This class contains fossiliferous sedimentary geologic units whose fossil content varies in significance, abundance, and predictable occurrence. Also included are sedimentary units of unknown fossil

Table 3-33 Miles of Formations Which Would be Crossed by Alternative D						
Formation	Miles Crossed by Land Ownership				State Total (miles)	Percent of State
	Forest Service	BLM	State	Private		
South Dakota						
Alluvium and Colluvium		0.3		18.4	18.7	10.4
White River Group				24.4	24.4	13.6
Pierre Shale			0.3	69.6	69.9	39.0
Niobrara Formation, Carlile Shales and Greenhorn Limestone			0.1	8.0	8.1	4.5
Carlile Shale			1.4	17.6	19.0	10.6
Greenhorn Formation				2.0	2.0	1.1
Belle Fourche Shale		1.0	0.2	9.3	10.5	5.9
Belle Fourche and Mowry Shales				20.8	20.8	11.6
Mowry Shales				1.2	1.2	0.7
Skull Creek Shale and Inyan Kara Group				3.0	3.0	1.7
Unknown				1.7	1.7	0.9
South Dakota Total		1.3	2.0	176.0	179.3	100
Wyoming						
Alluvium and Colluvium	0.2	0.2	2.9	20.9	24.2	13.4
Wasatch Formation, Main Body	1.6		0.5	10.6	12.7	7.0
Fort Union: Tongue River and Lebo Members		0.2	1.6	16.1	17.9	9.9
Fort Union: Lebo Member	18.7	0.1	2.6	41.9	63.3	34.9
Fort Union: Tullock Member				0.5	0.5	0.3
Lance Formation				3.0	3.0	1.7
Fox Hills Sandstone			0.4	0.3	0.7	0.4
Pierre Shale	0.6	1.2	0.1	10.7	12.6	7.0
Niobrara Formation and Carlile Shale	0.3			4.1	4.4	2.4
Greenhorn Formation and Belle Fourche Shale	3.5	<0.1		28.6	32.1	17.8
Cloverly and Morrison				1.2	1.2	0.7
Gravel, pediment and fan deposits				1.4	1.4	0.8
Newcastle Sandstone and Skull Creek Shale	1.8	<0.1	0.7	4.2	6.7	3.7
Wyoming Total	26.7	1.7	8.8	143.5	180.7	100

potential. This classification is primarily marine origin with sporadic known occurrences of vertebrate fossils (other than fish scales and shark teeth). Vertebrate fossils and significant nonvertebrate fossils are known to occur inconsistently - predictability known to be low. The class area may be poorly studied and/or poorly documented - potential yield cannot be assigned without ground reconnaissance. Ground disturbing activities on Class 3 will require sufficient mitigation to determine whether significant paleontological resources occur in the area of the alternatives. Mitigation beyond initial findings will range from no further mitigation necessary to full and continuous monitoring of significant localities during the action.

Class 5. The land manager's highest concern for paleontological resources should focus on this classification. This class is identified as highly fossiliferous geologic units that regularly and predictably produce vertebrate fossils and/or scientifically significant nonvertebrate fossils, and that are at risk of natural degradation and/or human-caused adverse impacts. Vertebrate fossils and/or scientifically significant nonvertebrate fossils are known and documented to occur consistently, predictably, and/or abundantly. This class may have extensive exposed outcrops which erode easily and which may form badlands. These areas are likely to be poached. Mitigation of ground disturbing activities is required and may be intense.

Table 3-34 Description and Probable Fossil Yield Classification of Formations Which Would be Crossed by the Alternatives		
Formation	**Probable Fossil Yield Classification**	**Description**
Alluvium and Colluvium	3	Clay, silt, sand, and gravel in flood plains, fans, terraces, and slopes.
Gravel, Pediment and Fan Deposits	3	Mostly locally derived clasts. Includes some glacial deposits along east flank of Wind River Range. Locally includes some Tertiary gravels.
White River Group	5	Brule clay and Chadron formation; gravel at base.
Wasatch Formation, Main Body	5	Variegated red to gray, brown and gray mudstone and sandstone; conglomeratic lenses.
Fort Union: Tongue River and Lebo Members	3	Thick beds of yellow sandstone interbedded with gray and black shale and many coal beds. Dark-gray clay shale and concretionary sandstone.
Fort Union: Lebo Member	3	Dark-gray clay shale and concretionary sandstone.
Fort Union: Tullock Member	3	Soft gray sandstone, gray and brown carbonaceous shale, and thin coal beds.
Lance Formation	5	Brown and gray sandstone and shale; thin coal and carbonaceous shale beds.
Fox Hills Sandstone	3	Light-colored sandstone and gray sandy shale containing marine fossils.
Pierre Shale	3	Dark-gray concretionary marine shale; contains several bentonite beds.
Niobrara Formation	5	Light-colored limestone and gray to yellow speckled limey shale.
Carlile Shale	5	Dark-gray sandy shale.
Greenhorn Formation	5	Light-colored limestone, marl, and limey sandstone interbedded with gray concretionary shale.
Belle Fourche Shale	3	Black soft bentonitic concretionary shale.
Mowry Shale	3	Silvery-gray hard siliceous shale containing abundant fish scales and bentonite beds.
Newcastle Sandstone	3	Gray sandstone and sandy shale containing some bentonite and coal.
Skull Creek Shale	3	Black soft fissile shale.
Cleverly Formation	5	Rusty to light-gray sandstone containing lenticular chert-pebble conglomerate interbedded with variegated bentonitic claystone.
Inyan Kara Group	5	Rusty to light-gray sandstone containing lenticular chert-pebble conglomerate interbedded with variegated bentonitic claystone.
Morrison Formations	5	Dully variegated siliceous claystone, nodular white limestone, and gray silty sandstone.

Proposed Thunder Basin Paleontological Special Interest Area. As was discussed in Section 1.4.1.3, Alternatives B and C would cross 2.0 and 2.4 miles, respectively, of proposed Management Prescription Area 2.1c identified in the proposed TBNG Grassland Plan (Forest Service, 1999b). Figure 3-23 shows the routes of the alternatives through this proposed management area. The proposed TBNG Grassland Plan identifies this area as a special interest area. Consistency of the alternatives with this proposed management prescription is discussed on Table 15 in Appendix A of this report.

This 5,140-acre site features a high concentration of fossil remains from the late Cretaceous Period ending about 65 million years ago. The site is within the Lance Formation, which is composed of 2,600 feet of dull-gray sandy shales alternating with lenticular, light-colored sandstones and thin lignite beds. The Lance Formation has a very good potential to produce a large variety of fossils of excellent research value. This is the most productive fossil-bearing site on the TBNG. The proposed grassland plan places management emphasis on interpretation and education of geology and paleontology.

3.12 Water Resources

3.12.1 Impact Analysis Area. The impact analysis area for water resources includes the aquifers which would be crossed by the alternatives. In addition, all perennial and intermittent drainages, as shown on USGS 7.5-minute quad maps, are considered in the analysis of impacts to surface waters.

3.12.2 Groundwater. The entire project area is underlain by the Northern Great Plains aquifer system which includes most of North Dakota and South Dakota as well as eastern Montana and northeastern Wyoming.

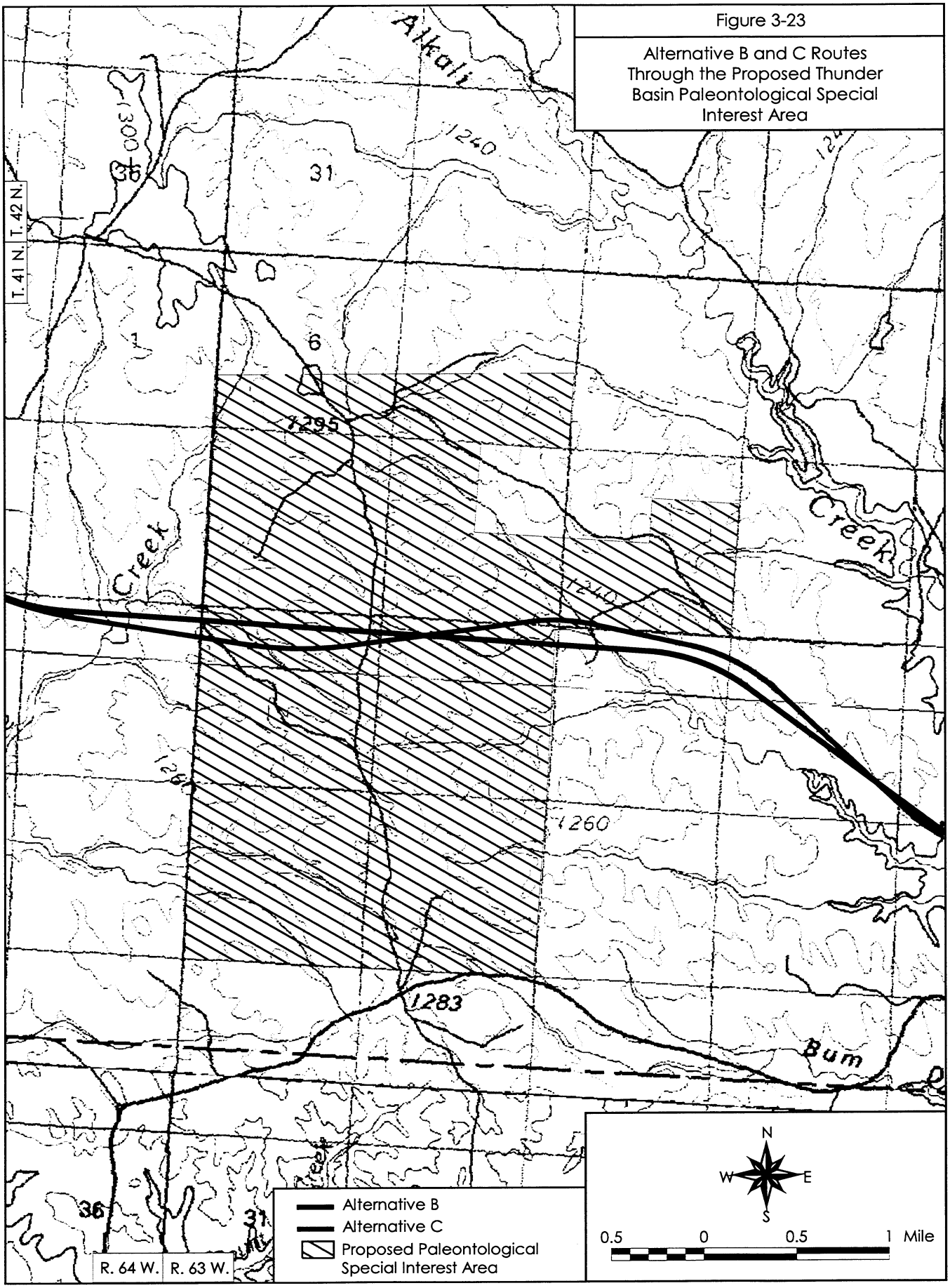


Figure 3-23

Alternative B and C Routes Through the Proposed Thunder Basin Paleontological Special Interest Area

The major aquifers of the Northern Great Plains aquifer system are sandstones of Tertiary and Cretaceous age and carbonate rocks of Paleozoic age. These aquifers, along with regional confining units that separate some of them, form one of the largest confined aquifer systems in the United States (USGS, 1996).

Groundwater is obtained primarily from wells completed in unconsolidated deposit aquifers that consist mostly of sand and gravel, and from wells completed in semi-consolidated and consolidated rock aquifers, chiefly sandstone and limestone. Most wells in the project area are on privately-owned land and are used for irrigation. Shallow groundwater is absent or scarce in most of the area, but can be obtained from the larger stream valleys including the Cheyenne River and the Belle Fourche River valleys. There are larger, reliable sources of deep groundwater for municipal and industrial use, but they are generally too deep for stock or domestic use.

The aquifers in unconsolidated deposits which support shallow wells are primarily limited to the areas surrounding the Cheyenne and Belle Fourche rivers. These are productive aquifers where they consist of sand and gravel and are the source of water for thousands of shallow wells. These aquifers are very important sources of water because they are located in flat lowlands in rural and urban areas where population is concentrated. Wells in these aquifers generally yield from 10 to 20 gallons per minute which is adequate to supply domestic and livestock watering needs.

For Alternatives B and C, the aquifers exposed to the land surface include the lower Cretaceous aquifers in small bands near the flanks of the Black Hills, the upper Cretaceous aquifers and the Lower Tertiary aquifers in eastern Wyoming. Much of the alternative routes are underlain by the Pierre Shale which is a confining layer of impermeable rock. Alternative D would cross similar aquifers exposed to the land surface but also Paleozoic aquifers and crystalline rocks as it passes through the Black Hills uplift.

Groundwater is sometimes pumped from large capacity wells to supplement surface water during times of drought or during seasons of the year when surface water is in short supply and in many areas, groundwater is the only source of water for irrigation. As a result of excessive withdrawal, ground water levels and artesian pressures have declined significantly in some areas. Programs have been enacted by state governments to prevent further groundwater development by limiting the number of wells in certain areas (USGS, 1996).

In both Wyoming and South Dakota, agricultural use (primarily irrigation) is the largest use category. In South Dakota, public supply is the second largest use. In Wyoming, the second largest use category is mining. There are 3 major withdrawal sites in the vicinity of the project alternatives (USGS, 1996). Pennington County is a major fresh groundwater withdrawal site (50 to 115 million gallons per day in 1985) for public supply, rural domestic and commercial use. Campbell and Niobrara counties are also major fresh groundwater withdrawal sites (10 to 50 million gallons per day in 1985) for irrigation and industrial use. Campbell County also is a withdrawal site for public supply.

3.12.3 Surface Water. In addition to the information provided in this report, DM&E is preparing a 404 permit application which will address potential impacts to waters of the U.S. Included in that report are plan and profile drawings of proposed bridge structures across major streams and rivers as well as results of hydrology studies which will be used to size water conveyance structures under the railroad bed.

The area which would be crossed by the alternatives is drained by many small streams which all empty into 2 encircling rivers, the Belle Fourche and Cheyenne. The Belle Fourche, rising in Wyoming, first flows northeastward, then swings abruptly around the Bearlodge Mountains to continue in a southeasterly direction. The Cheyenne, also rising in Wyoming, flows toward the southeast, then turns northeastward along the southern Black Hills to receive the Belle Fourche some 50 miles east of the Black Hills. About 60 miles farther downstream, the Cheyenne empties into Lake Oahe on the Missouri River.

Alternatives B and C would follow the Cheyenne River flood plain for a large portion of their routes through South Dakota and into Wyoming. Alternative D would cross the Cheyenne River between Wall and Wasta, but then would take a northern route to Rapid City using the Box Elder Creek drainage. All of the alternatives would cross the Belle Fourche River in Wyoming. Several smaller perennial streams would be crossed by the alternatives which are tributary to either the Cheyenne River or the Belle Fourche River. However, the vast majority of the stream and river crossings for all of the alternatives are intermittent or ephemeral waters.

It has been determined that between 6 and 27 percent of precipitation in the Black Hills is available for streamflow (Forest Service, 1996). Snowfall is important for soil-mantle recharge in the Black Hills. It is less important in terms of total streamflow. The melting of accumulated snow adds to the sharp increase of channel flow occurring in April, but it has been found that the greatest water yield occurred from the rains of April, May and June.

Most of the precipitation increase between May and June goes to rapidly increasing evapotranspiration rather than to water yield. Between July and September,

decreases in water yield are greater than the decline in precipitation. During most years, precipitation between October and April does little more than replenish soil moisture. The result is that most streams in this area are intermittent or ephemeral (Forest Service, 1996).

Nine hydrologic units (USGS, 1974 and 1978) would be crossed by the alternatives (see Figure 3-24). Tables 3-35 through 3-39 provide a listing of perennial streams which would be crossed by each alternatives by hydrologic unit and Tables 3-40 through 3-44 present a listing of perennial streams that are adjacent to (within 50 feet) the alternatives and may be affected by construction (although not crossed). Tables 3-45 through 3-49 show the number of intermittent streams which would be crossed or affected by (within 50 feet) each alternative by landowner.

None of the 4 proposed mine loops would cross perennial streams. The Black Thunder North, Black Thunder South, North Antelope East and North Antelope West would cross 9, 12, 4 and 2 intermittent streams, respectively.

Surface Water Quality- South Dakota. The SDENR has established beneficial uses of waters of the state. The beneficial use classifications of surface waters of the state, shown in Table 3-50, do not limit the actual use of such waters. The classifications designate the minimum quality at which the surface waters of the state are to be maintained and protected. According to Steinke (1999), all waters of the state have at least a beneficial use designation of 9 and 10 (see Table 3-50). Even though the waters may not meet the quality standards of Class 9 or 10, dischargers to those water would be required to meet quality standards of Class 9 and 10. Table 3-51 provides the classifications (where classifications have been designated) for streams and rivers crossed by the alternatives in South Dakota.

Surface Water Quality - Wyoming. The Wyoming Environmental Quality Council, pursuant to W.S. 35-11-101 through 1304, has promulgated regulations for quality standards for Wyoming surface waters. The objectives of the Wyoming pollution control program are outlined in W.S. 35-11-102 and are specifically designed to maintain the best possible quality of waters commensurate with the designated use. The state has designated 4 classes of surface water. Streams which would be crossed by the alternatives that have been rated by the state are listed in Table 3-52. Any waters which are unlisted have the same classification as the first listed water to which it is tributary.

Definitions for stream classifications for perennial streams which would be crossed by the alternative are listed below:

Class 2 - Those surface waters, other than those classified as Class 1, which are determined to (i) be presently supporting game fish; or (ii) have the hydrologic and natural water quality potential to support game fish; or (iii) include nursery areas or food sources for game fish.

Class 4 - Those surface waters, other than those classified as Class 1, which are determined to not have the hydrologic or natural water quality potential to support fish including all intermittent and ephemeral streams. Class 4 waters receive protection for agricultural uses and wildlife watering.

South Dakota and Wyoming 305(b) Water Quality Assessment. Section 303(d) of the Clean Water Act requires states to identify waters which are not supporting their designated uses, and/or which need to have a Total Maximum Daily Load (TMDL) established to support their uses. In South Dakota, SDENR is responsible for gathering information and preparing the 305(b) Water Quality Assessment. Table 3-53 lists the stream segments which would be crossed by the alternatives which are on the 303(d) waterbody list.

SDENR has developed a system of prioritization criteria for TMDL calculations. Included in these factors are the required elements of "the severity of the pollution and the uses to be made of such waters". The priorities are as follows:

Priority 1	High
Priority 2	Medium
Priority 3	Low
Priority 0	Not Targeted

The Cheyenne River has been given a priority of 2, whereas Rapid Creek and Box Elder Creek have been given priority 3 for TMDL development. These waters are not on the 1998-2000 Biennium Targeted TMDL Waters list. This means that presently there are no plans to calculate TMDLs for these waters in the next 2 years (Steinke, 1999).

In Wyoming, the WDEQ, Water Quality Division has responsibility for gathering information and preparing the 305(b) Water Quality Assessment. A comparison of the Wyoming 303(d) Waterbody List with the alternative crossings shows that the only water on the list is the Belle Fourche River in Section 36, T. 50 N., R. 68 W. on Alternative D. According to Parfitt (1999), this portion of the Belle Fourche River is on the 303(d) list because of impairment from fecal coliform. Plans to either calculate TMDLs or develop a Watershed Management Plan are being evaluated by the Conservation District in conjunction with the WDEQ, Water Quality Division.

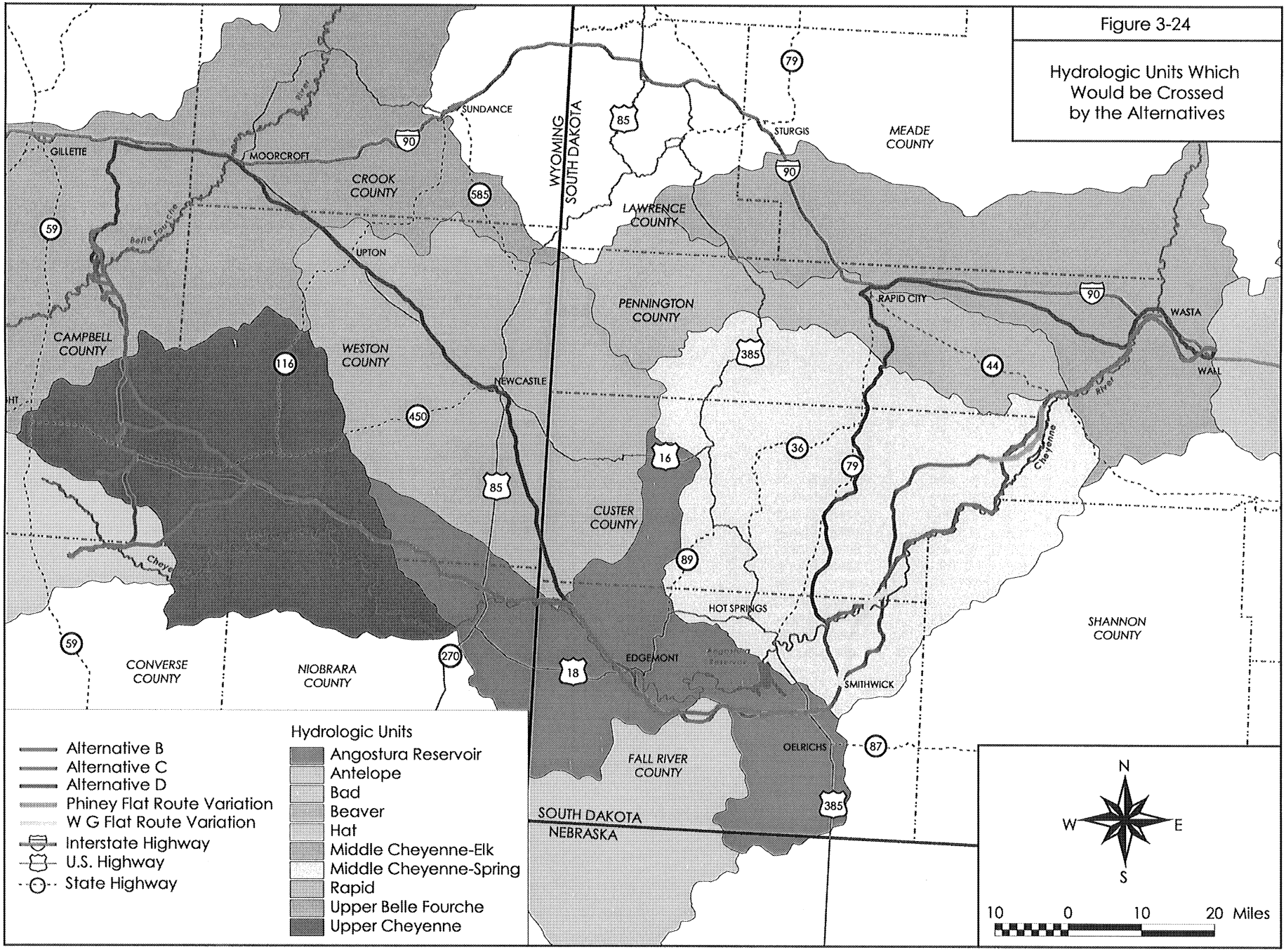


Figure 3-24
Hydrologic Units Which Would be Crossed by the Alternatives
WYOMING
SOUTH DAKOTA
NEBRASKA
SUNDANCE
GILLETTE
MOORCROFT
CROOK COUNTY
UPTON
CAMPBELL COUNTY
WESTON COUNTY
NEWCASTLE
LAWRENCE COUNTY
STURGIS
MEADE COUNTY
PENNINGTON COUNTY
RAPID CITY
WASTA
WALL
CUSTER COUNTY
HOT SPRINGS
EDGEMONT
SMITHWICK
OELRICHS
FALL RIVER COUNTY
SHANNON COUNTY
CONVERSE COUNTY
NIOBRARA COUNTY
Alternative B
Alternative C
Alternative D
Phiney Flat Route Variation
W G Flat Route Variation
Interstate Highway
U.S. Highway
State Highway
Hydrologic Units
Angostura Reservoir
Antelope
Bad
Beaver
Hat
Middle Cheyenne-Elk
Middle Cheyenne-Spring
Rapid
Upper Belle Fourche
Upper Cheyenne
N
W
E
S
10 0 10 20 Miles

Table 3-35
Perennial Streams Which Would be Crossed by Alternative B

Hydrologic Unit/Number	Perennial Stream by Land Ownership					Total Perennial Crossings
	Forest Service	BLM	State	Private	Legal Location	
South Dakota						
Middle Cheyenne Elk - 10120111				Cheyenne River Boxelder Creek	Sec. 20, T. 1 N., R. 14 E. Sec. 31, T. 1 N., R. 14 E.	2
Rapid - 10120110				Rapid Creek	Sec 3, T. 2 S., R. 12 E.	1
Middle Cheyenne Spring - 10120109	Spring Creek Spring Creek Spring Creek Battle Creek Cheyenne River Cheyenne River			Spring Creek Spring Creek Spring Creek Spring Creek Spring Creek Spring Creek Spring Creek Spring Creek Spring Creek Spring Creek Spring Creek Spring Creek Beaver Creek Cheyenne River Sand Creek Sand Creek Sand Creek Sand Creek Sand Creek	Sec. 20, T. 2 S., R. 12 E. Sec 20, T. 2 S., R. 12 E. Sec 20, T. 2 S., R. 12 E. Sec. 29, T. 2 S., R. 12 E. Sec. 29, T. 2 S., R. 12 E. Sec. 29, T. 2 S., R. 12 E. Sec. 29, T. 2 S., R. 12 E. Sec. 32, T. 2 S., R. 12 E. Sec. 32, T. 2 S., R. 12 E. Sec. 32, T. 2 S., R. 12 E. Sec. 32, T. 2 S., R. 12 E. Sec. 32, T. 2 S., R. 12 E. Sec. 32, T. 2 S., R. 12 E. Sec. 32, T. 2 S., R. 12 E. Sec. 15, T. 3 S., R. 11 E. Sec. 21, T. 4 S., R. 11 E. Sec. 22, T. 5 S., R. 9 E. Sec. 22, T. 5 S., R. 9 E. Sec. 22, T. 7 S., R. 7 E. Sec. 27, T. 7 S., R. 7 E. Sec. 24, T. 8 S., R. 7 E. Sec. 24, T. 8 S., R. 7 E. Sec. 25, T. 8 S., R. 7 E. Sec 25, T. 8 S., R. 7 E. Sec 25, T. 8 S., R. 7 E.	25
Angostura Reservoir - 10120106				Plum Creek Cottonwood Creek Cheyenne River	Sec. 25, T. 9 S., R. 3 E. Sec. 6, T. 9 S., R. 3 E. Sec. 36, T. 8 S., R. 2 E.	3
Hat - 10120108				Hat Creek Hat Creek Hat Creek	Sec. 36, T. 9 S., R. 4 E. Sec. 36, T. 9 S., R. 4 E. Sec. 36, T. 9 S., R. 4 E.	3
Beaver - 10120107			Beaver Creek		Sec. 16, T. 7 S., R. 1 E.	1
South Dakota Total	6	0	1	28		35

Table 3-35
Concluded

Hydrologic Unit	Perennial Stream by Land Ownership					Total Perennial Crossings
	Forest Service	BLM	State	Private	Legal Location	
Wyoming						
Upper Belle Fourche - 10120201				Belle Fourche River Belle Fourche River Belle Fourche River Caballo Creek Caballo Creek Caballo Creek	Sec. 29, T. 47 N., R. 70 W. Sec. 29, T. 47 N., R. 70 W. Sec. 29, T. 47 N., R. 70 W. Sec. 35, T. 48 N., R. 71 W. Sec. 35, T. 48 N., R. 71 W. Sec. 35, T. 48 N., R. 71 W.	6
Upper Cheyenne - 10120103						0
Antelope - 10120101						0
Wyoming Total	0	0	0	6		6

Table 3-36
Perennial Streams Which Would be Crossed by Alternative C

Hydrologic Unit	Perennial Stream by Land Ownership					Total Perennial Crossings
	Forest Service	BLM	State	Private	Legal Location	
South Dakota						
Middle Cheyenne Elk - 10120111				Cheyenne River Boxelder Creek	Sec. 20, T. 1 N., R. 14 E. Sec. 31, T. 1 N., R. 14 E.	2
Rapid - 10120110				Rapid Creek	Sec 3, T. 2 S., R. 12 E.	1
Middle Cheyenne Spring - 10120109				Spring Creek Battle Creek Cheyenne River Unnamed Stream Sand Creek Sand Creek Sand Creek	Sec. 29, T. 2 S., R. 12 E. Sec. 29, T. 2 S., R. 12 E. Sec. 29, T. 2 S., R. 12 E. Sec. 32, T. 2 S., R. 12 E. Sec. 32, T. 2 S., R. 12 E. Sec. 32, T. 2 S., R. 12 E. Sec. 32, T. 2 S., R. 12 E. Sec. 32, T. 2 S., R. 12 E. Sec. 32, T. 2 S., R. 12 E. Sec. 32, T. 2 S., R. 12 E. Sec. 31, T. 2 S., R. 12 E. Sec. 31, T. 2 S., R. 12 E. Sec. 1, T. 3 S., R. 11 E. Sec. 1, T. 3 S., R. 11 E. Sec. 14, T. 3 S., R. 11 E. Sec. 14, T. 3 S., R. 11 E. Sec. 14, T. 3 S., R. 11 E. Sec. 15, T. 3 S., R. 11 E. Sec. 15, T. 3 S., R. 11 E. Sec. 15, T. 3 S., R. 11 E. Sec. 15, T. 3 S., R. 11 E. Sec. 31, T. 3 S., R. 10 E. Sec. 1, T. 7 S., R. 8 E. Sec. 31, T. 8 S., R. 8 E. Sec. 31, T. 8 S., R. 8 E. Sec. 31, T. 8 S., R. 8 E. Sec. 31, T. 8 S., R. 8 E.	27
Angostura Reservoir - 10120106				Plum Creek Plum Creek Plum Creek Cheyenne River	Sec. 25, T. 9 S., R. 3 E. Sec. 25, T. 9 S., R. 3 E Sec. 25, T. 9 S., R. 3 E. Sec. 31, T. 8 S., R. 3 E.	4
Hat - 10120108				Hat Creek	Sec. 25, T. 9 S., R. 4 E.	1
Beaver - 10120107				Beaver Creek	Sec. 16, T. 7 S., R. 1 E.	1
South Dakota Total	0	0	0	36		36

Table 3-36 Concluded						
Hydrologic Unit	**Perennial Stream by Land Ownership**					**Total Perennial Crossings**
	Forest Service	**BLM**	**State**	**Private**	**Legal Location**	
Wyoming						
Beaver - 10120107						0
Upper Belle Fourche - 10120201				Belle Fourche River Caballo Creek Caballo Creek Caballo Creek	Sec. 31, T. 47 N., R. 70 W. Sec. 35, T. 48 N., R. 71 W. Sec. 35, T. 48 N., R. 71 W. Sec. 35, T. 48 N., R. 71 W.	4
Upper Cheyenne - 10120103						0
Antelope - 10120101						0
Wyoming Total	0	0	0	4		4

Table 3-37
Perennial Streams Which Would be Crossed by Alternative C With the Phiney Flat Route Variation

Hydrologic Unit	Perennial Stream by Land Ownership					Total Perennial Crossings
	Forest Service	BLM	State	Private	Legal Location	
South Dakota						
Middle Cheyenne Elk - 10120111				Cheyenne River Boxelder Creek	Sec. 20, T. 1 N., R. 14 E. Sec. 31, T. 1 N., R. 14 E.	2
Rapid - 10120110				Rapid Creek	Sec 3, T. 2 S., R. 12 E.	1
Middle Cheyenne Spring - 10120109				Spring Creek Battle Creek Cheyenne River Unnamed Stream Sand Creek Sand Creek Sand Creek	Sec. 20, T. 2 S., R. 12 E. Sec. 31, T. 3 S., R. 10 E. Sec. 1, T. 7 S., R. 8 E. Sec. 31, T. 8 S., R. 8 E. Sec. 31, T. 8 S., R. 8 E. Sec. 31, T. 8 S., R. 8 E. Sec. 31, T. 8 S., R. 8 E.	7
Angostura Reservoir - 10120106				Plum Creek Plum Creek Plum Creek Cheyenne River	Sec. 25, T. 9 S., R. 3 E. Sec. 25, T. 9 S., R. 3 E Sec. 25, T. 9 S., R. 3 E. Sec. 31, T. 8 S., R. 3 E.	4
Hat - 10120108				Hat Creek	Sec. 25, T. 9 S., R. 4 E.	1
Beaver - 10120107				Beaver Creek	Sec. 16, T. 7 S., R. 1 E.	1
South Dakota Total	0	0	0	16		16
Wyoming						
Beaver - 10120107						0
Upper Belle Fourche - 10120201				Belle Fourche River Caballo Creek Caballo Creek Caballo Creek	Sec. 31, T. 47 N., R. 70 W. Sec. 35, T. 48 N., R. 71 W. Sec. 35, T. 48 N., R. 71 W. Sec. 35, T. 48 N., R. 71 W.	4
Upper Cheyenne - 10120103						0
Antelope - 10120101						0
Wyoming Total	0	0	0	4		4

Table 3-38
Perennial Streams Which Would be Crossed by Alternative C With the W G Flat Route Variation

Hydrologic Unit	Perennial Stream by Land Ownership					Total Perennial Crossings
	Forest Service	BLM	State	Private	Legal Location	
South Dakota						
Middle Cheyenne Elk - 10120111				Cheyenne River Boxelder Creek	Sec. 20, T. 1 N., R. 14 E. Sec. 31, T. 1 N., R. 14 E.	2
Rapid - 10120110				Rapid Creek	Sec 3, T. 2 S., R. 12 E.	1
Middle Cheyenne Spring - 10120109			Cheyenne River	Spring Creek Battle Creek Sand Creek	Sec. 29, T. 2 S., R. 12 E. Sec. 29, T. 2 S., R. 12 E. Sec. 29, T. 2 S., R. 12 E. Sec. 32, T. 2 S., R. 12 E. Sec. 32, T. 2 S., R. 12 E. Sec. 32, T. 2 S., R. 12 E. Sec. 32, T. 2 S., R. 12 E. Sec. 32, T. 2 S., R. 12 E. Sec. 32, T. 2 S., R. 12 E. Sec. 32, T. 2 S., R. 12 E. Sec. 31, T. 2 S., R. 12 E. Sec. 31, T. 2 S., R. 12 E. Sec. 1, T. 3 S., R. 11 E. Sec. 1, T. 3 S., R. 11 E. Sec. 14, T. 3 S., R. 11 E. Sec. 14, T. 3 S., R. 11 E. Sec. 14, T. 3 S., R. 11 E. Sec. 15, T. 3 S., R. 11 E. Sec. 15, T. 3 S., R. 11 E. Sec. 15, T. 3 S., R. 11 E. Sec. 15, T. 3 S., R. 11 E. Sec. 31, T. 3 S., R. 10 E. Sec. 10, T. 7 S., R. 8 E. Sec. 30, T. 8 S., R. 8 E.	24
Angostura Reservoir - 10120106				Plum Creek Plum Creek Plum Creek Cheyenne River	Sec. 25, T. 9 S., R. 3 E. Sec. 25, T. 9 S., R. 3 E Sec. 25, T. 9 S., R. 3 E. Sec. 31, T. 8 S., R. 3 E.	4
Hat - 10120108				Hat Creek	Sec. 25, T. 9 S., R. 4 E.	1
Beaver - 10120107				Beaver Creek	Sec. 16, T. 7 S., R. 1 E.	1
South Dakota Total	0	0	1	32		33

Table 3-38 Concluded						
Hydrologic Unit	**Perennial Stream by Land Ownership**					**Total Perennial Crossings**
	Forest Service	**BLM**	**State**	**Private**	**Legal Location**	
Wyoming						
Beaver - 10120107						0
Upper Belle Fourche - 10120201				Belle Fourche River Caballo Creek Caballo Creek Caballo Creek	Sec. 31, T. 47 N., R. 70 W. Sec. 35, T. 48 N., R. 71 W. Sec. 35, T. 48 N., R. 71 W. Sec. 35, T. 48 N., R. 71 W.	4
Upper Cheyenne - 10120103						0
Antelope - 10120101						0
Wyoming Total	0	0	0	4		4

Table 3-39
Perennial Streams Which Would be Crossed by Alternative D

Hydrologic Unit	Perennial Stream by Land Ownership					Total Perennial Crossings
	Forest Service	BLM	State	Private	Legal Location	
South Dakota						
Middle Cheyenne Elk - 10120111				Cheyenne River Boxelder Creek Boxelder Creek Boxelder Creek Boxelder Creek Boxelder Creek Boxelder Creek Boxelder Creek Boxelder Creek Boxelder Creek Boxelder Creek Unnamed Stream Boxelder Creek	Sec. 2, T. 1 N., R. 14 E. Sec. 31, T. 1 N., R. 14 E. Sec. 36, T. 1 N., R. 13 E. Sec. 30, T. 1 N., R. 13 E. Sec. 24, T. 1 N., R. 12 E. Sec. 15, T. 1 N., R. 12 E. Sec. 16, T. 1 N., R. 12 E. Sec. 31, T. 2 N., R. 11 E. Sec. 35, T. 2 N., R. 10 E. Sec. 34, T. 2 N., R. 10 E. Sec. 28, T. 2 N., R. 10 E. Sec. 27, T. 2 N., R. 9 E. Sec. 23, T. 2 N., R. 8 E.	13
Rapid - 10120110				Unnamed Stream Unnamed Stream Rapid Creek Dry Creek	Sec 36, T. 2 N., R. 7 E. Sec. 36, T. 2 N., R. 7 E. Sec. 36, T. 2 N., R. 7 E. Sec. 27, T. 1 N., R. 8 E.	4
Middle Cheyenne Spring - 10120109				Spring Creek Battle Creek French Creek Beaver Creek Beaver Creek Beaver Creek Beaver Creek Beaver Creek Beaver Creek Beaver Creek Cheyenne River Sand Creek Sand Creek Sand Creek Sand Creek Sand Creek	Sec. 27, T. 1 S., R. 8 E. Sec 32, T. 2 S., R. 8 E. Sec 26, T. 4 S., R. 7 E. Sec 29, T. 6 S., R. 7 E. Sec. 16, T. 7 S., R. 7 E. Sec. 16, T. 7 S., R. 7 E. Sec. 22, T. 7 S., R. 7 E. Sec. 22, T. 7 S., R. 7 E. Sec. 22, T. 7 S., R. 7 E. Sec. 22, T. 7 S., R. 7 E. Sec. 27, T. 7 S., R. 7 E. Sec. 24, T. 8 S., R. 7 E. Sec. 24, T. 8 S., R. 7 E. Sec. 25, T. 8 S., R. 7 E. Sec. 25, T. 8 S., R. 7 E. Sec. 25, T. 8 S, R. 7 E.	16
Angostura Reservoir - 10120106				Plum Creek Plum Creek Plum Creek Cheyenne River	Sec. 25, T. 9 S., R. 3 E. Sec. 25, T. 9 S., R. 3 E. Sec. 25, T. 9 S., R. 3 E. Sec. 31, T. 8 S., R. 3 E.	4
Hat - 10120108				Hat Creek	Sec. 25, T. 9 S., R. 4 E.	1
South Dakota Total	0	0	0	37		38

Table 3-39 Concluded						
Hydrologic Unit	**Perennial Stream by Land Ownership**					**Total Perennial Crossings**
	Forest Service	**BLM**	**State**	**Private**	**Legal Location**	
Wyoming						
Beaver - 10120107				Stockade Beaver Creek Unnamed Stream Little Oil Creek Little Oil Creek Little Oil Creek Cambria Creek Unnamed Stream Poison Creek	Sec. 1, T. 43 N., R. 61 W. Sec. 34, T. 45 N., R. 61 W. Sec. 28, T. 45 N., R. 61 W. Sec. 28, T. 45 N., R. 61 W. Sec. 29, T. 45 N., R. 61 W. Sec. 29, T. 45 N., R. 61 W. Sec. 15, T. 46 N., R. 63 W. Sec. 15, T. 46 N., R. 63 W.	8
Upper Belle Fourche - 10120201			Belle Fourche River Caballo Creek	Donkey Creek Donkey Creek Caballo Creek Caballo Creek Caballo Creek Belle Fourche River Belle Fourche River Belle Fourche River Belle Fourche River	Sec. 36, T. 50 N., R. 68 W. Sec. 35, T. 50 N., R. 68 W. Sec. 28, T. 50 N., R. 69 W. Sec. 35, T. 48 N., R. 71 W. Sec. 35, T. 48 N., R. 71 W. Sec. 35, T. 48 N., R. 71 W. Sec. 36, T. 48 N., R. 71 W. Sec. 30, T. 47 N., R. 70 W. Sec. 30, T. 47 N., R. 70 W. Sec. 31, T. 47 N., R. 70 W. Sec. 31, T. 47 N., R. 70 W.	11
Upper Cheyenne - 10120103						0
Antelope - 10120101						0
Wyoming Total	0	0	2	17		19

Table 3-40
Summary of Perennial Streams Directly Adjacent to Alternative B

Hydrologic Unit	Perennial Stream by Land Ownership				Legal Location	Total Adjacent Perennial Streams
	Forest Service	BLM	State	Private		
South Dakota						
Middle Cheyenne Elk - 10120111						0
Rapid - 10120110						0
Middle Cheyenne Spring - 10120109	Battle Creek Cheyenne River				Sec. 20, T. 4 S., R. 11 E. Sec. 31, T. 4 S., R. 11 E.	2
Angostura Reservoir - 10120106						0
Hat - 10120108						0
Beaver - 10120107						0
South Dakota Total	2	0	0	0		2
Wyoming						
Upper Belle Fourche - 10120201						0
Upper Cheyenne - 10120103						0
Antelope - 10120101						0
Wyoming Total	0	0	0	0		0

Table 3-41
Summary of Perennial Streams Directly Adjacent to Alternative C

Hydrologic Unit	Perennial Stream by Land Ownership					Total Adjacent Perennial Streams
	Forest Service	BLM	State	Private	Legal Location	
South Dakota						
Middle Cheyenne Elk - 10120111				Cheyenne River Cheyenne River	Sec. 33, T. 1 S., R. 13 E. Sec. 32, T. 1 S., R. 13 E.	2
Rapid - 10120110						0
Middle Cheyenne Spring - 10120109				Spring Creek Spring Creek Spring Creek Spring Creek Spring Creek	Sec. 29, T. 2 S., R. 12 E. Sec. 31, T. 2 S., R. 12 E. Sec. 31, T. 2 S., R. 12 E. Sec. 1, T. 3 S., R. 11 E. Sec. 1, T. 3 S., R. 11 E.	5
Angostura Reservoir - 10120106						0
Hat - 10120108						0
Beaver - 10120107						0
South Dakota Total	0	0	0	7		7
Wyoming						
Upper Belle Fourche - 10120201						0
Upper Cheyenne - 10120103						0
Antelope - 10120101						0
Wyoming Total	0	0	0	0		0

Table 3-42
Summary of Perennial Streams Directly Adjacent to Alternative C With the Phiney Flat Route Variation

Hydrologic Unit	Perennial Stream by Land Ownership					Total Adjacent Perennial Streams
	Forest Service	BLM	State	Private	Legal Location	
South Dakota						
Middle Cheyenne Elk - 10120111				Cheyenne River Cheyenne River	Sec. 33, T. 1 S., R. 13 E. Sec. 32, T. 1 S., R. 13 E.	2
Rapid - 10120110						0
Middle Cheyenne Spring - 10120109						0
Angostura Reservoir - 10120106						0
Hat - 10120108						0
Beaver - 10120107						0
South Dakota Total	0	0	0	2		2
Wyoming						
Upper Belle Fourche - 10120201						0
Upper Cheyenne - 10120103						0
Antelope - 10120101						0
Wyoming Total	0	0	0	0		0

Table 3-43
Summary of Perennial Streams Directly Adjacent to Alternative C With the W G Flat Route Variation

Hydrologic Unit	Perennial Stream by Land Ownership					Total Adjacent Perennial Streams
	Forest Service	BLM	State	Private	Legal Location	
South Dakota						
Middle Cheyenne Elk - 10120111				Cheyenne River Cheyenne River	Sec. 33, T. 1 S., R. 13 E. Sec. 32, T. 1 S., R. 13 E.	2
Rapid - 10120110						0
Middle Cheyenne Spring - 10120109				Spring Creek Spring Creek Spring Creek Spring Creek Spring Creek	Sec. 29, T. 2 S., R. 12 E. Sec. 31, T. 2 S., R. 12 E. Sec. 31, T. 2 S., R. 12 E. Sec. 1, T. 3 S., R. 11 E. Sec. 1, T. 3 S., R. 11 E.	5
Angostura Reservoir - 10120106						0
Hat - 10120108						0
Beaver - 10120107						0
South Dakota Total	0	0	0	7		7
Wyoming						
Upper Belle Fourche - 10120201						0
Upper Cheyenne 10120103						0
Antelope - 10120101						0
Wyoming Total	0	0	0	0		0

Table 3-44
Summary of Perennial Streams Directly Adjacent to Alternative D

Hydrologic Unit	Perennial Stream by Land Ownership					Total Adjacent Perennial Streams
	Forest Service	BLM	State	Private	Legal Location	
South Dakota						
Middle Cheyenne Elk - 10120111				Cheyenne River Boxelder Creek Boxelder Creek Boxelder Creek	Sec. 4, T. 1 N., R. 14 E. Sec. 24, T. 2 N., R. 8 E. Sec. 24, T. 2 N., R. 8 E. Sec. 23, T. 2 N., R. 8 E.	4
Rapid - 10120110				Rapid Creek	Sec 6, T. 1 N., R. 8 E.	1
Middle Cheyenne Spring - 10120109				Beaver Creek Beaver Creek	Sec 29, T. 6 S., R. 7 E. Sec. 9, T. 7 S., R. 7 E.	1
Angostura Reservoir - 10120106						0
Hat - 10120108						0
Beaver - 10120107						0
South Dakota Total	0	0	0	7		7
Wyoming						
Beaver - 10120107				Stockade Beaver Creek Stockade Beaver Creek Unnamed Stream	Sec. 26, T. 44 N., R. 61 W. Sec. 23, T. 44 N., R. 61 W. Sec. 15, T. 46 N., R. 63 W.	3
Upper Belle Fourche - 10120201						0
Upper Cheyenne - 10120103						0
Antelope - 10120101						0
Wyoming Total	0	0	0	3		3

Table 3-45 Number of Intermittent Streams Which Would be Crossed or Affected by Alternative B					
	Forest Service	BLM	State	Private	Total
Middle Cheyenne Elk		3		36	39
Rapid				3	3
Middle Cheyenne Spring	34	1	1	76	112
Angostura Reservoir	3	2	4	134	143
Hat				14	14
Beaver					0
Upper Belle Fourche		1	1	54	56
Upper Cheyenne	88		7	147	242
Antelope	14			48	62
Total	139	7	13	512	671

Table 3-46 Number of Intermittent Streams Which Would be Crossed or Affected by Alternative C					
	Forest Service	BLM	State	Private	Total
Middle Cheyenne Elk		2		33	35
Rapid				8	8
Middle Cheyenne Spring	17			174	191
Angostura Reservoir	5	3	6	132	146
Hat				7	7
Beaver					0
Upper Belle Fourche			3	31	34
Upper Cheyenne	55		12	74	141
Antelope	44			31	75
Total	121	5	21	490	637

Table 3-47 Number of Intermittent Streams Which Would be Crossed or Affected by Alternative C With the Phiney Flat Route Variation					
	Forest Service	BLM	State	Private	Total
Middle Cheyenne Elk		2		33	35
Rapid				8	8
Middle Cheyenne Spring	6			149	155
Angostura Reservoir	5	3	6	132	146
Hat				7	7
Beaver					0
Upper Belle Fourche			3	31	34
Upper Cheyenne	55		12	74	141
Antelope	44			31	75
Total	110	5	21	465	601

Table 3-48 Number of Intermittent Streams Which Would be Crossed or Affected by Alternative C With the W G Flat Route Variation					
	Forest Service	BLM	State	Private	Total
Middle Cheyenne Elk		2		33	35
Rapid				8	8
Middle Cheyenne Spring	17			121	138
Angostura Reservoir	5	3	6	132	146
Hat				7	7
Beaver					0
Upper Belle Fourche			3	31	34
Upper Cheyenne	55		12	74	141
Antelope	44			31	75
Total	121	5	21	437	584

Table 3-49 Number of Intermittent Streams Which Would be Crossed or Affected by Alternative D					
	Forest Service	BLM	State	Private	Total
Middle Cheyenne Elk				77	77
Rapid				13	13
Middle Cheyenne Spring			11	97	108
Angostura Reservoir			3	97	100
Hat				7	7
Beaver	7		11	98	116
Upper Belle Fourche	4	3	7	122	136
Upper Cheyenne	33		0	42	75
Antelope	44			31	75
Total	88	3	32	584	707

Table 3-50 Beneficial Uses of Waters of the State of South Dakota and Water Quality Standards	
Class	**Beneficial Use**
1	Domestic water supply waters
2	Coldwater permanent fish life propagation waters
3	Coldwater marginal fish life propagation waters
4	Warmwater permanent fish life propagation waters
5	Warmwater semipermanent fish life propagation waters
6	Warmwater marginal fish life propagation waters
7	Immersion recreation waters
8	Limited contact recreation waters
9	Fish and wildlife propagation, recreation, and stock watering waters
10	Irrigation waters
11	Commerce and industry waters

Table 3-51 Beneficial Uses of Stream and Rivers Which Would be Crossed by the Alternatives in South Dakota		
Stream or River Name	**Stream Segment**	**Beneficial Use**
Cheyenne River	from confluence with the Belle Fourche River to confluence with the Fall River	5, 7, 8
Cheyenne River	from Angostura Reservoir to Wyoming border	5, 8
Hat Creek	from Cheyenne River to Nebraska border	5, 8
Battle Creek	from Cheyenne River to S.D. Highway 79	6, 8
Box Elder Creek	from Cheyenne River to Sec. 30, T. 1 N., R. 13 E. of the Black Hills Meridian	6, 8
Rapid Creek	from Cheyenne River to Sec. 15, T.1 N., R.8 E. of the Black Hills Meridian	4, 7, 8
Spring Creek	from the Cheyenne River to S.D. Highway 79	4, 8

Table 3-52 Water Quality Classifications of Perennial Streams Which Would be Crossed by the Alternatives in Wyoming	
Stream	**Water Quality Classification**
Belle Fourche River	2
Caballo Creek	2
Donkey Creek	2
Little Oil Creek	4
Cambria Creek	4
Stockade Beaver Creek	2

Table 3-53 List of Stream Segments on the 303(d) Waterbody List in South Dakota Which Would be Crossed by the Alternatives			
	Stream Segment	**Crossing Location**	**Priority**
Alternative B	Cheyenne River	Section 36, T. 8 S., R. 2 E. Section 20, T. 1 N., R. 14 E.	2
	Rapid Creek	Section 3, T. 2 S., R. 12 E.	3
Alternative C (including route variations)	Cheyenne River	Section 31 & 32, T. 8 S., R. 3 E. Section 20., T. 1 N., R. 14 E.	2
	Rapid Creek	Section 3, T. 2 S., R. 12 E.	3
Alternative D	Cheyenne River	Sections 31 & 32, T. 8 S., R. 3 E. Section 2, T. 1 N., R. 14 E.	2
	Box Elder Creek	Section 24, T. 1 N., R. 12 E. Section 15, T. 1 N., R. 12 E. Section 16, T. 1 N., R. 12 E. Section 31, T. 2 N., R. 11 E. Section 35, T. 2 N., R. 10 E. Section 34, T. 2 N., R. 10 E. Section 28, T. 2 N., R. 10 E. Sections 26 & 33, T. 2 N., R. 8 E.	3

Surface Water Quantity. The USGS maintains gauging stations at various locations which measure streamflow. Table 3-54 presents data from gauging stations which are located in the vicinity of alternative crossings.

3.13 Soil Resources

3.13.1 Impact Analysis Area. For purposes of determining impacts to soils, the analysis area was defined as a 500 foot wide buffer on either side of the alternative centerline.

3.13.2 Affected Environment. U.S. Department of Agriculture, Natural Resource Conservation Service (NRCS) soil surveys were used to identify the soil types and characteristics along the alternative alignments. The 7 soil surveys that were used are listed in Table 3-55. Digital data was used when it was available from either the NRCS or the Forest Service. Where only paper maps

Table 3-54
USGS Stream Gauging Station Streamflow Data for Streams Which Would be Crossed by the Alternatives

Station	Legal Location	USGS Station Number	Drainage Area (square miles)	Average Annual Mean Discharge (cfs)	Highest Daily Mean Discharge (cfs)	Annual Mean Discharge (cfs)	Lowest Average Monthly Streamflow (cfs)	Highest Average Monthly Streamflow (cfs)
Cheyenne River at Edgemont, SD	Section 36 T. 8 S., R. 2 E.	06395000	7,143	81.3	24,000 5/20/78	434 1962	7.85 Dec&Jan	253 June
Hat Creek near Edgemont, SD	Section 25 T. 9 S., R. 4 E.	06400000	1,044	16.6	8,350 6/16/67	112 1967	1.15 Oct	70.9 June
Battle Creek below Hermosa, SD	Sec. 3 T. 4 S., R. 10 E.	06406500	285	22.1	1,760 5/23/52	60.8 1997	9.06 Dec	75.9 June
Rapid Creek near Farmingdale, SD	Section 19 T. 1 S., R. 11 E.	06421500	602	76.4	2,860 6/10/72	269 1997	46.3 Sept.	173 June
Spring Creek near Hermosa, SD	Section 21 T. 1 S., R. 8 E.	06408500	199	7.15	3,300 6/10/72	46.6 1997	1.14. Jan	40.6 June
Cheyenne River near Wasta	Section 2 T. 1 N., R. 14 E.	07423500	12,800	346	19,200 6/16/67	1,143 1997	116 Dec	976 June

USGS, (1997 and 1999).

Table 3-55 Soil Surveys for Counties Which Would be Crossed by the Alternatives		
Soil Survey	**Date Published**	**Digital Data and Source**
Soil Survey of Custer and Pennington counties (Prairie Parts), South Dakota	1996	NRCS
Soil Survey of Fall River County, South Dakota	1982	None
Soil Survey of Custer and Pennington Counties, (Black Hills Part), South Dakota	1990	None
Soil Survey of Niobrara County, Wyoming	Preliminary, not yet published	None
Soil Survey of Weston County, Wyoming	1990	Forest Service (TBNG)
Soil Survey of Crook County, Wyoming	1983	None
Soil Survey of Campbell County (Southern Part), Wyoming	Not published	NRCS and Forest Service (TBNG)

were available, the published or preliminary surveys were digitized and then analyzed using GIS to determine the soil mapping units that would be crossed by the alternatives.

All of the alternatives would be constructed within the Northwestern Great Plains which is semi-arid with total annual precipitation ranging from about 12 to 16.5 inches. About 75 percent of this precipitation usually falls between April and September, which coincides with the growing season for most plants and crops. Relative humidity over the project area can be low and averages between about 50 and 65 percent throughout the year. Wind can be significant with north or northwesterly winds prevailing. Wind velocity averages about 13 miles per hour annually. The estimated annual pan evaporation for the area is 60 to 65 inches of water.

In Wyoming, the frost-free period of the project area is a maximum of about 137 days (which is the longest in the state) and decreases with increasing elevation. In South Dakota, the frost-free period ranges from 114 to 160 days (NRCS, 1982, 1986 and 1996a; and BLM, 1985 and 1998).

In South Dakota, the alternatives would cross the Pierre Hill physiographic division of the Northwestern Great Plains which is generally characterized as gently to strongly sloping with steep sloping drainages. Highly dissected hills and uplands border the Cheyenne River and associated alluvial plains. Stream patterns are primarily dendritic and exhibit little structural control (NRCS, 1982; and BLM, 1985).

All of the alternatives would be constructed within the Northwestern Great Plains which is semi-arid with total annual precipitation ranging from about 12 to 16.5 inches. About 75 percent of this precipitation usually falls between April and September, which coincides with the growing season for most plants and crops. Relative humidity over the project area can be low and averages between about 50 and 65 percent throughout the year. Wind can be significant with north or northwesterly winds prevailing. Wind velocity averages about 13 miles per hour annually. The estimated annual pan evaporation for the area is 60 to 65 inches of water.

In Wyoming, the frost-free period of the project area is a maximum of about 137 days (which is the longest in the state) and decreases with increasing elevation. In South Dakota, the frost-free period ranges from 114 to 160 days (NRCS, 1982, 1986 and 1996a; and BLM, 1985 and 1998).

In South Dakota, the alternatives would cross the Pierre Hill physiographic division of the Northwestern Great Plains which is generally characterized as gently to strongly sloping with steep sloping drainages. Highly dissected hills and uplands border the Cheyenne River and associated alluvial plains. Stream patterns are primarily dendritic and exhibit little structural control (NRCS, 1982; BLM, 1985; and USGS, 1998).

In Wyoming, the landscape which would be crossed by the alternatives is generally characterized as tablelands and wide, shallow valleys and low rolling hills. However, eroded buttes, badlands, scoria (burnt coal) mounds and salt pans also occur.

The characteristics of the soil are determined by 5 primary factors. These factors are parent material, climate, living organisms, time and topography. Of these factors, parent material and topography have the largest influence on soil variation. The soils in the project area formed in parent material composed of residuum of clayey shale, silty shale, sandstone, siltstone and limestone. Some soils formed in alluvium and in loess deposits. Parent materials affect many of the chemical and physical properties of the soil such as color, texture, and reaction. Soils formed from shales typically have fine textures while soils formed from sandstone materials typically have coarse textures. Alluvial soils along flood

plains typically have mixed textures that vary with depth and the conditions during deposition. Soil texture affects the strength, permeability, and water and nutrient holding capacity of the soil. The chemical properties inherent in the parent material also affect the soil's chemical characteristics. For example, marine shales typically are saline or sodic and acid soils form on acid shales. Climate directly affects the rate of chemical and physical weathering. The semi-arid climate in eastern Wyoming and western South Dakota, which is characterized by cold winters, hot summers and summer precipitation, favors the growth of grasses and the resulting accumulation of organic matter in the upper part of the soil. It also favors a moderately slow rate of weathering or soil formation. Climate patterns are fairly consistent along the alternative routes. However, climatic differences occur between the west- and south-facing slopes and the north- and east-facing slopes due to the amount of direct solar radiation these aspects receive. The prairie grasses in the project area have more influence than other living organisms on soil formation although earthworms, insects and borrowing animals (especially prairie dogs) help to keep the soil open and porous.

Topography affects soil formation by affecting drainage, runoff, erosion, plant cover and soil temperature. Soil on steeper slopes typically have shallower and more calcareous profiles because much of the rainfall is lost through runoff and does not penetrate the soil surface. Soil erosion is higher on steep slopes than on less sloping soils where eroded particles tend to accumulate and produce thicker soil profiles. Soils along drainages, flood plains or in depressions may be prone to flooding or water ponding. Depending on site-specific conditions, these soils can have a wide range of characteristics because they are alluvial soils formed from a mixture of materials. For example, some soils may be saline or sodic in poorly drained areas where salts accumulate and are not leached from the soil profile. In other areas, soils may be highly productive because their chemical and physical characteristics are not limiting to plant growth. Alluvial soils are typically deeper, have mixed textures and receive more moisture than other upland soils.

The oldest soils occur on landscapes that have been stable for the longest time. The youngest soils are those in which natural erosion removes nearly as much soil material as is formed or are alluvial soils which receive new material each time the area is flooded (NRCS, 1982).

Soil Limitations. The soils which would be crossed by the alternatives have been classified into 7 sensitive soil groups based on the soil properties that are most relevant to construction, environmental impact and impact mitigation. These sensitive soil groups have been defined according to NRCS guidelines (NRCS, 1996b) and are listed on Table 3-56. Table 3-57 provides a summary of the miles of each soil group which would be crossed by the alternatives. Tables 3-58 through 3-62 provide miles of soil groups which would be crossed by each of the alternatives by landowner.

Each of the soil groups are discussed below:

Group 1 includes soils that are either saline or sodic. These soils occur where soluble salts are concentrated in the soil profile. Salt crystal growth (white crusts) on the soil surface is common on saline soils in dry seasons and slick spots (areas barren of vegetation) may occur on sodic soils. High concentrations of salts interfere with the absorption of water by plants because the osmotic pressure in the soil solution is nearly as high as or higher than the plant's cells.

Salts may also interfere with the nutrient uptake of plants causing deficiencies. Sodic soils have high sodium concentrations which tend to disperse organic matter and clay particles reducing the soil's permeability and aeration. Reclamation of soils in this group is difficult and requires plant species which are adapted to these conditions. Because of their salt content, sediments from soils in this group have a high potential to impair water quality.

The soils in Group 2 have either a high or severe water erosion potential. These soils are characterized by having rapid water runoff and non-cohesive textures that are easily transported by water. These soils generally are moderately or steeply sloping, have shallow soil depths or are sparsely vegetated. Most of the sediment discharge in the project area occurs during a few days of the year during short periods of rapid runoff resulting from summer thunderstorms or snowmelt. These soils likely contribute to water quality problems in streams of the project area.

Group 3 consists of soils with a high wind erosion potential. These are generally dry soils with loamy sand textures and little vegetation cover. These soils may appear stabilized but when disturbed, have the potential to erode or blowout and be extremely difficult to stabilize.

Soils in Group 4 have low reclamation potential because they are shallow to bedrock, have a low available water capacity (AWC), or have a significant content of coarse fragments in their profiles. Shallow soils have a reduced root zone for plants to acquire water and nutrients for establishment and growth. Soils with low AWC are droughty because of their coarse textures or depth to bedrock or restrictive layer which limits their water holding or storage capacity. Soils with high contents of coarse fragments (i.e., greater than 35

Table 3-56 Limiting Characteristics of Soils Which Would be Crossed by the Alternatives			
Soil Limiting Property	**Parameter Value**	**Sensitive Soil Group**	**Limiting Characteristic/Potential Hazard**
Saline	Moderately to strongly saline (>8 mmhos/cm)	Group 1	Reduced reclamation potential and water quality impacts
Sodic	SAR ≥ 13 or natric horizon	Group 1	Reduced reclamation potential and water quality impacts
High water erosion hazard	High-Severe	Group 2	Sedimentation impacts; reduced reclamation potential; and loss of soil productivity
High wind erosion hazard	High-Severe	Group 3	Reduced reclamation potential: loss of soil productivity
Shallow to bedrock	Moderate < 40 inches (soft or hard)	Group 4	Reduced reclamation potential
Coarse fragments > 3 inches	> 35 percent	Group 4	Reduced reclamation potential
Low AWC	Low to very low (0-6")	Group 4	Reduced reclamation potential
Hydric	Yes	Group 5	Wetness
Prime farmland	Yes	Group 6	Highly productive soils taken out of production
Slope	> 15 percent	Group 7	Reduced reclamation potential; larger cuts and fills; and sedimentation

Table 3-57 Summary of Sensitive Soil Groups Which Would be Crossed by the Alternatives (1)						
Limiting Soil Property	**Soil Group**	**Alternative B (miles)**	**Alternative C (miles)**	**Alternative C With Phiney Flat Route Variation (miles)**	**Alternative C With W G Flat Route Variation (miles)**	**Alternative D (miles)**
Saline	Group 1	26.2	21.8	21.7	21.7	32.8
Sodic	Group 1	20.4	18.2	18.5	18.7	16.7
High water erosion hazard	Group 2	112.0	95.4	94.2	93.9	100.0
High wind erosion hazard	Group 3	19.2	19.2	19.2	22.0	10.8
Shallow to bedrock	Group 4	129.2	117.8	116.7	116.2	124.1
High coarse fragment content	Group 4	8.8	12.5	12.5	12.5	16.9
Low AWC	Group 4	156.7	143.9	142.6	145.5	157.5
Hydric	Group 5	1.4	1.0	1.0	1.0	1.4
Prime farmland	Group 6	28.7	30.0	31.3	27.2	38.6
Steep	Group 7	103.8	91.1	89.9	91.2	78.0
1 = Some soils may have more than one limiting property and therefore may be in more than one soil group. Consequently, the total miles of soil groups is larger than the actual length of the alternative. Soils which do not have limiting properties are not included.						

percent fragments larger than 3 inches) have less soil volume to hold moisture and nutrients.

The soils in Group 5 are hydric. Hydric soils are defined as soils that are wet long enough to periodically produce anaerobic conditions, thereby influencing the growth of plants. Areas with hydric soils that meet the wetland hydrology and plant community criteria are considered jurisdictional wetlands. These soils are rare in semi-arid areas and they typically support unique plant communities which provide important biological habitats and add to the diversity of the landscape.

Group 6 are prime farmland soils which are defined as those soils that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops and that are available for these uses. The soil's qualities, growing season and moisture supply are those needed for a well-managed soil to produce an economical and sustained high yield of

Table 3-58 Sensitive Soil Groups Which Would be Crossed by Alternative B (1)							
Limiting Soil Property	Soil Group	Miles Crossed by Land Ownership					
		Private	Forest Service	BLM	State	DOE	Total
South Dakota							
Saline	Group 1	10.1	1.5	0.0	0.0	0.0	11.6
Sodic	Group 1	6.3	0.0	0.0	0.0	0.0	6.3
High water erosion hazard	Group 2	39.1	7.0	2.9	2.1	0.3	51.4
High wind erosion hazard	Group 3	7.0	1.5	0.0	0.0	0.0	8.5
Shallow to bedrock	Group 4	54.0	8.3	3.2	2.5	0.3	68.3
Low AWC	Group 4	81.4	11.8	3.4	2.6	0.3	99.5
Hydric	Group 5	1.1	0.2	0.0	0.0	0.0	1.3
Prime farmland	Group 6	27.6	0.7	0.2	0.2	0.0	28.7
Steep	Group 7	44.9	7.0	2.7	2.1	0.3	57.0
Wyoming							
Saline	Group 1	10.8	3.2	0.0	0.6	0.0	14.6
Sodic	Group 1	10.3	3.2	0.0	0.6	0.0	14.1
High water erosion hazard	Group 2	42.0	14.1	2.1	2.4	0.0	60.6
High wind erosion hazard	Group 3	7.4	2.2	0.0	1.1	0.0	10.7
Shallow to bedrock	Group 4	39.8	15.9	1.4	3.8	0.0	60.9
High coarse fragment content	Group 4	6.8	1.2	0.8	0.0	0.0	8.8
Low AWC	Group 4	39.1	14.9	1.9	1.3	0.0	57.2
Hydric	Group 5	0.1	0.0	0.0	0.0	0.0	0.1
Steep	Group 7	33.6	9.7	1.9	1.6	0.0	46.8

1 = Some soils may have more than one limiting property and therefore may be in more than one soil group. Consequently, the total miles of soil groups may be larger than the actual length of the alternative. Soils which do not have limiting properties are not included.

crops. These soils have been identified because of their highly productive character. Industrial development on these soils would remove them from crop production or prevent their future use if they are not currently in production.

Soils in Group 7 have slopes greater than 15 percent. Construction activities on these soils typically result in proportionately larger disturbance because of the need for larger cut and fill slopes. In addition, these soils are easily eroded because of their slope and higher runoff potential. These conditions also contribute to the slopes being more difficult to revegetate because their higher runoff and erosion potential can damage newly seeded areas or established vegetation. These slopes generally receive less effective moisture and, depending on the slope's aspect (i.e., south and west facing slopes), they can receive more solar radiation which increases soil temperatures and evapotranspiration causing them to be drier. These conditions are detrimental to revegetation efforts when moisture is limiting. Another factor which hampers the revegetation potentials on these slopes is that some seeding methods, such as drill seeding using typical farm tractors, can be restricted because this equipment may not be able to safely work on these slopes. These conditions would require the use of more expensive seeding methods such as hydroseeding or broadcasting which may be less effective.

3.14 Vegetation Resources

3.14.1 Impact Analysis Area. For purposes of determining impacts to vegetation, the impact analysis area was defined as a 500 foot wide buffer on both sides of the alternative centerline.

3.14.2 Affected Environment. In the portion of the Northern Great Plains where the alternatives would be constructed, the dominate vegetation is characterized as shortgrass or mixed-grass prairie. The project area is in a broad transition area between the plains of the central United States and range physiographic provinces to the west. It occupies a north-south transition area between the southern and middle Rocky Mountains. Plants

Table 3-59 Sensitive Soil Groups Which Would be Crossed by Alternative C (1)						
Limiting Soil Property	Soil Group	Miles Crossed by Land Ownership				
		Private	Forest Service	BLM	State	Total
South Dakota						
Saline	Group 1	9.0	1.0	0.2	0.0	10.2
Sodic	Group 1	5.9	0.2	0.2	0.0	6.3
High water erosion hazard	Group 2	35.7	3.1	1.7	1.0	41.5
High wind erosion hazard	Group 3	7.9	0.0	0.2	0.0	8.1
Shallow to bedrock	Group 4	57.9	4.5	2.5	1.4	66.3
High coarse fragment content	Group 4	0.1	0.0	0.0	0.0	0.1
Low AWC	Group 4	81.8	5.3	2.9	1.4	91.4
Hydric	Group 5	1.0	0.0	0.0	0.0	1.0
Prime farmland	Group 6	29.4	0.0	0.1	0.5	30.0
Steep	Group 7	41.8	2.4	1.9	1.0	47.1
Wyoming						
Saline	Group 1	7.1	4.3	0.1	0.1	11.6
Sodic	Group 1	7.3	4.5	0.0	0.1	11.9
High water erosion hazard	Group 2	35.9	14.3	1.4	2.3	53.9
High wind erosion hazard	Group 3	7.6	2.6	0.0	0.9	11.1
Shallow to bedrock	Group 4	35.8	10.2	1.0	4.5	51.5
High coarse fragment content	Group 4	7.4	4.4	0.0	0.6	12.4
Low AWC	Group 4	35.4	14.4	1.0	1.7	52.5
Steep	Group 7	29.0	12.4	1.2	1.4	44.0

1 = Some soils may have more than one limiting property and therefore may be in more than one soil group. Consequently, the total miles of soil groups may be larger than the actual length of the alternative. Soils which do not have limiting properties are not included.

common to the Black Hills and Northern Great Plains (such as hawthorn, big bluestem, little bluestem and creeping juniper) and plants characteristic of the southern and central great plains (such as buffalo grass, blue grama and prickly pear cactus) are represented in plant communities which would be crossed by the alternatives. In addition, portions of the area also have plants common to the Intermountain Basin, such as sagebrush communities, greasewood, rabbitbrush, Sandberg bluegrass, prairie junegrass and bluebunch wheatgrass (BLM, 1998).

Tables 3-63 through 3-67 provide the miles of each vegetation type which would be crossed by the alternatives. The estimates are based on USGS 1:250,000 Land Use Land Cover Data described in Section 3.5.1.

Grassland Type. This is the dominate vegetation type which would be crossed by the alternatives, accounting for about 80 percent of the vegetation which would be crossed by Alternatives B and C. Grassland vegetation in the project area can be subdivided into 2 major divisions - the shortgrass and the mixed-grass prairie. The shortgrass prairie is dominated by blue grama and buffalo grass. It occurs intermixed with the mixed-grass prairie, possibly as a result of overgrazing. Pricklypear cactus, yucca, fringe sage and scarlet globemallow are common in this type.

The mixed grasses can be divided into several types, but all are characterized by needle-and-thread grass, western wheatgrass, blue grama, Sandberg bluegrass, threadleaf sedge, needleleaf sedge, junegrass, green needlegrass, Indian ricegrass, pricklypear cactus, fringed sage, scarlet globemallow, purple coneflower, white aster, blazing star, goldenrod, beardtongue, Hood phlox and various species of milkvetch. Species diversity in the mixed-grass prairie is high with as many as 50 species per hectare. In the foothills this type is generally dominated by bluebunch wheatgrass, little bluestem and sideoats grama.

Table 3-60 Sensitive Soil Groups Which Would be Crossed by Alternative C With the Phiney Flat Route Variation (1)						
Limiting Soil Property	Soil Group	Miles Crossed by Land Ownership				
		Private	Forest Service	BLM	State	Total
South Dakota						
Saline	Group 1	8.7	1.2	0.2	0.0	10.1
Sodic	Group 1	6.2	0.2	0.2	0.0	6.6
High water erosion hazard	Group 2	35.1	2.5	1.7	1.0	40.3
High wind erosion hazard	Group 3	7.9	0.0	0.2	0.0	8.1
Shallow to bedrock	Group 4	57.4	3.9	2.5	1.4	65.2
High coarse fragment content	Group 4	0.1	0.0	0.0	0.0	0.1
Low AWC	Group 4	80.9	4.9	2.9	1.4	90.1
Hydric	Group 5	1.0	0.0	0.0	0.0	1.0
Prime farmland	Group 6	30.7	0.0	0.1	0.5	31.3
Steep	Group 7	41.2	1.8	1.9	1.0	45.9
Wyoming						
Saline	Group 1	7.1	4.3	0.1	0.1	11.6
Sodic	Group 1	7.3	4.5	0.0	0.1	11.9
High water erosion hazard	Group 2	35.9	14.3	1.4	2.3	53.9
High wind erosion hazard	Group 3	7.6	2.6	0.0	0.9	11.1
Shallow to bedrock	Group 4	35.8	10.2	1.0	4.5	51.5
High coarse fragment content	Group 4	7.4	4.4	0.0	0.6	12.4
Low AWC	Group 4	35.4	14.4	1.0	1.7	52.5
Steep	Group 7	29.0	12.4	1.2	1.4	44.0

1 = Some soils may have more than one limiting property and therefore may be in more than one soil group. Consequently, the total miles of soil groups may be larger than the actual length of the alternative. Soils which do not have limiting properties are not included.

On sandy soils, Indian ricegrass, prairie sandreed, sand dropseed, sand sagebrush and yucca are common. Saline soils are dominated by halophytes such as alkali sacaton, fourwing saltbush, greasewood and inland saltgrass. In some areas, the grasslands change (gradually or abruptly) into sagebrush shrublands. Small parcels of tallgrass prairie, supporting big bluestem, Canada wildrye, little bluestem, Indiangrass, prairie drop seed, sideoats grama and switchgrass also may occur on sandy soils or along streams (Knight, 1994).

Big Sagebrush Shrubland. The big sagebrush shrubland type occurs on the lowlands to the west and south of the Black Hills. Several other species of sagebrush species are also present including silver sage, sand sagebrush and fringed sagebrush. Rabbitbrush is also abundant, especially on eroded or disturbed sites, and greasewood is typical where soils are fine textured and alkaline, such as in depressions or on flood plains. Understory species include western wheatgrass, blue grama, prairie junegrass, needle-and-thread grass, Sandberg bluegrass, pricklypear cactus and scarlet globemallow. This is the dominate type which would be crossed by Alternative D in Wyoming, accounting for 45 percent of the vegetation crossed.

Coniferous Woodland. This woodland type occurs in the south of the Black Hills and on river breaks in the Northern Great Plains to the east of the Black Hills. This type is dominated by Rocky Mountain juniper but ponderosa pine is often an overstory species. Other common shrub species include current, skunkbush sumac and yucca. The understory species are common prairie species including needle grass, blue grama and sideoats grama.

Deciduous Woodland. Woody draws occur in ravines in South Dakota, south and east of the Black Hills. Common shrubs in these draws typically include: green ash, chokecherry, skunkbush sumac, wild rose, western snowberry, wild plum, silver buffaloberry and sliver sagebrush. Trees may include green ash, American elm,

Table 3-61 Sensitive Soil Groups Which Would be Crossed by Alternative C With the W G Flat Route Variation (1)						
Limiting Soil Property	Soil Group	Miles Crossed by Land Ownership				
		Private	Forest Service	BLM	State	Total
South Dakota						
Saline	Group 1	8.9	1.0	0.2	0.0	10.1
Sodic	Group 1	6.4	0.2	0.2	0.0	6.8
High water erosion hazard	Group 2	34.2	3.1	1.7	1.0	40.0
High wind erosion hazard	Group 3	10.7	0.0	0.2	0.0	10.9
Shallow to bedrock	Group 4	56.3	4.5	2.5	1.4	64.7
High coarse fragment content	Group 4	0.1	0.0	0.0	0.0	0.1
Low AWC	Group 4	83.3	5.3	3.0	1.4	93.0
Hydric	Group 5	1.0	0.0	0.0	0.0	1.0
Prime farmland	Group 6	26.6	0.0	0.1	0.5	27.2
Steep	Group 7	41.9	2.4	1.9	1.0	47.2
Wyoming						
Saline	Group 1	7.1	4.3	0.1	0.1	11.6
Sodic	Group 1	7.3	4.5	0.0	0.1	11.9
High water erosion hazard	Group 2	35.9	14.3	1.4	2.3	53.9
High wind erosion hazard	Group 3	7.6	2.6	0.0	0.9	11.1
Shallow to bedrock	Group 4	35.8	10.2	1.0	4.5	51.5
High coarse fragment content	Group 4	7.4	4.4	0.0	0.6	12.4
Low AWC	Group 4	35.4	14.4	1.0	1.7	52.5
Steep	Group 7	29.0	12.4	1.2	1.4	44.0

1 = Some soils may have more than one limiting property and therefore may be in more than one soil group. Consequently, the total miles of soil groups may be larger than the actual length of the alternative. Soils which do not have limiting properties are not included.

boxelder, hawthorn, Rocky Mountain juniper and dwarf juniper. Except for cottonwood, these areas are characteristic of riparian areas. These areas provide important wildlife habitat and forage and shade for livestock.

Riparian and Wetlands. Riparian areas are plant communities contiguous to and affected by surface and subsurface hydrologic features of perennial or intermittent waterbodies (rivers, streams, lakes, or drainage ways). Riparian areas have one or both of the following characteristics: 1) distinctly different vegetative species than adjacent areas; and 2) species similar to adjacent areas but exhibiting more vigorous or robust growth forms. Riparian areas are usually transitional between wetland and upland (USFWS, 1997). In layman's terms, they are the green zones along the banks of rivers and streams and around springs, bogs, wet meadows, lakes and ponds. Riverine riparian ecosystems overlap a great deal with some wetland classifications, however, some riparian areas may not be flooded or saturated at some time each year nor do they necessarily have predominately hydrophytic cover as wetlands must have. Riverine riparian areas serve to transport water and eroded materials from the landscape. In comparison with upland areas, riparian areas tend to be wetter, to have more nutrients available to them and to be more frequently subject to catastrophic water flow. These conditions are expressed in their nutrient rich soils and lush growth of vegetation. Common plant species in riparian areas include plains cottonwoods, willows, green ash, chokecherry, western snowberry, wild plum, sliver sagebrush, box elder, buffaloberry and skunkbush sumac as well as wet meadows and irrigated and sub-irrigated pastures or hay fields. These areas provide important wildlife habitat and are used heavily by livestock for grazing, watering, shade and travel.

Bare Exposed Ground. Areas of very little or no vegetation are present in the project area on rock outcrops and slick spots, which are typically small depressional areas of sodic soils and badlands areas.

Table 3-62 Sensitive Soil Groups Which Would be Crossed by Alternative D (1)						
Limiting Soil Property	Soil Group	Miles Crossed by Land Ownership				
		Private	Forest Service	BLM	State	Total
South Dakota						
Saline	Group 1	8.4	0.0	0.1	0.1	8.6
Sodic	Group 1	7.8	0.0	0.1	0.1	8.0
High water erosion hazard	Group 2	24.0	0.0	0.0	0.4	24.4
High wind erosion hazard	Group 3	6.9	0.0	0.0	0.0	6.9
Shallow to bedrock	Group 4	49.3	0.0	1.3	1.3	51.9
High coarse fragment content	Group 4	0.1	0.0	0.0	0.0	0.1
Low AWC	Group 4	76.9	0.0	1.4	1.3	79.6
Hydric	Group 5	1.2	0.0	0.0	0.0	1.2
Prime farmland	Group 6	37.0	0.0	0.1	0.6	37.7
Steep	Group 7	28.1	0.0	1.0	0.3	29.4
Wyoming						
Saline	Group 1	19.4	3.0	0.8	1.0	24.2
Sodic	Group 1	6.5	1.8	0.0	0.4	8.7
High water erosion hazard	Group 2	57.9	13.6	1.7	2.4	75.6
High wind erosion hazard	Group 3	3.2	0.6	0.0	0.1	3.9
Shallow to bedrock	Group 4	57.0	10.9	1.7	2.6	72.2
High coarse fragment content	Group 4	11.6	4.4	0.0	0.8	16.8
Low AWC	Group 4	58.2	15.8	1.5	2.4	77.9
Hydric	Group 5	0.2	0.0	0.0	0.0	0.2
Prime farmland	Group 6	0.3	0.0	0.0	0.6	0.9
Steep	Group 7	35.9	10.4	1.1	1.2	48.6

1 = Some soils may have more than one limiting property and therefore may be in more than one soil group. Consequently, the total miles of soil groups may be larger than the actual length of the alternative. Soils which do not have limiting properties are not included.

Cultivated Crops. After the grassland type, cultivated crops, pastures and hay fields are generally the next most common vegetation type that would be crossed by the alternatives. The major crops in the project area include: oats, winter wheat, grain sorghum, corn, alfalfa hay and sunflowers. Table 3-68 provides the typical range in yields in western South Dakota and eastern Wyoming for these crops.

Strip Mines. In Wyoming, the alternatives would traverse coal mine permit areas that have been reclaimed. These reclaimed areas have been reseeded with both native and introduced grasses, shrubs and forbs. Typical species may include western wheatgrass, thickspike wheatgrass, pubescent wheatgrass, little bluestem, blue grama, sideoats grama, alfalfa, sweet clover, yarrow, big sagebrush and fringe sagebrush.

Noxious Weeds. Invasions of noxious weeds reduce or eliminate native plant species. The Federal Noxious Weed Act of 1974 authorizes the Secretary of Agriculture to use an integrated weed management approach to control and contain the spread of noxious weeds on NFS lands and from NFS lands to adjacent lands. Currently, management plans direct managers to treat noxious and exotic species on a priority basis. Control is emphasized on newly infested areas, priority areas and minor infestations. Table 3-69 lists the noxious weeds in the Northern Great Plains by state based on inventory results provided by the Forest Service in the plans revision. On BGNG, Canada thistle infestation is about 280 acres of which 147 acres is treated. Hoary cress and Russian knapweed individually infest approximately 25 acres on the grassland. Ten and 15 acres, respectively, are treated.

Table 3-63 Vegetation Types Which Would be Crossed by Alternative B							
Vegetation Type	Miles Crossed by Land Ownership					Total (miles)	Percent
	Forest Service	DOE	BLM	State	Private		
South Dakota							
Developed Lands (Residential, Industrial, etc.)	0.0	0.0	0.0	0.0	0.6	0.6	0.4
Cropland and Pastures	<0.1	0.0	0.0	0.2	20.4	20.6	14.2
Grasslands	15.3	0.3	3.2	2.5	92.3	113.6	78.4
Big Sagebrush Shrublands	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Deciduous Woodlands	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coniferous Woodlands	0.0	0.0	0.1	0.0	2.3	2.4	1.7
Riparian and Wetlands (1)	1.0	0.0	0.0	0.0	5.9	6.9	4.8
Strip Mines/Quarries	0.0	0.0	0.0	0.0	0.8	0.8	0.5
Total	16.3	0.3	3.3	2.7	122.3	144.9	100
Wyoming							
Developed Lands (Residential, Industrial, etc.)	0.0		0.0	0.0	0.0	0.0	0.0
Cropland and Pastures	0.7		0.0	0.0	7.0	7.7	5.1
Grasslands	34.5		2.4	6.6	84.5	128.0	84.6
Big Sagebrush Shrublands	0.3		0.0	0.8	13.5	14.6	9.7
Deciduous Woodlands	0.0		0.0	0.0	0.5	0.5	0.3
Coniferous Woodlands	0.0		0.0	0.0	0.0	0.0	0.0
Riparian and Wetlands (1)	0.0		0.0	0.0	0.0	0.0	0.0
Strip Mines	0.1		0.0	0.0	0.3	0.4	0.3
Total	35.6		2.4	7.4	105.8	151.2	100

1 = A more accurate estimate of wetlands which would be crossed by this alternative can be found in Section 3.16.

Currently, TBNG has a 1995 inventory of noxious weed species totaling approximately 3,715 acres. Treatment levels on TBNG between 1994 to 1996 was only 160 acres per year. Leafy spurge, spotted knapweed, Canada thistle and musk thistle were treated during this period.

3.15 Grazing Resources

3.15.1 Impact Analysis Area. The impact analysis area for grazing on Federal lands (NFS and public lands) includes 100 feet either side of the proposed centerline for each alternative. Federally-managed pastures or allotments and buffered areas which would be crossed by the alternatives were included in the analysis area.

3.15.2 Affected Environment. Livestock grazing is a traditional, permitted use on NFS and public lands. The grazing allotments which would be crossed by the alternatives are listed on Tables 3-70 through 3-73. In South Dakota, all of the Forest Service's allotments are administered by the BGNG, Fall River Ranger District. All of the BLM allotments in South Dakota are administered by the South Dakota Field Office. In Wyoming, all of the Forest Service allotments are administered by TBNG, Douglas Ranger District. The BLM allotments in Wyoming are either managed by the Newcastle or Buffalo Field Offices. Private grazing lands which would be crossed by the alternatives are not included in Tables 3-70 through 3-73. Allotment pastures that are denoted as private on these tables are those that the alternative alignment would cross only on private lands within that allotment pasture.

The land management objective on the Federal grazing allotments is to provide livestock forage while providing for wildlife, recreation and other uses of natural resources. These allotments are used either by grazing associations or individual ranchers. A grazing association is a grazing permittee user group organized to assist with administering grazing use. The grazing associations have a set of rules guiding their operation. These include a grazing agreement, rules of management and a set of by-laws. Individuals not part of a grazing association have grazing use administered through a direct grazing permit system. All of the BLM allotments are administered through a direct grazing permit with individual ranchers. The dependence of individual ranch operations on forage

Table 3-64 Vegetation Types Which Would be Crossed by Alternative C						
Vegetation Type	Miles Crossed by Land Ownership				Total (miles)	Percent
	Forest Service	BLM	State	Private		
South Dakota						
Developed Lands (Residential, Industrial, Transportation, etc.)	0.0	0.0	0.0	0.5	0.5	0.4
Croplands and Pastures	0.0	0.0	0.5	20.1	20.6	14.4
Grasslands	5.2	2.7	1.5	100.6	110.0	77.1
Big Sagebrush Shrublands	0.0	0.0	0.0	0.0	0.0	0.0
Deciduous Woodlands	0.0	0.3	0.1	0.3	0.7	0.4
Coniferous Woodlands	0.0	0.4	0.0	2.6	3.0	2.1
Riparian and Wetlands (1)	0.0	0.0	0.0	6.1	6.1	4.3
Bare Exposed Ground	0.9	0.0	0.0	0.8	1.7	1.3
Total	6.1	3.4	2.1	131.0	142.6	100
Wyoming						
Developed Lands (Residential, Industrial, Transportation, etc.)	0.0	0.0	0.0	0.0	0.0	0.0
Cropland	0.7	0.0	0.0	8.6	9.3	7.1
Grasslands	31.8	1.5	8.8	68.2	110.3	84.1
Big Sagebrush Shrublands	0.0	0.0	0.8	10.5	11.3	8.6
Deciduous Woodlands	0.0	0.0	0.0	0.0	0.0	0.0
Coniferous Woodlands	0.3	0.0	0.0	0.0	0.3	0.2
Riparian and Wetlands (1)	0.0	0.0	0.0	0.0	0.0	0.0
Strip Mines	0.0	0.0	0.0	0.0	0.0	0.0
Total	32.8	1.5	9.6	87.3	131.2	100
1 = A more accurate estimate of wetlands which would be crossed by this alternative can be found in Section 3.16.						

produced on Federal grazing leases varies in the project area from almost nothing to critical, depending primarily on the acreage leased. The Federal leases are typically important in satisfying season forage needs (BLM, 1984).

In South Dakota, Alternative B would cross 25 Forest Service and 7 BLM allotments or allotment pastures. In Wyoming, this alternative would cross 55 Forest Service and 4 BLM allotments or allotment pastures. Alternative C in South Dakota would cross 13 Forest Service and 6 BLM allotments/pastures and in Wyoming would cross 46 Forest Service and 4 BLM allotments/pastures. Alternative D would not cross any Forest Service-administered allotments in South Dakota, however, 3 BLM allotments would be crossed. In Wyoming, Alternative D would cross 39 Forest Service and 6 BLM allotments/pastures.

Cattle is the principal livestock grazed on these allotments, however, sheep, horses and bison graze several of the allotments. The carrying capacity of the allotments varies from about 1.7 to 11.9 acres/animal use month (AUM), with the average of all allotments being about 4.5 acres per AUM. An AUM is defined as the amount of forage required to sustain a 1,000-pound animal for 1 month and is equivalent to about 800 pounds of air-dry forage. The carrying capacity of the allotments varies with soil type, vegetation type (forage production), slope and water availability. The amount of rock, roads, waterbodies, bare ground or other areas in the allotment that do not provide forage for livestock use also affect the carrying capacity. The season-of-use varies by allotment and operator. Grazing may begin as early as March and extend through December on some allotments. For most operations the total grazing period on public and private lands is April to November (7 to 8 months), however some allotments are used year-long. Livestock are generally fed hay and supplements on winter pastures (BLM, 1998 and 1985).

Numerous range improvements have been constructed on the allotments to improve cattle distribution and forage use. These improvements include water developments (such as wells, pipelines, reservoirs, catchments and developed springs) fences, corrals, and cattle guards. Allotments are monitored periodically to

Table 3-65 Vegetation Types Which Would be Crossed by Alternative C With the Phiney Flat Route Variation						
Vegetation Type	Miles Crossed by Land Ownership				Total (miles)	Percent
	Forest Service	BLM	State	Private		
South Dakota						
Developed Lands (Residential, Industrial, Transportation etc.)	0.0	0.0	0.0	0.4	0.4	0.3
Croplands and Pastures	0.0	0.0	0.5	25.4	25.9	18.0
Grasslands	4.4	2.7	1.5	97.1	105.7	73.7
Big Sagebrush Shrublands	0.0	0.0	0.0	0.1	0.1	0.1
Deciduous Woodlands	0.0	0.3	0.1	0.3	0.7	0.5
Coniferous Woodlands	0.0	0.4	0.0	2.6	3.0	2.1
Riparian and Wetlands (1)	0.0	0.0	0.0	5.9	5.9	4.1
Bare Exposed Ground	0.9	0.0	0.0	0.8	1.7	1.2
Total	5.3	3.4	2.1	132.6	143.4	100
Wyoming						
Developed Lands (Residential, Industrial, Transportation etc.)	0.0	0.0	0.0	0.0	0.0	0.0
Croplands and Pastures	0.7	0.0	0.0	8.6	9.3	7.1
Grasslands	31.8	1.5	8.8	68.2	110.3	84.1
Big Sagebrush Shrublands	0.0	0.0	0.8	10.5	11.3	8.6
Deciduous Woodlands	0.0	0.0	0.0	0.0	0.0	0.0
Coniferous Woodlands	0.3	0.0	0.0	0.0	0.3	0.2
Riparian and Wetlands (1)	0.0	0.0	0.0	0.0	0.0	0.0
Strip Mines	0.0	0.0	0.0	0.0	0.0	0.0
Total	32.8	1.5	9.6	87.3	131.2	100
1 = A more accurate estimate of wetlands which would be crossed by this alternative can be found in Section 3.16.						

determine range condition, production and trend. The ecological range condition reflects the current vegetation composition of the rangeland in relation to the potential climax plant community. The potential plant community is determined by evaluating relict range sites, grazed areas with known records of past use, available literature on soils and ecology of the area and historical narratives and photographs.

Range trend is defined as the direction of change in range condition observed over time. Trend is usually expressed as improving, stable or declining. In the evaluation of trend, the following indicators of range condition are considered: presence, vigor, and reproduction of desirable and less desirable forage species; utilization levels; litter accumulation and evidence of accelerated erosion. Declining trend may be caused by or accelerated by overstocking, improper season of use, and poor livestock distribution. Other causes include drought and invasion of noxious weeds or pests. Improved trend in range condition generally results when grazing management provides for physiological needs of desirable forage plants. According to the BLM (1984, 1985 and 1998) and Forest Service (1999c), current range condition is generally good and is in a stable or slightly upward trend. This is especially true when compared to the turn of the century when unregulated grazing and drought caused extensive rangeland degradation.

In both South Dakota and Wyoming, the public lands are typically isolated and scattered 40- to 80-acre parcels that are surrounded by private lands and generally are not accessible to the public. The ranchers using these parcels generally have a low percentage of public land in their total operations.

Implementation of the Phiney Flat Route Variation would affect the same allotments as Alternative C except it would not cross the Reed (FRRD 97 or FRRD 98) or Circle C (FRRD 38) allotments on BGNG. The W G Flat Route Variation would affect all of the allotments as would Alternative C, except it would not cross the Sand Creek Allotment (FRRD 181) on the BGNG. In addition, this variation would cross BLM allotment number 7329 (record number 8428) and the alignment would cross immediately

Table 3-66 Vegetation Types Which Would be Crossed by Alternative C With the W G Flat Route Variation						
Vegetation Type	Miles Crossed by Land Ownership				Total (miles)	Percent
	Forest Service	BLM	State	Private		
South Dakota						
Developed Lands (Residential, Industrial, Transportation etc.)	0.0	0.0	0.0	0.5	0.5	0.4
Croplands and Pastures	0.0	0.1	0.5	24.5	25.1	17.8
Grasslands	5.2	2.7	1.5	97.7	107.1	75.7
Big Sagebrush Shrublands	0.0	0.0	0.0	<0.1	<0.1	<0.1
Deciduous Woodlands	0.0	0.3	0.1	0.3	0.7	0.5
Coniferous Woodlands	0.0	0.4	0.0	2.6	3.0	2.1
Riparian and Wetlands (1)	0.0	0.0	0.0	3.3	3.3	2.3
Bare Exposed Ground	0.9	0.0	0.0	0.8	1.7	1.2
Total	6.1	3.5	2.1	129.7	141.4	100
Wyoming						
Developed Lands (Residential, Industrial, Transportation etc.)	0.0	0.0	0.0	0.0	0.0	0.0
Cropland	0.7	0.0	0.0	8.6	9.3	7.1
Grasslands	31.8	1.5	8.8	68.2	110.3	84.1
Big Sagebrush Shrublands	0.0	0.0	0.8	10.5	11.3	8.6
Deciduous Woodlands	0.0	0.0	0.0	0.0	0.0	0.0
Coniferous Woodlands	0.3	0.0	0.0	0.0	0.3	0.2
Riparian and Wetlands (1)	0.0	0.0	0.0	0.0	0.0	0.0
Strip Mines	0.0	0.0	0.0	0.0	0.0	0.0
Total	32.8	1.5	9.6	87.3	131.2	100
1 = A more accurate estimate of wetlands which would be crossed by this alternative can be found in Section 3.16.						

adjacent to a 160-acre BLM parcel. This Federal parcel within allotment 7329 has 18 AUMs and is grazed from November through April by cattle.

The Black Thunder North Mine Loop would cross 5 pastures in 2 allotments. These include: the Stringer allotment's North Highway pasture, the Little Thunder allotment's Mine pasture as well as the 2 Kerr-McGee Mine pastures and the #4 pasture in the Kerr-McGee allotment. The Black Thunder South Mine Loop would cross 3 pastures in 2 allotments. These include: the Stringer allotment's North Highway pasture and the Little Thunder allotment's Mine and West Peck pastures.

3.16 Wetland and Riparian Resources

3.16.1 Impact Analysis Area. For purposes of determining impacts to wetlands, the analysis area was defined as a 500 foot wide buffer on each side of the alternative centerline. Information provided in this section was taken from NWI Maps developed by the USFWS at 1:24,000 scale. Additional wetland delineations are currently being performed by DM&E to support the 404 permit application. These additional delineations are using low-level aerial photography of the centerline for Alternative C (including the route variations) along with selective field verification. Wetland delineation reports for Alternative C have been prepared for Wyoming and western South Dakota. The COE is in the process of verifying the wetland delineation results.

3.16.2 Affected Environment. The principal riparian resources near the alternatives in South Dakota are the Cheyenne River, Rapid Creek, Spring Creek, Boxelder Creek, Lame Johnny Creek, Beaver Creek, Battle Creek, French Creek, Sand Creek, Hay Canyon, Horsehead Creek, Dry Creek, Hat Creek, Plum Creek and Beaver Creek. In Wyoming, riparian resources are less prevalent but include Alkali Creek, Lodge Creek, Black Thunder Creek, Little Thunder Creek, School Creek, Antelope Creek, Porcupine Creek, Caballo Creek, Donkey Creek and the Belle Fourche River.

Riparian Resources. Riparian or stream corridors are complex ecosystems which include the land, plants, animals, and a network of streams within them. They perform a number of ecological functions such as modulating streamflow, storing water, removing harmful

Table 3-67 Vegetation Types Which Would be Crossed by Alternative D						
Vegetation Type	Miles Crossed by Land Ownership				Total (miles)	Percent
	Forest Service	BLM	State	Private		
South Dakota						
Developed Lands (Residential, Industrial, Transportation etc.)		0.0	0.0	9.9	9.9	5.5
Croplands and Pastures		0.0	0.0	42.5	42.5	23.7
Grasslands		0.9	2.0	116.2	119.1	66.3
Big Sagebrush Shrublands		0.0	0.0	0.0	0.0	0.0
Deciduous Woodlands		0.0	0.0	0.5	0.5	0.3
Coniferous Woodlands		0.4	0.0	1.9	2.3	1.3
Riparian and Wetlands (1)		0.0	0.0	4.6	4.6	2.6
Bare Exposed Rock		0.0	0.0	0.1	0.1	0.1
Strip Mines		0.0	0.0	0.3	0.3	0.2
Total		1.3	2.0	176.0	179.3	100
Wyoming						
Developed Lands (Residential, Industrial, Transportation etc.)	0.0	0.0	0.9	13.2	14.1	7.8
Cropland	0.0	0.0	0.2	8.3	8.5	4.7
Grasslands	20.0	0.1	4.3	44.4	68.8	38.1
Big Sagebrush Shrublands	5.5	1.6	3.4	70.2	80.7	44.6
Deciduous Woodlands	0.0	0.0	0.0	0.0	0.0	0.0
Coniferous Woodlands	1.1	0.0	0.0	5.9	7.0	3.9
Riparian and Wetlands (1)	0.0	0.0	0.0	0.0	0.0	0.0
Strip Mines	0.1	0.0	0.0	1.5	1.6	0.9
Total	26.7	1.7	8.8	143.5	180.7	100
1 = A more accurate estimate of wetlands which would be crossed by this alternative can be found in Section 3.16:						

Table 3-68 Ranges in Crop Yields in the Area Which Would Be Crossed by the Alternatives		
Crop	Unit/Acre	Production Range
Oats	Bushels	17 to 46
Alfalfa hay	Tons	0.7 to 2.0
Cool-season grass pastures	Animal Unit Month	1.2 to 3.4
Winter wheat	Bushels	16 to 45
Grain sorghum	Bushels	15 to 41
Corn	Bushels	70 to 135

materials from water, and providing habitat for aquatic and terrestrial plants and animals. Stream corridors also have vegetation and soil characteristics distinctly different from surrounding uplands and support higher levels of species diversity, species densities, and rates of biological productivity than most other landscape elements. Streams and riparian corridors evolve in concert with and in response to surrounding ecosystems. Changes within a surrounding ecosystem (e.g., watershed) will impact the physical, chemical, and biological processes occurring within a stream corridor.

Stream systems normally function within natural ranges of flow, sediment movement, temperature, and other variables, in what is termed dynamic equilibrium. When changes in these variables go beyond their natural ranges, dynamic equilibrium may be lost, often resulting in adjustments in the ecosystem that might conflict with

Table 3-69 Noxious Weeds Which are Known to Occur in the Vicinity of the Alternatives			
Common Name	**Scientific Name**	**South Dakota**	**Wyoming**
Absenth wormwood	*Artemisia absinthum*	X	
Canada thistle	*Cirsium arvense*	X	X
Common burdock	*Arctium minus*		X
Dalmatian toadflax	*Linaria daimatica*		X
Diffuse knapweed	*Centaurea diffusa*		X
Dyers wood	*Isatis tinctoria*		X
Field bindweed	*Convolvulus arvensis*	X	
Hoary cress	*Cardaria spp*	X	X
Horse nettle	*Solanum carolanense*	X	
Houndstongue	*Cynoglossum officinale*		X
Leafy spurge	*Euphorbia esula*	X	X
Musk thistle	*Carduus nutans*		X
Oxey daisy	*Chrysanthemum leucanthemum*		X
Perennial pepperweed	*Lepidium latifolium*	X	X
Perennial sowthistle	*Sonchus arvensis*	X	X
Plumeless thistle	*Carduus acanthoides*		X
Quackgrass	*Agropyron repens*		X
Russian knapweed	*Centaurea repens*	X	X
Saltcedar	*Tamarix ramosissima*		X
Scotch thistle	*Cytisus scoparius*		X
Skeletonleaf bursage	*Ambrosia tomentosa*		X
Spotted knapweed	*Centaurea maculosa*		X
Squarrose knapweed	*Centaurea virgata*	X	
Yellow starthistle	*Centaurea solstitialis*	X	
Yellow toadflax	*Linaria vulgaris*		X

societal needs. In some circumstances, a new dynamic equilibrium may eventually develop, but the time frames in which this happens can be lengthy, and the changes necessary to achieve this new balance significant.

Riparian ecosystems overlap a great deal with some wetland classifications, however, riparian areas may not be flooded or saturated at some time each year nor do they necessarily have predominately hydrophytic cover as wetlands must have.

Common plant species in riparian areas include plains cottonwoods, willows, green ash, chokecherry, western snowberry, wild plum, sliver sagebrush, box elder, buffaloberry and skunkbush sumac as well as wet meadows and irrigated and sub-irrigated pastures or hay fields. These areas provide important wildlife habitat and are used heavily by livestock for grazing, watering, shade and travel.

Wetlands. Wetlands are a subset of riparian areas and are subject to protection under a number of Federal laws. The EPA and COE use the following definition of wetland for administering the Clean Water Act's Section 404 permit program for dredge and fill activities:

"Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas"

Wetlands have 3 essential characteristics: hydrophytic vegetation, hydric soils and wetland hydrology. The USFWS has developed a list of wetland plant species (Reed, 1988) and the NRCS has developed a list of hydric soils and characteristics that are used in delineation.

Table 3-70 Allotments Which Would be Crossed by Alternative B							
Allotment	Pasture	Allotment Size (acres)	Administration	Total Stock	Kind	Acres/AUM	AUMs in Pasture
South Dakota							
Creston	FRRD 41	558.0	Fall River RD	Private	Private	Private	
Gilmore	FRRD 63	2510.4	Fall River RD	85	Cattle	2.7-5.0	652.1
Reed	FRRD 98	1195.4	Fall River RD	125	Cattle	2.6-3.3	406.2
Circle C	FRRD 38	837.7	Fall River RD	219	Cattle	4.0-5.0	186.2
Reed	FRRD 97	556.4	Fall River RD	125	Cattle	2.6-3.3	188.6
Hardpan	FRRD 396	2350.6	Fall River RD	Private	Private	Private	
Kaiser	FRRD 79	2954.6	Fall River RD	136	Cattle	2.2-2.5	1257.3
Hardpan	FRRD 397	2521.7	Fall River RD	300	Cattle	3.95	638.4
Red Shirt	FRRD 100	1475.8	Fall River RD	175	Cattle	3.9-5.0	331.6
Hardpan	FRRD 426	339.9	Fall River RD	No Grazing	No Grazing	No Grazing	
Red Shirt	FRRD 99	1061.9	Fall River RD	175	Cattle	3.9-5.0	238.6
Chalk Hills	FRRD 8	4992.2	Fall River RD	466	Cattle	6	832.0
Chalk Hills	FRRD 13	1197.1	Fall River RD	466	Cattle	5	239.4
Likewise	FRRD 81	156.5	Fall River RD	39	Cattle	1.7	92.1
Chalk Hills	FRRD 14	175.2	Fall River RD	466	Cattle	4.7	37.3
Chalk Hills	FRRD 17	574.8	Fall River RD	466	Cattle	4.0	143.7
Likewise	FRRD 80	492.3	Fall River RD	39	Cattle	3.3	149.2
Chalk Hills	FRRD 11	229.6	Fall River RD	466	Cattle	4.7	48.9
Chalk Hills	FRRD 10	347.6	Fall River RD	466	Cattle	2.2	158.0
Bondurant	FRRD 33	1198.3	Fall River RD	160	Cattle	2.2	544.7
ND Misc	FRRD 451	82.3	Fall River RD	No Authorized Use			
Chalk Hills	FRRD 12	836.7	Fall River RD	466	Cattle	5.0	167.3
Chalk Hills	FRRD 2	868.8	Fall River RD	466	Cattle	4.0	217.2
Chalk Hills	FRRD 1	659.5	Fall River RD	466	Cattle	1.7	387.9
Stumer	FRRD 116	923.2	Fall River RD	63	Cattle	4.0	230.8
DDD/Soderquist 8292		185.3 (1)	BLM South Dakota		Cattle	3.3	57.0 (1)
Mosier/Tepaske John/ 8428		240 (1)	BLM South Dakota		Cattle	6.7-10 (1)	32.0 (1)
River Allotment/Hinesley Ted 8133		480 (1)	BLM South Dakota		Cattle	4.8-5.0 (1)	98.0 (1)
Wasta/Schell 8413		80 (1)	BLM South Dakota		Cattle	4.4	18 (1)
Breakneck Hill/ B&H Ranches		40 (1)	BLM South Dakota		Cattle	5	8.0 (1)
Maude Walter		127.8 (1)	BLM South Dakota		Cattle	6.4	20 (1)
Beaver Creek/ Andersen Edwin 8032		120 (1)	BLM South Dakota		Cattle	5.5 (1)	22 (1)
Wyoming							
Ostlund/ 270	Cottonwood	3002.8	Douglas RD	225	Cattle	4.9	612.8
Keeline /271	Black Thunder	25702.5	Douglas RD	822	Cattle	6.2	4145.6
Ostlund/270	Castle Rock	700.7	Douglas RD	20	Cattle	5	140.1
Ostlund/270	East	1719.9	Douglas RD	105	Cattle	4.9	351.0
Ostlund/270	Diamond L	2956.6	Douglas RD	Private	Private	Private	

Table 3-70 Continued							
Allotment	Pasture	Allotment Size (acres)	Administration	Total Stock	Kind	Acres/AUM	AUMs in Pasture
Keeline/271	East Black Thunder	9224.3	Douglas RD	510	Cattle	6.5	1419.1
Kerr-McGee/214	Kerr-McGee Mine	7397.8	Douglas RD	0	None	0	0
West Cellars/10	South	2756.7	Douglas RD	300	Cattle	5	551.3
Kerr-McGee/214	6	463.1	Douglas RD	335	Cattle	4.1	113.0
Kerr-McGee/214	3, 4 and 5	2294.5	Douglas RD	770	Cattle	4.7-5.3	458.9
Kerr-McGee/214	Kerr-McGee Mine	115.5	Douglas RD	0	None	0	0
Gordon/262	Summer	5379.4	Douglas RD	167	Cattle	5.6	960.6
Stringer/273	North Highway	244.9	Douglas RD	25	Cattle	6.8	36.0
Gordon/262	Private	861.1	Douglas RD	Private	Private	Private	
Gordon/262	Spring	1265.5	Douglas RD	167	Cattle	3.1	408.2
Gordon/262	South Winter	1498.9	Douglas RD	150	Cattle	2.3	651.7
Gordon/262	North Winter	459.3	Douglas RD	64	Cattle	4.5	102.1
Sewell/394	Calving	2861.7	Douglas RD	264	Cattle	3.7	773.4
Bruce/313	Calf	1883.7	Douglas RD	100	Cattle	4.3	438.1
Wildcat Creek/398	Shook	1867.5	Douglas RD	195	Cattle	3.9	478.8
Lynch/222	Winter	1472.6	Douglas RD	125	Cattle	4.5	327.2
Lynch/222	Yearling	1335.9	Douglas RD	Private	Private	Private	
Lynch/222	Calf	573.1	Douglas RD	Private	Private	Private	
Wildcat Creek/398	Fisher	2043.9	Douglas RD	155	Cattle	3.9	524.1
Lynch/222	Heifer	833.0	Douglas RD	42	Cattle	7.2	115.7
Lynch/222	Calving	1376.2	Douglas RD	175	Cattle	3.4	404.8
Lynch/222	Private	76.3	Douglas RD	Private	Private	Private	
Lynch/222	Private	12.3	Douglas RD	Private	Private	Private	
Lynch/222	Field	336.4	Douglas RD	Private	Private	Private	
Lynch/222	Little Frog Creek	2575.9	Douglas RD	170	Cattle	4.3	599.0
Lynch/222	Bull	319.5	Douglas RD	15	Cattle	4.1	77.9
Grieves /352	Wildcat	2694.1	Douglas RD	250	Cattle	4	673.5
Lynch/222	Big Frog Creek	1729.3	Douglas RD	170	Cattle	4.2	411.7
AU7/365	Lodgepole	6105.0	Douglas RD	300	Cattle	4.2	1453.6
South Rochelle Hills/272	Dry Lake	1975.5	Douglas RD	86	Cattle	10.1	195.6
Irwin/212	East	7500.2	Douglas RD	338	Cattle	4.9	1530.7
Shaw/395	Summer	4316.9	Douglas RD	300	Cattle	4.2	1027.8

Table 3-70 Concluded							
Allotment	**Pasture**	**Allotment Size (acres)**	**Administration**	**Total Stock**	**Kind**	**Acres/AUM**	**AUMs in Pasture**
Rosecrans/299	Rochelle Hills	2677.8	Douglas RD	193	Cattle	6.3	425.0
Rosecrans/299	Rough Draw Exclosure	5.6	Douglas RD	0	None	0	0
Irwin/212	Winter	4478.3	Douglas RD	286	Cattle	4.9	913.9
Shaw/395	North	1620.4	Douglas RD	312	Cattle	4.2	385.8
AU7/365	Spring Creek	3959.2	Douglas RD		Cattle	4.2	942.6
AU7/365	Stud	635.0	Douglas RD	127	Cattle	4.2	151.2
Irwin/212	Middle Beckwith	420.0	Douglas RD	163	Cattle	3.2	131.3
North Antelope/205	North Horse	166.6	Douglas RD	Managed as part of Meadow		2.4	69.4
North Antelope/205	South Horse	135.3	Douglas RD	Managed as part of Meadow		2.4	56.4
North Antelope/205	Meadow	271.6	Douglas RD	8/60	Horse/sheep	2.4	113.2
Irwin/212	House	690.1	Douglas RD	162	Cattle	4.7	146.8
North Antelope/205	Red Hills	2895.6	Douglas RD	500	Sheep	3.8	762.0
Jacob's/213	Railroad	607.1	Douglas RD	0	None	0	0
Jacob's/213	Railroad	1033.2	Douglas RD	0	None	0	0
Smith Claude		122.1 (1)	BLM Newcastle		Cattle/bison	6.8	18 (1)
Christensen Chris		551.4 (1)	BLM Newcastle	17/86	Cattle/sheep	6.6	83.5 (1)
Michael Harris		440.0	BLM Newcastle	18	Cattle	6.7	66.1
School Creek/240	Little Thunder	4467.5	Douglas RD	220	Cattle	3.5	1276.4
School Creek/240	Lovin	2378.4	Douglas RD	300/60	Sheep/cattle	4.3	553.1
School Creek/240	Mine	994.1	Douglas RD				
School Creek/240	Rock	601.3	Douglas RD	200	Sheep	4.5	133.6
School Creek/240	South Basin	2467.9	Douglas RD				
School Creek/240	South Pasture	575.8	Douglas RD				
Stringer/273	Stringer	829.7	Douglas RD	25	Cattle	4.5	184.4
Dry Creek Ranch/ 7143		681.3	BLM Buffalo		Cattle	4.1	168

1 = Allotment acres and AUMs only include the BLM acres and AUMs from the BLM parcels affected within the allotment and does not consider private lands.

Table 3-71 Allotments Which Would be Crossed by Alternative C and Alternative C With the W G Flat Route Variation							
Allotment	Pasture	Allotment Size (acres)	Administration	Total Stock	Kind	Acres/AUM	AUMs in Pasture
South Dakota							
Gilmore	FRRD 63	2510.4	Fall River RD	85	Cattle	2.7-5.0	652.1
ND Misc	FRRD 420	177.6	Fall River RD	0	None	2.7	65.7
Reed	FRRD 98	1195.4	Fall River RD	125	Cattle	2.6-3.3	406.2
Circle C	FRRD 38	837.7	Fall River RD	219	Cattle	4.0-5.0	186.2
Reed	FRRD 97	556.4	Fall River RD	125	Cattle	2.6-3.3	188.6
Red Shirt	FRRD 106	2156.8	Fall River RD	175	Cattle	5	431.4
Red Shirt	Unknown	40.3	Fall River RD	175	Cattle	5	8.0
Triple Seven	FRRD 25	1426.9	Fall River RD	1300	Bison	2.7	528.5
South Fork	FRRD 115	663.0	Fall River RD	Private	Private	Private	
Chalk Hills	FRRD 5	989.7	Fall River RD	466	Cattle	5.0	197.9
Chalk Hills	FRRD 2	868.8	Fall River RD	466	Cattle	4.0	217.3
Stumer	FRRD 116	923.2	Fall River RD	63	Cattle	.4	230.8
Sand Creek (2)	FRRD 181	1388.3	Fall River RD	0	None	0	0
DDD/Soderquist 8292		185.3 (1)	BLM South Dakota		Cattle	3.3	57 (1)
River Allotment/ Hinesley Ted 8133		480 (1)	BLM South Dakota		Cattle	4.8-5.0	98 (1)
Breakneck Hill/ B&H Ranches		40 (1)	BLM South Dakota		Cattle	5	8 (1)
Wasta/Schell 8413		80 (1)	BLM South Dakota		Cattle	4.4	18 (1)
Beaver Creek/ Andersen Edwin 8032		120 (1)	BLM South Dakota		Cattle	5.5	22 (1)
Maude Walter		12(1)	BLM South Dakota		Cattle	6.4	20
BLM 7329/8428 (3)		160.0	BLM South Dakota		Cattle	8.8	18
Wyoming							
Ostlund/270	Thomas (NW)	1528.1	Douglas RD	Private	Private	4.9/6.0	280.4
Ostlund/270	Cottonwood	3002.8	Douglas RD	225	Cattle	4.9	612.8
Ostlund/270	Bull	1593.1	Douglas RD	150	Cattle	6.0	265.5
Kerr-McGee/214	Kerr-McGee Mine	7397.8	Douglas RD	0	None	0	0
Kerr-McGee/214	6	463.1	Douglas RD	335	Cattle	4.1	113.0
Kerr-McGee/214	3, 4 and 5	2294.5	Douglas RD	770	Cattle	4.7-5.3	458.9
Stringer/273	North Highway	244.9	Douglas RD	25	Cattle	6.8	36.0
Stringer/273	Stringer	829.7	Douglas RD	25	Cattle	4.5	184.4
School Creek/240	Little Thunder	4467.5	Douglas RD	220	Cattle	3.5	1276.4
School Creek/240	Lovin	2378.4	Douglas RD	300/60	Sheep/cattle	4.3	553.1
Keeline/271	South Burdwick	2841.1	Douglas RD	150	Cattle	11.7	242.8

Table 3-71 Continued							
Allotment	Pasture	Allotment Size (acres)	Administration	Total Stock	Kind	Acres/AUM	AUMs in Pasture
Small/220	Little Thunder	632.9	Douglas RD	100	Cattle	3.7	171.1
Keeline/271	Bull	1358.3	Douglas RD	12	Cattle	3.6	377.3
Keeline/271	Piney Creek	3509.0	Douglas RD	160	Cattle	2.2	1595.0
School Creek/240	Buck	591.2	Douglas RD	20	Cattle	10.1	58.5
School Creek/240	Meadow	187.9	Douglas RD	Private	Private	4.6	40.8
School Creek/240	Rock	601.3	Douglas RD	200	Sheep	4.5	133.6
School Creek/240	Thornburg I	4344.2	Douglas RD	100	Cattle	4.9	886.6
School Creek/240	Thornburg II	976.0	Douglas RD	200	Sheep	7.4	131.9
School Creek/240	Calf	1098.3	Douglas RD	100	Cattle	5	219.6
Sewell/394	Calving	2861.7	Douglas RD	264	Cattle	3.7	773.4
Bruce/313	Calf	1883.7	Douglas RD	100	Cattle	4.3	438.1
Wildcat Creek/398	Shook	1867.5	Douglas RD	155	Cattle	3.9	478.8
Wildcat Creek/398	Fisher	2043.9	Douglas RD	195	Cattle	3.9	524.0
Teckla/298	North	1855.8	Douglas RD	192	Cattle	11.9	155.9
Teckla/298	South	1899.0	Douglas RD	192	Cattle	11.9	159.6
Grieves/352	Wildcat	2694.1	Douglas RD	250	Cattle	4	673.5
AU7/365	Lodgepole	6105.0	Douglas RD	300	Cattle	4.2	1453.6
Teckla/298	West Beckwith Exclosure	2.9	Douglas RD	0	Cattle	0	0
North Antelope/205	Reno	2003.8	Douglas RD	400	Sheep	4.6	435.6
Shaw/395	Summer	4316.9	Douglas RD	300	Cattle	4.2	1027.8
Irwin/212	Winter	4478.3	Douglas RD	286	Cattle	4.9	913.9
Shaw/395	North	1620.4	Douglas RD	312	Cattle	4.2	385.8
AU7/365	Stud	635.0	Douglas RD	127	Cattle	4.2	151.2
North Antelope/205	North Horse	166.6	Douglas RD	Managed as part of Meadow		2.4	69.4
North Antelope/205	South Horse	135.3	Douglas RD	Managed as part of Meadow		2.4	56.4
North Antelope/205	Meadow	271.6	Douglas RD	8/60	Horse/sheep	2.4	113.2
Irwin/212	House	690.1	Douglas RD	162	Cattle	4.7	146.8
North Antelope/205	Red Hills	2895.6	Douglas RD	500	Sheep	3.8	762.0
Jacob's/213	Railroad	1033.2	Douglas RD	0	None	0	
Smith Claud		122.1 (1)	BLM Newcastle		Cattle/bison	6	18 (1)
Christensen Chris 4051		551.4 (1)	BLM Newcastle	17/86	Cattle/sheep	6.6	83.5 (1)

Table 3-71 Concluded							
Allotment	**Pasture**	**Allotment Size (acres)**	**Administration**	**Total Stock**	**Kind**	**Acres/AUM**	**AUMs in Pasture**
Michael Harris 4333		440 (1)	BLM Newcastle	18	Cattle	6.7	66.1 (1)
Dale Osborn/ 7410		40.0 (1)	BLM Buffalo	27	Cattle	6.7	6 (1)
School Creek/240	Mine	994.1	Douglas RD				
School Creek/240	South Basin	2467.9	Douglas RD				
School Creek/240	South Pasture	575.8	Douglas RD				

1 = Allotment acres and AUMs only include the BLM acres and AUMs from the BLM parcels affected within the allotment and does not consider private lands. Total Acres and AUMs provided from grazing permits.
2 = Allotment would not be impacted by the WG Flat Route Variation.
3 = Allotment is only affected by the WG Flat Route Variation.

Table 3-72 Allotments Which Would be Crossed by Alternative C With the Phiney Flat Route Variation							
Allotment	Pasture	Allotment Size (acres)	Administration	Total Stock	Kind	Acres/AUM	AUMs in Pasture
South Dakota							
Gilmore	FRRD 63	2510.4	Fall River RD	85	Cattle	2.7-5.0	652.1
ND Misc	FRRD 420	177.6	Fall River RD	0	None	2.7	65.7
Red Shirt	FRRD 106	2156.8	Fall River RD	175	Cattle	5	431.4
Red Shirt	Unknown	40.3	Fall River RD	175	Cattle	5	8.0
Triple Seven	FRRD 25	1426.9	Fall River RD	1300	Bison	2.7	528.5
South Fork	FRRD 115	663.0	Fall River RD	Private	Private	Private	
Chalk Hills	FRRD 5	989.7	Fall River RD	466	Cattle	5.0	197.9
Chalk Hills	FRRD 2	868.8	Fall River RD	466	Cattle	4.0	217.3
Stumer	FRRD 116	923.2	Fall River RD	63	Cattle	4	230.8
Sand Creek	FRRD 181	1388.3	Fall River RD	0	None	0	0
DDD/Soderquist 8292		185.3 (1)	BLM South Dakota		Cattle	3.3	57 (1)
River Allotment/ Hinesley Ted 8133		480 (1)	BLM South Dakota		Cattle	4.8-5.0	98 (1)
Breakneck Hill/ B&H Ranches		40 (1)	BLM South Dakota		Cattle	5	8 (1)
Wasta/Schell 8413		80 (1)	BLM South Dakota		Cattle	4.4	18 (1)
Beaver Creek/ Andersen Edwin 8032		120 (1)	BLM South Dakota		Cattle	5.5	22 (1)
Maude Walter		12(1)	BLM South Dakota		Cattle	6.4	20
Wyoming							
Ostlund/270	Thomas (NW)	1528.1	Douglas RD	Private	Private	4.9/6.0	280.4
Ostlund/270	Cottonwood	3002.8	Douglas RD	225	Cattle	4.9	612.8
Ostlund/270	Bull	1593.1	Douglas RD	150	Cattle	6.0	265.5
Kerr-McGee/214	Kerr-McGee Mine	7397.8	Douglas RD	0	None	0	0
Kerr-McGee/214	6	463.1	Douglas RD	335	Cattle	4.1	113.0
Kerr-McGee/214	3, 4 and 5	2294.5	Douglas RD	770	Cattle	4.7-5.3	458.9
Stringer/273	North Highway	244.9	Douglas RD	25	Cattle	6.8	36.0
Stringer/273	Stringer	829.7	Douglas RD	25	Cattle	4.5	184.4
School Creek/240	Little Thunder	4467.5	Douglas RD	220	Cattle	3.5	1276.4
School Creek/240	Lovin	2378.4	Douglas RD	300/60	Sheep/cattle	4.3	553.1
Keeline/271	South Burdwick	2841.1	Douglas RD	150	Cattle	11.7	242.8
Small/220	Little Thunder	632.9	Douglas RD	100	Cattle	3.7	171.1
Keeline/271	Bull	1358.3	Douglas RD	12	Cattle	3.6	377.3
Keeline/271	Piney Creek	3509.0	Douglas RD	160	Cattle	2.2	1595.0

Table 3-72 Concluded							
Allotment	**Pasture**	**Allotment Size (acres)**	**Administration**	**Total Stock**	**Kind**	**Acres/AUM**	**AUMs in Pasture**
School Creek/240	Buck	591.2	Douglas RD	20	Cattle	10.1	58.5
School Creek/240	Meadow	187.9	Douglas RD	Private	Private	4.6	40.8
School Creek/240	Rock	601.3	Douglas RD	200	Sheep	4.5	133.6
School Creek/240	Thornburg I	4344.2	Douglas RD	100	Cattle	4.9	886.6
School Creek/240	Thornburg II	976.0	Douglas RD	200	Sheep	7.4	131.9
School Creek/240	Calf	1098.3	Douglas RD	100	Cattle	5	219.6
Sewell/394	Calving	2861.7	Douglas RD	264	Cattle	3.7	773.4
Bruce/313	Calf	1883.7	Douglas RD	100	Cattle	4.3	438.1
Wildcat Creek/398	Shook	1867.5	Douglas RD	155	Cattle	3.9	478.8
Wildcat Creek/398	Fisher	2043.9	Douglas RD	195	Cattle	3.9	524.0
Teckla/298	North	1855.8	Douglas RD	192	Cattle	11.9	155.9
Teckla/298	South	1899.0	Douglas RD	192	Cattle	11.9	159.6
Grieves/352	Wildcat	2694.1	Douglas RD	250	Cattle	4	673.5
AU7/365	Lodgepole	6105.0	Douglas RD	300	Cattle	4.2	1453.6
Teckla/298	West Beckwith Exclosure	2.9	Douglas RD	0	Cattle	0	0
North Antelope/205	Reno	2003.8	Douglas RD	400	Sheep	4.6	435.6
Shaw/395	Summer	4316.9	Douglas RD	300	Cattle	4.2	1027.8
Irwin/212	Winter	4478.3	Douglas RD	286	Cattle	4.9	913.9
Shaw/395	North	1620.4	Douglas RD	312	Cattle	4.2	385.8
AU7/365	Stud	635.0	Douglas RD	127	Cattle	4.2	151.2
North Antelope/205	North Horse	166.6	Douglas RD	Managed as part of Meadow		2.4	69.4
North Antelope/205	South Horse	135.3	Douglas RD	Managed as part of Meadow		2.4	56.4
North Antelope/205	Meadow	271.6	Douglas RD	8/60	Horse/sheep	2.4	113.2
Irwin/212	House	690.1	Douglas RD	162	Cattle	4.7	146.8
North Antelope/205	Red Hills	2895.6	Douglas RD	500	Sheep	3.8	762.0
Jacob's/213	Railroad	1033.2	Douglas RD	0	None	0	
School Creek/240	Mine	994.1	Douglas RD				
School Creek/240	South Basin	2467.9	Douglas RD				
School Creek/240	South Pasture	575.8	Douglas RD				
Smith Claud		122.1 (1)	BLM Newcastle		Cattle/bison	6	18 (1)
Christensen Chris 4051		551.4 (1)	BLM Newcastle	17/86	Cattle/sheep	6.6	83.5 (1)
Michael Harris 4333		440 (1)	BLM Newcastle	18	Cattle	6.7	66.1 (1)
Dale Osborn/ 7410		40.0 (1)	BLM Buffalo	27	Cattle	6.7	6 (1)

1 = Allotment acres and AUMs only include the BLM acres and AUMs from the BLM parcels affected within the allotment and does not consider private lands. Total Acres and AUMs provided from grazing permits.

Table 3-73 Allotments Which Would be Crossed by Alternative D							
Allotment	Pasture	Allotment Size (acres)	Administration	Total Stock	Kind	Acres/AUM	AUMs in Pasture
South Dakota							
8377- 7274		80.0 (1)	BLM South Dakota		Cattle	5	16 (1)
River Allotment/ Hinesley Ted 8133		480 (1)	BLM South Dakota		Cattle	4.8-5.6	98 (1)
Breakneck Hill/ B&H Ranches		40 (1)	BLM South Dakota		Cattle	5	8 (1)
Wyoming							
East Upton-Osage Community - 4	South	3087.6	Douglas RD	98	Cattle	5.8	532.3
Middle Upton-Osage Community - 5	#3	4170.0	Douglas RD	170	Cattle	6.9	604.3
Middle Upton-Osage Community - 5	#2	3306.3	Douglas RD	170	Cattle	6.9	479.2
West Upton-Osage #6	South	2231.3	Douglas RD	77 Cattle, 600 sheep	Cattle & Sheep	4.2	531.3
Oliver - 380	North	454.1	Douglas RD	300 sheep	Sheep	4.2	108.1
Huckins - 397	1	98.2	Douglas RD	31	Cattle	6.2	15.8
Mirich - 372	Railroad	78.2	Douglas RD	4	Cattle -Bulls	4.5	17.4
Mirich - 372	Bush	144.6	Douglas RD	38	Cattle	4.5	32.1
North Antelope/205	Meadow	271.6	Douglas RD	8/60	Horse/sheep	2.4	113.2
North Antelope/205	North Horse	166.6	Douglas RD	Managed as part of Meadow		2.4	69.4
North Antelope/205	Red Hills	2895.6	Douglas RD	500	Sheep	3.8	762.0
North Antelope/205	Reno	2003.8	Douglas RD	400	Sheep	4.6	435.6
North Antelope/205	South Horse	135.3	Douglas RD	Managed as part of Meadow		2.4	56.4
Irwin/212	House	690.1	Douglas RD	162	Cattle	4.7	146.8
Irwin/212	Winter	4478.3	Douglas RD	286	Cattle	4.9	913.9
Jacob's/213	Railroad	607.1	Douglas RD	0	None	0	
Kerr-McGee/214	Kerr-McGee Mine	7397.8	Douglas RD	0	None	0	0
Kerr-McGee/214	6	463.1	Douglas RD	335	Cattle	4.1	113.0
Kerr-McGee/214	3, 4 and 5	2294.5	Douglas RD	770	Cattle	4.7-5.3	458.9
School Creek/240	Buck	591.2	Douglas RD	20	Cattle	10.1	58.5
School Creek/240	Meadow	187.9	Douglas RD	Private	Private	Private	Private
School Creek/240	Rock	601.3	Douglas RD	200	Sheep	4.5	133.6
School Creek/240	Thornburg I	4344.2	Douglas RD	100	Cattle	4.9	886.6
School Creek/240	Thornburg II	976.0	Douglas RD	200	Sheep	7.4	131.9

Table 3-73 Concluded							
Allotment	**Pasture**	**Allotment Size (acres)**	**Administration**	**Total Stock**	**Kind**	**Acres/AUM**	**AUMs in Pasture**
School Creek/240	Calf	1098.3	Douglas RD	100	Cattle	5	219.7
School Creek/240	Lovin	2378.4	Douglas RD	300/60	Sheep/cattle	4.3	553.1
School Creek/240	Little Thunder	4467.5	Douglas RD	220	Cattle	3.5	1276.4
Ostlund/270	Cottonwood	3002.8	Douglas RD	225	Cattle	4.9	612.8
Ostlund/270	Bull	1593.1	Douglas RD	150	Cattle	6.0	265.5
Ostlund/270	Thomas (NW)	1528.1	Douglas RD	Private	Private	4.9/6.0	280.4
Stringer/273	North Highway	244.9	Douglas RD	25	Cattle	6.8	36.0
Stringer/273	Stringer	829.7	Douglas RD	25	Cattle	4.5	184.4
Teckla/298	West Beckwith Exclosure	2.9	Douglas RD	0	Cattle	0	0
Teckla/298	North	1855.8	Douglas RD	192	Cattle	11.9	155.9
Teckla/298	South	1899.0	Douglas RD	192	Cattle	11.9	159.6
School Creek/240	Mine	994.1	Douglas RD				
School Creek/240	South Basin	2467.9	Douglas RD				
School Creek/240	South Pasture	575.8	Douglas RD				
Fern Porter - 04281		80.0 (1)	BLM Newcastle		Cattle	6.7	12 (1)
True Ranches - 04337		80.0 (1)	BLM Newcastle		Cattle	3.2	25 (1)
Barton Land & Livestock Co - 14016		160.0 (1)	BLM Newcastle		Cattle	4	40 (1)
Steven Mirich - 04205		320.0 (1)	BLM Newcastle		Cattle	4	80 (1)
West Timber Creek 12091		120 (1)	BLM Buffalo		Cattle	8.6	14 (1)
Dale Osborn/ 7410		40.0 (1)	BLM Buffalo	27	Cattle	6.7	6 (1)

1 = Allotment acres and AUMs only include the BLM acres and AUMs from the BLM parcels affected within the allotment and does not consider private lands.

In November, 1998 field investigations were conducted to verify USFWS NWI Maps (1:24,000 scale) along Alternatives B and C. Approximately 5 percent of the wetlands in each type (i.e., wet meadow, aquatic bed, palustrine scrub shrub, etc.) were sampled in the field to determine how well the NWI correlated with field delineations. According to Intermountain Ecosystems (Kass, 1999), the NWI Maps proved to be accurate about 80 percent of the time in depicting the classification and extent of jurisdictional wetlands.

Tables 3-74 through 3-78 provide the miles of wetlands by type (as identified on the NWI Maps) that would be crossed by the alternatives. A general description of each of the NWI wetland types that could be affected follows.

Wet Meadow. This type accounts for the majority of the wetlands which would be crossed by the alternatives. This wetland type includes Cowardian *et al.* (1979) classifications of palustrine emergent both temporarily and seasonally flooded. Typical plant species found in this type include Baltic rush, Nebraska sedge, spikerush, prairie cordgrass, switch grass, rumex, cattails, saltgrass and bulrush.

The Black Thunder South Mine Loop Option would cross 0.3 miles of wet meadow wetland type in Wyoming. The North Antelope East Mine Loop would cross 0.06 miles of wet meadow also in Wyoming. The Black Thunder South and the North Antelope West mine loops would not cross wetlands.

Aquatic Bed. This type is the second most common type which would be crossed by the alternatives. Aquatic bed is the most frequent wetland type which would be crossed in Wyoming by Alternatives B and C. Aquatic bed wetlands are areas which support standing water less than 6 feet deep nearly all year long. Aquatic bed wetlands are typically associated with stock ponds and impoundments of intermittent streams, especially in Wyoming. This type can be found in oxbows of old river channels along the Cheyenne River and the larger perennial streams which would be crossed by the alternatives. Typical plant species found in this type include cattails, rushes and sedges.

Stock Ponds. This type represents the Cowardian *et al.* (1979) classifications of palustrine unconsolidated bottom and palustrine unconsolidated shore, both temporarily and seasonally flooded. Stock ponds are man-made excavations and small dams constructed along intermittent stream channels. They are important water sources for both wildlife and livestock. Depending on the amount of water held by the stock pond, the perimeter of the pond may support wet meadow plant species. Foxtail barley and rumex are typical plant species in this type. Many of the stock ponds have also been mapped in the wet meadow and aquatic bed types.

Riparian Scrub/Shrub. This wetland type represents the Cowardian *et al.* (1979) classification of palustrine scrub/shrub, broad-leaved deciduous. This type is primarily associated with the Cheyenne River and the larger perennial streams which would be crossed by the alternatives. Typical plant species found in this type include peachleaf willow and other willows, silver sagebrush, wild rose and plains cottonwood.

Riparian Forest. This wetland type represents the Cowardian *et al.* (1979) classification of palustrine forested, broad-leaved deciduous. This type is also primarily associated with the Cheyenne River and the larger perennial streams. Typical plant species found in this type include plains cottonwood, peachleaf willow, silver sagebrush and wild rose. This riparian forested type is important habitat for beavers and migrating species including bald eagles and other raptors.

Riverine. This wetland type primarily represents the Cowardian *et al.* (1979) classification of riverine lower perennial with unconsolidated bottoms and shores that are temporarily or seasonally flooded. These types are located on perennial and intermittent drainage channels that show signs of consistent channel forming processes (*i.e.*, are at bed and grade crossing) and may be free of vegetation.

3.17 Threatened and Endangered Species and Special Status Species

3.17.1 Impact Analysis Area. Generally, these species are described based on their occurrence in the counties which would be crossed by the alternatives.

3.17.2 Affected Environment. The USFWS (1998a, 1998b and 1999a) identified 10 Federally-listed threatened or endangered wildlife and plant species that could potentially occur in the project area. These are the black-footed ferret (*Mustela nigripes*, endangered), peregrine falcon (*Falco peregrinus*, endangered), whooping crane (*Grus americana*, endangered), interior least tern (*Sterna antillarum*, endangered), pallid sturgeon (*Scaphirhynchus albus*, endangered), Topeka shiner (*Notropis topeka*, endangered), American burying beetle (*Nicrophorus americanus,* endangered), piping plover (*Charadrius melodus*, threatened), bald eagle (*Haliaeetus leucocephalus*, threatened) and Ute ladies'-tresses (*Spiranthes diluvialis*, threatened). Since those communications, however, USFWS has proposed to remove the bald eagle from the endangered species list.[10] And, USFWS determined that the American peregrine falcon is no longer endangered or threatened and removed

[10] See Federal Register: July 6, 1999, 64(128):36453-36464.

Table 3-74 NWI Wetland Types Which Would be Crossed by Alternative B								
Wetland Type	Cowardian Classification	Miles Crossed by Land Ownership					Total	Percent
		Forest Service	DOE	BLM	State	Private		
South Dakota								
Wet Meadow	Palustrine Emergent temporarily and Seasonal Flooded	0.00	0.00	0.00	0.00	0.78	0.78	46.4
Aquatic Bed	Palustrine Aquatic Bed Semipermanently Flooded	0.00	0.00	0.00	0.00	0.26	0.26	15.5
Stock Ponds	Palustrine Unconsolidated Bottom and Shore Palustrine Emergent	0.00	0.00	0.00	0.00	0.17	0.17	10.1
Riparian Scrub/ Shrub	Palustrine Scrub Shrub	0.00	0.00	0.00	0.00	0.05	0.05	3.0
Riparian Forest	Palustrine Forested	0.00	0.00	0.00	0.00	0.03	0.03	1.8
Riverine	Riverine Lower Perennial Unconsolidated Bottom & Unconsolidated Shore	0.23	0.00	0.00	0.00	0.16	0.39	23.2
Total		0.23	0.00	0.00	0.00	1.45	1.68	100.0
Wyoming								
Wet Meadow	Palustrine Emergent Temporarily and Seasonal Flooded	0.00		0.00	0.00	0.14	0.14	21.9
Aquatic Bed	Palustrine Aquatic Bed Semipermanently Flooded	0.02		0.00	0.00	0.12	0.14	21.9
Stock Ponds	Palustrine Unconsolidated Bottom and Shore Palustrine Emergent,	0.03		0.00	0.00	<0.01	0.03	4.7
Riparian Forest	Palustrine Forested	<0.1		0.00	0.00	0.09	0.09	14.1
Riverine	Riverine Lower Perennial Unconsolidated Bottom & Unconsolidated Shore	0.00		0.00	0.00	0.24	0.24	37.4
Total		0.05		0.00	0.00	0.59	0.64	100.0

removed the species from the Federal List of Endangered and Threatened Wildlife on August 25, 1999.[11]

In addition to these species, mountain plovers (*Charadrius montanus*) have been proposed for listing as a threatened species.[12] Three other species are candidates for listing as threatened or endangered: swift fox (*Vulpes velox*), sturgeon chub (*Macrhybopsis gelida*), and sicklefin chub (*Macrhybopsis meeki*). Swift fox and sturgeon chub occur within the project area in South Dakota and swift fox are found in the project area in Wyoming. Sicklefin chub did occur in the Missouri River downstream from the alternatives. USFWS was petitioned to list both sturgeon chub and sicklefin chub as endangered and determined that listing may be warranted.[13] Draft documents for the species' listing are in preparation but both are currently candidate species. Finally, the USFWS was petitioned to list the black-tailed prairie dog (*Cynomys ludovicianus*) as threatened under the Endangered Species Act.[14] The USFWS determined listing as threatened was warranted but precluded at this time. Currently, the black-tailed prairie dog is a candidate species.[15]

Listed Species

Black-footed Ferret. The black-footed ferrets' original distribution in North America closely corresponded to distributions of prairie dogs (Hall and Kelson, 1959 and Fagerstone, 1987) and until 1985, a free-living population inhabited white-tailed prairie dog colonies located west of Meeteetse, Wyoming. This population was reduced by canine distemper in 1985 (Clark, 1985) and surviving ferrets were captured for captive breeding and eventual reintroduction to the wild. Black-footed ferrets depend on prairie dogs for food and prairie dog burrows for shelter (Hillman and Clark, 1980 and Fagerstone, 1987). They are mostly nocturnal and spend much of their time underground so their presence

[11] See Federal Register: August 25, 1999, 64(164):46541-46588.

[12] See Federal Register: February 16, 1999, 64(30):7587-7601

[13] See Federal Register. January 18, 1995, 60(11):3613-3615.

[14] See Federal Register: March 25, 1999, 64(57):14424-14428

[15] See Federal Register: February 4, 2000, 65(24):5476-5488

Table 3-75 NWI Wetland Types Which Would be Crossed by Alternative C							
Wetland Type	Cowardian Classification	Miles Crossed by Land Ownership				Total	Percent
		Forest Service	BLM	State	Private		
South Dakota							
Wet Meadow	Palustrine Emergent Temporarily and Seasonal Flooded	0.00	0.00	0.00	0.70	0.70	53.8
Aquatic Bed	Palustrine Aquatic Bed Semipermanently Flooded	0.00	0.00	0.00	0.27	0.27	20.8
Stock Ponds	Palustrine Unconsolidated Bottom and Shore Palustrine Emergent,	0.00	0.00	0.00	0.07	0.07	5.4
Riparian Scrub/ Shrub	Palustrine Scrub Shrub	0.00	0.00	0.00	0.05	0.05	3.8
Riparian Forest	Palustrine Forested	0.00	0.00	0.00	0.07	0.07	5.4
Riverine	Riverine Lower Perennial Unconsolidated Bottom & Unconsolidated Shore	0.00	0.00	0.00	0.14	0.14	10.8
Total		0.00	0.00	0.00	1.30	1.30	100.0
Wyoming							
Wet Meadow	Palustrine Emergent Temporarily and Seasonal Flooded	0.04	0.0	0.01	0.11	0.16	57.1
Aquatic Bed	Palustrine Aquatic Bed Semipermanently Flooded	0.05	0.0	0.02	0.05	0.12	42.9
Stock Ponds	Palustrine Unconsolidated Bottom and Shore Palustrine Emergent,	0.0	0.0	0.0	<0.01	0.00	0.0
Total		0.09	0.0	0.03	0.16	0.28	100.0

Table 3-76 NWI Wetland Types Which Would be Crossed by Alternative C With the Phiney Flat Route Variation							
Wetland Type	Cowardian Classification	Miles Crossed by Land Ownership				Total	Percent
		Forest Service	BLM	State	Private		
South Dakota							
Wet Meadow	Palustrine Emergent Temporarily and Seasonal Flooded	0.00	0.00	0.00	0.70	0.70	53.8
Aquatic Bed	Palustrine Aquatic Bed Semipermanently Flooded	0.00	0.00	0.00	0.27	0.27	20.8
Stock Ponds	Palustrine Unconsolidated Bottom and Shore Palustrine Emergent	0.00	0.00	0.00	0.07	0.07	5.4
Riparian Scrub/ Shrub	Palustrine Scrub Shrub	0.00	0.00	0.00	0.05	0.05	3.8
Riparian Forest	Palustrine Forested	0.00	0.00	0.00	0.07	0.07	5.4
Riverine	Riverine Lower Perennial Unconsolidated Bottom & Unconsolidated Shore	0.00	0.00	0.00	0.14	0.14	10.8
Total		0.00	0.00	0.00	1.30	1.30	100.0
Wyoming							
Wet Meadow	Palustrine Emergent Temporarily and Seasonal Flooded	0.04	0.0	0.01	0.11	0.16	57.1
Aquatic Bed	Palustrine Aquatic Bed Semipermanently Flooded	0.05	0.0	0.02	0.05	0.12	42.9
Stock Ponds/ Reservoirs	Palustrine Unconsolidated Bottom and Shore Palustrine Emergent, Palustrine Open Water	0.0	0.0	0.0	<0.01	0.00	0.0
Total		0.09	0.0	0.03	0.16	0.28	100.0

Table 3-77 NWI Wetland Types Which Would be Crossed by Alternative C With the W G Flat Route Variation							
Wetland Type	Cowardian Classification	Miles Crossed by Land Ownership				Total	Percent
		Forest Service	BLM	State	Private		
South Dakota							
Wet Meadow	Palustrine Emergent Temporarily and Seasonal Flooded	0.00	0.00	0.00	0.57	0.57	57.0
Aquatic Bed	Palustrine Aquatic Bed Semipermanently Flooded	0.00	0.00	0.00	0.16	0.16	16.0
Stock Ponds	Palustrine Unconsolidated Bottom and Shore Palustrine Emergent,	0.00	0.00	0.00	0.00	0.00	0.0
Riparian Scrub/ Shrub	Palustrine Scrub Shrub	0.00	0.00	0.00	0.05	0.05	5.0
Riparian Forest	Palustrine Forested	0.00	0.00	0.00	0.07	0.07	7.0
Riverine	Riverine Lower Perennial Unconsolidated Bottom & Unconsolidated Shore	0.00	0.02	0.00	0.13	0.15	15.0
Total		0.00	0.02	0.00	0.98	1.00	100.0
Wyoming							
Wet Meadow	Palustrine Emergent Temporarily and Seasonal Flooded	0.04	0.0	0.01	0.11	0.16	57.1
Aquatic Bed	Palustrine Aquatic Bed Semipermanently Flooded	0.05	0.0	0.02	0.05	0.12	42.9
Stock Ponds/ Reservoirs	Palustrine Unconsolidated Bottom and Shore Palustrine Emergent, Palustrine Open Water	0.0	0.0	0.0	<0.01	0.00	0.0
Total		0.09	0.0	0.03	0.16	0.28	100.0

Table 3-78 NWI Wetland Types Which Would be Crossed by Alternative D							
Wetland Type	Cowardian Classification	Miles Crossed by Land Ownership				Total	Percent
		Forest Service	BLM	State	Private		
South Dakota							
Wet Meadow	Palustrine Emergent Temporarily and Seasonal Flooded	0.00	0.00	0.00	0.29	0.29	58.0
Aquatic Bed	Palustrine Aquatic Bed Semipermanently Flooded	0.00	0.00	0.00	0.06	0.06	12.0
Stock Ponds	Palustrine Unconsolidated Bottom and Shore Palustrine Emergent	0.00	0.00	0.00	0.00	0.00	0.0
Riparian Scrub/ Shrub	Palustrine Scrub Shrub	0.00	0.00	0.00	0.03	0.03	6.0
Riparian Forest	Palustrine Forested	0.00	0.00	0.00	0.00	0.00	0.0
Riverine	Riverine Lower Perennial Unconsolidated Bottom & Unconsolidated Shore	0.00	0.00	0.00	0.12	0.12	24.0
Total		0.00	0.00	0.00	0.50	0.50	100.0
Wyoming							
Wet Meadow	Palustrine Emergent Temporarily and Seasonal Flooded	0.10	0.0	0.01	0.70	0.80	61.1
Aquatic Bed	Palustrine Aquatic Bed Semipermanently Flooded	0.05	0.0	0.00	0.35	0.40	30.5
Stock Ponds/ Reservoirs	Palustrine Unconsolidated Bottom and Shore Palustrine Emergent, Palustrine Open Water	0.01	0.0	0.00	0.10	0.11	8.4
Total		0.16	0.0	0.01	1.15	1.31	100.0

in an area is difficult to confirm. Black-footed ferrets breed from mid-March through early April (Clark and Stromberg, 1987) and young are born in prairie dog burrows. Young ferrets venture above ground during July but remain near the nest burrow (Fagerstone, 1987).

Black-tailed prairie dog colonies occur throughout the project area in Wyoming and South Dakota. Some have been mapped by the Forest Service and dated mapping is available from the WGFD. Maps of colonies on private lands have been provided by county weed and pest control district agents in Wyoming and South Dakota. And, black-tailed prairie dog colonies were mapped along Alternative C from black-and-white aerial photographs (1:2,400) extending to approximately 1,000 feet on each side of the alternative's centerline. The North Antelope West Mine Loop would pass through prairie dog colonies for 0.6 miles. The current activity status of each prairie dog colony is unknown: some colonies have become inactive due to sylvatic plague epizootics (in Wyoming only) and others have been poisoned by county weed and pest control agents and/or private land owners. For most of the colonies that have been mapped there are no additional data about the areal extent or geographic proximity of other colonies that would form a local colony complex.

According to available information compiled by Clark (1978 and 1980), the WGFD (Kinter and Martin, 1992), USFWS (Jobman and Anderson, 1991), Wyoming Natural Diversity Database (WNDDB, 1999), and South Dakota Natural Heritage Database (SDNHDB, 1999), the following sightings or physical evidence exists for black-footed ferrets within counties in Wyoming and South Dakota which would be crossed by the alternatives: 16 in Campbell; 14 in Converse; 4 in Crook; 6 in Niobrara; 6 in Weston; 3 in Custer; 2 in Fall River; 5 in Pennington; and 3 in Shannon (adjacent but not crossed). Some of these sightings were rated by the various sources as "confirmed", "positive", or "probable" but most are farther than 20 miles from the alternatives. Those closer than 20 miles are listed in Table 3-79. Only 3 of these, records of 2 skulls and 1 skin, are unquestionably physical evidence.

Experimental populations of black-footed ferrets have been reintroduced to Federally-managed lands in South Dakota from 1994 through 1999. Those areas (the Conata Basin/Badlands reintroduction site) are within portions of BGNG and Badlands National Park. All black-tailed prairie dog colonies within the reintroduction area were mapped and indicate lower densities on the periphery of core reintroduction areas (USFWS, unpublished information). Densities of black-tailed prairie dog colonies are low on portions of BGNG that would be closest to the alternatives.

The Black-footed Ferret Recovery Implementation Team has identified TBNG as a high-priority reintroduction site for black-footed ferrets. The Forest Service has worked with The Nature Conservancy to block up NFS ownership in the Rosecrans Area, south of the alternatives. These blocked up NFS lands will form the core of the TBNG's ferret reintroduction site. If the site is successful, ferrets may expand to prairie dog towns which would be crossed by the alternatives.

Whooping Crane. Until several years ago, whooping cranes occurred in western Wyoming (Ritter, 1990). These birds were from the experimental flock from the Grays Lake National Wildlife Refuge in Idaho, which was initiated in 1975 as an experiment to cross-foster whooping crane eggs in nests of sandhill cranes (USFWS, 1986). The cross-fostering program was discontinued in 1989 and there were only 2 birds from the Grays Lake flock known to be alive in 1999. The USFWS designated the Rocky Mountain population of whooping cranes as experimental and nonessential in 1997.[16] As a nonessential experimental population, the potential presence of whooping cranes from the Greys Lake population do not require formal consultation with USFWS but Federal programs are required to conserve the species nevertheless. Habitats utilized by whooping cranes in Wyoming included marshes, wet meadows, and grain fields near water (Dorn and Dorn, 1990). Similar habitats are utilized in South Dakota during cranes' migrations (Ashton and Dowd, 1991).

The only reproducing wild population of whooping cranes is the Aransas/Wood Buffalo flock that nests in northern Canada and migrates to the Gulf of Mexico (Binkley and Miller, 1988). Their migration pathway appears to pass through central (Hughes, Stanley, Sully counties; USFWS, 1989) and western (Pennington County; USFWS, 1989) South Dakota, but were mainly in the Missouri River drainage (Ashton and Dowd, 1991).

From 1957 through 1990, 5 confirmed sightings of whooping cranes were made in Pennington County, 7 sightings were from Jackson County, 2 from Haakon County, 20 from Stanley and 14 from Hughes counties (USFWS, unpublished data). During the spring migration in 1988, a small group (4 adults and 1 young) of whooping cranes was observed feeding in a grain field north of Rapid Creek approximately 3 miles from Alternative D in Pennington County. Possibly the same group was observed a week later approximately 11 miles southeast of Wall in eastern Pennington County (SDNHDB, 1999). The following year, 1989, a single whooping crane was seen flying 3 miles east of Ellsworth Air Force Base in Pennington County during fall migration (USFWS, 1989).

Interior Least Tern. This species occurs in South Dakota where successful nesting has been documented on the Missouri and Cheyenne rivers (Dirks *et al.*, 1993a).

[16] See Federal Register July 21, 1997, 62(139): 38932-38939.

Table 3-79
Reports of Black-footed Ferrets (Listed as Possible, Probable, or Confirmed) Within an Approximate 20-mile Distance of the Alternatives

County, State	Year Observed	Location Description or Twp	Rng	Sec	Distance from Alternative	Observation Rating
Campbell, WY	1972	41N	69W	26	1 mile from Alternative C	Possible/Probable (1)
	1974	43N	73W	05	16 miles from Alternatives B, C	Confirmed (2)
	1976	43N	70W	30	1.5 miles from Alternatives B, C	Possible/Probable (1)
	1976	43N	73W	24	13 miles from Alternatives B, C	Possible/Probable (1)
	1981	43N	72W	02	6.5 miles from Alternatives B, C	Probable (1)
	1981	43N	72W	11	9 miles from Alternatives B, C	Confirmed (2)
	1986	43N	70W	30	1 mile from Alternatives B, C	Possible/Probable (1)
	1987	45N	71W	23	5.5 miles from Alternative C	Possible/Probable (1)
Converse, WY	1972	41N	69W	21	<1 mile from Alternative B	Possible/Probable (1)
	1979	41N	70W	32	<1 mile from Alternatives B, C	Positive, Skull (1, 3)
	1983	39N	71W	SE¼	10 miles from Alternatives B, C	Possible/Probable (1)
Crook, WY	1930	Four Horse Ck, south of Moorcroft			6-15 miles from Alternative D	Positive (3)
	1971	Middle-Osage Comm. Pasture			> 10 miles from Alternative D	Positive (3)
	1973	3 miles east Crook Co. line, 8 mile north I-90			8 miles from Alternative D	Probable (3)
	1977	Hwy 14 near Keyhole Res.			8 miles from Alternative D	Not Rated (1)
Niobrara, WY	1976	36 mi N. Lusk, Hwy 85			12 miles from Alternatives B, C	Confirmed (2)
Weston, WY	1895	Newcastle			0-5 miles from Alternative D	Positive, Skin (3)
	1910	Newcastle			0-5 miles from Alternative D	Positive, Skull (3)
	1930	18 mi. southwest of Upton on Deep Water Ck			18 miles from Alternative D	Positive (3)
	1920-1935	46N	65W	22/23	8 miles from Alternative D	Not Rated (1)
	1972	45N	62W	SE¼	0-3 miles from Alternative D	Not Rated (1)
	1972	5 mi. south of Hwy 16 on South Dakota border			2 miles from Alternative D	Positive (3)
Custer, SD	1984	6S	9E	17-20	1 mile from Alternatives B, C	Probable (2)
	1988	55N	5E	26	13 miles from Alternative C	Probable (2)
Fall River, SD	1980	near Edgemont			<2 miles from Alternative B	Probable (2)
	1983	9S	3E	07	<1 mile from Alternative B	Confirmed (2)
Pennington, SD	1921	3S	12E	17	1 mile from Alternatives B, C	Not Rated (4)
	1927	2S	9E	08	11 miles from Alternative C 6 miles from Alternative D	Not Rated (4)

Notes on Observational Ratings:
1 = Ratings of Possible/Probable not differentiated by Kinter and Martin, 1992.
2 = Ratings of Confirmed or Probable provided by USFWS 1981 and update (Jobman and Anderson, 1991).
3 = Ratings of Positive or Probable from Clark, 1980
4 = Information with no observation ratings from South Dakota Natural Heritage Database, 1999

Interior least terns nest in colonies on sand islands and sandbars in rivers; a key factor for nest site selection is continuous exposure of the site above water for at least 100 days during the nesting period from mid-May to the end of August (Smith and Renkin, 1991). Terns excavate shallow scrapes in sand, soil or gravel (Carreker, 1985) but may select specific sites if there is an object present, such as a rock or driftwood (Dirks *et al.*, 1993b). Apparently suitable nesting habitat has been created at pits dug for sand and gravel mining operations adjacent to the Platte River, in Nebraska (Sidle and Kirsch, 1993). Once natural vegetation regrowth or reclamation occurs on abandoned pits, their suitability for nesting by least terns diminishes (Sidle and Kirsch, 1993).

Because nests are on the ground near water level, with very little (less than 10 percent) vegetation, less than 4 inches tall (Dirks *et al.*, 1993b), they are vulnerable to flooding following natural precipitation pulses but also during hydroelectric dam operational water releases. Nests are also susceptible to avian and mammal predators and human disturbance (Rimmer and Deblinger, 1992; Mayer, 1993; Kruse *et al.,* 1993; Schwalbach *et al.*, 1993; Smith and Renken, 1993). Least terns also nest on alkaline flats where they are exposed to similar impacts (flooding, predators, human disturbance) as nests on river sand and gravel bars (Koenen *et al.*, 1996). Initiation of nesting in South Dakota may be dependent on water levels, occurring earlier during years with low water levels in May; nesting begins in late May and chicks fledge by mid-July (Schwalbach *et al.,* 1993).

In addition to the presence of suitable nesting substrate, nesting sites are selected for presence of food fish such as shiners, suckers, killifish, gizzard shad and sunfish (Erwin, 1983; Carreker, 1985). Nesting success depends, in part, on proximity to food sources (Schweitzer and Leslie, 1996). Suitable nesting sites and foraging areas apparently occur along the Cheyenne River near the confluence with the Missouri River at Lake Oahe (Dirks *et al.* 1993a), upstream from Pierre. Two records of least terns on the Missouri River in the vicinity of Pierre, Hughes County and Fort Pierre, Stanley County were provided by SDNHDB (1998) but there were no records from that source in the vicinity of the alternatives. Biologists with BGNG conducted a search for interior least terns along 20 miles of the Cheyenne River in Custer and Pennington counties in 1994 but no evidence was found (Hetlet, 1994). However, least terns were observed nesting on an island in the Cheyenne River in 1986, approximately midway between the confluence with Rapid Creek and Wasta (Melius, 1999) where proposed routes for Alternative B and Alternative C closely parallel the river. From 1988 through 1997, least terns have nested along the Cheyenne River in Pennington County several miles downstream from where the river is crossed by Alternative D (SDNHDB, 1999). There are sand and gravel bars in the Cheyenne River where it parallels Alternatives B and C upstream from the Alternative D crossing but most are small and some partially covered with vegetation and may not be suitable for nesting (Hetlet, 1994).

A survey for interior least terns and piping plovers was conducted along approximately 28 miles of the Cheyenne River between Spring Creek and Wasta. None of either species were seen. During the survey, USGS water flow data on the river at Wasta (see Table 3-80) indicated flows of 2,300 cubic feet per second (cfs). Many of the sand and gravel bars in the survey area had been under water several days prior to the survey, probably on June 22 when flows reached 3,500 cfs. Comparisons of flows on the June 26 survey date with flows recorded at the Wasta USGS gauging station and other stations downstream on the Cheyenne River indicate much lower water flows on dates when least terns had been observed nesting in the past (Table 3-80). Thus, it is not surprising that least terns were not seen during the June 26, 1999 survey: water levels had been too high for nesting to be initiated or sustained successfully.

Least terns require approximately 54 to 61 days with continuous exposure of a nesting island or sand bar to be above water. That time duration for successful nesting is based on 14 to 21 days between courtship and egg laying, 20 days of egg incubation, and 20 days of chick development through to fledging (data from Erwin, 1983). Calculations based on river flow data collected at Wasta indicate there have been 12 years between 1985 and 1998 when sand bars or islands in the Cheyenne River would have been exposed above water during the nesting season. During those years, no river flows exceeded 2,500 cfs for at least 54 consecutive days between May 20 and July 31. Consequently, interior least terns may nest on the Cheyenne River within the project area during some time in the future.

Pallid Sturgeon. Records of pallid sturgeon were provided by SDNHDB (1998); all were from the Missouri River in the vicinity of Pierre, Hughes and Stanley counties (Lake Sharpe) between 1967 and 1989. The sturgeon is native to the Missouri and Mississippi rivers and persists in Lake Sharpe, South Dakota (Dryer and Sandvol, 1993). Its occurrence upstream from Oahe Dam in Lake Oahe and tributaries has also been reported during the 1960s. Most collections in reservoirs on the Missouri River are from the upstream ends (below dams) indicating sturgeons' preference for swifter moving water (Kallemeyn, 1983). Since pallid sturgeons prefer main channels of large, turbid rivers where they feed on fish and aquatic insects along the bottom (Kallemeyn, 1983), suitable habitat does not exist in the vicinity of the alternatives paralleling the Cheyenne River. No evidence from any surveys exists for their occurrence in the Cheyenne River (Hampton, 1998; USFWS, 1993a).

Table 3-80 River Flow Data at 3 USGS Gauging Stations on the Cheyenne River, South Dakota in Vicinities Where Interior Least Terns Were Observed Actually Nesting Compared to River Flows Recorded Before, During and After a Survey for Nesting Interior Least Terns and Piping Plovers Conducted on June 26, 1999			
Interior Least Tern Observed Nesting Date	River Flows (Cubic Feet per Second) at Gauging Stations (With USGS Station Numbers) on the Cheyenne River, South Dakota		
	06423500 - Downstream from Wasta, Pennington County	06438500 - Near Plainview, Ziebach County	06439300 - Near Cherry Creek, Ziebach County
June 7, 1986 (1)	150	no data	486
June 1986 (2)	1338 (June 1986 average)	no data	2,022 (June 1986 average)
August 4, 1987 (1)	77	no data	339
June 26, 1988 (3)	82	no data	204
June 30, 1995 (3)	1,120	2,500 (estimated value)	no data
June 26, 1997 (3)	876	no data	no data
June 27, 1997 (3)	841	no data	no data
This Survey, Before and After:			
June 22, 1999	3,500 (350 = median for date)	7,500 (925 = median for date)	no data
June 26, 1999	2,300 (250 = median for date)	4,250 (700 = median for date)	no data
June 28, 1999	1,880 (300 = median for date)	3,780 (675 = median for date)	no data

1 = data from South Dakota Ornithologists' Union, 1991, nesting on lower Cheyenne River near mainstem of Missouri River.
2 = observation reported by Michael Melius, Hermosa, SD nesting on Cheyenne River island between Rapid Creek and Wasta, Pennington County.
3 = data from SDNHDB, 1999, nesting on Cheyenne River in northern Pennington County near Haakon County.

Topeka Shiner. The Topeka shiner was recently listed as endangered.[17] The species' distribution appears restricted to the Missouri, Mississippi, and Arkansas river drainages including southeastern South Dakota and southern Minnesota (Lee *et al.*, 1980). It inhabits small, clear streams that drain upland prairies where it is found in quiet, open pools with mostly gravel bottoms (Minckley and Cross, 1959 and Lee *et al,* 1980). Inhabited streams often become intermittent during summer and survival during periods without flowing water depends on pools fed by springs or percolation through gravel bottoms (Minckley and Cross, 1959). Recent collections of Topeka shiners in Nebraska were in a low gradient stream, surrounded by grasslands used for livestock grazing, with pool bottoms layered with detritus (Michl and Peters, 1993)

Recent collections of Topeka shiners have been made in the Big Sioux River watershed in Brookings and Beadle counties of eastern South Dakota (USFWS, 1999a and 1998a). The shiner has been found in 5 streams crossed by the existing railroad in Brookings County and 3 streams crossed in Beadle County. Also in South Dakota, there is one report of the species collected in the late 1960s from the Cheyenne River embayment at Lake Oahe (USFWS, 1999a).

No Topeka shiners were sampled near any of the alternatives in South Dakota from the Cheyenne River (Hampton, 1998; USFWS, 1994; USFWS, 1993a), Cottonwood Creek (tributary to the Cheyenne River in Fall River County - Simpson and Chapman, 1993), Horsehead Creek (tributary to the Cheyenne River in Fall River County - Cunningham *et al*, 1995), Battle Creek (tributary to the Cheyenne River in Custer County - Cunningham *et al*, 1995), Spring Creek and Rapid Creek (tributaries to the Cheyenne River in Pennington County - USFWS, 1994; Cunningham *et al*, 1995) or the Bad River (tributary to the Missouri River, originating near Interstate-90, Jackson County - USFWS, 1993a).

American Burying Beetle. This largest species of carrion beetle was found throughout eastern North America but elimination of climax forests, with deep litter, humus and soils has been theorized as factors responsible for the species' decline (Anderson, 1982). The beetle feeds on carrion as an adult and larva; adults lay eggs adjacent to carcasses they bury and provide parental care to the young (Creighton *et al.*, 1993). Carcasses used for breeding are small vertebrates but

[17] See Federal Register, December 15, 1998, 63(240):69008-69021.

those selected by American burying beetles tend to be larger bird and mammal carcasses than carcasses selected by other, smaller carrion beetle species (Lomolino and Creighton, 1996 and Holloway and Schnell, 1997).

Oak-hickory forests in western Arkansas and eastern Oklahoma are inhabited by American burying beetles and, in some respects, have characteristics of other inhabited sites: there was little undergrowth (Creighton *et al*, 1993), the roots of which inhibit beetles from burying carcasses (Anderson, 1982). Grasslands are seldom used as breeding habitats because litter is nearly absent and grassland soils are often compacted, making carcass burial difficult (Lomolino and Creighton, 1996). American burying beetles have also been found in the Sandills of northcentral Nebraska where there are sufficient carrion, even though sandy soils may make carcass burial difficult (Ratcliffe and Jameson, 1992). And, one specimen was collected in 1994 near Jamison, Rock County, Nebraska just south of the South Dakota border (Backlund and Marrone, 1997).

The American burying beetle was collected in 1945 at several locations in Union and Brookings counties, eastern South Dakota (Backlund and Marrone, 1997); one of the sites near Brookings was within 1 mile of the existing railroad (SDNHDB, 1998). There is also an historic record but with no date of specimens collected near Nowlin, Haakon County (Backlund and Marrone, 1997; Lomolino *et al*, 1995). That collection site is the most western extension of the beetle in South Dakota and was apparently within the immediate vicinity of the existing DM&E railroad in the Bad River floodplain. Since 1990, efforts to relocate the beetle in those areas have been unsuccessful. Although there have been no recent collections made in the project area and vicinity, numerous specimens were collected in 1995 in the southern South Dakota, Tripp and Gregory counties, north of the 1994 record from Rock County, Nebraska. There, American burying beetles were captured in riparian areas, grasslands, and grasslands with interspersed stands of cottonwoods (Backlund and Marrone, 1997). Further, beetles were found on hilltops and in valleys. Consequently, any habitat in South Dakota with significant humus and/or topsoil suitable for burying carrion is considered potential beetle habitat (USFWS, 1998a).

Although the alternatives are farther west than the known range of the species (recent searches in Badlands National Park and Wind Cave National Park were unsuccessful - Backlund, 1999), each alternative would affect herbaceous rangeland, forested (cottonwood) wetlands, croplands and pastures in varying amounts. Soils in the project area that could potentially be used by American burying beetles include dry soils with sand and/or loamy sand textures that are subject to wind erosion and prime farmland soils with relatively deep topsoil except where those soils are irrigated and/or cultivated. Specific locations of where these soil types occur can be determined for each alternative but coincidental information on potential carrion availability is totally lacking.

Piping Plover. Nesting habitats used by piping plovers appear identical to those described above for interior least terns. Likewise, nests of piping plovers are subject to similar threats including inundation, predation and human disturbance (Mayer, 1993; Schwalbach *et al*, 1993; Kruse *et al.*, 1993). Piping plovers do appear to select nest sites closer to objects and/or taller vegetation than least terns (Dirks *et al.*, 1993b). Unlike piscivorous least terns, piping plovers' eat invertebrates including worms, insects, crustaceans and mollusks (Dinsmore, 1983). Their nesting chronology is similar to least terns with nest initiation in late May through early June and chicks fledge by mid-July (Schwalbach *et al.*, 1993)

Piping plovers have been recorded near Pierre on islands or sandbars in the Missouri River (SDNHDB, 1998) and their distribution on the Cheyenne River does not appear to extend upstream from the confluence with the Belle Fourche River in Meade County, South Dakota (South Dakota Ornithologists' Union, 1991). Searches for piping plovers along the Cheyenne River and Lake Oahe revealed their presence, but none were found nesting on sandbars in the Cheyenne River during 1986 and 1987 (Dirks *et al.*, 1993a).

Searches were conducted for least terns and piping plovers along 20 miles of the Cheyenne River in Custer and Pennington counties in 1994 but no evidence for either species was found (Hetlet, 1994). Likewise, no piping plovers were observed during a survey conducted along approximately 28 miles of the Cheyenne River between Spring Creek and Wasta on June 26, 1999. Water flow rates measured at a USGS gauging station downstream of Wasta (see Table 3-80) indicated that suitable nesting habitat for piping plovers was unavailable on this section of the river in 1999.

Since they begin nesting earlier than least terns, usually by May (Dinsmore, 1983), USGS flow rate data indicates that suitable nesting habitats on sand bars and islands on the Cheyenne River have probably been submerged and/or scoured during the month of May in 10 out of 15 years between 1983 and 1998. However, a male piping plover was observed defending a territory in late May, 1981 along the south shore of Angostura Reservoir in Fall River County (SDNHDB, 1999). Other than this single record, piping plover nesting observations on the upper and middle reaches of the Cheyenne River are non-existent.

Bald Eagle. Critical to bald eagle reproductive success is their overwinter survival which is dependent, in

large part, on adequate food supplies (Steenhof, 1978). Specific food items consumed by wintering bald eagles vary by geographic area and availability of items (Steenhof, 1978). In western Wyoming, bald eagles consume carcasses of mule deer and domestic livestock (Jenkins, 1982) including big game killed by trains and vehicles (Reeve, unpublished data). Importance of big game and livestock carrion to wintering bald eagles in the Powder River Basin of northeast Wyoming have also been documented by Anderson and Patterson (1988). Ice that prevents bald eagles from feeding on fish, waterfowl or aquatic mammals can be a principal factor in their use of diverse winter food sources that can include garbage and offal (Ewins and Andress, 1995).

In western Oregon, substantial portions of the diet of wintering bald eagles were carrion of domestic sheep and afterbirth; maximum numbers of eagles were observed to coincide with lambing (DellaSala *et al.*, 1989). Anderson and Patterson (1988) likewise observed that wintering eagles and eagle roosts were closely associated with sheep ranches in northeastern Wyoming. Carrion of smaller mammals, specifically jackrabbits, may be a significant food source such as described for wintering bald eagles (Platt, 1976). On bald eagle winter ranges in the midwest, fish and waterfowl are principal prey sources (Steenhof *et al.*, 1980; Griffin *et al.*, 1982; Griffin and Baskett, 1985; Lingle and Krapu, 1986).

Perching sites in the vicinity of food sources are important components of bald eagle habitats (Steenhof, 1978 and Chandler *et al.*, 1995). At several locations where food availability coincides with waterbodies, bald eagles perch on a variety of substrates that border lake shores or riverbanks but demonstrate strong preferences for trees (Knight *et al.*, 1979; Steenhof *et al.*, 1989; Fielder and Starkey, 1986; Reynolds *et al.*, 1985). Selectivity of diurnal perches by bald eagles appears to be for dead trees and deciduous trees having substantial horizontal branches (Stalmaster and Newman, 1979 and Steenhof *et al.*, 1980).

Communal roosts used by wintering bald eagles at night provide relatively optimum shelter from wind (Buehler *et al.*, 1991) and low ambient temperatures (Steenhof *et al.*, 1980; Anthony *et al.*, 1982; Stalmaster and Gessaman, 1984; Anderson and Patterson, 1988). Apparent preferences for mature and old-growth conifers with open branch structures have been described for roosts in the northwest (Anthony *et al.*, 1982; Keister and Anthony, 1983; Stalmaster and Gessaman, 1984; Isaacs and Anthony, 1987; Stohlgren, 1993). Similar to tree characteristics selected as diurnal perch sites, roost trees provide openness and visibility but also provide significant canopy cover (Anthony *et al.* 1982 and Stohlgren 1993) that probably minimizes heat loss at roosting sites during the night.

Coniferous habitats provide warmer nocturnal temperatures and attenuated wind velocities than snags or deciduous forests during winter (Stalmaster and Newman, 1979 and Stalmaster and Gessaman, 1984). Where deciduous forests are used for nocturnal roosts, bald eagles select sites that provide maximum protection from winds (Steenhof *et al.*, 1980). And, use of roosts in snags and large ponderosa pines with open structures were found to be protected from winds by ridges (Anderson and Patterson 1988). Because suitable roosting areas may not be proximate to food sources, bald eagles will travel significant distances daily between the two (Swisher, 1964; DellaSala *et al.*, 1989) and may conserve more energy doing so than if they roosted in less thermally protected sites that were closer to foraging areas (Stalmaster and Gessaman, 1984).

Results of field surveys for wintering bald eagles conducted in February 1999 along Alternatives B and C are provided in Table 3-81. Most observations were of single eagles perched in deciduous cottonwood trees adjacent to rivers. All eagles that were observed along creeks and rivers were associated with stretches of ice-free water; no bald eagles were seen where water was frozen. The Black Thunder South and North Antelope West mine loops would be within 0.5 mile of potential wintering habitats along Antelope Creek and Little Thunder Creek for approximately 3.2 miles.

Communal roosts in the vicinity of alternatives have been documented on TBNG by the Forest Service (T. Byer, Forest Service, TBNG. Unpublished data). Many of these have also been documented on the WGFD Wildlife Observation System (WOS) as well as other observations of bald eagle winter concentration areas (see Table 3-82). With few exceptions, habitats associated with those sites are coniferous woodlands, consistent with results of studies that demonstrate the thermal protection provided by conifers such as ponderosa pine.

Biologists with BGNG have conducted ground surveys for bald eagles wintering along the Cheyenne River in South Dakota since 1994 (Hetlet, 1995b, 1996a, 1997a, 1998). Those survey results are provided in Table 3-83 and indicate considerable variation between years. However, distributions of bald eagles recorded in December of each year, 1994-1997, generally coincide with bald eagles observed during aerial surveys reported here for February, 1999.

Available data indicates that bald eagles vacate the middle reaches of the Cheyenne River in South Dakota, at least between Edgemont and Wasta, by late March. The USFWS conducted an aerial survey of the Cheyenne River on March 26, 1998 (J. Peterson, USFWS, Lake Andes National Wildlife Refuge, Lake Andes, South Dakota. Unpublished data). Bald eagles were seen near Angostura Reservoir and on the lower reach of the

Table 3-81
Observations of Bald Eagles During 1999 Winter Bald Eagle Survey of Alternatives B and C in Wyoming and South Dakota

Observation Date	Number/Age Seen	Habitat	State	County	Quadrangle	Twp Rng Sec ¼ ¼ ¼	Latitude & Longitude	Nearest Alternative
2/13/99	1 adult	cottonwood riparian-Antelope Creek	WY	Converse	Dugout Creek	41N 70W 33 NE SW SW	43°28.70′N 105°16.76′W	C
	1 adult	cottonwood riparian-HA Creek	WY	Campbell	Piney Canyon NW	43N 69W 04 SE SW SW	43°43.56′N 105°09.57′W	B
	1 adult	cottonwood riparian-Robbers Roost Creek	WY	Niobrara	Riverview	40N 61W 09 SW SE NE	43°27.55′N 104°11.24′W	C
	1 adult	cottonwood riparian-Cheyenne River	WY	Niobrara	Twentyone Divide	40N 60W 20 NE NE NE	43°26.14′N 104°05.04′W	B&C
	1 adult	Ponderosa pine woodland	SD	Fall River	Rumford	9S 4E 27 NW NW SW	43°14.28′N 103°38.47′W	C
2/14/99	1 immature 2 adults	riparian bluff-Cheyenne River	SD	Custer	Red Shirt NE	4S 11E 16 SE NW NE	43°42.36′N 102°48.27′W	B
	1 adult	cottonwood riparian-Cheyenne River	SD	Pennington	Red Shirt NE	4S 11E 10 NE SW NW	43°42.98′N 102°47.48′W	B
	1 adult	cottonwood riparian-Cheyenne River	SD	Custer	Red Shirt SW	5S 10E 18 NE NE SE	43°37.05′N 102°58.05′W	B
	3 adults	cottonwood riparian-Cheyenne River	SD	Custer	Red Shirt SW	5S 9E 13 SW NE SW	43°36.68′N 102°59.96′W	B
	2 adults	cottonwood riparian-Cheyenne River	SD	Custer	Fairburn SE	5S 9E 22 NW SW SE	43°35.79′N 103°01.97′W	B
	1 adult	cottonwood riparian-Cheyenne River	SD	Custer	Fairburn SE	5S 9E 28 NE NW NE	43°35.52′N 103°03.06′W	B
	1 immature 2 adults	cottonwood riparian-Bad River	SD	Jones	Capa NW	2N 27E 17 NW SE SE	44°07.68′N 100°53.42′W	Existing

Table 3-82 Bald Eagle Winter Roosts and Concentration Sites With 5 or More Eagles Seen During Winter in Wyoming							
Observation Date	Number Seen	Twp	Rng	Sec	¼ or ¼ of ¼	Habitat (WGFD Code)	Approximate Distance to Nearest Alternative
2/4/83	12	40N	69W	13		not recorded	3.6 miles from Alternative B >8 miles from Alternative C
1/15/88	16	41N	68W	06	NW	1.40-Ponderosa pine savannah	2.0 miles from Alternative B 3.4 miles from Alternative C
2/21/83	6	41N	68W	34	SW of NE	5.11-Basin big sagebrush	3.0 miles from Alternative B 6.5 miles from Alternative C
1/18/83 2/4/83 3/27/85 1/5/88 1/9/89	10 15 10 7 17	41N	69W	01	NW	not recorded not recorded not recorded 1.40-Ponderosa pine savannah 1.80-Pine-juniper	2.5 miles from Alternative B 3.2 miles from Alternative C
3/5/79 3/11/79 2/5/80 1/19/82 1/10/83	5 9 12 16 8	41N	70W	25	NW of SW	not recorded 1.40-Ponderosa pine savannah 1.81-Pinyon pine-juniper 1.80-Pine-juniper not recorded	0.2 mile from Alternative B 1.8 miles from Alternative C
3/1/79	12	41N	70W	25	SE	not recorded	0.1 mile from Alternative B 2.5 miles from Alternative C
1/30/81 1/19/82 1/9/85	9 3 8	42N	69W	05	NE of NE	not recorded 1.80-Pine-juniper 1.40-Ponderosa pine savannah	>8 miles from Alternative B 1.1 miles from Alternative C
11/7/90	6	42N	69W	24		1.40-Ponderosa pine savannah	3.6 miles from Alternative B 3.8 miles from Alternative C
12/3/80 1/18/83 3/27/85	1 22 2	43N	69W	01	SW	4.11-Basin big sagebrush not recorded not recorded	0.2 mile from Alternative B 4.0 miles from Alternative C
1/30/83	10	43N	70W	26		not recorded	1.5 miles from Alternative B 1.0 mile from Alternative C
1/9/85	6	43N	71W	25	NW of NE	4.12-Wyoming big sagebrush	2.5 miles from Alternative B 2.5 miles from Alternative C
3/2/79 2/23/80	5 7	47N	70W	21	NW of SW	1.40-Ponderosa pine savannah 1.81-Pinyon pine-juniper	1.5 miles from Alternative B 1.5 miles from Alternative C
Source: WGFD WOS							

Cheyenne River near its confluence with the Missouri River but none were observed on the middle reach. Similarly, the Forest Service conducted surveys in May, 1996 and 1997 along the same portions of the Cheyenne River that were included in December surveys, but no bald eagles were seen either year (Hetlet 1996b and 1997b). Together, these observations indicate the importance of the Cheyenne River corridor in South Dakota and the TBNG in Wyoming to wintering bald eagles. Communal nocturnal roosts, diurnal perch sites, and feeding areas are all key winter habitat components that are proximate to the alternatives.

Bald eagles have attempted to nest on TBNG at least twice in the past, but both nests were unsuccessful (T. Byer, Forest Service, TBNG. Unpublished data). Aerial surveys for nesting bald eagles and other raptors were conducted from April 11-13, 1999 along Alternatives B and C. Only one pair of bald eagles was seen perched near a nest on private land along the Cheyenne River in Weston County, Wyoming on April 11. No follow-up survey was conducted but, given the relatively late date, the pair probably did not actively nest. The site was more than 1 mile from any of the alternatives.

Ute Ladies'-tresses. Known distributions of this rare orchid includes the front range of Colorado, southeastern Wyoming, northwestern Nebraska as well as Utah, Idaho and Montana (WNDDB. Unpublished data). Populations closest to the alternatives include the Niobrara River in Platte County, Nebraska and Van Tassel Creek in southeast Niobrara County, Wyoming. The orchid

Table 3-83
Observations of Bald Eagles During Winter Surveys Conducted by BGNG Along the Cheyenne River in South Dakota from 1994 through 1997

December, 1997			December, 1996			December, 1995			December, 1994		
Number Seen (1)	Twp Rng Sec ¼	Distance to Nearest Alternative (2)	Number Seen (1)	Twp Rng Sec ¼	Distance to Nearest Alternative (2)	Number Seen (1)	Twp Rng Sec ¼	Distance to Nearest Alternative (2)	Number Seen (1)	Twp Rng Sec ¼	Distance to Nearest Alternative (2)
1 ad	3S 12E 08 SE	1.9 mi - A	1 imm	4S 11E 31 NW	0.2 mi - B	1 imm	4S 11E 21 SW	0.5 mi - B	1 imm	3S 12E 19 NE	2.1 mi - A
1 imm	3S 12E 19 NE	2.0 mi - A	4 ads	5S 9E 27 NW	0.6 mi - B	1 ad	4S 10E 36 NE	0.6 mi - B	1 ad	4S 11E 29 NE	0.2 mi - B
1 imm	3S 12E 19 NW	2.0 mi - A	2 ads	6S 9E 16 NW	1.8 mi - B	2 ads	4S 9E 13 SE	0.5 mi - B	1 imm	4S 11E 32 NW	0.2 mi - B
1 ad	4S 11E 21 NW	0.4 mi - B				2 ads	5S 9E 27 NW	0.4 mi - B	1 ad	5S 10E 18 NW	0.1 mi - B
2 ads	4S 11E 21 SW	0.5 mi - B				1 imm	5S 9E 27 NW	0.4 mi - B	2 imm	5S 9E 13 SW	0.2 mi - B
1 imm	4S 11E 28 SW	0.5 mi - B				1 ad	5S 9E 28 NE	0.3 mi - B	1 ad	5S 9E 22 NE	0.1 mi - B
1 ad	4S 11E 28 SW	0.4 mi - B				3 imm	5S 9E 28 SW	0.1 mi - B	1 imm	5S 9E 33 SW	0.4 mi - B
1 ad	4S 11E 32 NE	0.2 mi - B				1 ad	5S 9E 33 NE	0.5 mi - B	1 ad	6S 9E 21 SW	2.2 mi - B
1 ad	4S 11E 31 NW	0.3 mi - B				1 ad	5S 9E 33 NW	0.1 mi - B	1 imm	6S 9E 21 SW	2.2 mi - B
3 ads	5S 9E 23 NW	0.2 mi - B									
1 imm	5S 9E 22 NE	0.1 mi - B									
1 ad	5S 9E 22 NE	0.1 mi - B									
2 ads	5S 9E 22 NW	0.1 mi - B									
1 ad	5S 9E 27 NW	0.5 mi - B									
1 imm	5S 9E 33 NW	0.1 mi - B									
1 imm	5S 9E 31 SW	0.1 mi - C									
1 ad	6S 9E 36 SE	0.1 mi - C									
1 imm	6S 8E 01 NE	0.1 mi - C									

1 = ad = adult eagle, imm = immature eagle
2 = Alternatives routes are A = both, B = Alternative B, C = Alternative C

inhabits moist soils, in wet meadows, riparian and palustrine habitats from 4,000 to 7,000 feet elevation (USFWS, 1996). In eastern Wyoming and Nebraska the species was found in moist cut banks of saline meadows, abandoned river channels and alluvial terraces adjacent to creeks in association with white sweetclover, arrow-grass, creeping bentgrass, and baltic rush (Hazlett, 1996; Fertig, 1998; Intermountain Ecosystems, 1998).

Positive identification of Ute ladies'-tresses is only possible when it is flowering, from late July to early or mid September (USFWS, 1996). Difficulties in locating populations are compounded by the species' tendency to bloom every 3 to 5 years (Intermountain Ecosystems, 1998). Pollinators include bumblebees, anthophorid bees, and tiphiid wasps (Larson and Larson, 1990 and Sipes and Tepedino, 1995).

Searches for Ute ladies'-tresses along Alternatives B and C were conducted in Wyoming and South Dakota in September, 1998. Because access to potential sites on private lands was restricted, only 22 sites could be adequately evaluated. Four of those were considered potential habitat for the species and 2 others had low habitat potential (Intermountain Ecosystems, 1998) The 4 sites were in Wyoming at Lodgepole Creek and School Creek (Weston County), and South Dakota at Hay Canyon South and Dry Creek (Fall River County, see Table 3-84).

Proposed and Candidate Species

Mountain Plover. Mountain plovers have been associated with prairie dog towns where vegetation has been reduced (Knowles *et al.*, 1982; Olson-Edge and Edge, 1987; Knopf and Miller, 1994). They nest in areas of low herbaceous vegetation, reduced shrub cover, and near prominent objects such as cow-manure piles or similar-sized rocks (Graul ,1975; Prellwitz, 1993; Knopf and Miller, 1994). Results of a study conducted in northeast Wyoming showed that mountain plovers nested at sites with low or absent shrub growth and where grasses and forbs were also short (Parrish *et al.*, 1993). In that study, mountain plovers seldom nested on prairie dog colonies but adults with broods were seen on colonies (Parrish *et al.*, 1993).

Surveys have been conducted on TBNG since 1992 and 14,302 acres have been identified as occupied by mountain plovers. Surveys for occurrence of mountain plovers on black-tailed prairie dog colonies were conducted on the TBNG in 1997. A total of 26 adults and 20 juvenile plovers were seen within approximately 4,900 acres prairie dog colonies surveyed (T. Byer, Forest Service, TBNG. Unpublished data). Too, mountain plovers were seen on one National Biological Survey (NBS) breeding bird survey route (Newcastle) in Wyoming, but none were reported on breeding bird survey routes in South Dakota. And, their historical nesting occurrence in southwest South Dakota in the vicinity of Edgemont has been noted (South Dakota Ornithologists' Union, 1991). Mountain plovers have also been documented in annual wildlife monitoring reports on coal mines and vicinities in Campbell County, near all alternatives in Wyoming.

Sturgeon Chub. This member of the minnow family is found in the Missouri River and western tributaries where it inhabits shallow sand or gravel bottom zones in areas with strong currents in warm and highly turbid medium to large rivers (Lee *et al.*, 1980). Their greatest abundance is in gravel riffle zones (USFWS, 1993b and Hesse, 1994). Populations have existed in the Powder River drainage in Wyoming (USFWS, 1993b) and recent sampling efforts documented its continued presence in the mainstem of the Powder River as well as Crazy Woman Creek, a small tributary stream (Patton *et al.*, 1998). None were found in the Belle Fourche River or its tributaries in Wyoming (Patton *et al.*, 1998).

Sturgeon chubs have been repeatedly documented in the Cheyenne River in Pennington County (Hampton, 1998; Cunningham *et al*, 1995; USFWS, 1993a and 1993b) and in Custer County (SDNHDB, 1998 and Cunningham *et al*, 1995). Recent surveys conducted in 1997 indicate sturgeon chubs were collected at multiple sampling sites in the Cheyenne River between Angostura Dam and Lake Oahe by researchers from South Dakota State University (Hampton, 1998). In that study, sturgeon chubs were found in the upper reaches of the Cheyenne River, several miles upstream from the confluence with Rapid Creek and at several middle and lower reach locations, downstream from Wasta (Hampton, 1998). No sturgeon chubs were collected during surveys of tributaries to the Cheyenne River in 1994 (Cunningham *et al*, 1995) that included Spring Creek, Rapid Creek, Battle Creek, Horsehead Creek, streams that would be crossed by some of the alternatives.

Surveys of streams tributary to the Cheyenne River which would be crossed by Alternatives B and C in South Dakota were completed in October, 1999. No chubs were found in the vicinity of the alternatives. However, suitable habitat was identified on Rapid Creek and the species may be present in the creek during portions of the year. Though still classified as a candidate species, USFWS is preparing documents that will recommend the species for listing as endangered (USFWS, 1999b).

Sicklefin Chub. These minnows are mostly restricted to large rivers, including the Missouri River where it was collected in 1952 near Pierre, South Dakota (SDNHDB, 1998). This species is even more adapted to highly turbid waters than sturgeon chubs (Lee *et al*, 1980 and Hesse, 1994) and dams constructed along the Missouri River have been held responsible, in part, for the

Table 3-84 Sites Examined Where Potentially Suitable Habitat Exists for Ute Ladies'-tresses					
Site Name	**USGS Quadrangle Legal Description**	**NWI Wetland Classification**	**Plant Association**	**Direct Access to Alternative**	**Potentially Suitable Habitat**
Hay Canyon South	Smithwick NW, South Dakota T. 8 S., R. 8 E., Section 2	PEMA, PUBH	cattails, bulrush, cordgrass	No	Yes
Dry Creek	Lone Well Creek West, South Dakota T. 9 S., R. 6 E. , Section 29	PEMA	cattails, cordgrass, threesquare bulrush	Yes	Yes
Lodgepole Creek	The Nose East, Wyoming T. 42 N., R. 64 W., Section 32	PEMC	baltic rush, threesquare bulrush, cordrush	Yes	Yes
Little Thunder Creek	Piney Canyon NW, Wyoming T. 43 N., R. 69 W., Section 30	PEMA, PABFH	cordgrass	No	Low
School Creek	Piney Canyon NW, Wyoming T. 42 N., R. 69 W. , Section 6	PABFH	cordgrass	Yes	Yes
Black Thunder Creek	Open A Ranch, Wyoming T. 44 N., R. 70 W., Section 14	PABFH	sagebrush	No	Low
Source: Intermountain Ecosystems, 1998					

species' decline since much of the rivers' sediment flows have been reduced by the dams (Hesse, 1994). Sicklefin chubs are now believed to be extirpated in the Missouri River between Lake Sakakawea in North Dakota to Sioux City, Iowa (USFWS, 1999b). It is highly unlikely that they ever inhabited the Cheyenne River near any of the alternatives. Though still classified as a candidate species, USFWS is preparing documents that will recommend the species for listing as endangered (USFWS, 1999b).

Swift Fox. The swift fox, a candidate for listing as endangered or threatened under the Endangered Species Act, is found in short grass and midgrass prairies over much of the Great Plains where their dens were mostly near hill tops in undulating terrain covered by midgrass and shortgrass prairie (Uresk and Sharps, 1986). In northeastern Colorado, this fox appears to be most abundant in areas with relatively flat to gently rolling terrain (Cameron, 1984 and Loy, 1981) and rare in terrain that is highly eroded with gullies, washes and canyons (Fitzgerald, 1994). These apparent habitat preferences are contrary to many observations made in Wyoming where swift fox were found on short and mixed grasslands, sagebrush-grasslands, and greasewood-sagebrush vegetation with topography varying from flat to eroded badlands (Woolley *et al.*, 1995). In many areas, cottontails and jackrabbits constitute a bulk of their diet (Cameron, 1984; Zumbaugh *et al.,* 1985) and Fitzgerald (1994) noted that swift fox population will decline during periods of low rabbit densities. In South Dakota, swift foxes consumed a variety of vertebrate and invertebrate prey items but mostly they fed on thirteenlined ground squirrels (Uresk and Sharps, 1986). Covell and Rongstad (1990) have suggested that high coyote densities may serve to limit swift fox numbers. That, and the fact that they are quite easy to trap, undoubtedly contributes to their mortality.

In Wyoming, recent surveys conducted in central and eastern Wyoming included sites in Weston, Campbell and Converse counties. Swift foxes were found in Converse and Weston counties, roughly coinciding with distributions reported by trappers and Forest Service observations on TBNG (Woolley *et al.*, 1995). And, they have recently been found in Campbell County. There are also records of swift fox from the vicinity of the alternatives in Custer and Fall River counties (SDNHDB, 1998) and on the Wall and Fall River Ranger Districts, BGNG (Hetlet and Hodorff, 1997). All observations in northeastern Wyoming and southwestern South Dakota indicate that the species is likely to occur in the vicinity of all alternatives.

Black-tailed Prairie Dog. USFWS recently identified the black-tailed prairie dog as a candidate species throughout its range that includes Wyoming and South Dakota. Although once extensively distributed throughout the Great Plains from southern Saskatchewan to Texas and northern Mexico, black-tailed prairie dogs have declined throughout their range. Conversion of rangelands to agriculture and urbanization, poisoning programs aimed at controlling colonies, unregulated recreational shooting and disease, specifically sylvatic plague, have contributed to the species' decline (USFWS, 1999c).

Black-tailed prairie dog colonies occur throughout the project area in Wyoming and South Dakota. Black-tailed prairie dog colonies were mapped along Alternative C from black-and-white aerial photographs (1:2,400) extending to approximately 1,000 feet on each side of the alternative's centerline. Additional colonies have been

mapped by Forest Service and the WGFD mapped some colonies during the late 1980's. Maps of colonies on private lands have been provided by county weed and pest control district agents in Wyoming and South Dakota. These data are compiled in Table 3-85 and show that all alternatives would affect prairie dog colonies but that Alternative C would cross the most colonies, a function of mapping effort conducted along that alternative.

The current activity status of each prairie dog colony is unknown: some colonies have become inactive due to sylvatic plague epizootics (in Wyoming only) and others have been poisoned by county weed and pest control agents and/or private land owners. For most of the colonies that have been mapped there are no additional data about the areal extent or geographic proximity of other colonies that would form a local colony complex.

Other Species With Special Status

Many species are known to occur or potentially occur in the vicinity of the alternatives that have been designated with special status, whether by the USFWS, Forest Service, BLM, WGFD, SDGFP, WNDDB, and/or SDNHDB. These species are listed in Table 3-86. Species listed as Federal threatened, endangered, proposed or candidate species under the Endangered Species Act are not included in Table 3-86. Some species included in the table are also Management Indicator Species (MIS), designated by the Forest Service on TBNG and BGNG.

Animal Species with Special Status. Of the 14 species of mammals listed in Table 3-86 with special status and that potentially occur in the project area, only small-footed myotis, fringed myotis, spotted bat, big brown bat, Townsend's big-eared bat, river otter and eastern spotted skunk have been documented in at least one county coinciding with at least one of the alternatives in Wyoming and/or South Dakota. However, 30 of the 31 bird species have been documented by at least one source as occurring in a county through which one of the project alternatives passes. In addition, there are at least 2 species of amphibian, 3 species of reptiles and 5 species of special status fish that occur in the area, whether in specific counties or drainages.

Plant Species with Special Status. Thirty-eight plant species are included in Table 3-86, most of them found in Wyoming where site descriptions are provided by WNDDB and Dorn (1992). Most occur on NFS lands within TBNG. Where full descriptions are given, most of the plant species are on sites that have been grazed by livestock and are in sandy soils, often associated with ponderosa pine woodlands, on eastern plains grasslands, or in riparian zones.

3.18 Wildlife and Aquatic Resources

3.18.1 Impact Analysis Area. Wildlife resources are generally described at the herd unit or county level. Aquatic resources are described for the streams and rivers which would be affected.

3.18.2 Affected Environment. Grasslands, sagebrush steppe, forested riparian zones, woody shrub-dominated draws and coniferous woodlands contribute to diverse vegetation in the vicinity of the alternatives in Wyoming and South Dakota. Along with varying topography, these vegetation types provide habitats for a diverse array of wildlife species including big game, upland game birds, waterfowl, furbearing mammals, raptors, non-game mammals and birds, reptiles and amphibians.

Big Game. Four big game species are known to inhabit the counties which would be crossed by the alternatives in Wyoming. These are pronghorn, mule deer, white-tailed deer and elk. Mountain lions, classified as trophy game animals in Wyoming but are protected as a threatened species in South Dakota, may occasionally be present as they disperse from more distant population centers. In the vicinity of the alternatives in South Dakota there are mule deer, white-tailed deer and pronghorns. Wild turkeys are classified as big game in South Dakota but are designated as upland game birds in Wyoming.

Pronghorn. Pronghorn are the most abundant big game animal in the vicinity of the alternatives which, in Wyoming, would pass through or be adjacent to 5 population areas or Antelope Herd Units: North Black Hills, South Black Hills, Highlight, Thunder Basin and Lance Creek. The South Black Hills, Thunder Basin and Lance Creek Herd Units are managed by biologists in the WGFD's Casper District and cover portions of southern Crook, Weston, Niobrara, southeast Campbell, and eastern Converse counties. The North Black Hills and Highlight Antelope herd units are managed by the WGFD Sheridan District and cover portions of eastern Campbell County (Highlight) and Crook County (North Black Hills). Pronghorn seasonal ranges in the vicinity of the alternatives in Wyoming are shown on Figure 3-25.

Alternatives B and C pass through the Lance Creek, Thunder Basin and Highlight herd units. The majority of land in the Lance Creek Herd Unit is privately owned (80 percent). The remainder is on Federally - (Forest Service and BLM) and state-owned lands (Kroger, 1998a). Sagebrush interspersed with short grass prairie is the primary vegetation cover although there are cottonwood riparian zones along several drainages, ponderosa pine woodlands, and croplands. Similarly, most land (70 percent) within the Thunder Basin Herd Unit is privately owned and is covered with sagebrush steppe and low hills with ponderosa pine woodlands (Anderson, 1998a).

Table 3-85 Miles of Each Alternative Which Would Intersect Black-tailed Prairie Dog Colonies in Wyoming and South Dakota						
Alternative	State	Miles of Prairie Dog Town Crossed by Land Ownership				
		Forest Service	BLM	State	Private	Total
B (1)	Wyoming	1.8	0	1.5	4.9	8.2
	South Dakota	0.2	0	0	3.2	3.4
	Total	2.0	0	1.5	8.1	11.6
C (2)	Wyoming	1.7	0	1.6	9.1	12.4
	South Dakota	0	0	0.2	4.9	5.1
	Total	1.7	0	1.8	14.0	17.5
D (3)	Wyoming	0.3	0	0.1	2.8	3.3
	South Dakota	0	0	0.0	2.8	2.9
	Total	0.3	0	0.1	5.6	6.2

1 = Prairie dog colonies mapped from aerial photographs where Alternative B coincides with Alternative C, by USFS on TBNG, and by WGFD.
2 = Prairie dog colonies mapped from aerial photographs, by USFS on TBNG, and by WGFD.
3 = Prairie dog colonies mapped from aerial photographs where Alternative D coincides with Alternative C, by USFS on TBNG, and by WGFD.

Pronghorns probably move between the Lance Creek and Thunder Basin Herd Units by crossing State Highway 450, their common border (Kroger, 1998a). There is little public land in the Highlight Herd Unit and a portion of the private land in the Herd Unit (90 percent privately owned) has been mined for coal, some of which is reclaimed while other land is used for alfalfa croplands (Oedekoven, 1997).

In Wyoming, Alternative D would follow the dividing line between the South Black Hills and Thunder Basin antelope herd units (U.S. Highway 16) and the dividing line between the North Black Hills and Highlight antelope herd units (I- 90). In the project area, the South Black Hills Herd Unit is covered with sagebrush steppe; ponderosa pine covers hills and ridgelines. Most land is privately owned, much of it cultivated for alfalfa and winter wheat (Anderson, 1998b). Likewise, most of the North Black Hills Herd Unit is privately owned which affects the ability of WGFD to effectively manage the population (Oedekoven, 1998a).

Alternatives B and C would cross one Hunt Area in each of the Highlight and Thunder Basin antelope herd units but would cross 3 hunt areas in the Lance Creek Herd Unit (Table 3-87). Alternative D would cross through 2 hunt areas in the South Black Hills Herd Unit, 2 Hunt Areas in the North Black Hills Herd Unit, and 1 Hunt Area in the Highlight Herd Unit. Management for pronghorn harvest in each population is made difficult by hunter access on private lands although populations in the Highlight and Thunder Basin Herd Units appear to be slightly decreasing while the others are slightly increasing.

In Wyoming, the alternatives would cross pronghorn ranges that are used throughout the year (yearlong range, YRL) with some habitats classified as winter-yearlong range (WYL) to which additional animals migrate during winter and winter (WIN) ranges that are used primarily in winter. In the Lance Creek Herd Unit there are severe winter relief (SWR) ranges along Antelope Creek in northeastern Converse County that are documented as survival areas, used occasionally during extremely severe winters (see Table 3-82). The Black Thunder North, Black Thunder South, North Antelope East and North Antelope West mines loops would be within the Highlight and Lance Creek pronghorn herd units. The loops would pass through WYL ranges for 11.6 miles (5.1 miles through the Highlight Herd Unit and 6.5 miles through the Lance Creek Herd Unit) and through YRL range in the Lance Creek Herd Unit for 3.9 miles.

Alternative B would directly affect WYL and YRL seasonal ranges in the Highlight and Thunder Basin herd units as well as SWR, WYL and YRL ranges in the Lance Creek Herd Unit (Table 3-88). Alternative C would only affect the Highlight and Lance Creek herd units (Table3-89) but Alternative D would pass through all 5 antelope herd units in the region: North Black Hills, Highlight, Thunder Basin, South Black Hills and Lance Creek (Table 3-90), albeit adjacent to an existing heavy haul railroad.

Pronghorns in these populations have been impacted by fences (livestock and highway rights-of-way), oil and gas developments, coal mining and livestock grazing. Numerous studies have documented dietary overlap between pronghorns and domestic livestock (Taylor, 1975; Olsen and Hansen, 1977; Severson *et al.*, 1980; Schwartz and Ellis, 1981; Lauenroth *et al.*, 1994). Pronghorn survival depends on different habitat components in different seasons. Topographic diversity that provides thermal shelter and shrub cover are two key

Table 3-86
Vertebrate and Plant Species with Special Status that are Known to Occur or Potentially Occur in the Vicinity of the Alternatives

Common Name/Scientific Name	Status (1)	Local Occurrence (2)	Expected Habitats in Wyoming and South Dakota	Source
Mammals				
Dwarf Shrew *Sorex nanus*	USFS R2-S WGFD-SSC3	SDNHDB record - SD county	coniferous forests, mountain-foothills shrublands	Luce *et al.*, 1997 SDNHDB, 1999
Western Small-footed Myotis *Myotis ciliolabrum*	USFWS-SC WGFD-SSC3	USFS record - WY county	basin-prairie shrublands, sagebrush-grasslands	Luce *et al.*, 1997
Long-eared Myotis *Myotis evotis*	USFS R2-S USFWS-SC WGFD-SSC2	unknown	cottonwood-riparian, basin-prairie shrublands, sagebrush-grasslands	Luce *et al.*, 1997
Keen's Myotis *Myotis keenii*	WGFD-SSC2	unknown	ponderosa pine/mixed deciduous forests	Luce *et al.*, 1997
Little Brown Myotis *Myotis lucifugus*	WGFD-SSC3	unknown	riparian shrub, sagebrush-grasslands near water	Luce *et al.*, 1997
Fringed Myotis *Myotis thysanodes*	USFS R2-S USFWS-SC WGFD-SSC2	WNDDB record-WY county SDNHDB record-SD county	basin-prairie shrublands	Luce *et al.*, 1997; WNDDB, 1999 SDNHDB, 1999
Long-legged Myotis *Myotis volans*	USFWS-SC WGFD-SSC2	unknown	prairie and mountain-foothills shrublands	Luce *et al.*, 1997
Big Brown Bat *Eptesicus fuscus*	WGFD-SSC3	USFS record - WY county	basin-prairie shrublands, grasslands, urban areas	Luce *et al.*, 1997
Spotted Bat *Euderma maculatum*	USFS R2-S USFWS-SC WGFD-SSC2	WNDDB record-WY county	cliffs near water, juniper shrublands, desert sagebrush-grasslands	Luce *et al.*, 1997 WNDDB, 1999
Townsend's Big-eared Bat *Plecotus townsendii*	USFS R2-S USFWS-SC WGFD-SSC2	WNDDB record-WY county	desert grasslands, basin-prairie shrublands	Luce *et al.*, 1997 WNDDB, 1999
Black-tailed Prairie Dog *Cynomys ludovicianus*	WGFD-SSC3 MIS-TBNG	USFS record-SD county USFS record-WY county	shortgrass and midgrass grassland	Luce *et al.*, 1997 USFS-TBNG, BGNG
Black Bear *Ursus americanus*	SDGFP-ST	SDGFP record-SD county	coniferous forest, aspen, riparian shrub, montain-foothills grasslands	Ashton & Dowd, 1991
Eastern Spotted Skunk *Spilogale putorius*	USFWS-SC	SDNHDB record-SD county	ponderosa pine, juniper, cottonwood-riparian, native hay meadows, rural developments, near streams	Luce *et al.*, 1997 SDNHDB, 1999
River Otter *Lutra canadensis*	SDGFP-ST	SDNHDB record-SD county observation record	lakes, streams, aquatic habitats: cottonwood-riparian, willow shrub riparian, marsh-swamp grasslands	Ashton & Dowd, 1991 SDNHDB, 1999 Reeve, 1999
Mountain Lion *Felis concolor*	SDGFP-ST	SDGFP record-SD county	habitats where deer occur - remote areas	Ashton & Dowd, 1991

Table 3-86 Continued				
Common Name/Scientific Name	**Status (1)**	**Local Occurrence (2)**	**Expected Habitats in Wyoming and South Dakota**	**Source**
Birds				
Common Loon *Gavia immer*	USFS R2-S USFWS-SC WGFD-SSC1	WNDDB record-WY county	lakes lower than 6,000 feet elevation during migration	Luce *et al.*, 1997 WNDDB, 1999
American White Pelican *Pelicanus erythrorhynchos*	WGFD-SSC3	WNDDB record-WY county	rivers, lakes, ponds	Luce *et al.*, 1997 WNDDB, 1999
American Bittern *Botaurus lentiginosus*	USFS R2-S USFWS-SC WGFD-SSC3	NBS/BBS record-SD county	marshes	Luce *et al.*, 1997 Sauer *et al.*, 1997
Great Blue Heron *Ardea herodias*	WGFD-SSC4	NBS/BBS record-SD county NBS/BBS record-WY county SDNHDB record-SD county	cottonwood riparian	Luce *et al.*, 1997 Sauer *et al.*, 1997 SDNHDB, 1999
Black-crowned Night-Heron *Nycticorax nycticorax*	WGFD-SSC3	NBS/BBS record-SD county	willow shrubs, marshes	Luce *et al.*, 1997 Sauer *et al.*, 1997
Northern Harrier *Circus cyaneus*	USFWS-SC	NBS/BBS record-WY county NBS/BBS record-SD county	basin-prairie shrublands, grasslands, marshes	Luce *et al.*, 1997 Sauer *et al.*, 1997
Ferruginous Hawk *Buteo regalis*	USFS R2-S USFWS-SC WGFD-SSC3 MIS-TBNG	NBS/BBS record-WY county NBS/BBS record-SD county WNDDB record-WY county SDNHDB record-SD county	basin-prairie shrublands, rock outcrops, cottonwood-riparian	Luce *et al.*, 1997 Sauer *et al.*, 1997
Merlin *Falco columbarius*	USFS R2-S WGFD-SSC3	NBS/BBS record-WY county WNDDB record-WY county	moist habitats below 8,500 feet	Luce *et al.*, 1997 Sauer *et al.*, 1997 WNDDB, 1999
Snowy Plover *Charadrius alexandrinus*	USFS R2-S USFWS-SC	WNDDB record-WY county	shorelines, aquatic areas	Luce *et al.*, 1997 WNDDB, 1999
Upland Sandpiper *Bartramia longicauda*	USFS R2-S USFWS-SC WGFD-SSC4 MIS-TBNG	NBS/BBS record-WY county NBS/BBS record-SD county WNDDB record-WY county	eastern Great Plains grassland	Luce *et al.*, 1997 Sauer *et al.*, 1997 WNDDB, 1999
Long-billed Curlew *Numenius americanus*	USFS R2-S USFWS-SC WGFD-SSC3 MIS-TBNG	NBS/BBS record-WY county NBS/BBS record-SD county WNDDB record-WY county SDNHDB record-SD county	sagebrush-grasslands; wet-moist meadow grasslands, irrigated native hay meadows	Luce *et al.*, 1997 Sauer *et al.*, 1997 WNDDB, 1999 SDNHDB, 1999

Table 3-86
Continued

Common Name/Scientific Name	Status (1)	Local Occurrence (2)	Expected Habitats in Wyoming and South Dakota	Source
Black Tern *Childonias niger*	USFS R2-S USFWS-SC WGFD-SSC3	NBS/BBS record-SD county	marshes with emergent vegtation	Luce *et al.*, 1997 Sauer *et al.*, 1997
Yellow-billed Cuckoo *Coccyzus americanus*	USFS R2-S WGFD-SSC2	NBS/BBS record-SD county WNDDB record-WY county	cottonwood riparian below 7,000 feet, urban areas	Luce *et al.*, 1997 Sauer *et al.*, 1997 WNDDB, 1999
Barn Owl *Tyto alba*	USFWS-SC	SDNHDB record-SD county	basin-prairie shrublands, grasslands, agricultural areas	Luce *et al.*, 1997 SDNHDB, 1999
Burrowing Owl *Athene cunicularia*	USFS R2-S USFWS-SC WGFD-SSC4	NBS/BBS record-WY county NBS/BBS record-SD county WNDDB record-WY county SDNHDB record-SD county	grasslands, basin-prairie shrublands, agricultural areas	Luce *et al.*, 1997 Sauer *et al.*, 1997 WNDDB, 1999 SDNHDB, 1999
Short-eared Owl *Asio flammeus*	USFWS-SC	NBS/BBS record-WY county NBS/BBS record-SD county	basin-prairie shrublands, grasslands, marshes, irrigated native hay meadows	Luce *et al.*, 1997 Sauer *et al.*, 1997
Black Swift *Cypseloides niger*	USFWS-SC	NBS/BBS-SD county	steep narrow cliffs, near waterfalls	Wassink, 1991 Sauer *et al.*, 1997
Lewis' Woodpecker *Melanerpes lewis*	USFS R2-S WGFD-SSC3	WNDDB record-WY county	cottonwood-riparian below 8,500 feet	Luce *et al.*, 1997 WNDDB, 1999
Red-headed Woodpecker *Melanerpes erythrocephalus*	USFWS-SC MIS-TBNG	NBS/BBS record-WY county NBS/BBS record-SD county	cottonwood-riparian	Luce *et al.*, 1997 Sauer *et al.*, 1997
Black-backed Woodpecker *Picoides arcticus*	USFS R2-S WGFD-SSC4	NBS/BBS record-SD county	lodgepole pine, Douglas fir, Englemann spruce-subalpine fir (especially burned)	Luce *et al.*, 1997 Sauer *et al.*, 1997
Veery *Catharus fuscescens*	USFWS-SC WGFD-SSC4	NBS/BBS record-WY county	cottonwood-riparian forests below 9,000 feet	Luce *et al.*, 1997 Sauer *et al.*, 1997
Loggerhead Shrike *Lanius ludovicianus*	USFS R2-S USFWS-SC	NBS/BBS record-WY county NBS/BBS record-SD county SDNHDB record-SD county	greasewood flats, prairie and mountain-foothills shrublands	Luce *et al.*, 1997; Sauer *et al.*, 1997
Orange-crowned Warbler *Vermicorva celata*	WGFD-SSC4	unknown	cottonwood-riparian	Luce *et al.*, 1997
American Redstart *Seophaga ruticilla*	WGFD-SSC4	NBS/BBS record-WY county NBS/BBS record-SD county	cottonwood-riparian, riparian shrub	Luce *et al.*, 1997 Sauer *et al.*, 1997
Common Yellowthroat *Geothlypis trichas*	WGFD-SSC4	NBS/BBS record-WY county NBS/BBS record-SD county	willow and marshes below 8,000 feet	Luce *et al.*, 1997 Sauer *et al.*, 1997

Table 3-86
Continued

Common Name/Scientific Name	Status (1)	Local Occurrence (2)	Expected Habitats in Wyoming and South Dakota	Source
Dickcissel *Spiza americana*	USFWS-SC	NBS/BBS record-WY county NBS/BBS record-SD county	eastern Great Plains grasslands	Luce *et al.*, 1997 Sauer *et al.*, 1997
Brewer's Sparrow *Spizella breweri*	USFWS-SC MIS-TBNG	NBS/BBS record-WY county NBS/BBS record-SD county SDNHDB record-SD county	basin-prairie sagebrush shrublands	Luce *et al.*, 1997 Sauer *et al.*, 1997 SDNHDB, 1999
Lark Bunting *Calamospiza melanocorys*	USFWS-SC	NBS/BBS record-WY county NBS/BBS record-SD county	basin-prairie shrublands, basin-foothills grasslands	Luce *et al.*, 1997 Sauer *et al.*, 1997
Baird's Sparrow *Ammodramus bairdii*	USFS R2-S USFWS-SC WGFD-SSC4 SDGFP-R	NBS/BBS record-WY county	shortgrass eastern Great Plains grasslands	Luce *et al.*, 1997 Sauer *et al.*, 1997
Grasshopper Sparrow *Ammodramus savannarum*	USFWS-SC WGFD-SSC4	NBS/BBS record-WY county NBS/BBS record-SD county WNDDB record-WY county	basin-prairie shrublands, wet-moist meadow grasslands	Luce *et al.*, 1997 Sauer *et al.*, 1997 WNDDB, 1999
Chestnut-collared Longspur *Calcarius ornatus*	USFWS-SC	NBS/BBS record-WY county NBS/BBS record-SD county	basin-prairie shrublands, agricultural area	Luce *et al.*, 1997 Sauer *et al.*, 1997
Bobolink *Dolichonyx oryzivorus*	WGFD-SSC4	NBS/BBS record-SD county	eastern Great Plains grasslands, basin-prairie shrublands	Luce *et al.*, 1997 Sauer *et al.*, 1997
Amphibians and Reptiles				
Tiger Salamander *Ambystoma tigrinum*	USFS R2-S	TBNG record - WY	most habitats with non-flowing water nearby	Luce *et al.*, 1997
Northern Leopard Frog *Rana pipiens*	USFS R2-S	WNDDB record-WY county	swampy cattail marshes, beaver ponds on plains, foothills to 9,000 feet elevation	Luce *et al.*, 1997 WNDDB, 1999
Spiney Softshell Turtle *Apalone spinifera*	SDGFP-ST	SDNHDB record-SD county	mud flats, sandbars, soft sandy-muddy bottoms with aquatic vegetaion in lakes, rivers, ponds, streams	Ashton & Dowd, 1991 SDNHDB, 1999
Eastern Short-horned Lizard *Phrynosoma douglassi breviriostre*	USFWS-SC SDGFP-R	SDNHDB record-SD county	grasslands, sagebrush communities	Ashton & Dowd, 1991 SDNHDB, 1999
Black Hills Redbelly Snake *Storeria occipitomaculata pahasapae*	USFS R2-S	WNDDB record-WY county	moist woodlands, near water, found under rocks, logs, other objects	Luce *et al.*, 1999 WNDDB, 1999

Table 3-86
Continued

Common Name/Scientific Name	Status (1)	Local Occurrence (2)	Expected Habitats in Wyoming and South Dakota	Source
Fish				
Flathead Chub *Platygobio gracilis*	USFS R2-S	drainage record-WY drainage record-SD	turbid, flowing waters in main channels of large rivers, shallow to deep water over mud, rocky bottoms	Lee *et al.*, 1980 Patton *et al.*, 1998 USFWS, 1993a
Sicklefin Chub *Machrybopsis meeki*	USFS R2-S SDGFP-ST	drainage record-SD	consistent heavily turbid, warm waters; shallows in strong currents in Missouri River	Lee *et al.*, 1980 SDNHDB, 1998
Finescale Dace *Phoxinus neogaeus*	SDGFP-ST	drainage record-WY WNDDB record-WY county	small boggy creeks and lakes, beaver ponds	Lee *et al.*, 1980 Patton *et al.*, 1998 WNDDB, 1999
Longnose Sucker *Catostomus catostomus*	SDGFP-ST	drainage record-SD	common in clear, cold waters	Lee *et al.*, 1980 USFWS, 1993a
Plains Topminnow *Fundulus sciadicus*	USFS R2-S SDGFP-ST	drainage record-WY drainage record-SD SDNHDB record-SD county	small to medium size clear, sandy-rocky bottom streams with moderate to rapid flow; quiet pools and backwaters	Lee *et al.*, 1980 Patton *et al.*, 1998 USFWS, 1993a Simpson/Chapman 1993 SDNHDB, 1999
Plants				
American Trailplant *Adenocaulon bicolor*	USFS R2-S WNDDB-S1 BLM-SC	WNDDB record-WY county	moist woods and ravines in Crook County	WNDDB, 1999 Dorn, 1992
Slender False-Foxglove *Agalinis tenuifolia* var. *parviflora*	WNDDB-S1 NPS-SC	WNDDB record-WY county	woods and canyons, peripheral in WY	WNDDB, 1999 Dorn, 1992
Tall Hairy Groovebur *Agrimonia gryposepala*	WNDDB-S1	WNDDB record-WY county	woods and canyons in Crook County	WNDDB, 1999 Dorn, 1992
Virginia Anemone *Anemone virginiana*	WNDDB-S1	WNDDB record-WY county	meadows and thickets in Crook County	WNDDB, 1999 Dorn, 1992
Small-flower Columbine *Aquilegia brevistyla*	WNDDB-S1 BLM-SC	WNDDB record-WY county	woods and streambanks, Weston County	WNDDB, 1999 Dorn, 1992
Laramie Columbine *Aquilegia laramiensis*	USFS R2-S BLM-SC WNDDB-S2	WNDDB record-WY county	granite rock crevices, endemic to WY-Converse County	WNDDB, 1999 Dorn, 1992
Prairie Three-awn *Aristida oligantha*	USFS-SC WNDDB-S1S2	WNDDB record-WY county	sandy or shaley areas in Weston County; peripheral in WY, on TBNG	WNDDB, 1999 Dorn, 1992
Whorled Milkweed *Asclepias verticillata*	WNDDB-S1	WNDDB record- WY county	plains and open woods in Crook County	WNDDB, 1999 Dorn, 1992

Table 3-86
Continued

Common Name/Scientific Name	Status (1)	Local Occurrence (2)	Expected Habitats in Wyoming and South Dakota	Source
Barr's Milkvetch *Astragalus barrii*	WNDDB-S3 SDNHDB-S3	WNDDB record-WY county SDNHDB record-SD county	on clay hills on northeast WY, endemic in WY; present in Custer and Shannon counties, SD	WNDDB, 1999 SDNHDB, 1999 Dorn, 1992
Long-stalked Racemose Milkvetch *Astragalus racemosus* var. *longiseta*	BLM-SC WNDDB-S1	WNDDB record-WY county	plains and hills in Niorbrara County, peripheral in WY	WNDDB, 1999 Dorn, 1992
Bun Milkvetch *Astragalus simplicifolius*	WNDDB-S3	WNDDB record-WY county	barren hills and ridges in northeastern and central-eastern WY, endemic to WY	WNDDB, 1999 Dorn, 1992
Dissected Bahia *Bahia dissecta*	USFS-SC WNDDB-S1S2	WNDDB record-WY county	gravelly hills, peripheral in WY	WNDDB, 1999 Dorn, 1992
Hairy gramma *Bouteloua hirsuta* var. *hirsuta*	BLM-SC WNDDB-S1	WNDDB record-WY county	plains and hills, peripheral in WY	WNDDB, 1999 Dorn, 1992
Fox-tail Sedge *Carex alopecoidea*	USFS R2-S SDNHDB-S2	unknown-SD WY county	wet meadows in Crook Count, WY; historical presence in Brookings County, SD	SDNHDB, 1998 Dorn, 1992
Emory's Sedge *Carex emoryi*	WNDDB-S1	WNDDB record-WY county	wet places in Crook County	WNDDB, 1999 Dorn, 1992
Smooth Goosefoot *Chenopodium subglabrium*	BLM-SC WNDDB-S2	WNDDB record-WY county	sandy places, peripheral in WY	WNDDB, 1999 Dorn, 1992
Wyoming Dodder *Cuscuta plattensis*	BLM-SC WNDDB-S1	WNDDB record-WY county	forbs and shrubs in Converse County, regional endemic in WY	WNDDB, 1999 Dorn, 1992
Red-root Flatsedge *Cyperus erythrorhizos*	BLM-SC WNDDB-S1	WNDDB record-WY couny	wet areas in Crook County	WNDDB, 1999 Dorn, 1992
Nine-anther Prairie-clover *Dalea enneandra*	BLM-SC WNDDB-S1	WNDDB record-WY county	plains, hills and roadsides in Crook, Weston counties; peripheral in WY	WNDDB, 1999 Dorn, 1992
Sim-leaf Witchgrass *Dichanthelium linearifolium*	USFS-SC WNDDB-S1	WNDDB record-WY county	disjunct population in WY	WNDDB, 1999
Interrupted Wildrye *Elymus diversiglumis*	WNDDB-S1	WNDDB record-WY county	hills and open woods in Crook County	WNDDB, 1999 Dorn, 1992
Slender Wildrye *Elymus villosus*	WNDDB-S1	WNDDB record-WY county	woods and canyons in Crook County	WNDDB, 1999 Dorn, 1992
Dwarf Scouring Rush *Equisetum scirpoides*	USFS R2-S BLM-SC WNDDB-S1	WNDDB record-WY county	moist, often wooded areas in Crook County	WNDDB, 1999 Dorn, 1992
Dakota vervain *Glandularia bipinnatifida*	WNDDB-S1 BLM-SC	WNDDB record-WY county	plains and hills in Crook County	WNDDB, 1999 Dorn, 1992
Plains Frostweed *Helianthemum bicknellii*	WNDDB-S1	WNDDB record-WY county	sandy hills and open woods in Crook County	WNDDB, 1999 Dorn, 1992

Table 3-86
Continued

Common Name/Scientific Name	Status (1)	Local Occurrence (2)	Expected Habitats in Wyoming and South Dakota	Source
Sidesaddle Bladderpod *Lesquerella arenosa* var *argillosa*	BLM-SC USFS-SC WNDDB-S1	WNDDB record-WY county	in Crook, Weston counties; regional endemic in WY	WNDDB, 1999 Dorn, 1992
Great Blue Lobelia *Lobelia siphilitica*	WNDDB-S1	WNDDB record-WY county	wet places, peripheral in WY	WNDDB, 1999 Dorn, 1992
Texas Spreading Loeflingia *Loeflingia squarrosa* var *texana*	BLM-SC WNDDB-S1 SDNHDB-SU	WNDDB record-WY county SDNHDB record-SD county	local disjunct population on sandy plains in Crook, Weston counties	WNDDB, 1999 SDNHDB, 1999 Dorn, 1992
Treelike Clubmoss *Lycopodium dendroideum*	USFS R2-S WNDDB-S1	WNDDB record-WY county	wood and moist places in Crook County	WNDDB, 1999 Dorn, 1992
Spring Forget-me-not *Myosotis verna*	WNDDB-S!	WNDDB record-WY county	open sandy areas in Crook County	WNDDB, 1999 Dorn, 1992
Cut-leaved Evening-primrose *Oenothera laciniata*	WNDDB-S1	WNDDB record-WY county	sandy places in Crook County	WNDDB, 1999 Dorn, 1992
Alpine Fever-few *Parthenium alpinum*	USFS R2-S WNDDB-S3	WNDDB record-WY county	regional endemic to WY	WNDDB, 1999
Crown-seed Fetid-marigold *Pectis angustifolia*	USFS-SC WNDDB-S1	WNDDB record-WY county	scoria hills and sandy places; peripheral in WY, on TBNG	WNDDB, 1999 Dorn, 1992
Whorled Milkwort *Polygala verticillata*	BLM-SC WNDDB-S1	WNDDB record-WY county	hills and woods, northeast WY	WNDDB, 1999 Dorn, 1992
Cottongrass Bulrush *Scirpus atrocinctus*	USFS R2-S BLM-SC WNDDB-S1	WNDDB record-WY county	wet places in Crook County	WNDDB, 1999 Dorn, 1992
Waxleaf Meadow-rue *Thalictrum revolutum*	WNDDB-S1	WNDDB record-WY county	disjunct population in Crook, Weston counties	WNDDB, 1999 Dorn, 1992
Prairie Violet *Viola pedatifida*	WNDDB-S1	WNDDB record-WY county	plains, hills and open woods in Crook County	WNDDB, 1999 Dorn, 1992

Table 3-86
Concluded

Common Name/Scientific Name	Status (1)	Local Occurrence (2)	Expected Habitats in Wyoming and South Dakota	Source

1 = Status: USFWS-SC: US Fish and Wildlife Service Species of Concern.
USFS R2-S: US Forest Sevice, Region 2: Sensitive Species.
MIS-TBNG: US Forest Service Management Indicator Species on Thunder Basin National Grassland.
WGFD-SSC1, 2, 3 or 4: Wyoming Game and Fish Department Species of Special Concern (Oakleaf *et al.,* 1996
Priority 1: populations greatly restricted or declining-extirpation appears possible.
Priority 2: populations are declining or restricted in numbers and/or distribution-extirpation not imminent.
Priority 3: species is widely distributed; population status and trends are unknown but are suspected to be stable.
Priority 4: populations are stable or increasing and not restricted in numbers and/or distribution.
SDGFP-SE: South Dakota Department of Game, Fish and Parks State Endangered Species.
SDGFP-ST: South Dakota Department of Game, Fish and Parks State Threatened Species.
SDGFP-R: South Dakota Department of Game, Fish and Parks State Rare Species.
BLM-SC: BLM sensitive species/species of concern.
WNDDB and/or SDNHDB-S1, S2, S3: Wyoming Natural Diversity Database and/or South Dakota Natural Heritage Database State Ranks:
S1 - Critically imperiled in WY and/or SD because of extreme rarity (5 or fewer occurrence, or very few remaining individuals) or because of some factor of its biology making it especially vulnerable to extinction (critically endangered in state).
S2 - Imperiled in WY and/or SD because of rarity (6 to 20 occurrences) or because of other factors demonstrably making it very vulnerable to extinction throughout its range (endangered in state).
S3 - Rare in WY and/or SD (on the order of 20+ occurrences) (threatened in state).

2 = Local Occurrence: unknown - indicates the species range overlaps in the degree block encompassing the project (Luce *et al.*, 1997) but no specific occurrences are known.
WNDDB record - records from Wyoming Natural Diversity Database indicate species is in Campbell, Converse, Niobrara and/or Weston Counties.
SDNHDB record- records from South Dakota Natural Heritage Databse indicte species is in Custer, Fall River, and/or Pennington Counties.
NBS/BBS record - records that species occurs on at least one National Biological Survey, Breeding Bird Survey Route in one of the counties, above.

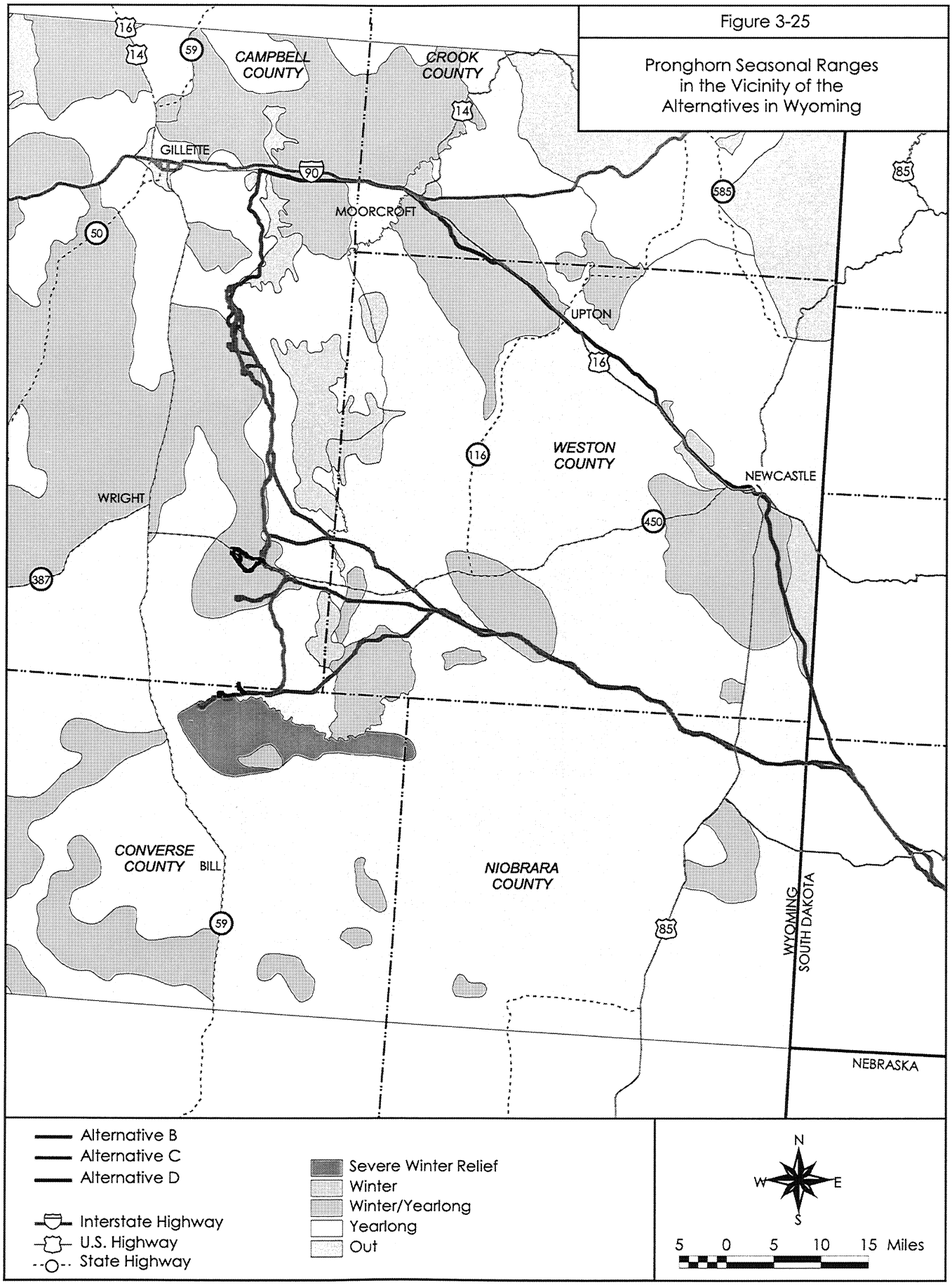


Figure 3-25

Pronghorn Seasonal Ranges in the Vicinity of the Alternatives in Wyoming

Table 3-87
Big Game Populations, Hunt Area Harvest and Occupied Seasonal Ranges Which Would be Crossed by the Alternatives in Wyoming

Big Game Species	Population Herd Unit	1998 Post-Harvest Population Objective	1997 Post-Harvest Population Estimate	Apparent Population Trend	Hunt Area	1997 Harvest in Hunt Area	Seasonal Ranges in Hunt Area Coinciding with the Project (1)	Authority
Pronghorn	North Black Hills	14,000	10,255	Increasing	3	320	WIN	Oedekoven, 1998a
					19	625	WIN, WYL	
	Highlight	11,000	9,281	Decreasing	24	361	YRL, WYL	Oedekoven, 1998b
	Thunder Basin	8,000	5,890	Decreasing	7	718	YRL, WYL	Anderson, 1998a
	South Black Hills	3,000	1,760	Increasing	4	117	WYL	Anderson, 1998b
					5	154	YRL. WIN	
	Lance Creek	27,000	22,994	Increasing	6	369	YRL, WYL	Kroger, 1998a
					8	590	YRL, SWR	
					27	385	YRL, WYL, SWR	
Mule Deer	Thunder Basin	13,000	13,969	Increasing	7	177	YRL, WYL	Anderson, 1998c
					8	309	YRL, WYL	
					9	148	YRL, WYL	
					10	135	YRL, WYL	
					11	295	YRL, WYL	
					21	241	YRL	
	Black Hills	20,000	15,351	Increasing	3	232	YRL	Anderson, 1998d
					5	122	YRL	
					6	240	WYL, Crucial WYL	
	Powder River	52,000	40,711	Increasing	18	1,025	YRL	Oedekoven, 1998c
White-Tailed Deer	Black Hills	40,000	21,090	Increasing	3	156	YRL	Anderson, 1998e
					5	86	YRL	
					6	61	WYL, Crucial WYL	
	Thunder Basin	1,750	no data	unknown	7	0	YRL	Kroger, 1998b
					8	4	YRL	
					9	15	YRL	
					10	19	YRL	

Table 3-87
Concluded

Big Game Species	Population Herd Unit	1998 Post-Harvest Population Objective	1997 Post-Harvest Population Estimate	Apparent Population Trend	Hunt Area	1997 Harvest in Hunt Area	Seasonal Ranges in Hunt Area Coinciding with the Project (1)	Authority
White-Tailed Deer	Thunder Basin	17,50	no data	unknown	11	105	YRL	Kroger, 1998b
					21	24	YRL	
Elk	Rochelle Hills	400	371	Increasing	113	0	YRL, WYL, Crucial WIN, PAR	Oedekoven, 1998d
					123	0	YRL, WYL, Crucial WIN, PAR	
	Black Hills	500	no data	unknown	117	68	none	Anderson, 1998f

Notes:
1 = Any ranges designated as crucial by WGFD are those areas which determine whether a population maintains and reproduces itself at or above the WGFD population objective over the long term (Wildlife Society, 1990):
YRL: Yearlong ranges, used by a population or portion in suitable habitats on a year-round basis, except perhaps under extreme conditions (i.e. winter).
WYL: Winter-yearlong ranges are occupied throughout the year but during winter they are utilized by additional animals that migrate from other seasonal ranges.
WIN: Winter ranges are used by substantial numbers of animals only during the winter period (11/15 - 4/30).
SWR: Severe winter relief ranges are documented survival ranges, crucial or non-crucial, used in occasionally extremely severe winters but may lack habitat characteristics that would make them attractive or capable of supporting major portions of the population during years with normal conditions.
PAR: Parturition areas used by more than a few females of the population for giving birth.
OUT: The area is not occupied by animals during any time of year.

Table 3-88
Miles of Seasonal Ranges Used by Big Game Populations in Wyoming Which Would be Crossed by Alternative B

Big Game Species and Herd Unit	Seasonal Range Affected (1)	Miles Crossed by Land Ownership				
		Forest Service	BLM	State	Private	Total
Pronghorn North Black Hills Herd Unit - 339	not affected	--	--	--	--	--
Pronghorn Highlight Herd Unit - 316	WYL	2.4	1.1	0.7	12.1	16.3
	YRL	3.8	0.3	1.6	32.4	38.1
Pronghorn Thunder Basin - 741	WYL	0	0	0	0	0
	YRL	3.2	0	0	8.5	11.7
Pronghorn South Black Hills Herd Unit -740	not affected	--	--	--	--	--
Pronghorn Lance Creek - 742	SWR	1.8	0	0	0.5	2.3
	WYL	14.3	0	0.6	8.4	23.3
	YRL	10.1	1.0	4.5	43.9	59.5
Pronghorn Totals		35.6	2.4	7.4	105.8	151.2
Mule Deer Thunder Basin - 752	WYL	4.8	0	0	6.2	11.0
	YRL	27.5	1.5	7.4	87.1	123.5
Mule Deer Black Hills - 751	not affected	--	--	--	--	--
Mule Deer Powder River - 319	not affected	--	--	--	--	--
Mule Deer Totals		32.3	1.5	7.4	93.3	134.5
White-Tailed Deer Black Hills - 706	not affected	--	--	--	--	--
White-Tailed Deer Thunder Basin - 702	WYL	0	0	0	0	0
	YRL	1.0	0	0	2.7	3.7
White-Tailed Deer Totals		1.0	0	0	2.7	3.7
Elk Rochelle Hills - 344	Crucial WIN	0.3	0	0	0.1	0.4
	WYL	2.9	0	0	6.8	9.7
	YRL	12.5	0	0.4	8.9	21.8
Elk Totals		15.7	0	0.4	15.8	31.9

1 = Any ranges designated as crucial by WGFD are those areas which determine whether a population maintains and reproduces itself at or above the WGFD population objective over the long term (Wildlife Society, 1990):
YRL: Yearlong ranges, used by a population or portion in suitable habitats on a year-round basis, except perhaps under extreme conditions (ie. winter).
WYL: Winter-yearlong ranges are occupied throughout the year but during winter are utilized by additional animals that migrate from other seasonal ranges.
WIN - Winter ranges are used by substantial numbers of animals only during the winter period (11/15 - 4/30).
SWR - Severe winter relief ranges are documented survival ranges, crucial or non-crucial, used in occasionally extremely severe winters but may lack habitat characteristics that would make them attractive or capable of supporting major portions of the population during years with normal conditions.

elements of pronghorn winter ranges (Cook and Irwin, 1984). Several studies conducted in Wyoming have revealed the influence of water on pronghorn distribution during winter (Irwin *et al.*, 1984) and especially during summer (Sundstrom, 1969 and Alldredge and Deblinger, 1988). These and other studies also emphasized the importance of shrubs, especially sagebrush, in pronghorn diets throughout the year (Severson *et al.*, 1968 and Alldredge and Deblinger, 1988).

In South Dakota, pronghorns are managed mostly on a county-by-county basis. The counties which would be crossed by the alternatives are divided into Hunt Units which are managed for pronghorn harvest (Table 3-91). By far the largest antelope harvest in 1997 was in Fall River County Hunt Unit 127A which covers the western half of the county and extends into southwest Custer County. Although no seasonal ranges have been formally defined, SDGFP biologists have mapped pronghorn use areas intersected by Alternatives B and C in Custer

Table 3-89
Miles of Seasonal Ranges Used by Big Game Populations in Wyoming Which Would be Crossed by Alternative C

Big Game Species and Herd Unit	Seasonal Range Affected (1)	Miles Crossed by Land Ownership				
		Forest Service	BLM	State	Private	Total
Pronghorn North Black Hills Herd Unit - 339	not affected	--	--	--	--	--
Pronghorn Highlight Herd Unit - 316	WYL	3.1	0	1.8	16.3	21.2
	YRL	0.2	0.1	0.6	19.3	20.2
Pronghorn Thunder Basin - 741	not affected	--	--	--	--	--
Pronghorn South Black Hills Herd Unit -740	not affected	--	--	--	--	--
Pronghorn Lance Creek - 742	SWR	2.1	0	0	0.3	2.4
	WYL	9.4	0	1.9	8.0	19.3
	YRL	18.0	1.4	5.3	43.4	68.1
Pronghorn Totals		32.8	1.5	9.6	87.3	131.2
Mule Deer Thunder Basin - 752	WYL	2.5	0	0.7	5.8	9.0
	YRL	26.3	1.4	8.2	67.5	103.4
Mule Deer Black Hills - 751	not affected	--	--	--	--	--
Mule Deer Powder River - 319	not affected	--	--	--	--	--
Mule Deer Totals		28.8	1.4	8.9	73.3	112.4
White-Tailed Deer Black Hills - 706	not affected	--	--	--	--	--
White-Tailed Deer Thunder Basin - 702	WYL	0	0	0	0	0
	YRL	0.2	0	0	1.2	1.4
White-Tailed Deer Totals		0.2	0	0	1.2	1.4
Elk Rochelle Hills - 344	Crucial WIN	2.3	0	0	0.2	2.5
	WYL	3.7	0	0	1.0	4.7
	YRL	12.0	0	1.7	7.7	21.4
Elk Totals		18.0	0	1.7	8.9	28.6

1 = Any ranges designated as crucial by WGFD are those areas which determine whether a population maintains and reproduces itself at or above the WGFD population objective over the long term (Wildlife Society, 1990):
YRL: Yearlong ranges, used by a population or portion in suitable habitats on a year-round basis, except perhaps under extreme conditions (ie. winter).
WYL: Winter-yearlong ranges are occupied throughout the year but during winter are utilized by additional animals that migrate from other seasonal ranges.
WIN - Winter ranges are used by substantial numbers of animals only during the winter period (11/15 - 4/30).
SWR - Severe winter relief ranges are documented survival ranges, crucial or non-crucial, used in occasionally extremely severe winters but may lack habitat characteristics that would make them attractive or capable of supporting major portions of the population during years with normal conditions.

County. Most of Alternative B, a portion of Alternative C, and the W G Flat Variation of Alternative C where they parallel the Cheyenne River and Spring Creek, Custer County, are used by pronghorns in the winter and on a yearlong basis (Tables 3-87, 3-92 and 3-93). Portions of Alternative C and the W G Flat Variation west of Spring Creek pass through areas used by pronghorns yearlong (Table 3-94) and scattered pronghorn annual use is expected along Alternative D (Table 3-96), in western Pennington County (Chambers, 1999). The Phiney Flat Variation of Alternative C avoids most of the pronghorn winter range associated with Spring Creek (Table 3-95). Scattered pronghorn may also occur along Alternative D where it parallels Box Elder Creek east of Rapid City (Tietsort, 1999). No pronghorn seasonal use areas were mapped by SDGFD biologists in Fall River County but some portions of the route alternatives are within winter and yearlong pronghorn ranges (Rice, 1999).

Mule Deer. Alternative B and C in Wyoming coincides with the Thunder Basin Mule Deer Herd Unit, managed by the Casper WGFD District, and would cross

Table 3-90
Miles of Seasonal Ranges Used by Big Game Populations in Wyoming Which Would be Crossed by Alternative D

Big Game Species and Herd Unit	Seasonal Range Affected (1)	Miles Crossed by Land Ownership				
		Forest Service	BLM	State	Private	Total
Pronghorn North Black Hills Herd Unit - 339	WYL	0	0	0	8.3	8.3
Pronghorn Highlight Herd Unit - 316	WYL	3.1	0	2.1	19.0	24.2
	YRL	0.1	0.3	2.3	40.9	43.6
Pronghorn Thunder Basin - 741	WYL	2.6	1.1	1.4	16.4	21.5
	YRL	0	0	0	2.7	2.7
Pronghorn South Black Hills Herd Unit -740	WIN	0	0	0	5.2	5.2
	YRL	3.7	0	1.3	15.5	20.5
Pronghorn Lance Creek - 742	SWR	2.2	0	0	0.3	2.5
	WYL	5.5	0.3	0	14.0	19.8
	YRL	9.5	0	0	8.0	17.5
Pronghorn Totals		26.7	1.7	7.1	130.3	165.8
Mule Deer Thunder Basin - 752	WYL	2.6	0	0	8.5	11.1
	YRL	16.4	1.6	6.8	82.5	107.3
Mule Deer Black Hills - 751	WYL	3.7	0	1.3	20.7	25.7
Mule Deer Powder River - 319	YRL	0	0	0	1.0	1.0
Mule Deer Totals		22.7	1.6	8.1	112.7	145.1
White-Tailed Deer Black Hills - 706	WYL	3.7	0	1.3	20.7	25.7
White-Tailed Deer Thunder Basin - 702	WYL	0	0.3	0	1.7	2.0
	YRL	0.2	0	0.3	9.2	9.7
White-Tailed Deer Totals		3.9	0.3	1.6	31.6	37.4
Elk Rochelle Hills - 344	Crucial WIN	2.3	0	0	0.2	2.5
	WYL	3.7	0	0	1.0	4.7
	YRL	10.1	0	0	6.4	16.5
Elk Totals		16.1	0	0	7.6	23.7

1 = Any ranges designated as crucial by WGFD are those areas which determine whether a population maintains and reproduces itself at or above the WGFD population objective over the long term (Wildlife Society, 1990):
YRL: Yearlong ranges, used by a population or portion in suitable habitats on a year-round basis, except perhaps under extreme conditions (ie. winter).
WYL: Winter-yearlong ranges are occupied throughout the year but during winter are utilized by additional animals that migrate from other seasonal ranges.
WIN - Winter ranges are used by substantial numbers of animals only during the winter period (11/15 - 4/30).
SWR - Severe winter relief ranges are documented survival ranges, crucial or non-crucial, used in occasionally extremely severe winters but may lack habitat characteristics that would make them attractive or capable of supporting major portions of the population during years with normal conditions.

each of 6 hunt areas in the Herd Unit (Table 3-87). The population area covers southeast Campbell County, northern Niobrara County and Weston County with most of the habitats occupied by mule deer (71 percent) under private ownership (Anderson, 1998b). Habitats in the Herd Unit include sagebrush steppe in short grass prairie, ponderosa pine woodlands on rolling hills, drainages with decadent stands of cottonwoods, and alfalfa hay fields in which mule deer are likely to concentrate and cause crop damage (Anderson, 1998b). Seasonal mule deer ranges in the vicinity of the alternatives in Wyoming are shown on Figure 3-26.

Alternative D would cross through the Black Hills Mule Deer Herd Unit, managed by the Casper WGFD District, the Powder River Mule Deer Herd Unit, managed by the Sheridan WGFD District, and the Thunder Basin Herd Unit. Vegetation in those herd units is similar to vegetation in the Thunder Basin Herd Unit except more ponderosa pine and mountain shrub species are present.

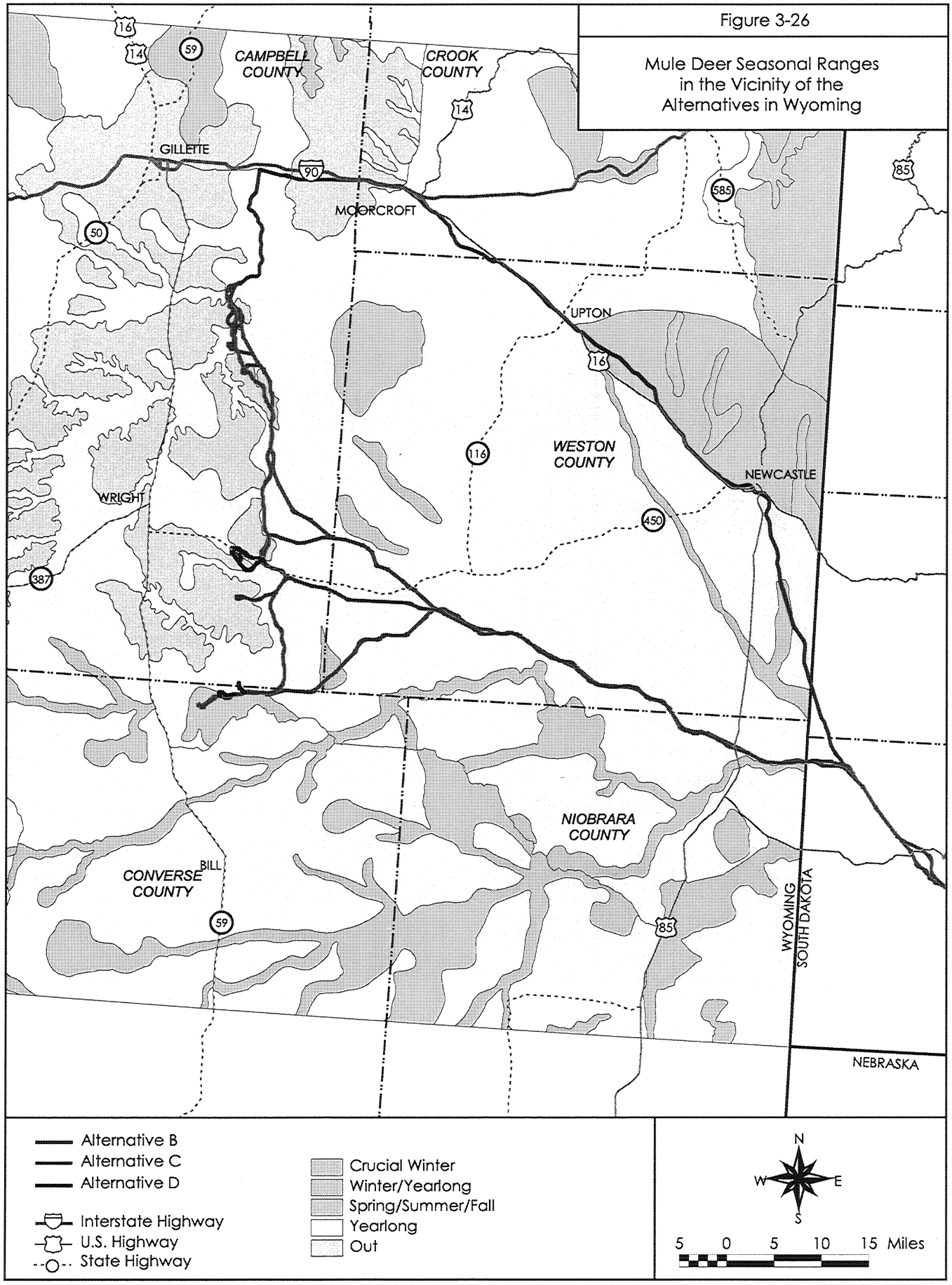


Figure 3-26
Mule Deer Seasonal Ranges in the Vicinity of the Alternatives in Wyoming
CAMPBELL COUNTY
CROOK COUNTY
GILLETTE
MOORCROFT
UPTON
WESTON COUNTY
NEWCASTLE
WRIGHT
NIOBRARA COUNTY
CONVERSE COUNTY
BILL
WYOMING
SOUTH DAKOTA
NEBRASKA
16
14
59
90
50
585
85
116
450
387
Alternative B
Alternative C
Alternative D
Interstate Highway
U.S. Highway
State Highway
Crucial Winter
Winter/Yearlong
Spring/Summer/Fall
Yearlong
Out
N
W
E
S
5 0 5 10 15 Miles

Table 3-91
Big Game Hunt Unit Harvest in Hunt Units Coinciding with the Project Area in South Dakota.

County	1997 Firearm Deer Harvest			1997 Youth Deer Harvest			1997 Deer Muzzle-loader Harvest			1997 Deer Archery Harvest			1997 Firearm Antelope Harvest		1997 Wild Turkey Harvest		
	Hunt Unit	White-Tailed	Mule Deer	Hunt Unit	White-Tailed	Mule Deer	Hunt Unit	White-Tailed	Mule Deer	Hunt Unit	White-Tailed	Mule Deer	Hunt Unit	Total	Hunt Unit	Spring Total	Fall Total
Pennington	302B	113	59	802B	2	0	902B	2	0	702B	4	0	102B	30	102A	112	85
	302C	35	75	802C	2	2	902C	1	1	702C	1	0	102C	103	102B	15	9
	302D	21	57	802D	63	18											
Custer	321A	41	88	821A	1	4	921A	2	0	721A	0	1	121A	148	121A	10	7
Fall River	327A	46	157	827A	2	9	927A	0	6	727A	1	0	127A	220	127A	84	101
	327B	339	473	827B	2	17	927B	0	8	727B	0	4	127B	176			

Source: McPhillips and Schlueter (1998)

Alfalfa hay and winter wheat are cultivated on privately owned, non-timbered lands, especially in the Black Hills Herd Unit (Anderson, 1998c). Alternative B would directly affect WYL and YRL seasonal ranges in the Thunder Basin mule deer herd unit (Table 3-88). Alternative C would also only affect the Thunder Basin herd unit but by 16.6 fewer miles than Alternative B (Table 3-89). Alternative D would pass through all 3 mule deer herd units in the region, Thunder Basin, Black Hills and Powder River (Table 3-90), albeit adjacent to an existing heavy haul railroad (BNSF).

The Thunder Basin Mule Deer population appears to be increasing and the 1997 population estimate indicates it is above the population objective set by WGFD (Anderson, 1998b). Most of Alternatives B and C would cross land occupied by mule deer on a year-long basis (Table 3-87). There are areas, mostly along river drainages (Black Thunder Creek, Beaver Creek, Cheyenne River), classified as winter-year-long (WYL) habitat where mule deer congregate, particularly in the winter. Mule deer in the Powder River and Black Hills herd units suffered winter losses during 1997 (Oedekoven, 1998c; Anderson, 1998c). Since then, both populations appear to be increasing. Alternative D would cross some crucial WYL range south of Newcastle, in Weston County. Although livestock grazing is the principal land use in the Herd Unit, oil fields, bentonite mining and coal mining have been developed in the past and continue to operate but land disturbances have not significantly increased in the past decade (Anderson, 1998b). All of the mine loops would be within the Thunder Basin Mule Deer Herd Unit. The loops would pass through WYL range for 2.1 miles and through YRL range for 8.0 miles. The mine loops would also be within the Rochelle Hills Elk Herd Unit. The loops would pass through WYL range for 0.1 mile and through YRL range for 3.6 miles.

As with pronghorn, there are no defined mule deer populations or seasonal use areas in South Dakota. SDGFP biologists have provided information about seasonal deer use in the vicinity of the project alternatives. In Fall River County, winter and summer use by mule deer and white-tailed deer are expected along the alternatives where they would follow the Cheyenne River, cross ponderosa pine-dominated topography east of Edgemont, Hat Creek west of Heppner, and Horsehead Creek. Mule deer and white-tailed deer also utilize Hay Canyon (Alternative C, Table 3-93) and areas along Sand Creek and the existing tracks (Alternative B, Table 3-92) from Smithwick to Oral during winter and summer (Meadows, 1999). The W G Flat Variation of Alternative C (Table 3-94) avoids Hay Canyon but crosses more deer yearlong range in Fall River County than either Alternative C or Alternative C with the Phiney Flat Route Variation. In Custer County, mule deer concentrate in the Cheyenne River valley during winter and are found year-round along Spring Creek and upland areas coinciding with Alternative C (Table 3-94). The Phiney Flat Variation of Alternative C (Table 3-95) avoids wintering areas associated with Spring Creek and reduces the route distance through deer wintering areas by 6 miles. Mule deer are also found in juniper woodlands in the vicinity of Wall Hill during the year (Tietsort, 1999).

Some year-round mule deer and white-tailed deer use is also expected along the existing track (Alternative D, Table 3-96) north of Oral, in Custer County (Chambers, 1999). White-tailed deer utilize the Box Elder Creek drainage where it parallels Alternative D east of Rapid City through out the year (Tietsort, 1999).

Mule deer and white-tailed deer are managed together on a county-by-county basis. The counties which would be crossed by alternatives are divided into Hunt Units which are managed for mule deer and white-tailed deer harvest, whether by firearms, archery, muzzle loading riffle, or special youth harvests (see Table 3-91). More mule deer and white-tailed deer are harvested than pronghorn in roughly the same geographic area. In the 3-county region, most white-tailed deer and mule deer harvest was in Fall River County Hunt Unit 327B (see Table 3-91) which covers most of the east and southern portion of the county, south of the Cheyenne River.

White-tailed Deer. Alternatives B and C in Wyoming would cross the Thunder Basin White-tailed Deer Herd Unit and would cross 6 of the 12 Hunt Areas in the Herd Unit (see Table 3-87). Except for the Black Hills in northeast Weston and Crook counties, the population area covers most of northeastern Wyoming including Campbell, Weston, Niobrara and eastern Converse counties with most of the area (76 percent) privately owned (Kroger, 1998b). Alternative D would coincide with the Thunder Basin and Black Hills white-tailed deer herd units. Habitats mostly used by white-tailed deer in northeast Wyoming include coniferous forests (ponderosa pine and juniper), cottonwood-dominated riparian zones and agricultural croplands in which they cause crop damage, especially in late summer and early autumn (Kroger, 1998b). Seasonal ranges for white-tailed deer in the vicinity of the alternatives in Wyoming are shown on Figure 3-27.

There are no population estimates for the Thunder Basin White-tailed Deer Herd Unit although there are indications that the population is increasing (Kroger, 1998b). The Black Hills Herd Unit population is estimated to be 21,090 in 1997 (Anderson, 1998e). Alternatives B and C would cross land occupied by white-tailed deer on a year-long basis (Tables 3-88 and 3-89) coinciding mostly with drainages including Antelope Creek, Black Thunder Creek, Beaver Creek, and Cheyenne River. Alternative D would cross YRL, and WYL white-tailed deer ranges in both herd units (Table 3-

Table 3-92
Miles of Seasonal Ranges Used by Big Game Populations in South Dakota Which Would be Crossed by Alternative B

Big Game Species and County	Seasonal Range Affected (1)	Miles Crossed by Land Ownership				
		Forest Service	BLM	State	Private	Total
Pronghorn Fall River	None Identified	--	--	--	--	--
Pronghorn Custer	Winter	1.4	0	0	10.8	12.2
	Yearlong	3.9	0	0	6.5	10.4
Pronghorn Pennington	Winter	1.8	0	0	0.6	2.4
	Yearlong	0	0	0	0	0
Pronghorn Totals		7.1	0	0	17.9	25.0
Mule Deer - White-tailed Deer Fall River	Winter	0	0	0	0	0
	Yearlong	0	1.2	0.5	33.7	35.4/2
Mule Deer - White-tailed Deer Custer	Winter	13.7	0	1.2	22.8	37.7
	Yearlong	13.7	0	1.2	25.5	40.4
Mule Deer - White-tailed Deer Pennington	Winter	1.5	0	0	0.6	2.1
	Yearlong	2.6	0.9	0	15.5	19.0
Mule Deer - White-tailed Deer Totals		31.5	2.1	2.9	98.1	134.6 (2)

1 = Seasonal ranges identified by SDGFP personnel in written and oral communications.
2 = Total does not include 0.3 mile through yearlong range on land owned by DOE.

Table 3-93
Miles of Seasonal Ranges Used by Big Game Populations in South Dakota Which Would be Crossed by Alternative C

Big Game Species and County	Seasonal Range Affected (1)	Miles Crossed by Land Ownership				
		Forest Service	BLM	State	Private	Total
Pronghorn Fall River	None Identified	--	--	--	--	--
Pronghorn Custer	Winter	0.4	0	0	11.4	11.8
	Yearlong	3.3	0	0	24.0	28.1
Pronghorn Pennington	Winter	1.6	0	0	0.8	2.4
	Yearlong	0	0	0	0	0
Pronghorn Totals		5.3	0	0.8	36.2	42.3
Mule Deer - White-tailed Deer Fall River	Winter	0	0	0	0.1	0.1
	Yearlong	0	1.6	0.5	22.6	24.7
Mule Deer - White-tailed Deer Custer	Winter	1.8	0	0.8	28.4	31.0
	Yearlong	2.7	0	0	23.2	25.9
Mule Deer - White-tailed Deer Pennington	Winter	1.4	0	0	0.8	2.2
	Yearlong	2.5	0.8	0	15.8	19.1
Mule Deer - White-tailed Deer Totals		8.4	2.4	1.3	90.9	103.0

1 = Seasonal ranges identified by SDGFP personnel in written and oral communications.

Table 3-94
Miles of Seasonal Ranges Used by Big Game Populations in South Dakota Which Would be Crossed by Alternative C With the W G Flat Route Variation

Big Game Species and County	Seasonal Range Affected (1)	Miles Crossed by Land Ownership				
		Forest Service	BLM	State	Private	Total
Pronghorn Fall River	None Identified	--	--	--	--	--
Pronghorn Custer	Winter	0.4	0	0	12.0	12.4
	Yearlong	3.3	0	0.8	24.0	28.1
Pronghorn Pennington	Winter	1.6	0	0	0.8	2.4
	Yearlong	0	0	0	0	0
Pronghorn Totals		5.3	0	0.8	36.8	42.9
Mule Deer - White-tailed Deer Fall River	Winter	0	0	0	0	0
	Yearlong	0	1.7	0.5	28.4	30.6
Mule Deer - White-tailed Deer Custer	Winter	1.8	0	0.8	28.6	31.2
	Yearlong	2.7	0	0	24.1	26.8
Mule Deer - White-tailed Deer Pennington	Winter	1.4	0	0	0.8	2.2
	Yearlong	2.5	0.8	0	15.8	19.1
Mule Deer - White-tailed Deer Totals		8.4	2.5	1.3	97.7	109.9

1 = Seasonal ranges identified by SDGFP personnel in written and oral communications.

Table 3-95
Miles of Seasonal Ranges Used by Big Game Populations in South Dakota Which Would be Crossed by Alternative C With the Phiney Flat Route Variation

Big Game Species and County	Seasonal Range Affected (1)	Miles Crossed by Land Ownership				
		Forest Service	BLM	State	Private	Total
Pronghorn Fall River	None Identified	--	--	--	--	--
Pronghorn Custer	Winter	0	0	0	4.2	4.2
	Yearlong	3.3	0	0.8	31.6	35.7
Pronghorn Pennington	Winter	1.2	0	0	0.8	2.0
	Yearlong	0	0	0	0	0
Pronghorn Totals		4.5	0	0.8	36.6	41.9
Mule Deer - White-tailed Deer Fall River	Winter	0	0	0	0.1	0.1
	Yearlong	0	1.6	0.5	22.6	24.7
Mule Deer - White-tailed Deer Custer	Winter	1.4	0	0.8	22.5	24.7
	Yearlong	2.2	0	0	24.5	26.7
Mule Deer - White-tailed Deer Pennington	Winter	1.0	0	0	1.0	2.0
	Yearlong	2.0	0.8	0	16.1	19.0
Mule Deer - White-tailed Deer Totals		6.6	2.4	1.3	86.8	97.2

1 = Seasonal ranges identified by SDGFP personnel in written and oral communications.

Table 3-96 Miles of Seasonal Ranges Used by Big Game Populations in South Dakota Which Would be Crossed by Alternative D						
Big Game Species and County	Seasonal Range Affected (1)	Miles Crossed by Land Ownership				
		Forest Service	BLM	State	Private	Total
Pronghorn Fall River	None Identified	--	--	--	--	--
Pronghorn Custer	Winter	0	0	0	0	0
	Yearlong	0	0	0.2	24.8	25.0
Pronghorn Pennington	Winter	0	0	0	0	0
	Yearlong	0	0	0	0	0
Pronghorn Totals		0	0	0.2	24.8	25.0
Mule Deer - White-tailed Deer Fall River	Winter	0	0	0	0	0
	Yearlong	0	0.8	0	19.6	20.4
Mule Deer - White-tailed Deer Custer	Winter	0	0	0	0	0
	Yearlong	0	0	0	0	0
Mule Deer - White-tailed Deer Pennington	Winter	0	0	0	0	0
	Yearlong	0	0	0	41.1	41.1
Mule Deer - White-tailed Deer Totals		0	0.8	0	60.7	61.5
1 = Seasonal ranges identified by SDGFP personnel in written and oral communications.						

90). All of the proposed mine loops would be within the Thunder Basin White-tailed Deer Herd Unit. The loops would pass through YRL range for 1.5 miles.

Although there are no defined white-tailed deer populations in South Dakota, SDGFD biologists have provided maps of where mule deer and white-tailed deer are expected. However, they did not distinguish between mule deer ranges and white-tailed deer ranges in all counties so both species were combined in Tables 3-92 through 3-96. White-tailed deer occur year-round along the Cheyenne River in Pennington, Custer and Fall River counties. They also inhabit riparian areas associated with Spring Creek, Battle Creek, Hay Canyon, Sand Creek, Horsehead Creek and Hat Creek (Meadows, 1999 and Chambers, 1999). The W G Flat Route Variation and Phiney Flat Route Variation of Alternative C would avoid white-tailed deer ranges in Hay Canyon and Spring Creek, respectively. Along Alternative D, white-tailed deer are commonly found in the riparian zone of Box Elder Creek, east of Rapid City (Tietsort, 1999).

Elk. Except for captive elk held on private lands east of Edgemont in Fall River County, none of the alternatives in South Dakota cross habitats that are occupied by elk (Meadows, 1999).

In Wyoming, Alternatives B and C would cross one elk population area, the Rochelle Hills Elk Herd Unit (Table 3-88 and Table 3-89) that is in southeast Campbell County, southwest Weston County, and north central Converse County (Oedekoven, 1998b). Elk were transplanted to the area nearly 50 years ago and the population has been growing slowly and now are estimated to be nearly 400 animals. Elk utilize ponderosa pine woodlands and savannah in the Rochelle Hills interspersed with sagebrush and short grass prairie. Most of the areas used by elk are on the TBNG (Oedekoven, 1998b). Alternative D would pass near a portion of the Black Hills Elk Herd Unit, crossing Hunt Area 117 southeast of Newcastle in Weston County but it would not affect any seasonal ranges in that herd unit (Table 3-90). Currently, WGFD is unable to estimate population size for this herd: elk tend to be widely dispersed during winter and occupy ranges where they are obscured by conifers (Anderson, 1998f). Seasonal ranges used by elk in the vicinity of the alternatives is shown on Figure 3-28.

In addition to year-long and winter-year-long ranges, Alternatives B and C would cross crucial winter ranges (Table 3-88, Table 3-89). Alternative B would cross elk parturition areas where cows congregate to give birth (see Figure 3-28). Occupied elk habitats have been affected by energy exploration and developments and there is concern about vehicle accidents, poaching and harassment during critical winter and calving periods (Oedekoven, 1998b).

Mountain Lion. In Wyoming, the alternatives would cross Mountain Lion Hunt Area 21 which covers nearly one-quarter of northeast Wyoming, excluding the Black Hills in Crook and northeastern Weston counties. In 1997, WGFD maintained a harvest quota of 2 mountain lions but none were killed (Rothwell, 1998a); one was harvested in 1996 (Rothwell, 1997). WGFD WOS indicate mountain lions have been seen occasionally in

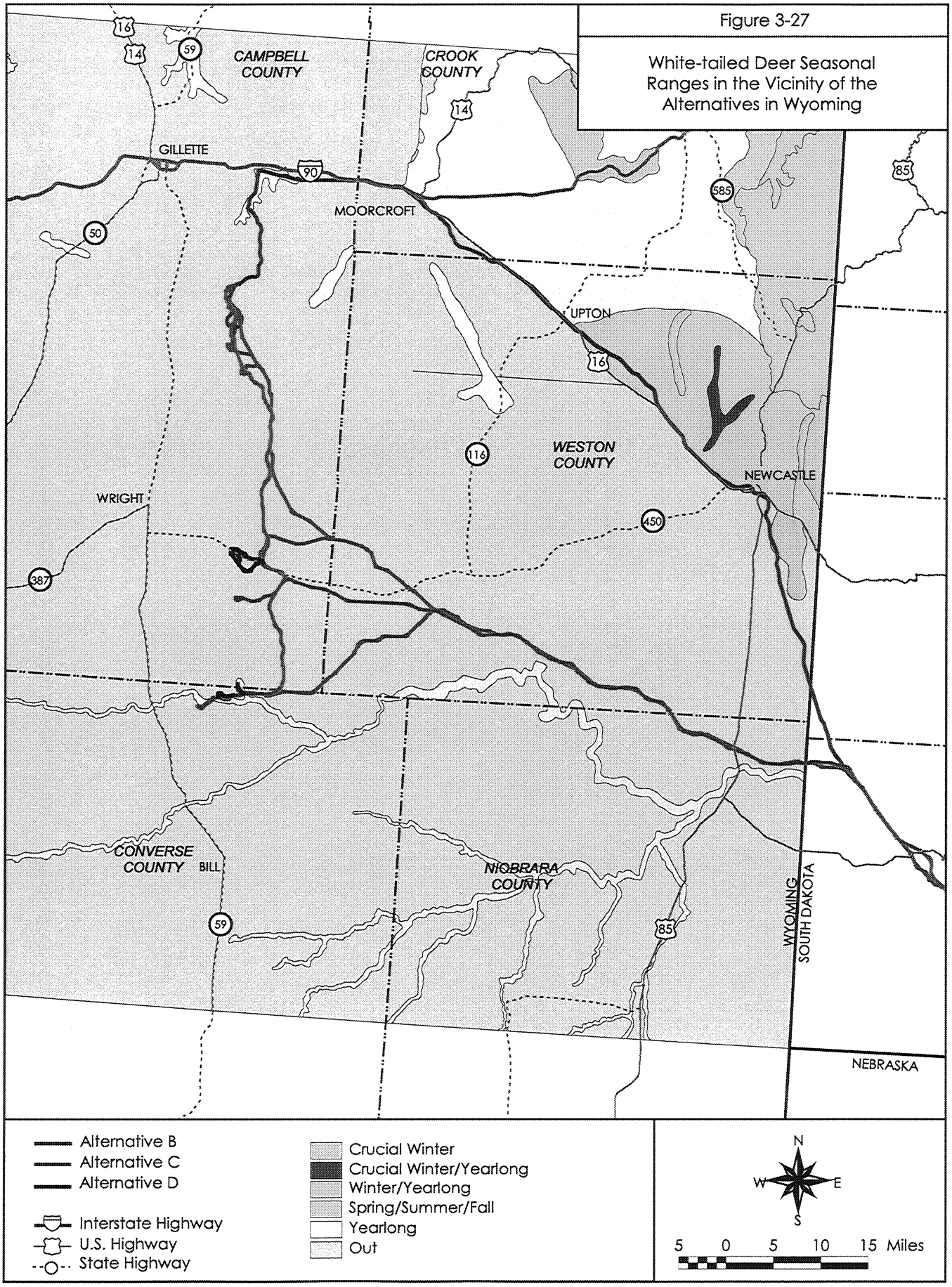


Figure 3-27

White-tailed Deer Seasonal Ranges in the Vicinity of the Alternatives in Wyoming

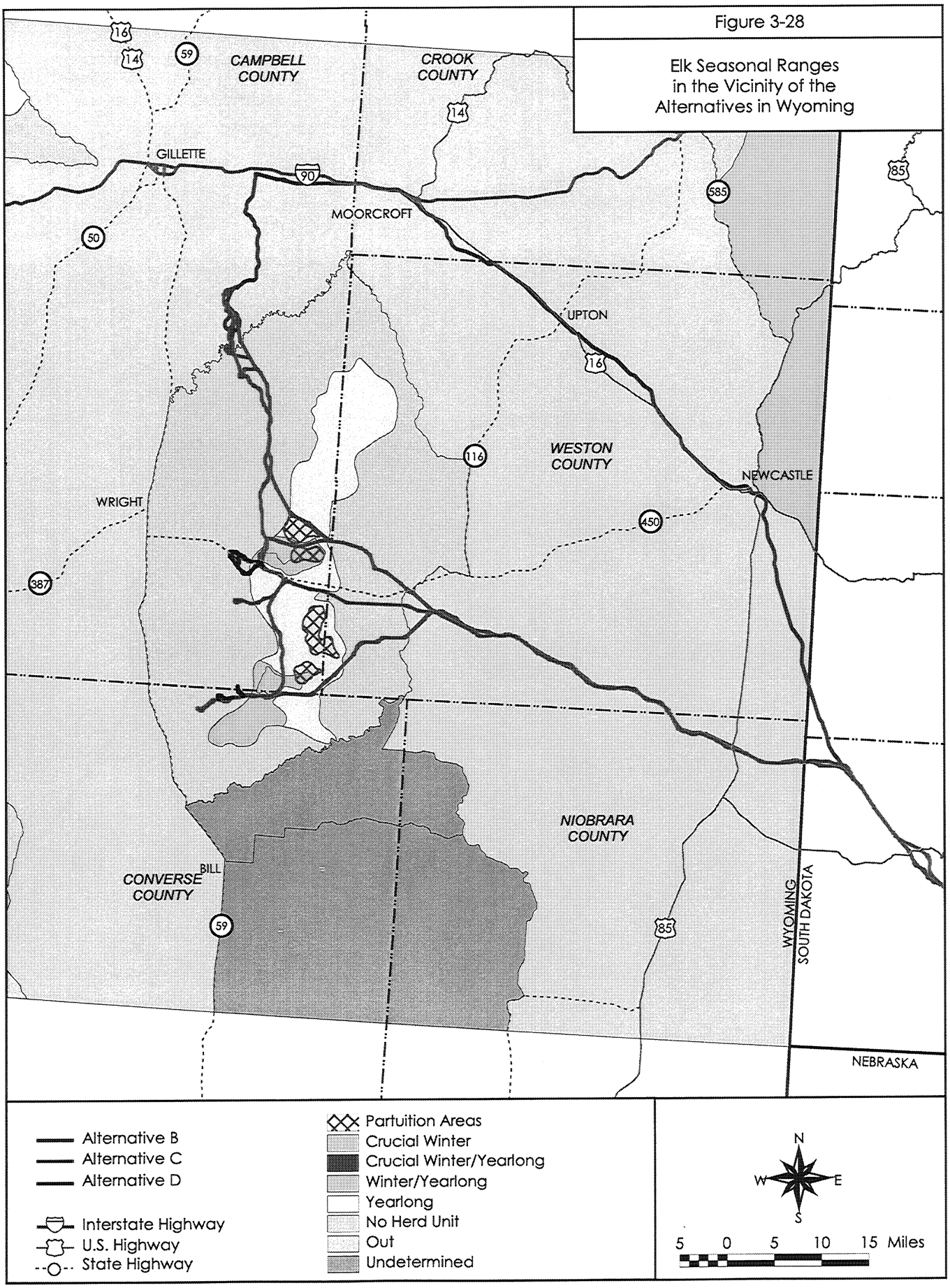


Figure 3-28

Elk Seasonal Ranges in the Vicinity of the Alternatives in Wyoming

the vicinity of Newcastle, northeastern Weston County and once in 1980 near coal mines in eastern Campbell County.

Waterfowl, Upland Game Birds, Furbearers, Small Game

Waterfowl. All alternatives in Wyoming would cross one WGFD Waterfowl Management Area, WFMA 1A (Rothwell, 1998b) for which harvest data on geese and ducks are documented (Table 3-97). This WFMA covers Weston and Crook counties and most of Campbell, Converse and Niobrara counties where the Cheyenne River and its tributaries serve as important nesting habitat and migratory/staging habitats, especially during fall. No waterfowl harvest data are available for the area which would be crossed by the alternatives in South Dakota.

Species of migratory waterfowl inhabiting the area which would be affected by the alternatives have been documented during breeding bird surveys coordinated through NBS (Sauer *et al.*, 1997) and provide data on species' occurrence and abundance during the spring breeding period for at least the past decade (Table 3-98). Data reported from 10 NBS breeding bird survey routes in Wyoming indicate the most common waterfowl species observed are green-winged teal, mallard, blue-winged teal, northern pintail, northern shoveler, gadwall, and American wigeon. Only rarely were Canada geese, cinnamon teal, common goldeneye, ruddy duck, common merganser and American coots reported.

Likewise, there are 7 breeding bird survey routes in South Dakota that suggest migratory waterfowl are more common there. Canada geese, green-winged teal, mallard, northern pintail, blue-winged teal, northern shoveler, gadwall, American wigeon, ruddy ducks and American coots were reported on most of the South Dakota routes. Cinnamon teal, redheads, lesser scaup and wood duck were observed less frequently. The Cheyenne River and its tributaries provide most of the nesting and staging habitat for waterfowl in the project area of South Dakota.

Upland Game Birds. In Wyoming, Alternatives B and C would cross 2 Upland and Small Game Management Areas - USGMA numbers 36 (Niobrara) and 39 (Belle Fourche). Alternative D would cross USGFMA numbers 44 (Black Hills) and 43 (Weston). Eight upland game bird species are harvested in those areas, combined, and include pheasant, chukar partridge and gray partridge, sage grouse, sharp-tailed grouse, ruffed grouse and mourning doves (Table 3-97). Wild turkeys in the Black Hills Hunt Area are also harvested in Wyoming. Mourning doves, also upland game birds, may occur near the alternatives and have been regularly observed in NBS surveys.

In South Dakota, turkeys are classified as big game species and, as in Wyoming, are harvested during spring and fall (see Table 3-91). Turkeys in South Dakota occur along the Cheyenne River, Spring Creek and Hay Canyon and have year-round roosts there, mainly in cottonwoods, as well as along Lame Johnny Creek, French Creek and Battle Creek (Chambers, 1999). During winters, turkeys tend to be more concentrated in roosts in those drainages (Rice, 1999). Turkeys also utilize juniper woodlands on Wall Hill and are found along Box Elder Creek (Tietsort, 1999). Gray partridge, pheasant, sage grouse, sharp-tailed grouse, mourning dove, common snipe and turkeys were upland game birds reported on at least 1 of 7 breeding bird survey routes in South Dakota (see Table 3-98). Pheasants were observed on 5 out of 7 routes and mourning doves have been regularly observed on all 7 NBS survey routes in South Dakota.

Turkeys in South Dakota are opportunistic feeders, eating a variety of insects as well as plant materials: acorns, corn, oats and grass seeds (Laudenslager and Flake, 1978). Hens with young depend heavily on insects but grazing by livestock reduces herbaceous plant cover with diminished abundance of invertebrates (Rumble and Anderson, 1993). As with other gallinaceous birds, turkeys nest on the ground and are dependent on dense brush and/or tall grass to conceal nests from predators (Schroeder, 1985).

Sage grouse are the most common and important game bird in most of Wyoming, but sage grouse populations - indicated by harvests - have declined throughout Wyoming over the past 20 years (Heath *et al.,* 1997). So too, have sage grouse harvests declined in 3 of the 4 USGMAs that would be crossed by the alternatives (Table 3-94).

Suitable sage grouse nesting habitats include areas within 0.5 to 3 miles from leks (Pyrah, 1971; Wallestad and Pyrah, 1974; Martin, 1976; Braun *et al.*, 1977), but sage grouse may nest up to 12 miles from the lek where they were captured (Heath *et al.*, 1997). Three important habitat components for sage grouse include strutting/nesting grounds, brood rearing areas, and wintering areas. Not every lek that has been identified in Wyoming is currently active or has been monitored within the past several years to determine current level of use. And, there may be some areas which would be crossed by the alternatives that have not been surveyed for leks recently and extensive searches for leks in South Dakota have, for the most part, not been conducted.

Sage grouse typically nest on the ground beneath sagebrush 15 to 22 inches tall (Braun *et al.*, 1977) and depend on sufficient sagebrush canopy cover for nest concealment (Pyrah, 1971). Sage grouse chicks consume insects and forbs (Peterson, 1970; Wallestad, 1975) and consumption of water is dependent on forb succulence

Table 3-97 Game Species Harvest in Waterfowl Management Areas and Upland and Small Game Management Areas that Would be Crossed by the Alternatives in Wyoming			
Game Species Category	**Management Area**	**Game Species**	**1997 Harvest of Species in Management Area**
Waterfowl	WFMA 1A - Missouri, Little Powder River	Geese	127
		Ducks	1,293
Upland Game Birds	USGMA 36 - Niobrara	Pheasant	212
		Chukar Partridge	42
		Sage Grouse	0
		Sharp-Tailed Grouse	14
		Mourning Doves	14
	USGMA 39 - Belle Fourche	Pheasant	56
		Gray Partridge	70
		Sage Grouse	70
		Sharp-Tailed Grouse	127
		Mourning Dove	318
	USGMA 43 - Weston	Gray Partridge	91
		Sharp-Tailed Grouse	275
		Mourning Dove	466
	USGMA 44 - Black Hills	Ruffed Grouse	106
		Sage Grouse	176
		Sharp-Tailed Grouse	190
		Mourning Dove	282
Wild Turkey	Hunt Area 1 - Black Hills	Spring Harvest	511
		Fall Harvest	64
Small Game	USGMA 36 - Niobrara	Cottontail	311
	USGMA 39 - Belle Fourche	Cottontail	685
		Squirrel	106
	USGMA 43 - Weston	Cottontail	14
	USGMA 44 - Black Hills	Cottontail	98
		Squirrel	70
Rothwell (1998b)			

(Wallestad, 1971). During summer, sage grouse tend to stay within 1.5 miles of water where meadow and/or riparian areas along intermittent and perennial streams and playas are important brood-rearing habitats (Hayden-Wing *et al.*, 1985). Recent studies have shown that limited herbaceous vegetative cover (grasses and forbs) is significantly related to nest failure, usually due to predators. These studies point to the influence of livestock grazing on sage grouse reproductive success (Gregg *et al.*, 1994; Heath *et al.*, 1997; Sveum *et al.*, 1998).

Harvests of other game bird species in the project area show varying trends (Table 3-99). In the past 8 years, pheasants were only harvested in 1997. Chukar partridge and gray partridge have been harvested intermittently. While mourning dove harvests in USGMA 39, 43 and 44 have been erratic, harvests in USGMA 36 have declined dramatically since 1995. Sharp-tailed grouse harvests have also been quite variable and in some years, no harvest occurred in some areas. Ruffed grouse have only been harvested in the Black Hills USGMA 44.

In Wyoming WGFD biologists have documented 14 sage grouse leks within 1 mile of Alternative B (Table 3-100), 10 sage grouse leks within 1 mile of Alternative C (Table 3-101), and 9 sage grouse leks within 1 mile of Alternative D (Table 3-102). There are no sage grouse leks within 2 miles of any of the proposed mine loops.

Table 3-98
Number of Bird Species Observed on Breeding Bird Survey Routes in Wyoming and South Dakota

County and State	Breeding Bird Survey Route and Number	Number of Species Observed in General Group or Habitat Category									
		Wading & Water Birds	Waterfowl	Shorebirds	Raptors	Upland Game Birds	Grassland Species	Shrubland Species	Riparian Shrub & Forest	Coniferous Woodland Species	Cliffs &- Canyon Species
Campbell WY	Piney-92047	1	3	2	8	3	9	10	9	6	2
	Highlight-92067	1	6	2	6	3	10	7	6	4	2
Converse WY	Bill-92013	0	4	1	6	2	9	6	7	3	2
Crook WY	Government Valley-92150	2	1	3	5	5	7	6	14	8	1
Niobrara WY	Redbird-92014	0	1	2	8	0	9	10	18	8	1
	Riverview-92068	2	10	2	10	2	7	7	11	4	2
Weston WY	Upton-92049	2	8	4	7	4	7	8	10	6	2
	Newcastle-92069	3	8	3	8	3	9	8	13	11	2
	Raven-92070	0	2	1	7	4	7	8	13	8	2
	Hampshire-92214	0	0	2	2	1	7	8	8	6	2
Custer SD	Hazelrodt-81905	0	1	2	4	4	9	7	17	24	3
	Pleasant Valley-81046	0	0	1	5	2	2	4	9	18	2
Fall River SD	Pioneer-81900	5	10	4	6	3	8	5	10	0	0
	Cottonwood-81901	4	12	6	9	1	7	7	12	2	1
Haakon SD	Ottumwa-81030	6	10	5	8	3	11	5	18	2	0
Pennington SD	Owanka-81026	4	13	3	8	7	10	7	20	8	3
	Badlands-81043	2	6	4	9	3	10	8	16	9	4

Table 3-99
Trends of Upland Game Bird Harvests in Upland and Small Game Management Areas Which Would be Crossed by the Alternatives in Wyoming

Upland and Small Game Management Area	Game Species	Harvest Trend							
		1990	1991	1992	1993	1994	1995	1996	1997
USGMA 36 Niobrara	Pheasant	0	0	0	0	0	0	0	212
	Chukar Partridge	0	0	21	0	0	13	0	42
	Sage Grouse	3161	381	113	32	165	60	22	0
	Sharp-tailed Grouse	0	36	0	0	89	86	0	14
	Mourning Dove	1103	1661	606	1373	1077	1626	378	14
USGMA 39 Belle Fourche	Pheasant	0	0	0	0	0	0	0	56
	Gray Partridge	0	0	25	0	0	0	36	70
	Sage Grouse	244	360	186	90	96	35	15	70
	Sharp-tailed Grouse	0	0	37	23	31	46	0	127
	Mourning Dove	713	89	215	38	173	443	302	318
USGMA 43 Weston	Gray Partridge	0	20	12	0	0	0	0	91
	Sage Grouse	207	401	184	88	129	4	30	0
	Sharp-tailed Grouse	51	95	92	6	38	32	70	275
	Mourning Dove	441	463	270	100	231	86	119	466
USGMA 44 Black Hills	Ruffed Grouse	113	146	107	42	140	46	4	106
	Sage Grouse	160	234	188	41	16	155	45	176
	Sharp-tailed Grouse	110	89	117	86	96	118	84	190
	Mourning Dove	144	361	202	360	5	683	497	282

Table 3-100
Number of Known Sage Grouse and Sharp-tailed Grouse Leks Within 1 Mile of Alternative B in Wyoming

Upland and Small Game Management Area	Grouse Species	Number of Leks by Land Ownership				
		Forest Service	BLM	State	Private	Total
USGMA 36 Niobrara	Sage Grouse	1	0	1	1	3
	Sharp-tailed Grouse	0	0	0	0	0
	Total	1	0	1	1	3
USGMA 39 Belle Fourche	Sage Grouse	2	0	1	8	11
	Sharp-tailed Grouse	0	0	0	0	0
	Total	2	0	1	8	11
USGMA 43 Weston	Sage Grouse	0	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0	0
	Total	0	0	0	0	0
USGMA 44 Black Hills	Sage Grouse	0	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0	0
	Total	0	0	0	0	0

Source: Wyoming Game and Fish Department Data, District 3 and District 7

Table 3-101 Number of Known Sage Grouse and Sharp-tailed Grouse Leks Within 1 Mile of Alternative C in Wyoming						
Upland and Small Game Management Area	Grouse Species	Number of Leks by Land Ownership				
		Forest Service	BLM	State	Private	Total
USGMA 36 Niobrara	Sage Grouse	2	0	0	1	3
	Sharp-tailed Grouse	0	0	0	0	0
	Total	2	0	0	1	3
USGMA 39 Belle Fourche	Sage Grouse	0	0	0	7	7
	Sharp-tailed Grouse	0	0	0	0	0
	Total	0	0	0	7	7
USGMA 43 Weston	Sage Grouse	0	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0	0
	Total	0	0	0	0	0
USGMA 44 Black Hills	Sage Grouse	0	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0	0
	Total	0	0	0	0	0
Source: Wyoming Game and Fish Department Data, District 3 and District 7						

Table 3-102 Number of Known Sage Grouse and Sharp-tailed Grouse Leks Within 1 Mile of Alternative D in Wyoming						
Upland and Small Game Management Area	Grouse Species	Number of Leks by Land Ownership				
		Forest Service	BLM	State	Private	Total
USGMA 36 Niobrara	Sage Grouse	0	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0	0
	Total	0	0	0	0	0
USGMA 39 Belle Fourche	Sage Grouse	0	0	0	9	9
	Sharp-tailed Grouse	0	0	0	0	0
	Total	0	0	0	9	9
USGMA 43 Weston	Sage Grouse	0	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0	0
	Total	0	0	0	0	0
USGMA 44 Black Hills	Sage Grouse	0	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0	0
	Total	0	0	0	0	0
Source: Wyoming Game and Fish Department Data, District 3 and District 7						

No sharp-tailed grouse leks in Wyoming are within 1 mile of any alternative. Sharp-tailed grouse on the Great Plains inhabit brushy grasslands often in oak savannahs or early successional stages of mixed (coniferous-deciduous) forests (Prose, 1987). Such habitats appear less common in Wyoming than in South Dakota where short and mixed grass prairies are interrupted by woody draws in tributaries and ravines leading to the Cheyenne River, undoubtedly providing important cover as well as winter food (Prose, 1987).

In South Dakota, some active sharp-tailed grouse leks have been documented along the Cheyenne River in Custer and Pennington counties (Hetlet, 1995a) and Fall River County (Meadows, 1999). Forest Service biologists also provided locations of with leks on BGNG. In all there are 5 sage grouse leks and 9 leks of unidentified grouse species within 1 mile of Alternative B in South Dakota (Table 3-103). Within 1 mile of Alternative C there are 6 sage grouse and 14 leks of unidentified grouse species (Table 3-104) and nearly the same numbers for the

Table 3-103 Number of Known Sage Grouse and Sharp-tailed Grouse Leks Within 1 Mile of Alternative B in South Dakota						
County	Grouse Species	Number of Leks by Land Ownership				
		Forest Service	BLM	State	Private	Total
Fall River	Sage Grouse	0	0	0	5	5
	Sharp-tailed Grouse	0	0	0	0	0
	Unidentified Grouse	0	0	0	0	0
	Total	0	0	0	5	5
Custer	Sage Grouse	0	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0	0
	Unidentified Grouse	1	0	0	1	2
	Total	1	0	0	1	2
Pennington	Sage Grouse	0	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0	0
	Unidentified Grouse	6	0	0	1	7
	Total	6	0	0	1	7
Source: SDGFP and Forest Service, BGNG						

Table 3-104 Number of Known Sage Grouse and Sharp-tailed Grouse Leks Within 1 Mile of Alternative C in South Dakota						
County	Grouse Species	Number of Leks by Land Ownership				
		Forest Service	BLM	State	Private	Total
Fall River	Sage Grouse	0	0	0	6	6
	Sharp-tailed Grouse	0	0	0	0	0
	Unidentified Grouse	0	0	0	0	0
	Total	0	0	0	6	6
Custer	Sage Grouse	0	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0	0
	Unidentified Grouse	2	0	0	4	6
	Total	2	0	0	4	6
Pennington	Sage Grouse	0	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0	0
	Unidentified Grouse	7	0	0	1	8
	Total	7	0	0	1	8
Source: SDGFP and Forest Service, BGNG						

Phiney Flat and W G Flats Variations of Alternative C (Table 3-105 and Table 3-106). No information about leks for either species is available where Alternative D (Table 3-107) deviates from Alternatives B and C in Custer and Pennington counties.

Small Game. Desert cottontails are probably the most abundant small game species in the project area although Nuttall's cottontails and eastern fox squirrels have been harvested within some of the USGMAs (see Table 3-97). Desert cottontails inhabit all vegetation types in the area but the highest populations are expected in greasewood and sagebrush drainages. Nuttall's cottontails are most likely to be in the western part of the project area, in Campbell County, but they tend to be found at higher elevations in riparian willows, aspen and other shrubby vegetation (Clark and Stromberg, 1987). The desert cottontail is a common food source for golden eagles, ferruginous hawks and other raptor species. In the Wyoming portion of the project area, fox squirrels are

Table 3-105
Number of Known Sage Grouse and Sharp-tailed Grouse Leks Within 1 Mile of Alternative C With the Phiney Flat Route Variation in South Dakota

County	Grouse Species	Number of Leks by Land Ownership				
		Forest Service	BLM	State	Private	Total
Fall River	Sage Grouse	0	0	0	6	6
	Sharp-tailed Grouse	0	0	0	0	0
	Unidentified Grouse	0	0	0	0	0
	Total	0	0	0	6	6
Custer	Sage Grouse	0	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0	0
	Unidentified Grouse	3	0	0	4	7
	Total	3	0	0	4	7
Pennington	Sage Grouse	0	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0	0
	Unidentified Grouse	6	0	0	1	7
	Total	6	0	0	1	7

Source: SDGFP and Forest Service, BGNG

Table 3-106
Number of Known Sage Grouse and Sharp-tailed Grouse Leks Within 1 Mile of Alternative C With the W G Flat Route Variation in South Dakota

County	Grouse Species	Number of Leks by Land Ownership				
		Forest Service	BLM	State	Private	Total
Fall River	Sage Grouse	0	0	0	5	5
	Sharp-tailed Grouse	0	0	0	0	0
	Unidentified Grouse	0	0	0	0	0
	Total	0	0	0	5	5
Custer	Sage Grouse	0	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0	0
	Unidentified Grouse	2	0	0	4	6
	Total	2	0	0	4	6
Pennington	Sage Grouse	0	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0	0
	Unidentified Grouse	7	0	0	1	8
	Total	7	0	0	1	8

Source: SDGFP and Forest Service, BGNG

Table 3-107
Number of Known Sage Grouse and Sharp-tailed Grouse Leks Within 1 Mile of Alternative D in South Dakota

County	Grouse Species	Number of Leks by Land Ownership				
		Forest Service	BLM	State	Private	Total
Fall River	Sage Grouse	0	0	0	6	6
	Sharp-tailed Grouse	0	0	0	0	0
	Unidentified Grouse	0	0	0	0	0
	Total	0	0	0	6	6
Custer	Sage Grouse	0	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0	0
	Unidentified Grouse	0	0	0	0	0
	Total	0	0	0	0	0
Pennington	Sage Grouse	0	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0	0
	Unidentified Grouse	0	0	0	0	0
	Total	0	0	0	0	0

Source: SDGFP and Forest Service, BGNG

Table 3-108
Number of Known Raptor Nests Within 0.5 Mile of the Alternatives

Alternative	State	Number of Known Raptor Nests by Land Ownership				
		Forest Service	BLM	State	Private	Total
B (1)	Wyoming	13	2	2	54	71
	South Dakota	1	1	0	10	12
	Total	14	3	2	64	83
C (1)	Wyoming	19	1	3	44	67
	South Dakota	0	1	0	11	12
	Total	19	2	3	55	79
Phiney Flat Route Variation	South Dakota	1	1	0	12	14
W G Flat Route Variation	South Dakota	0	1	0	10	11
D (2)	Wyoming	18	1	1	46	66
	South Dakota	0	1	0	6	7
	Total	18	2	1	52	73

1 = Raptor nest locations from aerial nesting surveys conducted during Spring 1999 and records obtained from Wyoming Department of Environmental Quality, Land Quality Division, annual reports (Appendix D-9) submitted by coal mines in the Powder River Basin, Wyoming.
2 = Raptor nest locations limited to records obtained from Wyoming Department of Environmental Quality, Land Quality Division, annual reports (Appendix D-9) submitted by coal mines in the Powder River Basin, Wyoming except where Alternative D coincides with Alternatives B and C where aerial surveys were conducted in 1999.

most common in the Black Hills, probably associated with deciduous cottonwoods along streams (Clark and Stromberg, 1987).

Furbearers. Beaver, muskrat, mink, badger, striped skunk, red fox, bobcat, ermine and long-tailed weasels are expected to occur locally in the Wyoming portion of the project area. These species would be expected to occur throughout most of the wildlife habitat types present. Harvest of furbearers in Wyoming is not summarized for different WGFD management areas and consequently not included in Table 3-97.

Non-Game Wildlife

Raptors. Raptors nesting within the project area have been documented by several sources including WGFD, Forest Service, BLM records, WNDDB, SDNHDB, annual surveys conducted on coal mines in the Thunder Basin, and NBS breeding bird surveys. Raptor surveys on coal mines indicate there are 18 ferruginous hawk nests, 3 red-tailed hawk nests, 2 golden eagle and 1 great horned owl nest within 0.5 mile of the proposed mine loops. Raptor nesting surveys were conducted in the Spring of 1999 along Alternatives B and C in South Dakota and Wyoming and a portion of Alternative D in Wyoming. Those data have been summarized in Table 3-108 which indicates the number of known raptor nests, active or inactive, that are within 0.5 mile of each alternative. However, that data also reflects the levels of effort that have been applied to surveying nests along each route.

At least 13 species of nesting raptors have been observed in the project area including bald and golden eagles, turkey vultures, ferruginous hawk, red-tailed and Swainson's hawks, northern harrier, prairie falcon, merlin, American kestrel, great horned owl, burrowing owl, and short-eared owl. Osprey, Cooper's hawk, sharp-shinned hawk, northern goshawk, rough-legged hawk, barn owl, snowy owl, northern pygmy owl, long-eared owl and northern saw-whet owls have been observed in the region within Wyoming (Luce *et al.,* 1997) but there are no reports of their nesting. Observations of these species have been infrequent and mostly coincide with spring and/or fall migrations. Rough-legged hawks are winter residents.

In South Dakota, red-tailed hawks have been seen on every breeding bird survey route (see Table 3-98). Other species commonly observed include northern harriers, Swainson's hawk, ferruginous hawk, golden eagle, American kestrel, great horned owl, burrowing owl and short-eared owl. Turkey vultures and prairie falcons were observed on rare occasions.

Rocky knobs, cliffs, and low rock outcrops provide suitable nesting substrates for ferruginous hawks, prairie falcons, and kestrels. Nesting by merlins, red-tailed hawks, great horned owls and Swainson's hawks is most likely restricted to the cottonwood riparian zones along the Cheyenne River and tributaries. Golden eagles are likely to nest in a variety of substrates but nests are concentrated in riparian cottonwoods. Burrowing owls nest in burrows excavated by prairie dogs or other fossorial mammals and short-eared owls nest on the ground, often in low vegetation (Johnsgard, 1988).

During spring, peregrine falcons migrate through South Dakota from March through late May and fall migrations occur between September and November, most in late September (South Dakota Ornithologists' Union, 1991). No reintroduction efforts have been made in the vicinity of the alternatives and no suitable or potential nesting habitat exists along any alternative in Wyoming and South Dakota. Young peregines were placed at a release site in the Black Hills in 1979 but they did not return in subsequent years (Burnham *et al.*, 1988). One peregrine nest record in 1945 was within the Black Hills in Pennington County and another in 1976 along the Cheyenne River in Haakon County, South Dakota are the only breeding records found for the project area vicinity (South Dakota Ornithologists' Union, 1991). Peregrine falcons may pass near the alternatives during migrations but available information indicates their occurrence is infrequent and unpredictable.

According to the WGFD's WOS, only one record of a peregrine falcon exists in the vicinity of the alternatives: one was seen in June, 1984 near Riverview in northeast Niobrara County. No records of peregrine falcons were provided by the South Dakota Natural Heritage Data Base (SDNHDB) although they have been occasionally observed in the Black Hills, Pennington County, during summers and migrations (Ashton and Dowd, 1991; South Dakota Ornithologists' Union, 1991).

Nongame Wildlife Species. A variety of nongame mammals, birds, and herpetofauna are likely to inhabit the project area. Nongame mammals known or expected include Merriam's shrew, little brown myotis, long-legged myotis, big brown bat, silver haired bat, and hoary bat (Priday and Luce, 1997), white-tailed jackrabbit, black-tailed jackrabbit, least chipmunk, yellow-bellied marmot, thirteen-lined ground squirrel, black-tailed prairie dog, northern and plains pocket gophers, olive-backed and silky pocket mice, Ord's kangaroo rat, plains and western harvest mice, bushy-tailed wood rat, deer mouse, northern grasshopper mouse, southern red-backed vole, prairie, meadow and sagebrush voles, porcupine, and coyote.

Riparian zones associated with the Cheyenne River and its tributaries provide habitats for and generally support the greatest variety of bird species in Wyoming and South Dakota. NBS breeding bird survey data (Table 3-98) indicates that these habitats and associated riparian croplands support several species of shorebirds (killdeer, avocet, willet, spotted sandpiper, upland sandpiper, long-billed curlew, black tern), downy woodpecker and red-shafted flicker, flycatchers (willow, least, cordilleran), magpie, Cassin's kingbird, blackbirds (yellow-headed, red-winged, Brewer's), brown-headed cowbird, common yellowthroat, yellow-breasted chat, sparrows (white-crowned, chipping, song), a variety of swallows (tree, violet-green, bank, cliff, barn), yellow warbler and Wilson's warbler. Many of these species undoubtedly nest in the cottonwood-willow riparian zone in tree cavities or tree-shrub substrates and some undoubtedly occur in coniferous woodlands, as well. Great blue heron rookeries are scattered where cottonwoods are present.

Native short and mixed grass prairies, sagebrush, greasewood, and rock outcrop habitats present within the project area support numerous non-game bird species. The predominant passerine in the area is the horned lark, a year-long resident. Common summer visitors in local shrub-dominated habitats include Brewer's sparrow, vesper sparrow, sage sparrow, lark bunting, green-tailed towhee, and sage thrasher. Rock wrens, cliff swallows, bank swallows and Say's phoebes have been seen in rocky draws or along rock outcrops. Grasslands in the area support species such as bobolink, grasshopper sparrows, chestnut-collared longspurs, McCown's longspur, western meadowlark, and lark bunting. The National Partners-In-Flight program has identified and assigned a numeric rating with regards to the importance of TBNG and BGNG.

Some species are found only in ponderosa pine woodlands that are most extensive in South Dakota. Those species observed include spotted towhee, solitary and warbling vireos, mountain chickadee, red- and white-breasted nuthatches, Townsend's solitaire, Swainson's thrush, pine grosbeak, red crossbill, and pine siskin.

Tiger salamanders, Woodhouse's toad, Great Plains toad, and northern leopard frogs probably occur in emergent wetlands in the project area of Wyoming (WNDDB, 1999; Baxter and Stone, 1980; Luce *et al.*, 1997). Woodhouse's toad and leopard frogs have been observed along the Cheyenne River in South Dakota (Hetlet, 1994) as well as spiny softshell turtle and unidentified garter snake. Other reptiles likely to be found in the vicinity of the project in South Dakota include short-horned lizard and six-lined racerunner (SDNHDB, 1999). In Wyoming, grasslands, sagebrush, greasewood and rock outcrops are suitable habitats for the eastern short-horned lizard, northern sagebrush lizard, prairie rattlesnake, bullsnake, and plains hognose snake. Eastern yellowbelly race is common in woodlands in the Black Hills. Wandering and red-sided garter snakes might occur in upland grassland and sagebrush habitats but is more closely associated with permanent water (Baxter and Stone, 1980; Luce *et al.*, 1997).

Fisheries

In Wyoming, the alternatives would not cross streams that can support game fisheries although there are some ponds and reservoirs in the region that support rainbow trout and largemouth bass (BLM, 1998). Fish species recently sampled in the Cheyenne River and Wyoming tributaries (Beaver Creek, Stockade Creek, Lance Creek and Indian Creek) include common carp, fathead minnow, flathead chub, longnose dace, plains minnow, sand shiner, river carpsucker, white sucker, black bullhead, plains killifish, and green sunfish (Patton *et al.*, 1998). Samples taken in the upper reaches of the Belle Fourche River include common carp, common shiner, fathead minnow, longnose dace, plains minnow, red shiner, sand shiner, white sucker, black bullhead, and green sunfish (Patton *et al.*, 1998)

The only fishery in the South Dakota that would be crossed by the alternatives is the Cheyenne River. However, the principal game species there is channel catfish (USFWS, 1993a). Recent (1996 and 1997) samples taken in the upper reach of the Cheyenne River - Wasta to Angostura Reservoir - included many of those found in Wyoming. Species reported only from the Cheyenne River in South Dakota include western silvery minnow, emerald shiner, shorthead redhorse, goldeye, freshwater drum, white bass, sturgeon chub, stonecat, and spottail shiner as most frequently sampled (8 or more captured). Infrequent species were sauger, smallmouth bass, largemouth bass, plains topminnow, spottail shiner, yellow bullhead, plains killifish, bluegill, creek chub, emerald shiner, northern pike and sturgeon chub, noted earlier (Hampton, 1998).

CHAPTER FOUR - ENVIRONMENTAL CONSEQUENCES

4.1 Introduction

It has been a number of years since a new heavy haul railroad has been proposed for construction in the western United States. For the most part, existing railroad corridors in the western United States were established prior to the turn of the century and their routes were determined long before environmental regulations were adopted. Grade was a major factor in selecting the routes for the existing railroads - the flatter the route the less excavation which resulted in lower construction costs. Grade also affects the operating cost of a railroad. As a result, existing railroads were aligned in many places along the flood plains of major rivers and streams where grade was the least steep.

Although a century has passed, grade remains one of the primary considerations in selecting an acceptable route for DM&E's new railroad. Associated with the new railroad are a unique set of circumstances that are not typically encountered in other linear projects, such as pipelines and transmission lines. The new railroad has specific operable grade and curve limits. Feasible alternative routes for the new railroad are, to a large degree, limited to a grade of not more than 1 percent. According to DM&E, this why using their exiting Black Hills Subdivision Branch Line is not a feasible alternative - the grades are just too steep for a heavy haul railroad. This grade limitation reduces the number of feasible alternative routes between Wall and the SPRB coal mines to just a few and makes site-specific avoidance of natural resource conflicts very difficult or, in many cases, impossible. Additional information regarding the effects of grade on route suitability is contained in the 404(b)(1) showing prepared for the COE.

Like nearly a century ago, the feasible alternatives are still largely restricted to drainage ways where grade is the least steep. Construction outside of these drainage ways would necessitate moving so much dirt to achieve an operable grade, that construction of the new railroad would become cost prohibitive. Unfortunately, from an environmental perspective, sensitive natural resources in the West tend to be concentrated in drainage ways and along stream corridors. Consequently, impacts to sensitive natural resources are somewhat proportional to how closely the alternatives for the new railroad follow drainage ways.

Similar to Chapter Three, the impact discussion in this chapter is organized by resource and alternative. However, not all of the resource impacts are described individually for each alternative. In some cases, alternative impacts are essentially or nearly the same. In these cases, impacts are described for the alternatives together to avoid unnecessary repetition.

Significance criteria were developed for most of the impact analyses to measure the degree to which an impact would affect the human and natural environment. Developing significance criteria is difficult for a number of reasons. First, it is often difficult to quantify impacts for some resources. In these cases, a significance determination must be subjective and often rely on the professional opinion of the persons preparing and reviewing the impact analysis. Second, for the reader the significance of an impact is often framed in terms of personal experience. For instance, persons who benefit directly from the positive economic impacts of the new railroad are more likely to consider that positive impact more significant than someone who will not receive financial gain. Similarly, someone who recreates in the project area is likely to find conflicts with the new railroad much more severe than someone who recreates elsewhere. Finally, much design work for the new railroad remains to be completed. Many decisions made during final design of the new railroad will influence the significance of the impacts to the natural and human environment.

4.2 Socioeconomic Resources

Very little project design information is currently available to assess potential impacts (especially potentially adverse impacts) to socioeconomic resources. For instance, DM&E has determined that it would be necessary to establish mancamps for the new railroad construction crews. However, the locations, sizes and facilities provided at these mancamps are currently unknown. Similarly, the spatial and temporal needs for construction employment are not well defined at this point. To determine potential impacts from the construction workforce, including local hires and inmigrants, more precise estimates of manpower needs will be required. Evaluation of these types of potential socioeconomic impacts must be delayed until further design is completed.

However, information is currently available to allow general estimates of project-wide (not spread-specific) employment, earnings and tax revenues. Information presented below was summarized from a report prepared by Economic Policy & Analysis, Planning Information Corporation, and Charles E. Lamberton (hereafter, Economic Policy & Analysis, *et al.*) which describes the economic impact in Minnesota, South Dakota and Wyoming of the entire DM&E project.[1] It is important to note that information provided in this section was developed from projections made in late 1998 before a number of the current alternatives were developed. As such, the estimates are likely more reflective of the

[1] Portions of that report, including economic and fiscal estimates, have been posted on DM&E's web site (http://www.dmerail.com).

impacts associated with Alternative B, although impacts from Alternative C would be expected to differ only slightly. However, Alternative D is much longer and would affect counties not considered in the initial estimates provided by Economic Policy & Analysis, *et al.* Consequently, estimates of economic and fiscal impacts from Alternative D are not provided in this report.

The economic and fiscal impact estimates provided by Economic Policy & Analysis, *et al.* were based on very preliminary construction design plans prepared by DM&E outside engineering design consultants. These preliminary design plans identified expected labor, materials and project construction costs. Property (ad valorem) tax estimates were based on the preliminary total value of the new railroad (as determined by the engineering design consultants) in each state and local taxing district. DM&E provided estimates of the number of direct DM&E operating jobs and the corresponding direct earnings using national railroad wage rates. Indirect jobs, earnings and tax revenues were also estimated by Economic Policy & Analysis, *et al.*

The engineering design studies for the project identified the cost of labor, materials, equipment, and other items for the new railroad and the type of work to be performed. Economic Policy & Analysis, *et al.* assumed that 30 percent of the estimated labor costs were not available for local spending. Economic Policy & Analysis, *et al.* calculated the number of direct construction jobs by dividing the remaining labor cost by an average construction annual labor cost of $45,000 per job year. They estimated additional indirect jobs created by using the U.S. Department of Commerce, Bureau of Economic Analysis (BEA) job multipliers for the construction industry in South Dakota and Wyoming.[2] The direct and indirect jobs created would result from expenditures by construction workers on motels, restaurants, housing, recreation, service facilities, entertainment, etc. Indirect earnings were calculated by applying the corresponding Regional Input-Output Modeling System (RIMS) II construction earnings multiplier for each of the states.

4.2.1 Construction Impacts. Jobs and earnings were calculated for the direct construction jobs using the construction estimates described above. Indirect jobs and earnings were calculated using BEA multipliers. The direct and indirect jobs estimated reflect the amount of work to be performed - on average about 2 job years per job. However, it should be noted that the actual timing of the jobs may be of shorter duration. For instance, 30 jobs may be required for 1.5 years instead of 20 jobs for 2 years.

[2] These multipliers are published in the BEA's Regional Input-Output Modeling System Handbook.

As is shown on Table 4-1, Economic Policy & Analysis, *et al.* estimated that construction of the new railroad would create nearly 1,850 direct construction-related job years in Wyoming and South Dakota (excluding employment from construction of the yards which was not estimated). These job years would be spread over the 3 year construction period (about 600 job years provided annually during construction). Using the method described above for estimating indirect employment, Economic Policy & Analysis, *et al.* projected a total of over 1,900 indirect job years associated with construction of the new railroad. Like the direct employment, these job years would be spread over the 3 year construction period but, according to Economic Policy & Analysis, *et al.*, would also extend for 2 to 3 years beyond the end of construction. Direct job years would be about equally split between Wyoming and South Dakota while Economic Policy & Analysis, *et al.* suggested nearly twice as much indirect employment would be generated in South Dakota.

Projected earnings are also shown on Table 4-1 and, according to Economic Policy & Analysis, *et al.,* represent the total direct and indirect earnings (without fringes) for the entire construction period. Although estimated jobs are shown by county on Table 4-1, workers may actually reside elsewhere and their expenditures may take place elsewhere.

Economic Policy & Analysis, *et al.* estimated that the construction employment earnings associated with the new railroad in South Dakota and Wyoming would be about $124 million, excluding earnings from construction-related employment at the yards which was not estimated. A total of about $78 million in earnings would be generated in South Dakota and $48 million in Wyoming. Even though direct job years between the states are approximately equal, indirect jobs generated in South Dakota are expected to be about double of those generated in Wyoming.

Taxes were calculated by Economic Policy & Analysis, *et al.* based on the following:

- Excise taxes on contractor billing - excluding material purchased directly by the railroad.
- Sales and use taxes on material purchased directly by the railroad.
- Sales and use taxes generated from the spending by construction workers and indirect employment earnings.
- Income tax, where applicable, on the employment earnings.

Based on the above, Economic Policy & Analysis, *et al.* estimated that construction of the new railroad would generate nearly $15 million in tax payments including

Table 4-1 Summary of Direct and Indirect Construction Employment, Earnings and Tax Revenues from the New Railroad in South Dakota and Wyoming				
	Direct Job Years	Indirect Job Years	Earnings	Taxes
South Dakota				
Pennington	316	536	$30,844,800	$3,037,800
Custer	298	328	$20,585,500	$2,238,100
Fall River	378	418	$26,179,200	$3,011,900
South Dakota Total	992	1,282	$77,609,500	$8,287,800
Wyoming				
Niobrara	88	66	$4,965,000	$942,000
Weston	336	250	$18,867,000	$2,443,000
Converse	78	58	$4,351,000	$525,000
Campbell	350	260	$19,604,000	$2,687,000
Wyoming Total	852	634	$47,787,000	$6,597,000

about $8.3 million in South Dakota and $6.6 million in Wyoming (see Table 4-1).

4.2.2 Operations Impacts. In addition to the construction-related impacts to employment, earnings and revenues discussed above, Economic Policy & Analysis, *et al.* also provided estimates of operation impacts. In their report, they projected direct and indirect operations-related jobs by state. However, these estimates were made using very incomplete design information. As such, the estimates were based on ranges using "high" and "low" facility location cases. The high case represents the impact that would occur if all discretionary location decisions are made to locate facilities within that state. The low case represents the impact that would occur if all discretionary location decisions are made to locate the facility in another state. Another variable considered in the analysis was the amount of coal hauled annually on the new railroad. Two cases were studied: 40 and 100 million tons/year. Table 4-2 provides high and low estimates based on 40 million tons/year hauled and Table 4-3 provides estimates based on the 100 million tons/year case. As can be seen on the tables, the range of impact is significant. (It is important to note that the estimates in Tables 4-2 and 4-3 contain the entire project in South Dakota, including the new railroad and rebuild. Estimates provided by Economic & Policy Analysis, *et al.* did not distinguish between the new railroad and the rebuild.

4.2.2.1 40 Million Tons/Year. At what DM&E terms "start up", Economic & Policy Analysis, *et al.* estimated that approximately 505 DM&E jobs would be created system-wide (Minnesota to Wyoming). In addition, Economic Policy & Analysis, *et al.* estimated that 636 indirect jobs would be generated and that 45 new jobs would be created at Wyoming coal mines. In total, it was estimated 1,115 jobs would be created (direct and indirect). Direct jobs created in South Dakota (including the new railroad and rebuild) would range from 72 (low) to 462 (high), depending on final facility selection decisions. Indirect employment would result in 79 (low) to 506 (high) additional jobs (see Table 4-2). Wyoming direct jobs would range from 14 (low) to 309 (high). Economic & Policy Analysis, *et al.* projected 79 (low) to 405 (high) indirect jobs in Wyoming, some of which include indirect jobs created by 45 additional direct jobs at coal mines. DM&E employees in South Dakota would be expected to earn between $3.7 (low) and $26.9 (high) million annually while indirect earnings were estimated to range from $2.6 (low) to over $18 million (high). DM&E employees in Wyoming could earn between $606,000 (low) to as much as over $17 (low) million annually. Approximately $2.5 million in additional mining earnings would be expected to be generated by new mining jobs in Wyoming. Total tax revenue for both the high and low case is also provided on Table 4-2. In South Dakota, annual tax revenues generated by the operating railroad would be expected to range from $14.4 to $15.9 million. In Wyoming, total tax revenue would range from between $2.7 and $3.5 million. As can be seen on the table, the majority of the revenue would be generated by additional property tax.

4.2.2.2 100 Million Tons/Year. If the operating railroad reaches this level of traffic, Economic & Policy Analysis, *et al.* estimated total employment may reach as high as 4,020. Total DM&E employment in Wyoming could be as low as 14 (low) or as high as 711 (see Table 4-3). Direct new mining jobs could be nearly 600. South Dakota direct employment would range from 86 to 1,117 and indirect jobs could be as low as 94 or as high as 1,223.

Annual earnings of DM&E employees in Wyoming could be as low as $606,000 but could reach nearly $42 million. South Dakota DM&E employee earnings could be as low as $4.5 million and as high as nearly $69 million. As shown on Table 4-3, total tax revenue in Wyoming for this scenario is anticipated to be between $4.7 and $6.7 million. South Dakota total tax revenues could range from over $17 to nearly $22 million. The majority of the tax revenues would be from property tax except for the high

Table 4-2
Estimated Annual Jobs, Earnings and Annual Tax Revenues Generated in Wyoming and South Dakota
(40 million tons per year coal hauled)

	South Dakota (1)		Wyoming	
	High	Low	High	Low
Annual Jobs Created				
Direct Jobs	462	72	309	14
Mining Jobs			45	45
Indirect Jobs	506	79	405	86
Total Jobs Created	968	151	759	145
Annual Earnings Created				
Direct Earnings	$26,861,000	$3,755,000	$17,258,000	$606,000
Mining Earnings			$2,500,000	$2,500,000
Indirect Earnings	$18,401,000	$2,572,000	$12,981,000	$2,016,000
Total Earnings Created	$45,262,000	$6,327,000	$32,739,000	$5,122,000
Annual Tax Revenues Generated				
Sales/Use	$1,743,000	$244,000	$947,000	$148,000
Income Tax (2)				
Property Tax	$14,123,000	$14,123,000	$2,597,000	$2,597,000
Total Tax Revenues	$15,866,000	$14,367,000	$3,544,000	$2,745,000

1 = Includes both the rebuild and new railroad in South Dakota
2 = Excludes corporate income taxes

Table 4-3
Estimated Annual Jobs, Earnings and Annual Tax Revenues Generated in Wyoming and South Dakota
(100 million tons per year coal hauled)

	South Dakota (1)		Wyoming	
	High	Low	High	Low
Annual Jobs Created				
Direct Jobs	1,117	86	711	14
Mining Jobs			591	591
Indirect Jobs	1,223	94	1,707	953
Total Jobs Created	2,340	180	3,009	1,558
Annual Earnings Created				
Direct Earnings	$68,877,000	$4,446,000	$41,805,000	$606,000
Mining Earnings			$32,200,000	$32,200,000
Indirect Earnings	$47,187,000	$3,046,000	$48,766,000	$21,636,000
Total Earnings Created	$116,064,000	$7,492,000	$122,771,000	$54,442,000
Annual Tax Revenues Generated				
Sales/Use	$4,468,000	$288,000	$3,551,000	$1,575,000
Income Tax (2)				
Property Tax	$17,184,000	$17,184,000	$3,138,000	$3,138,000
Total Tax Revenues	$21,652,000	$17,472,000	$6,689,000	$4,713,000

1 = Includes both the rebuild and new railroad in South Dakota
2 = Excludes corporate income taxes

case for Wyoming for which sales and use tax would be nearly equal to property tax.

4.2.3 Proposed Yard Sites. Subsequent to the report prepared by Economic & Policy Analysis, et al., DM&E made final decisions regarding yards for the new railroad. DM&E has announced a major rail staging facility at the Western Yard. The facility is expected to include maintenance and minor repair facilities. At full operations DM&E expects the facilities at the Western Yard will cost in excess of $50 million and employ approximately 300 direct railroad employees. About 100 direct rail employees would be employed within its first year of operations. Support services required for the facility is expected to generate additional indirect employment which could be significant. According to DM&E, permanent railroad salary and benefit packages for direct employees at this yard will average from $60,000 to $90,000 annually.

The railroad also intends to construct a yard at Wall. At full operations the Wall Yard is expected to create 50 jobs. The Wall Yard will be coordinated with track maintenance facilities in Philip and Midland, South Dakota. It will serve as a staging yard for loaded and empty unit trains. It will also contain 2 marshaling tracks for use by manifest, grain, and way freight trains in serving local area customers.

Projections of employment have not been provided for the Edgemont Interchange Yard.

4.3 Environmental Justice

Over the last decade, attention to the impact of environmental pollution on low-income and minority segments of society has been steadily growing. Environmental justice is a concern because communities sometimes lack political clout, economic means, or awareness of rights and opportunities to participate in environmental decision making.[3] Generally, environmental justice means the fair treatment of people of all races and incomes with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment implies that no person or group of people should shoulder a disproportionate share of negative environmental impacts.

Concern that low-income and minority segments of society bear a disproportionate amount of adverse health and environmental effects, led President Clinton to issue Executive Order 12898 in 1994, focusing Federal agency attention on these issues. The purpose of the Executive Order is to achieve equal environmental protection so no segment of the population, regardless of race, ethnicity, culture or income bears an undue burden of environmental pollution and to ensure that the benefits of environmental protection are shared by everyone.

4.3.1 Significance Criteria. A significant impact is defined as a disproportionate share of environmental impacts from construction or operation of the new railroad on minority or low-income communities.

4.3.2 Summary of Impacts Common to All Alternatives (Except the No Action Alternative). None of the alternatives are anticipated to result in a disproportionate share of the negative environmental impacts on minority or low-income communities. As was discussed in Section 3.3.5, Alternative B would pass near the Pine Ridge Indian Reservation in South Dakota (see Figure 1-1). EPA identified the Pine Ridge Indian Reservation as an Environmental Justice Focus Area because of poverty and the minority population. Although less than 1 mile from the reservation, Alternative B would not be constructed on the reservation. In fact, at its closest Alternative B would be constructed on NFS lands and would be separated from the reservation by the Cheyenne River.

All the alternatives and the North Antelope mine loops would be constructed in Census BNA 9561 in Converse County (see Figure 3-1) north of Bill. As was discussed in Section 3.3.5, 2 of the 6 block groups in BNA 9561 exceed 30 percent of the population below the poverty level and are therefore considered Environmental Justice Focus Areas by EPA. However, as can be seen on Figure 3-1, neither below poverty block group would be crossed by the alternatives or the mine loop options.

In summary, although 2 Environmental Justice Focus Areas are in close proximity to the alternatives, only one would be crossed by the alternatives. However, below poverty block groups in this focus area would not be crossed. Therefore, issues of environmental justice should not be a concern for the new railroad.

4.4 Transportation

Additional information regarding potential impacts to transportation are presented in the draft EIS. Included in the EIS are the types of crossings which would be provided (at grade or separated crossings) and a discussion of impacts to the traveling public's safety at the crossings. Other safety issues, such as the potential disruption of emergency response vehicle travel across occupied tracks, are also addressed in the draft EIS. This

[3] In 1982, in Warren County, North Carolina, the environmental justice movement grew out of a grassroots protest against the siting of a PCB landfill in a predominantly African-American community. This protest led to an investigation by the General Accounting Office which concluded that there was a correlation between the siting of hazardous waste landfills and race in the host communities.

section focuses primarily on impacts associated with construction-related traffic.

4.4.1 Summary of Impacts Common to All Alternatives (Except the No Action Alternative). Potential impacts from all of the alternatives, except Alternative A, could include the following:

- Increased traffic volume on area highways and roads.
- Accelerated deterioration of public road surfaces.
- Increased road maintenance requirements because of increased traffic.
- Increased likelihood of traffic accidents, vehicle-person and vehicle-animal collisions.
- Increased speeding.

As was discussed in Section 2.5.4, preliminary design indicates that each construction spread would employ about 50 workers. Most construction traffic would travel along the construction rights-of-way, however public roads would be utilized to access construction sites. Although traffic volumes from the estimated 50 workers per spread have not been estimated, peak traffic on public roads from these workers is expected to occur during shift changes. Construction is planned to occur between 7 a.m. and midnight, therefore, 2 periods at about 7 a.m. and 4 p.m. could impact local traffic on public roads utilized to access construction sites. This impact is expected to be insignificant for several reasons. First, traffic from the estimated 50 workers should not cause noticeable increases in traffic volumes on area highways and roads. Secondly, construction activities would be occurring at numerous locations over the entire spread and added construction-related traffic would be dispersed throughout the area.

Many of the public roads in the project area are unpaved. Although traffic volumes are not expected to be significant, repeated use of these roads, frequent heavy equipment traffic (i.e., large trucks) and use during adverse weather conditions are expected to significantly impact these roads. Construction-related traffic is expected to accelerate the deterioration of these road surfaces and significantly increase the need for road maintenance.

Construction traffic is likely to affect road surfaces by generating wash boards, pot-holes, ruts, ponds or puddles. These impacts will require more frequent grading and resurfacing with gravel. If deteriorated road conditions are not mitigated, they may become safety hazards. Increased traffic on unpaved roads during dry periods will increase fugitive dust which can be a safety hazard and an annoyance to local residents. Dust abatement can be temporarily accomplished by watering the road or, for long-term remedies, by applying chemical binders to the road surface. Heavy equipment traffic could also damage road structures such as bridges and cattle guards. However, road deterioration impacts to paved roads in the project area are not generally anticipated.

Impacts from construction-related traffic would be considered a short-term impact because this traffic would only occur during construction of the new railroad which is expected to last approximately 3 years. The major road crossings listed in Tables 3-10 through 3-14 could be potential safety hazards from construction traffic merging onto the construction right-of-way or onto collector roads from the construction right-of-way. This hazard would depend on site distances at intersections and average daily traffic on those roads. Traffic controls, including warning signs, flag personnel, or turn-outs may be required during construction at those crossings to prevent accidents.

Each of the alternatives would cross grassland roads which are identified in Tables 3-15 through 3-17. These roads, as well as two track roads on the grasslands will require a commercial use permit if they are to be used by heavy equipment (i.e., greater the 33,000 pounds gross vehicle weight). Some of the roads may have a seasonal use restriction or may require upgrading if used out of season. All other two-track roads on NFS lands that would be used during construction would need to be identified with the proposed type and amount of traffic as well as the season of use. This information is currently unavailable.

Prior to project implementation, a transportation plan would be developed to allow for reasonable access by the public to the grasslands while reducing the number of grade crossings and subsequent train whistle noise impacts. The transportation plan would address any new roads that may be necessary to link the existing Forest Service road system to maintain public access along with the design standards that the roads would be constructed to. An objective of the plan would be to minimize the amount of new road miles that would be constructed on the grasslands to maintain reasonable public access to either side of the tracks. The plan would also address appropriate right-of-way fence standards to restrict or allow cattle passage at these crossings. In addition, the plan would address administrative needs for compliance oversight during construction or reconstruction of grassland roads to ensure that design standards are followed.

4.4.2 Alternative A (No Action). Implementation of this alternative would not increase traffic levels or cause any of impacts to area roads described above.

4.4.3 Alternative B (Proposed Action). As summarized in Table 3-10, this alternative would cross a total of 61 major roads in South Dakota and Wyoming. In

South Dakota, 35 major roads would be crossed including 8 in Pennington County, 6 in Custer County and 21 in Fall River County. In Wyoming, there would be 26 major roads crossed including 3 in Niobrara County, 8 in Weston County, 14 in Campbell County and 1 in Converse County. Most of these road crossings could provide access points to the construction right-of-way. Alternative B would cross 19 grassland roads with 11 of these crossings on BGNG and 8 crossings on TBNG (see Table 3-15).

4.4.4 Alternative C (Modified Proposed Action) and Route Variations. Alternative C would cross a total of 59 major roads in South Dakota and Wyoming (see Table 3-11). In South Dakota, 34 major roads would be crossed including 10 in Pennington County, 7 in Custer County and 17 in Fall River County. In South Dakota, Alternative C would cross the same roads as Alternative B but would have 1 less crossing. Compared to Alternative B, this alternative would not cross County Road 2G, County Road 14 or County Road 6E in Fall River, County. It would also cross County Road 2 two less times than Alternative B. However, this alternative would cross County Road 2C in Fall River County while Alternative B would not.

In Wyoming, this alternative would cross 25 major roads, one less than Alternative B. Crossings would include 3 in Niobrara County, 7 in Weston County, 12 in Campbell County and 3 in Converse County. Alternative C would cross the same roads in Niobrara County as Alternative B. In Weston County, this alternative would not cross the Rochelle Road or the Rochelle Hills Road but Alternative B would. Alternative C would cross State Highway 450 in Campbell County, while Alternative B would cross that highway in Weston County.

Alternative C would cross 16 grassland roads, 3 less than Alternative B. Ten of these roads would be crossed on BGNG and 6 would be crossed on TBNG.

Phiney Flat Route Variation. This route variation would cross the same roads in Wyoming as Alternative C. In South Dakota, this route variation would cross the same roads as Alternative C but would have an additional crossing of Creston Road in Pennington County and would cross Custer County Road 121 (Spring Creek Road) at 4 locations compared to 1 crossing by Alternative C (see Table 3-12).

W G Flat Route Variation. This route variation would cross the same roads at the same locations in Wyoming and Pennington and Custer counties, South Dakota as Alternative C. But in Fall River County, South Dakota, 8 additional county roads would be crossed (see Table 3-13).

4.4.5 Alternative D (Existing Corridors Alternative). This alternative would cross a total of 114 major roads in South Dakota and Wyoming, almost twice as many as Alternative C. There would be 68 major roads crossed in South Dakota with 41 of these roads crossed in Pennington County, 8 in Custer County and 19 in Fall River County. Most of the roads which would be crossed in Fall River County would be the same roads that would be crossed by Alternative C. Alternative D would impact many more roads in Pennington County than either Alternative B or C (33 more than Alternative B and 31 more than Alternative C). In addition to being routed through Rapid City, reconstruction of the main line and Black Hills Subdivision Branch Line would occur in Wall, Wasta, New Underwood, Box Elder, Hermosa, and Fairburn. Alternatives B or C would not be constructed through these communities. Many of the road crossings in Pennington County would occur in Rapid City where impacts to transportation could be significant. The draft EIS addresses these impacts.

If Alternative D was implemented, most agree it would be necessary to find alternative routes around Rapid City and perhaps some of the other towns along DM&E's existing main line and Black Hills Subdivision Branch Line. However, because DM&E would not implement this alternative (the company considers the alternative technically and economically unfeasible), no effort has been made to locate bypasses around these communities.

In Wyoming, a total of 46 road crossings would occur with 17 in Weston County, 5 in Crook County, 21 in Campbell County and 3 in Converse County. Unlike Alternatives B or C, Alternative D would run parallel to the existing BNSF railroad through Newcastle, Osage, Upton and Moorcroft and could compound existing traffic problems in these communities because of the additional train traffic. Questions have been raised about the feasibility of constructing a second railroad adjacent to BNSF's right-of-way through these Wyoming communities. If this alternative was selected, much additional evaluation would be necessary to determine whether bypasses would be required around these communities. Alternatives B and C would avoid communities in Wyoming.

Alternative D would cross the fewest number of grassland roads with only 6 crossed on TBNG (see Table 3-17). NFS lands would not be affected by Alternative D on BGNG.

4.4.6 Proposed Mine Loop Options. The Black Thunder South Mine Loop would only cross one state highway in Campbell County, State Highway 450, in the SW/NW Section 23, T. 43 N., R. 70 W. This option would

not cross any other county or grassland roads. The Black Thunder North mine loop option would not cross any state, county or grassland roads.

The North Antelope West Mine Loop would cross one major road, Irwin Road, in the NE/SW Section 33, T. 41 N., R. 70 W. in Converse County. No state, county or grassland roads would be crossed by the North Antelope East Mine Loop.

4.4.7 Proposed Yard Sites. The Wall Yard would cross Township Road which would also be crossed by Alternatives B and C. The Edgemont Interchange Yard would cross Fall River County Road 15 which would not be crossed by any of the alternatives. The Western Yard would not cross any major roads. Potential impacts to traffic on these roads are expected to be substantially greater because of the potential for delays. To mitigate these impacts, an alternate road or bypass may be required.

4.5 Land Use

4.5.1 Significance Criteria. A significant impact to land use would result if the following occurred:

- Other existing and legitimate land uses are degraded or precluded by the railroad.
- Degradation of the enjoyment or value of adjacent property occurs.
- Health risks or a nuisance or annoyance are introduced to an area where such risks, nuisance, or annoyance did not previously exist.

4.5.2 Summary of Impacts Common to All Alternatives (Except the No Action Alternative). All the alternatives are expected to result in direct changes in current land use. This would occur through conversion of the existing land use to the railroad bed. Although this loss may be locally severe, on the overall landscape the loss would be relatively small and considered insignificant. Many land uses associated with natural process (such as wetlands) would be allowed to continue within the railroad right-of-way, whereas human activities (such as recreation, agriculture and grazing) would not. Direct land use changes are anticipated to be long-term.

Throughout South Dakota and Wyoming, the predominant direct land use conversions would occur in rangeland and cropland types (see Section 3.5). Generally, the conversion would consist of a long, relatively narrow strip of land. Landowners would be compensated for the loss of these areas and mitigation would be developed to insure that economic remnants of land are not created. Impacts associated with conversion of these land use types are not anticipated to be significant and would amount to about 12 to 25 acres per linear mile of new railroad.

However, direct land use conversion associated with the new railroad may not represent the most severe land use impacts. Based on the significance criteria listed above, all the alternatives are anticipated to result in significant direct and indirect adverse impacts to land use whether by degrading or precluding existing uses, affecting adjacent property, or by introducing health risks, nuisance or annoyance where none previously existed. The severity and extent of the impacts by the alternatives are expected to be very different. As discussed below, Alternative D is expected to significantly affect a large number of residences in nearly a dozen communities in South Dakota and Wyoming. Alternatives B and C are expected to have the least significant impact to land use. But, those 2 alternatives would preclude other existing and legitimate land uses, albeit within a narrow and very localized corridor.

Noise and activities produced during construction, followed by railroad operation noise and activity, would extend beyond the limits of the right-of-way corridor for all alternatives. Noise and human presence may degrade or preclude some existing land uses on adjacent lands (such as livestock grazing, recreation, wildlife habitat) and will most certainly be an annoyance to residents living in the project area. Estimates of instantaneous noise levels due to operating trains with and without whistle noise were given in Table 2-6. Existing noise throughout most of the project area for the alternatives is assumed to be 39 dBA during daytime and 32 dBA at night (based on EPA's "farm in valley" noise category). Distance estimates for train noise to attenuate to those background levels (see Table 2-6) clearly demonstrate the long-distance effects that the operating railroad would have on inhabitants in the project area. Health and safety risks, too, will be introduced where and if unauthorized people, pets, and/or livestock cross the tracks or travel within fenced railroad rights-of-way and are struck by trains or debris.

4.5.3 Alternative A (No Action). Implementation of this alternative would not result in any of the impacts described above.

4.5.4 Alternative B (Proposed Action). Changes from existing land uses to a transportation corridor use would be a long-term impact. Existing land uses and land cover that would be affected by Alternative B have been summarized in Table 3-18. In both states, herbaceous rangelands (grasslands) are by far the most affected. Impacts to livestock grazing and to wildlife habitats are expected from land use conversion in any rangeland category by Alternative B. Approximately 260 miles or 86

percent of Alternative B would affect rangelands in Wyoming and South Dakota.

The most significant impacts, however, are expected where the alternative route coincides with residential land uses. Although only 0.3 mile of the route would affect residential land in South Dakota (none in Wyoming), residences in Smithwick and east of Edgemont would be affected since there are several located within 0.1 mile or less of Alternative B. Impacts due to noise, health and safety risks, degradation of the enjoyment or value of these adjacent properties are expected to be significant.

4.5.5 Alternative C (Modified Proposed Action) and Route Variations. For Alternative C and the Phiney Flat and W G Flat route variations, all changes from existing land uses to a transportation corridor land use would be long-term impacts. Existing land uses and land cover in Wyoming and South Dakota that would be affected by Alternative C are summarized in Table 3-19. Similar to Alternative B, rangelands would be affected most with approximately 230 miles or 84 percent of the route crossing that land cover category. Impacts to livestock grazing and to wildlife habitats are expected from conversion of rangelands to railroad use.

Significant impacts are expected where the alternative route coincides with residential lands, but those are only affected at Smithwick. Noise, health and safety risks, degradation of the enjoyment or value of properties adjacent to Alternative C are expected to be significant impacts.

Phiney Flat Route Variation. This variation of Alternative C would affect the same residential areas at Smithwick but no additional residential lands would be affected. Most of the differences between land use and cover affected by the route variation and Alternative C involve croplands, pastures, and herbaceous rangelands, only in South Dakota (see Table 3-20). Land use impacts are expected to be nearly identical to those for Alternative C.

W G Flat Route Variation. Most of differences between land use and cover affected by the W G Flat Route Variation and Alternative C involve wetlands, croplands, pastures, and herbaceous rangelands, only in South Dakota (see Table 3-21). The route variation would affect the same residential areas as Alternative C and the Phiney Flat Route Variation and land use impacts are expected to be nearly identical to those alternatives.

4.5.6 Alternative D (Existing Corridors Alternative). All impacts expected from changes in existing land uses by Alternative D would occur over the long-term. Existing land uses and land cover that would be affected by Alternative D have been summarized in Table 3-22. Reconstructing the existing DM&E railroad would affect considerably more lands identified as residential, commercial or industrial, and mixed urban or built-up lands than any other alternative. By virtue of its total length, the route also passes through more rangeland, croplands and pastures than the other alternatives.

Construction and operation of Alternative D would significantly affect residential areas in South Dakota and Wyoming, more by far than any other alternative. In South Dakota the existing main line passes near residences in Wall, Wasta, New Underwood, Box Elder, near Ellsworth Air Force Base and subdivisions in Rapid City and suburbs, Hermosa, Fairburn, Smithwick, Edgemont, and Dewey. By following the BNSF in Wyoming, Alternative D would pass near residences in Newcastle, Osage, Upton, and Moorcroft. Details of each residential area affected were provided in Section 3.5.2. Impacts due to noise, health and safety risks, degradation of the enjoyment or value of these adjacent properties are expected to be highly significant for this alternative and much higher than the other alternatives. Many thousands of individuals could be adversely affected by this alternative.

4.5.7 Proposed Mine Loop Options. The proposed mine loop options would mostly cross rangeland. The Black Thunder North and South mine loops would also cross the strip mines, quarries and gravel pits category for 0.6 and 1.0 miles, respectively. These two mine loops would also cross a small portion of the industrial category (0.1 miles for Black Thunder North and 0.3 miles for Black Thunder South). The North Antelope East and West mine loops would cross cropland and pasture for 0.3 and 1.9 miles, respectively.

4.5.8 Proposed Yard Sites. The proposed yard site at Wall would mostly affect cropland and pasture. A portion of the site intersects the Transportation, Communication and Utility land use type at the I-90 corridor. Another portion will affect a mixed urban and built-up area adjacent to Wall. Residences in that area will be impacted by the industrial use associated with the yard.

The Edgemont Interchange Yard and Western Yard sites primarily affect herbaceous rangelands and limited cropland or pastureland at the Western Yard. No impacts to residential lands would occur at the Western Yard site in Wyoming, but the Edgemont Interchange Yard Site is proximate to a few scattered residences and within 0.5 mile of Dudley. However, that yard site would be adjacent to existing BNSF tracks and would probably not change the character of land use or noise levels very much from those already present.

4.6 Recreation Resources

Recreation opportunities in close proximity to the alternatives are located in parks, recreation sites and facilities (Badlands National Park, Angostura State Recreation Area, etc.) and on NFS lands on BGNG and TBNG. Most recreation use in the immediate vicinity of the alternatives is associated with NFS lands and consists primarily of dispersed recreation (hiking, hunting, driving, etc.). While it is difficult to accurately determine the actual displacement of dispersed recreationists from the area near the railroad construction and operations, a railroad will cause recreationists who value more primitive settings to look elsewhere for their recreational exper-iences. Construction and operation of the railroad would affect the quality of dispersed recreational experiences (e.g. hunting, camping, hiking, etc.) by increasing traffic and dust during construction, producing noise and night light during operations, and by adding facilities and other disturbances to the landscape. It is anticipated that an unknown number of dispersed recreation users would be displaced from the immediate vicinity of the new railroad.

4.6.1 Significance Criteria. A significant impact to recreation would occur if construction or operation of the alternatives resulted in:

- Introduction of noise, visual or night light pollution into national grasslands or state parks or monuments.
- The elimination of the wilderness eligibility of all or a portion of any area.
- The elimination of the wild and scenic river eligibility of all or a portion of any stream or river.

4.6.2 Parks, Recreation Sites and Facilities. Of all the parks, recreation sites and recreation facilities described in Section 3.6.3, only Badlands National Park has the potential to be adversely affected by the alternatives. All of the other parks, sites and facilities are located over 1.5 miles from the alternatives and would not be significantly affected by construction or operation of the alternatives.

The proximity of Alternative B to Badlands National Park is shown on Figure 3-8. At its closest, the alternative would be about 3,700 feet from the park. Some of the most striking qualities of Badlands is its wilderness character, quiet and solitude. Quiet contemplation is an important park experience. Operating a railroad in close proximity to the park would have an adverse impact on these qualities. Using estimates of noise provided by Burns & McDonnell (see Table 2-6), it is expected that visitors to portions of Badlands National Park shown on Figure 3-8 would be able to hear the railroad. Introducing noise from the operating railroad into the park would be a significant adverse impact.

4.6.3 National Forest System Lands. Table 3-25 lists the current ROS designation for all NFS lands which would be crossed by the alternatives. As can be seen on the table, the vast majority of the lands which would be crossed (including all lands on TBNG) are classified as roaded natural, rural or urban. The operating railroad would be compatible with these ROS designations. However, semi-primitive motorized lands would be crossed by Alternatives B (1.6 miles) and C (0.8 miles) and Alternative C with the W G Flat Route Variation (0.8 miles) and the Phiney Flat Route Variation (0.4 miles) on BGNG.

NFS lands designated as semi-primitive motorized are expected to be predominately natural or natural appearing. The operating railroad would not be compatible with such a designation. If Alternatives B or C are implemented, it would be likely that these lands (described in Section 3.6.2.1) would be degraded to a lower ROS designation. Alternative B would have the largest impact on semi-primitive motorized lands. Alternative B would cross a total of 1.6 miles of semi-primitive motorized lands in the Spring Creek drainage (0.4 miles) and in the Cheyenne River RARE II Area (1.2 miles).

Alternative C would eliminate the crossing of semi-primitive motorized lands in the Cheyenne River RARE II Area (see Figure 3-4). However, this ROS designation would still be crossed in the Spring Creek drainage. In addition, a small area (0.4 miles) of semi-primitive motorized lands would be crossed in the Dry Creek drainage in Custer County by Alternative C. These lands are located in the NW/NE of Section 4, T. 4 S., R. 9 E. This section is the very edge of a large block of NFS lands and Alternative C would directly impact only the northwest corner of this block. The new railroad would create a very small (about 20 acres) isolated parcel of NFS lands which the Forest Service would find extremely difficult to access and manage. This small remnant parcel may be a candidate for exchange.

Indirect impacts to the semi-primitive motorized lands in the Dry Creek drainage are of concern. The operating railroad would introduce sights and sounds over the northern and western edges of this large, contiguous block of NFS lands. As such, the ability of users to enjoy the relatively-primitive characteristics of this area would be diminished. If Alternative C is selected, it may be necessary to reevaluate the ROS designation of portions of the this parcel and select a designation which may be more appropriate for the sights and sounds that will be introduced by the operating railroad. There is one two-track road that would be crossed by Alternative C just north of this area. If it is necessary to use the locomotive

whistle at this crossing, the noise impacts on the semi-primitive motorized area to the south would be compounded.

The Phiney Flat Route Variation would further reduce impacts to semi-primitive motorized lands. This route variation would avoid 0.4 miles of NFS lands with this ROS designation in the Spring Creek drainage.

Although not crossed, Alternative B would be located in close proximity to lands currently managed by BGNG as semi-primitive non-motorized. The location of these lands are shown on Figure 3-6. In the NE of Section 16, T. 4 S., R. 11 E., semi-primitive non-motorized NFS lands would be separated from Alternative B only by the Cheyenne River. This ROS designation has also been applied to lands in Section 21, T. 4 S., R. 11 E. Again, only the Cheyenne River would separate Alternative B from semi-primitive non-motorized lands. Semi-primitive non-motorized lands are managed such that motorized use is not permitted to avoid impacts on recreation opportunities. The lands are managed for primitive recreation experiences where the sights and sounds of human activities are not typically present. Because of its close proximity, it is likely that noise from the operating railroad and visual perturbations along the Cheyenne River adjacent to this ROS designation would degrade the recreation experience of those enjoying the area's wilderness-like qualities. Because there are no roads which would be crossed in this area, exacerbated noise problems from the locomotive whistle should not be a problem. The impacts may require the ROS designation for some of these lands to be lowered.

Although an operating railroad would be compatible with the ROS designations of roaded natural, rural, or urban, the sights and sounds of an operating railroad will displace a number of recreationists from these ROS areas. Those who have enjoyed dispersed camping, wildlife watching, and viewing scenery in the area of the proposed rail line will most likely be displaced to other areas of the grasslands when the railroad is constructed and operating. Motorized recreationists and many hunters who use the grasslands are generally more tolerant of facility additions to the landscape, such as oil wells, stock watering developments, and to some degree, railroads. However, some of these types of recreationists often desire an experience in a more natural appearing setting than adjacent to a railroad, and will seek this experience elsewhere.

As dispersed recreationists are displaced from the vicinity of the railroad, they will seek experiences they desire elsewhere on the grasslands. This will cause an increase of use in areas already experiencing dispersed recreation use. Due to the individual user preferences for the locations and types of experiences they seek, it is difficult to speculate on exactly where use will increase and become more concentrated. However, it can be assumed that such use will increase in areas of current and past high use due to the scenic attractiveness of these areas, hunting opportunities, and other attractions to recreationists.

Construction workers may seek recreation activities on the grasslands. Such increased recreation use, both in the short-term during construction and long-term, from the West Yard workers, may create a need for the Forest Service to respond to providing more concentrated recreation use opportunities, and to protect natural resources by providing developed sites. The increased recreation use from railroad construction and operation workers, and associated persons, may result in a need for increased Forest Service law enforcement efforts. Such increase of use will occur near the railroad from railroad-related persons, as well as elsewhere on the grasslands from those displaced by the railroad construction and operations.

Some of the recreation benefits of the past land consolidation on the TBNG will be lost due to an operating railroad. This loss will be the greatest under Alternative B as the railroad would cross the areas of the greatest land consolidation success. This includes the Rosecrans and Cellars Loop areas. Alternative C will impact the past consolidations to a lesser degree, but it will still have the effect of displacing recreationists in the Cellars Loop area and the area west of the Darlington School. These lost benefits from a railroad and yard in the vicinity of the land consolidations include the loss of the improved long-term recreation potential the land exchanges created.

These direct and indirect impacts to recreationists will be due to the visual, noise, and night light pollution impacts from the nearby operating railroad and West Yard site. The operations of the proposed railroad will also degrade the current feelings of vastness and remoteness, solitude and quiet, and visual experiences that include night sky viewing and a landscape that appears natural and primitive from a background perspective.

4.6.4 Public Lands. As was stated in Section 3.6.2.2, there are few if any recreation opportunities on public lands in the project area. As such, no impacts on these lands are anticipated.

4.6.5 Wilderness and Inventoried Roadless Areas

4.6.5.1 Wilderness Areas. The alternatives would not impact designated wilderness or wilderness study areas. At their closest, Alternatives B and C would be located more than 6 miles north of the Sage Creek

Wilderness Area in Pennington County (see Figure 3-11). No impacts to this wilderness area are anticipated.

4.6.5.2 RARE II and Inventoried Roadless Areas. As was discussed in Section 3.4.6.2, currently there are no inventoried RARE II roadless areas on TBNG. However, 3 roadless areas were identified on BGNG during RARE II, including: Indian Creek RARE II Area; Red Shirt RARE II Area; and Cheyenne River RARE II Area. The locations of these RARE II areas are shown on Figure 3-12. All 3 would be significantly and adversely affected by Alternative B.

The proximity of Alternative B to the Indian Creek RARE II Area is shown on Figure 3-14. As can be seen on the figure, the RARE II area is separated from the alternative only by the Cheyenne River. Alternative B would pass through the southeastern edge of the Red Shirt RARE II Area (see Figure 3-15) near the Village of Red Shirt. In Custer County, the alternative would pass through the southern edge of the Cheyenne River RARE II Area (see Figure 3-17).

Alternative B would have a direct impact on the Red Shirt and Cheyenne River RARE II Areas. The railroad would eliminate portions of both areas from future consideration for inclusion in the National Wilderness System. Such a loss would be significant and may be prohibited by recent actions undertaken by the Clinton Administration.

In addition, indirect impacts from the operating railroad would adversely affect the wilderness-like qualities of all 3 RARE II areas. Many of the characteristics (i.e., solitude and quiet) which make these areas eligible for consideration as wilderness would be lost. These losses would occur over any portion of the RARE II areas adversely affected by noise or light pollution from the operating railroad.

The preferred alternative for the proposed BGNG grassland would recommend the Red Shirt Area (see Figure 3-16) for inclusion in the National Wilderness System. Once such a recommendation is made, the Forest Service would be prohibited from providing a permit for the railroad across this area.

Also shown on Figure 3-16 is the route for Alternative C in relation to the Red Shirt Area. Although not crossed by the alternative, noise impacts from the operating railroad would be expected in the area the Forest Service proposes to recommend for inclusion in the National Wilderness System. The impact to this area would not be as severe as Alternative B, but would still be considered significant. Introducing noise into this area would degrade the wilderness qualities that make it eligible for inclusion in the National Wilderness System.

On TBNG, Alternative B would be routed directly adjacent to the H A Divide Inventoried Roadless Area identified in the TBNG proposed grassland plan. Like BGNG, the sights and sounds introduced into the area would have a significant impact on the wilderness-like qualities of this area. Such an impact would be considered significant. However, unlike the Red Shirt Area, H A Divide is not recommended for inclusion in the National Wilderness System by the proposed grassland plan preferred alternative, but the HA Divide is recommended for inclusion to the wilderness system under another action alternative.

4.6.6 National Natural Landmarks. As was discussed in Section 3.6.5, there are no national natural landmarks in close proximity to any of the alternatives. No impacts to landmarks are anticipated.

4.6.7 Wild and Scenic Rivers. Currently, no rivers or streams which have been designated as wild and scenic are located eastern Wyoming or western South Dakota. However, as was discussed in Section 3.6.6, the Forest Service, during the recent plans revision reviewed the eligibility of all streams within 6th level watersheds on the grasslands. The Forest Service determined that about 8 miles of the Cheyenne River on BGNG is eligible under the scenic classification. However, for reasons not explained in the draft EIS for the plans revision, under the preferred alternative for the plans revision this stretch would not be nominated for inclusion in the national Wild and Scenic River System. The stretch identified as scenic is shown on Figure 3-20. The characteristics which were used to determine its eligibility included:

- significant fisheries and wildlife resources;
- scenic qualities; and
- recreation values.

Implementation of Alternative B would adversely affect many, if not all, of these characteristics and would likely change the setting of the river so dramatically that it would no longer be eligible for inclusion in the national Wild and Scenic River System. Of most concern would be potential impacts to the scenic qualities of this relatively unspoiled stretch of the Cheyenne. As can be seen of Figure 3-20, through this stretch the railroad would be located 0.5 miles or less on the north side of the river. In at least 4 locations, the alternative would be constructed directly adjacent to the north bank of the river. Although engineering studies have not been conducted for this alternative, it is likely that significant cuts would be required into the high banks above the river to accommodate the railroad bed. Slopes would need to be laid back to prevent slumping and landslides. In many areas it would be anticipated that significant bank

armoring would be required to keep the river from washing out the tracks.

All of these construction requirements would significantly affect the scenic qualities of the eligible stretch of the Cheyenne River. In fact, the 4 "pinch points" extend from the beginning of the 8-mile long scenic stretch to the end in such a manner that major construction perturbations would be evident to recreation users over the majority of the eligible stretch.

Recreation use of the area would be adversely affected by noise from the operating trains. State Highway 40 would be crossed directly adjacent to the eligible stretch of the river. If it would be necessary to blow the locomotive whistle at this crossing (i.e., a grade separation of the track and the road was not possible), noise would be expected to resonate up and down the river valley which would further degrade recreation opportunities in the area.

Alternatives C and D would not adversely affect eligible wild and scenic rivers.

4.7 Research Natural Areas

As was discussed in Section 3.7 of this report, there are currently no RNAs in close proximity to the alternatives on BGNG or TBNG. However, the plans revision proposes new RNAs on both grasslands. The Hay Canyon Pasture Potential RNA is located on BGNG about 7 miles northeast of Smithwick and about 1.1 miles southeast of Alternative C (see Figure 3-22). It was considered by the plans revision for designation as a RNA because of its botanical value (see Table SAD-1 in the plans revision draft EIS, Forest Service, 1999c). Alternative C of the new railroad would not adversely affect the characteristics for which this potential RNA was proposed in the plans revision. In addition, the preferred alternative in the plans revision would not designate the area as a RNA. It would only be designated under Alternative 4.

Similarly, the South Pasture (777) RNA was proposed because of botanical qualities. Even though Alternative C would be routed less than 0.7 miles from the RNA boundary, the qualities for which the RNA was nominated would not be adversely affected.

The Antelope Creek Potential RNA is located south of the southern legs of all the alternatives on TBNG (see Figure 3-21). It also was proposed for inclusion as an RNA because of its botanical qualities - it provides a reasonably good example of a plains stream ecosystem. At its closest, Alternative B would be located over 2.5 miles north of the potential RNA. The characteristics for which the area was recommended as an RNA would not be adversely affected by either construction or operations. Like Hay Canyon, this potential RNA would not be designated under the plans revision preferred alternative. It would only be designated under Alternative 4.

4.8 Visual Resources

4.8.1 Significance Criteria. A significant impact to visual resources on NFS lands would occur if implementation of an alternative would not meet the VQO for an area. All of the alternatives and the Black Thunder North and South mine loops would cross areas on NFS lands that have an existing VQO of partial retention. In these areas, railroad construction is expected to cause significant impacts to visual resources because management activities are required to be subordinate to the natural environment. The railroad would dominate the landscape in these areas, especially during railroad operation when trains are passing through.

Alternatives B and C would cross areas proposed for a high scenic integrity level (SIL) by the proposed grassland plans. Like the existing partial retention VQO, the introd-uction of an operating railroad into these landscapes would result in a significant impact to the visual setting of the area and would likely result in the need to lower the SIL for the areas impacted.

4.8.2 Summary of Impacts Common to All Alternatives (Except the No Action Alternative). Impacts to visual resources to a large extent would depend on the distance of the activity or facility to the observer. Construction of the railroad would be a dominant feature on the landscape. Once operational, trains would be highly visible because, in general, there is little obscuring vegetation or topography. And, coal trains are expected to be from 1.2 to 1.5 miles long. Trains would probably be heard for long distances depending on intervening topography, vegetation and local weather conditions. Furthermore, the 1 percent design grade for the railroad would require large cuts and fills in many areas that will likely create an obvious visual contrast. Visual impacts of the railroad on the landscape would be considered a long-term impact. As indicated above, where the railroad would be constructed in areas with a VQO of partial retention or a high SIL, the impact would be considered significant. Significant visual impacts are not expected in areas with a VQO of modification because management activities in areas are allowed to dominate the landscape. Although these impacts would not be considered significant in the modification VQO's, the railroad would still substantially dominate the foreground and middleground of the landscape, and be obvious in the background viewpoints. This would result

in a substantial and long-term, change in the scenic qualities of these areas.

Implementation of the alternatives would cause an irreversible and irretrievable commitment of visual resources for the life of the railroad. The railroad would be a permanent aboveground structure. Development of the railroad in areas that provide a landscape of vastness and expansiveness would change the visual character of the landscape by adding a high use railroad to areas that have experienced little human development.

4.8.3 Alternative A (No Action). Implementation of this alternative would not result in impacts to visual resources.

4.8.4 Alternative B (Proposed Action). Approximately 44 miles of this alternative would cross NFS lands with a VQO of modification and 7.5 miles would cross lands that have a VQO of partial retention. On BGNG, Alternative B would cross 2.6 miles of NFS lands with a VQO of partial retention, where significant impacts to visual resources would occur. The alternative would affect 4.9 miles of land with a VQO of partial retention on TBNG. Based on the proposed grassland plans for BGNG and TBNG, 4.7 miles of land would be crossed that have a high SIL, defined as areas managed so that human activity is not scenically evident (see Table 3-27). This would be nearly twice as much as would be crossed by Alternative C.

4.8.5 Alternative C (Modified Proposed Action) and Route Variations. Alternative C would cross a total of 33.8 miles of NFS lands with a VQO of modification and 5.1 miles with a VQO of partial retention. On BGNG, Alternative C would crosse 0.7 miles of land with a VQO of partial retention but would affect 4.4 miles of land with a VQO of partial retention on TBNG (see Table 3-27).

Based on the new scenic management system in the proposed grassland plans for BGNG and TBNG, 2.4 miles of Alternative C would cross NFS lands that have a high SIL. In these areas, construction is anticipated to cause significant impacts to visual resources because the railroad would be scenically evident (see Table 3-27).

Phiney Flat Route Variation. In Wyoming, this route variation would have the same impact to visual resources as Alternative C. On BGNG, the route variation would affect lands with a VQO of partial retention by 0.3 miles less than Alternative C.

W G Flat Route Variation. This route variation would have the same impact to visual resources as Alternative C (see Table 3-27).

4.8.6 Alternative D (Existing Corridors Alternative). This alternative would not cross any NFS lands in South Dakota so there would be no impacts to visual resources on BGNG. Alternative D would cross 22.7 miles of lands with a VQO of modification and 4.0 miles with a VQO of partial retention on TBNG. Based on the TBNG proposed grassland plan, no areas with a high SIL would be affected by Alternative D (see Table 3-27).

Because this alternative would be constructed adjacent to or would replace an existing railroad, impacts to visual resources would be greatly reduced compared to Alternatives B and C. In areas near existing railroads, human activities are obvious and the general types of visual intrusions from the project would be similar to those already present.

4.8.7 Proposed Mine Loop Options. The Black Thunder North Mine Loop would cross 0.6 miles of lands with a VQO of modification and less than 0.1 miles with a VQO of partial retention on TBNG. The Black Thunder South Mine Loop would cross 2.7 miles of lands with a VQO of modification and 0.4 miles with a VQO of partial retention on TBNG. No areas with a high SIL would be affected by the Black Thunder mine loops. The North Antelope mine loops do not cross NFS lands.

4.8.8 Proposed Yard Sites. The only yard that would affect NFS lands is the Western Yard. All NFS lands that would be affected by this yard have a VQO of modification. The Western Yard will be a major rail staging facility and is expected to include maintenance and minor repair facilities. Consequently, the yard will be a dominate landscape feature, changing the landscape setting to an industrial use.

4.9 Cultural and Historic Resources

Potential impacts to cultural and historic resources are being evaluated in the draft EIS. Please refer to that document and the technical reports prepared by STB for full disclosure of potential impacts to these resources.

4.10 Air Quality

Potential impacts to air quality are currently being modeled by STB for inclusion in the draft EIS. The impacts to air quality will be fully disclosed in a technical report being prepared to support the EIS. Please refer to that technical report for additional information.

4.11 Geology and Paleontological Resources

4.11.1 Significance Criteria. Significant impacts due to geological hazards and to paleontological resources would occur if:

- Landslides or slumps result from project activities.
- Project facilities are damaged by landslides.
- Important fossils, which could substantially add to scientific understanding of paleontological resources, are destroyed during project construction.

4.11.2 Summary of Impacts Common to All Alternatives (Except the No Action Alternative). Construction of any of the alternatives should have a significant positive impact on the mineral resource industry in Wyoming. This positive impact would result from the construction of a new rail system that would allow mineral resources to be shipped to new markets or to existing markets on a more efficient and cost-effective system. The new railroad would provide the coal mining industry in the SPRB with an additional transportation network to haul coal to new markets or to existing markets on a more efficient route. Furthermore, local sand and gravel operations would likely benefit from the proposed project since large quantities of aggregate would be required for construction activities.

Earthquakes. According to seismic risk maps (International Congress of Building Officials, 1994 and Case, 1986), all alternatives are located within seismic risk zone 1 which predicts only slight earthquake damage to structures and a low hazard to people. Nearly all of the earthquakes in Wyoming have been due to movements of faults (Case, 1997). The alternatives would not cross any suspected active faults in Wyoming or South Dakota (Case *et al.*, 1995) although the alternatives in Wyoming and South Dakota would cross inactive faults systems near the Wyoming - South Dakota border south of Newcastle near Morrisey (Love and Chrstiansen, 1985). Only 2 earthquake epicenters have been mapped in the immediate vicinity of the alternatives or route variations (Hammond, 1993 and Case *et al.*, 1995). Two epicenters have been mapped adjacent to Alternative D, but these epicenters were associated with low intensity earthquakes with a modified Mercalli scale of VI or less. Based on this information, the potential for impacts by earthquakes to any of the alternatives does not appear to be significant.

Liquefaction. During liquefaction, materials composed primarily of water-saturated sands and silts lose their strength and behave as viscous fluids. Seismic waves passing through saturated materials may compact them, raising the pore water pressure. When the pore water pressure rises to the pressure of the weight of the overlying materials, liquefaction occurs. Because seismic activity is low for the project area, the potential for this phenomenon to occur is low for all of the alternatives. Furthermore, none of the alternatives in Wyoming would cross areas prone to liquefaction (Case, 1986a).

Landslides. In both Wyoming and South Dakota, portions of the alternatives cross the Pierre Shale and Fort Union formations which have a high landslide susceptibility (Redbrush-Hall *et al.* 1976). The clay-mineral content of these rocks is moderate to high, so that they are susceptible to slumps and earth flows. The weak and erodible rocks have generally low to moderate relief, with some buttes and badlands; slopes are generally moderate to steep along drainage courses. Areas of moderate and high incidence of landslides are confined mostly to valley walls of the Cheyenne River and its major tributaries. In these areas, cutting or loading of slopes or unusually high precipitation may cause landsliding. Flatter areas are also susceptible to landslides if slopes are steepened by construction activities. The potential for slumping along Alternatives B and C where these alternatives are immediately adjacent to the Cheyenne River have been observed on-site and are evident through photo interpretation of low level aerial photos.

To compare the potential landslide susceptibility of each alternative, crossing lengths of the Pierre Shale and Fort Union formations were determined. In addition, soils mapping units that are identified by NRCS as prone to slumping and landslides (based on their slope, landscape position, soil descriptions) (NRCS ,1982 and 1996a) were identified. These mapping units were quantified and compared to help refine the potential landslide hazard of each alternative.

Potential impacts from slumps and landslides would depend on their size and location. Potential impacts could include land or habitat disturbance as well as impacts to drainages that may impact water quality and aquatic resources from additional sedimentation. Slumps and landslides could be a potential safety and operational concern if one of these events caused a derailment or interrupted service. In areas where slumps and landslide are common and occur naturally (including areas of bank erosion with slumps or creeps toward the Cheyenne River), construction may require large disturbances to provide a stable surface for the railroad. Some activities that may be required to stabilize these areas could include excavating unstable material and reshaping slopes, providing positive drainage so that water drains away from the railroad bed and off of potential unstable slopes, and stabilization of river banks to reduce or eliminate under cutting.

Shrinking-swelling clays. There are several formations that would be crossed by the alternatives that have beds of bentonite, or rocks that have a bentonite

component. When wet, the bentonite clay structures expand, resulting in a loss of strength (Case, 1986b). If proper engineering designs are not implemented during construction, structural problems may occur to the railroad bed causing the tracks to sink, shift or otherwise be altered. If these problems are severe they can pose a safety and operational concern.

Paleontological Resources. There are world-famous paleontological deposits in the vicinity of the alternatives. Ancestors of the modern day rhinoceros, horse, pig, cat, early birds, reptiles and invertebrates may be found in various strata which would be crossed by the alternatives. There are known paleontological sites adjacent to the alternatives and the possibility is high that paleontological resources of scientific significance could be disturbed/uncovered by earth-moving activities during construction.

Subsurface paleontological resources could be revealed during construction and excavation for any of the alternatives and would offer a unique opportunity to discover new specimens. Given the Forest Service and BLM standards and guidelines, the possibility of irretrievably damaging a resource of scientific significance would be low on Federal lands. Because paleontological resources are not protected on private lands, scientifically significant specimens could be destroyed by any of the alternatives. The potential loss of significant paleontological resources on private lands is high.

The Forest Service requires Class III paleontological field surveys, conducted by a qualified paleontologist, where the alternatives cross formations that have a high Probable Fossil Yield Classification (PFYC). Accord to Beasley (1999), this would include all formations which have a PFYC of 3 or 5. These formations have a high probability of yielding paleontological resources that are of concern. This classification is based largely on how likely a geologic unit is to produce vertebrate fossils of terrestrial (non-marine) origin. Based on the results of these surveys, the Forest Service and BLM would determine the extent of monitoring that may be necessary during construction on NFS or public lands. Forest Service and BLM stipulations require that any paleontological resources discovered during construction must be immediately reported to the Federal agency having jurisdiction where the discovery is found. All operations in the immediate vicinity of the discovery would be halted until written authorization is issued by either the Forest Service or BLM. These agencies would conduct an evaluation of the discovery and determine appropriate actions to prevent the loss of significant scientific values.

To quantify potential impacts to paleontological resources, crossing lengths through each PFYC (i.e., 3 and 5) is compared by alternative. The PFYC for each formation which would be crossed by the alternatives is provided on Table 3-32. Geologic formations that would be crossed by each of the alternatives is based on the geologic mapping of Love and Christiansen (1985) and Darton (1951) and provided in Tables 3-27 through 3-31.

4.11.3 Alternative A (No Action). This alternative, if implemented, would not provide any positive impacts to the mineral industry in Wyoming because a new railroad would not be constructed to haul mineral commodities to their markets. In addition, because the project would not be built, it would not provide a new market for the local aggregate industry.

Implementation of the No Action Alternative would avoid the possibility of disturbing paleontological resources. However, this would eliminate the potential of discovering new scientifically-significant paleontological resources.

4.11.4 Alternative B (Proposed Action). This alternative would cross a total of 158 miles of the Pierre Shale and Fort Union formations which have a high susceptibility for slumps and landslides. The potential for slumps or landslides would be high where this alternative crosses steep slopes or where cutting or loading of slopes or anomalously high precipitation may cause landslides. In South Dakota, 48.2 miles of the Pierre Shale Formation would be crossed while in Wyoming 109.8 miles of the Pierre Shale and Fort Union formations would be crossed. In Wyoming, this alternative would not cross known landslides (Larsen *et al.,* 1991a and 1991b), therefore the landslide potential along this alternative would likely be confined to those areas in South Dakota where steep slopes adjacent to the Cheyenne River would be crossed.

Areas that are prone to slumping and landslides have been correlated to soils mapping units. Based on this analysis, Alternative B would traverse 36.4 miles of steeply sloping soils in the vicinity of the Cheyenne River, the most of any alternative. If construction triggered a landslide, the impact would be considered significant and long-term since these events can be difficult to stabilize and can cause other significant environmental impacts such as habitat degradation and severe water quality degradation.

Alternative B would cross a total of 41.7 miles of formations with a PFYC of 5 (8.9 miles in South Dakota and 32.8 in Wyoming). All of the formations in South Dakota that have a PFYC of 5 occur on private lands where there are no protective measures for paleontological resources. In Wyoming, 7.3 miles of these formations that have a PFYC of 5 occur on NFS lands (see Tables 3-29 and 3-34). The remaining 254.4

miles of this alternative would cross formations that have a PFYC of 3.

In Wyoming, this alternative would cross approximately 2 miles of the 5,140-acre Thunder Basin Paleontological Special Interest Area (SIA) on the TBNG (see Figure 3-23). This site is known to contain a high concentration of fossil remains from the late Cretaceous Period. This is the most productive fossil-bearing site on the TBNG. Standard stipulations and conditions of approval should prevent impacts from occurring to paleontological resources at this site and important discoveries could be made in the SIA during construction of this alternative.

4.11.5 Alternative C (Modified Proposed Action). This alternative would cross a total of 138.5 miles of the Pierre Shale and Fort Union formations. As with Alternative B, the potential for slumps or landslides would be high where this alternative crosses steep slopes or where cutting or loading of slopes or anomalously high precipitation may cause landsliding in these formations. In South Dakota, 52.8 miles of the Pierre Shale Formation would be crossed while in Wyoming 85.7 miles of the Fort Union and Pierre Shale formations would be crossed. In Wyoming, Alternative C would not cross known landslides (Larsen *et al.*, 1991a and 1991b) - the landslide potential along this alternative would likely be confined to those areas in South Dakota where steep slopes adjacent to the Cheyenne River would be crossed.

This alternative would traverse 21.1 miles of steeply sloping soils in the vicinity of the Cheyenne River that are prone to slumps and landslides. That distance is 15.3 miles less than Alternatives B. If construction of Alternative C triggered a landslide, the impacts would be considered significant and long-term impact because these events can cause habitat degradation and other environmental impacts.

Alternative C would cross a total of 56.2 miles of formations that have a PFYC of 5. Of that total, 19.9 miles of the route would affect those formations in South Dakota and 36.3 miles would affect formations in Wyoming. In South Dakota and Wyoming, 1.4 and 8.0 miles of these geologic units would be crossed on NFS lands, respectively (see Tables 3-30 and 3-34). Alternative C would cross 14.5 more miles of these highly fossiliferous units than Alternative B. This alternative would also cross 217.6 miles of formations that have a PFYC of 3, 36.8 miles less than Alternative B.

In Wyoming, this alternative would cross about 2.4 miles of the Thunder Basin Paleontological SIA, described above for Alternative B (see Figure 3-23). Standard stipulations and conditions of approval should prevent significant impacts from occurring to paleontological resources at this site or on other Federal lands which would be crossed by the alternatives. Construction of this alternative could result in important discoveries.

Phiney Flat Route Variation. This route variation would cross the same formations and have the same potential impacts in Wyoming as Alternative C. In South Dakota, approximately 7 miles more of the Pierre Shale Formation would be crossed by this variation. However, his difference is not considered noteworthy since the variation would primarily cross level terrain which should not be prone to slumping. In addition, this route variation would cross 0.8 miles less of soils that are prone to slumps and landslides than Alternative C.

This variation would also cross the same length of formations that have a PFYC of 5 as Alternative C (see Table 3-31). This route variation would have the same potential impacts to paleontological resources as Alternative C.

W G Flat Route Variation. This route variation would cross the same formations and have the same potential impacts in Wyoming as Alternative C. In South Dakota, this route variation would essentially cross the same lengths of the Pierre Shale and Fort Union formations as Alternative C. This route variation would cross about 1.3 fewer miles of soils that have a high potential for slumps and landslides. The W G Flat Route Variation would cross fewer miles of these soils because it would not parallel the Cheyenne River to the extent that Alternative C would. Therefore, this route variation may have slightly less of a potential for slumps and landslides.

Summarized in Table 3-32 are the formations crossed by this route variation. The route would cross the same amount of formations that have a PFYC of 5 as Alternative C. Therefore, potential impacts to paleontological resources would be the same for this route variation as Alternative C.

4.11.6 Alternative D (Existing Corridors Alternative). This alternative would cross a total of 164.2 miles of the Pierre Shale and Fort Union formations which have a high susceptibility for slumps and landslides. In South Dakota, 69.9 miles of the Pierre Shale Formation would be crossed and 94.3 miles of the Fort Union and Pierre Shale formations would be crossed in Wyoming. Also in Wyoming, Alternative D would cross two very small areas of known landslides (Larsen *et al*, 1991a and 1991b). One of these areas is located south of Newcastle in Sections 12 and 13, T. 4 S., R. 61 W.) in an area immediately east of the existing BNSF railroad. The other area is located west of Newcastle (Section 24, T. 2 S., R. 62 W.) and is also east of the existing BNSF railroad.

The Alternative D route would not parallel the Cheyenne River in South Dakota where steep slopes occur. Therefore, this alternative would cross the least amount of soils that have a high potential for slumps and landslides. Only 2.7 miles of those soil groups would be crossed. Compared to the other alternatives, Alternative D would have the least potential to trigger slumps or landslides.

This alternative would cross a total of 109.9 miles of highly fossiliferous formations that have a PFYC of 5, the most of any alternative. In South Dakota, 56.5 miles of these geologic units would be crossed and in Wyoming 53.4 miles would be crossed. Compared to Alternative C, this alternative would cross 53.7 more miles of these formations, with only 5.4 miles of these formation occurring on NFS lands (see Table 3-33). This alternative would not cross the Thunder Basin Paleontological SIA. However, because this alternative would cross the most formations with a PFYC value of 5 on private lands, it may have the greatest potential to significantly impact paleontological resources.

4.11.7 Proposed Mine Loop Options. The Black Thunder North Mine Loop would cross 3.6 miles of the Lebo Member of the Fort Union Formation and 0.90 miles of the main body of the Wasatch Formation. The Black Thunder South Mine Loop would cross 3.9 miles of the Lebo Member of the Fort Union Formation and 3.2 miles of the main body of the Wasatch Formation. The North Antelope East and West mine loops would cross 1.5 and 2.4 miles of the Fort Union Lebo Member, respectively.

The Black Thunder mine loops would have the potential to impact paleontological resources where they cross the Wasatch Formation. Both of the Black Thunder mine loops would cross soils that have a high potential for slumps or landslides. The North Antelope mine loops would not affect areas with a high potential for slumps or landslides. The Fort Union Formation has a PFYC of 3. However, because the North Antelope loops would be constructed entirely on non-Federal lands, protection of paleontological resources would not occur.

4.11.8 Proposed Yard Sites. All of the West Staging Yard would be constructed on the Lebo Member of the Fort Union Formation. The Wall Yard would be constructed on Skull Creek Shale and the White River Group and the Edgemont Yard would be constructed on alluvium and the Belle Fourche and Mowry Shale. The only yard that has the potential to impact paleontological resources is the Wall Yard where it would be constructed on the White River Group. The Western Yard is the only yard that would cross formations that have a high potential for landslides - however, the yard sites is relatively flat and landslides are not a concern.

4.12 Water Resources

DM&E is in the process of preparing permit applications for the COE and state 401 water quality agencies that address the impacts to all waters of the United States including perennial, ephemeral and intermittent streams. The information contained in those applications is not repeated here. Rather, this section provides a comparison of the number of streams that would be crossed by the alternatives. For additional information, including detailed plan and profile drawings of major water body crossings and hydrology studies, please refer to the applications.

4.12.1 Summary of Impacts Common to All Alternatives (Except the No Action Alternative)

Groundwater. Potential impacts to groundwater could occur if implementation of any of the alternatives destroys or impairs water supply wells that provide water for domestic, livestock or wildlife use. In addition, impacts could occur to groundwater if spills of fuel or other fluids contaminates groundwater. Potential impacts to water wells would be mitigated by DM&E replacing or repairing any well damaged during construction. A Spill Prevention Countermeasure and Control (SPCC) Plan would be developed by DM&E for both the construction and operation phases of the project to reduce the risk of surface water or groundwater being contaminated. During construction, any water necessary for construction purposes (i.e., compaction, dust abatement, etc.) would be acquired in compliance with appropriate regulations.

Surface Water. Disturbances within a stream corridor may trigger a variety of impacts that differ in frequency, duration, intensity and location. Physical disturbances within a stream corridor can cause impacts locally (i.e., stream reach) or at locations far removed from the site. Vegetation removal from streambanks, flood plains and uplands often impacts the hydrologic and geomorphic functions of stream corridors. Vegetation removal can result in increased erosion and sedimentation which degrades water quality. Increased erosion and sedimentation may be from disturbed upland areas, as well as from streambanks where vegetation has been removed which may contribute to unstable streambanks.

Stream channel modifications required to accommodate the railroad grade can directly affect stream hydraulics by potentially increasing stream velocities from straightened channels, reducing stream meanders and by creating a uniform crossing section. Some of the potential effects caused by these changes include:

increased erosion, levels of sediment and contaminants reaching streams, increased water temperature, turbidity and pH; incised channels; lower ground water elevations; stream bank failure and loss of habitat for aquatic and terrestrial species. Habitat diversity can also be lost from stream bank armoring.

Storm Water Requirements. One of the greatest areas of concern for impacts to surface water is sedimentation resulting from construction-related runoff. Sediment can flow directly to perennial streams or to intermittent drainages and then to perennial streams. The Clean Water Act establish a comprehensive framework for addressing storm water discharges under the NPDES program. In 1990, the EPA published regulations requiring all storm water discharges associated with industrial facilities, including construction projects which disturbs 5 acres or more, to obtain NPDES permits.

Under the permit, operators who are required to obtain an NPDES permit to discharge storm water must prepare a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP outlines the potential pollution sources and measures which will be used to prevent storm water contamination. Proper implementation and maintenance of these measures will be essential to minimize impacts to surface waters from construction of the railroad.

4.12.2 Alternative A (No Action). Implementation of this alternative would eliminate project-related impacts to surface waters or groundwater.

4.12.3 Alternative B (Proposed Action). This alternative would cross a total of 41 perennial streams in South Dakota and Wyoming. In South Dakota, 35 perennial streams would be crossed in 6 hydrologic units, with 25 of these stream crossings occurring within the Middle Cheyenne Spring hydrologic unit. In this hydrologic unit, 15 of the perennial stream crossings would occur on Spring Creek (see Table 3-35). To achieve the design grade of this alternative, numerous stream channel alterations of Spring Creek would be required. These stream alterations and impacts to adjacent riparian areas are expected to cause significant impacts to this stream. Three of the crossings of Spring Creek would occur on NFS lands and 12 would occur on private land. In Wyoming, this alternative would cross a total of 6 perennial streams in the Upper Belle Fourche hydrologic unit. This includes 3 crossings of the Belle Fourche River and 3 crossings of Caballo Creek (see Table 3-35). This alternative would also be constructed adjacent to 2 perennial streams in South Dakota (i.e., Battle Creek and Cheyenne River) where construction impacts to these streams could occur. These impacts could occur from stream channel alterations or bank stabilization/armoring work to accommodate construction of this alternative.

This alternative would cross a total of 671 intermittent streams in both South Dakota and Wyoming. Table 3-45 provides the number of intermittent stream crossings by hydrologic unit. This alternative would cross 34 and 70 more intermittent streams than Alternatives C and D, respectively. Most of these intermittent stream crossings would occur on private lands (i.e., 512 or 76 percent) with most of the remaining streams being crossed on NFS lands (139 or 21 percent).

This alternative would cross 3 stream segments that are on the 303(d) waterbody list in South Dakota which do not support their designated uses. Two of these stream segments are associated with the Cheyenne River and the other is associated with the crossing of Rapid Creek. This is the same number as Alternative C including the route variations and 8 fewer than Alternative D. Additional sediment loading of these streams from project activities would be considered a significant impact and may accelerate the need for TMDLs.

Most impacts to streams would be considered short-term as long as crossing structures do not impede either high or low flows and allow the passage of aquatic organisms. However, the potential impacts to Spring Creek from this alternative would be expected to be long-term. This is because of the number of stream crossings and channel alternations that are proposed for this stream. The addition of a railroad within the riparian areas of Spring Creek could significantly impact the functions of this system..

4.12.4 Alternative C (Modified Proposed Action). As with Alternative B, this alternative would also cross a total of 40 perennial streams in South Dakota and Wyoming. In South Dakota, 36 perennial streams would be crossed in 6 hydrologic units, with 27 of these stream crossings occurring within the Middle Cheyenne Spring hydrologic unit, which is more than Alternative B (see Table 3-36). This alternative would cross Spring Creek 21 times which is 6 more times than Alternative B. Like Alternative B, this alternative would require numerous stream channel alterations of Spring Creek which is expected to cause significant impacts to this stream and it's adjacent riparian and wetland areas.

All of the perennial stream crossings in South Dakota and Wyoming would occur on private lands. In Wyoming, this alternative would cross a total of 4 perennial streams in the Upper Belle Fourche hydrologic unit which is 2 less than Alternative B. This alternative would cross the Belle Fourche River once and Caballo Creek 3 times (see Table 3-35).

This alternative would also be constructed immediately adjacent to 7 perennial streams (2 areas along the Cheyenne River and 5 areas along Spring Creek) which would likely cause additional stream impacts (see Table 3-43). Close proximity of the alternative to these streams may require channel alteration or bank stabilization/armoring to accommodate construction of this alternative.

This alternative would cross 3 stream segments that are on the 303(d) waterbody list in South Dakota which do not support their designated uses. Two of these stream segments are associated with the Cheyenne River and 1 is associated with the crossing of Rapid Creek. As shown on Table 3-53, this alternative would cross 8 fewer streams that are on 303(d) list than Alternative D .

A total of 637 intermittent streams would be crossed by this alternative in South Dakota and Wyoming. Table 3-46 provides the number of intermittent stream crossings by hydrologic unit. Similar to all of the alternatives, most of the intermittent streams that would be crossed would occur on private lands (i.e., 490 or 76 percent) with most of the remaining intermittent streams crossings occurring on NFS lands (121 or 20 percent).

Phiney Flat Route Variation. This route variation would prevent significant impacts to Spring Creek by eliminating 20 crossings of this stream and numerous stream channel alterations. Avoiding these crossings would reduce the total number of perennial stream crossed in South Dakota to 16 (see Table 3-37) which is the least of all of the alternatives. This route variation would cross the same perennial streams in Wyoming, as Alternative C. This route variation would also have 36 fewer intermittent stream crossings than Alternative C, (601 vs. 637).

W G Flat Route Variation. As shown on Table 3-38, the W G Flat Route Variation would cross 33 perennial streams in South Dakota, which is 3 less than Alternative C. Although, this route variation would still result in significant impacts to Spring Creek, it would eliminate approximately 30 crossings and numerous alterations of the stream in Hay Canyon in Sections 12, 13, 24, 25 and 36 of T. 7 S., R. 8 E. and Section 1 of T. 8 S., R. 8 E. Based on stream designations on USGS 1:24,000 topographic maps, this stream is intermittent, however, field surveys suggest this stream may be perennial and supports abundant emergent riparian and wetland communities with high functions and values, particularly for wildlife. By avoiding Hay Canyon, this route variation would prevent significant and long-term impacts to this stream corridor. This route variation would cross the same perennial streams in Wyoming as Alternative C. This route variation would have 53 fewer intermittent stream crossings than Alternative C.

4.12.5 Alternative D (Existing Corridors Alternative). This alternative, if implemented, would cross a total of 57 perennial streams in South Dakota and Wyoming which is 16 and 14 more the Alternatives B and C, respectively. In South Dakota, 38 perennial streams would be crossed in 5 hydrologic units, with 16 of these stream crossings occurring within the Middle Cheyenne Spring hydrologic unit and 13 stream crossings occurring with in the Middle Cheyenne Elk hydrologic unit (see Table 3-39). Although this alternative would have 11 crossings of Boxelder Creek and 7 crossings of Beaver Creek, these stream crossings would occur in areas that have been previously crossed by the railroad. Consequently, impacts to these streams from multiple crossings is not expected to be significant. This alternative would avoid both Spring Creek and Hay Canyon in South Dakota. All of the perennial streams which would be crossed by this alternative in South Dakota would be on private lands.

In Wyoming, this alternative would cross 19 perennial streams which is 13 more than Alternative B and 15 more than Alternative C. These stream crossings would occur in 2 hydrologic units with 8 of these stream crossings occurring in the Beaver hydrologic unit and 11 crossings occurring in the Upper Belle Fourche hydrologic unit. All of the stream crossings in Wyoming would occur on private lands, except one of the crossing of Caballo Creek and one crossing of the Belle Fourche River which would occur on state lands (see Table 3-39).

This alternative would be constructed adjacent to 10 perennial streams in both South Dakota and Wyoming (see Table 3-44). Impacts to these streams would likely occur because of the proximity of the alternative. In these areas, streambanks may need to be stabilization or armored or the channel may need to be altered to allow construction of the alternative.

This alternative would cross 707 intermittent streams which is 70 more than Alternative C and 30 less than Alternative B. Like the other alternative, most of these intermittent stream crossings would occur on private lands (584 or 83 percent), with 88 (12 percent) occurring on NFS lands and 32 (5 percent) occurring on state lands.

Impacts to water resources from this alternative are expected to be less than Alternative B and C. This is because this alternative would be constructed within or adjacent to an existing transportation corridor for most of its length. Therefore, most of the streams that would be crossed by this alternative are already impacted by existing crossing structures.

4.12.6 Proposed Mine Loop Options. None of the proposed mine loop options would cross perennial streams. The Black Thunder North Mine Loop would cross 9 intermittent streams (1 on NFS lands, 3 on State of Wyoming lands and 5 on private lands). The Black Thunder South Mine Loop would cross 12 intermittent streams - 8 on NFS lands and 4 on private lands. The North Antelope West and North Antelope East mine loops would cross 4 and 2 intermittent streams, respectively, all on private lands.

4.12.7 Proposed Yard Sites. The proposed Wall Yard would not cross any perennial or intermittent streams. The Edgemont Yard would not cross any perennial streams and would only cross 1 intermittent stream. The West Staging Yard would not cross any perennial streams but would cross a total of 21 intermittent streams.

4.13 Soil Resources

4.13.1 Significance Criteria. Impacts to soils would be considered significant if:

- The loss of topsoil, soil productivity, or erosion prevents successful reclamation within 5 years of construction.
- Sedimentation decreases water quality below preconstruction conditions in the long-term.
- Occupied habitats (aquatic or terrestrial) for any Federally-listed or proposed threatened or endangered species are impaired from erosion or sedimentation.

4.13.2 Summary of Impacts Common to All Alternatives (Except the No Action Alternative). To evaluate the potential impacts from the alternatives, soils which would be crossed have been categorized according to their limiting characteristics and combined into 7 soil groups (see Table 3-56). Characteristics of these soil groups are described in Section 3.13.2 and are discussed in terms of their potential impacts below. Table 3-57 provides comparisons of the distance that each alternative and route variation would cross within the different the soil groups.

Construction of the railroad could adversely affect soils in several ways. The most serious effects include increased soil erosion and loss of soil productivity, thereby impairing revegetation success. Revegetation is crucial for soil stabilization and restoration and preventing off-site impacts.

Disturbance to soils in Group 1 would be difficult to reclaim because of their chemical and physical properties. Soils in Group 1 are either saline or sodic and revegetating these soils will require plant species that are adapted to these conditions. Group 1 soils have a high salt content that interferes with the water and nutrient uptake of plants. These conditions are especially sensitive to new plant seedlings because their root systems are not developed and they are extracting water and nutrients from a smaller volume of soil compared to established and deeper-rooted plants. In addition, erosion from these soils could adversely affect water quality and aquatic habitats because sediments would have a high salt content.

Vegetation clearing and grading operations during construction would expose soils surfaces and increase the potential for erosion. A soil's susceptibility to erosion from wind and water varies according to characteristics such as soil texture, structure, topography or slope, surface roughness, amount of vegetation cover, and climate. Erosion from water occurs primarily on exposed soils on moderate to steep slopes, whereas wind-induced erosion often occurs on dry, sandy soils where vegetation cover is sparse. Soils in Groups 2 and 3 have a high water and wind erosion hazard potential.

Soil erosion could result in the loss of topsoil and a potential increase in siltation and salinization of surface waters. This, in turn, could adversely effect the water quality and aquatic habitat of surface waters. The magnitude, extent and duration of the construction-related impact would depend on several factors including the proximity of construction sites to water, the properties of the soils affected, and the method, duration and time of year of construction activities.

Potential erosion from mass movement (i.e., slumps or landslides) is not quantified in Soil Groups 2 or 3 although these processes can cause significant impacts. In South Dakota, slumps and landslides are prevalent on steeply sloping soils adjacent to stream flood plains, especially along the Cheyenne River. These slumping areas have been correlated to the following soil mapping units:

- Samsil clay, 15 to 40 percent slopes, mapping unit SaE, in Fall River County.
- Schamber-Eckley complex, 9 to 40 percent slopes, mapping unit SmE, in Fall River County; .
- Samsil Clay, 25 to 40 percent slopes, mapping unit SbF, in Pennington and Custer counties.
- Samsil Rock Outcrop Complex, 25 to 75 percent slopes, mapping unit SdF, in Pennington and Custer counties.
- Samsil-Pierre clays, 15 to 25 percent slopes, mapping unit ScE, in Pennington and Custer counties.

The distance that would be crossed in these soil mapping units by each alternative have been quantified to provide an indication of the potential amount of slumping/landslide hazard terrain that would be affected by each alternative.

Soil compaction can result from the repeated movement of heavy construction equipment and vehicles within construction sites and on access roads. The degree of compaction would depend on the soils texture, moisture content and the amount of traffic. Compaction damages soil structure and reduces pore space, which impedes the movement of water and air in the soil. Compaction lowers soil productivity and increase runoff rates which also increases erosion potential. Most soils along the alternatives routes would be susceptible to compaction.

Another common impact that could occur from construction of the alternatives is the loss of soil productivity. Contributing factors include erosion, compaction and the burial or mixing of topsoil with subsoil horizons during grading activities. The mixing of soil horizons would lower soil productivity and could decrease successful revegetation by diluting the superior physical and chemical properties of the topsoil with the less productive subsoil. Topsoil is typically higher in organic matter, fertility and biologic activity than subsoils and generally has not accumulated high concentrations of salts.

Soils in Group 4 have physical characteristics that limit their reclamation potential because their profiles have a limited water storage or capacity which causes them to be drier or more droughty than other soils. Soils in this group are shallow to bedrock; have a high content of coarse fragments; or have a low available water capacity. Most of the soils which would be crossed in this group have several of these limiting properties. Soils that have a low available water capacity are typically 1) coarse textured; 2) have a limited soil volume because of a restrictive layer in their profile, such as a cemented layer, hardpan or shallow bedrock or; 3) have a high volume of coarse fragments. The semi-arid climate of the project area also compounds the revegetation problems with these soils because of their droughty characteristics.

The distance that each alternative would affect soils that are shallow to bedrock was evaluated. In addition to their droughty character, construction cuts in these shallow soils may encounter bedrock that would likely remain exposed after reclamation. Rock exposures can cause indirect impacts to reclaimed areas because these areas are often steep impervious surfaces that can accelerate storm water runoff and increase runoff volumes. Runoff from these areas onto newly reclaimed areas that have not yet stabilized can cause erosion and sedimentation impacts. In addition, cut slopes in some soft shale materials, such as the Pierre Shale, are easily weathered and can be difficult to stabilize because they continually erode. This potential impact would be greatest where these cut slopes occur near streams where eroded materials can be transported to surface waters. According to available soil surveys (NRCS, 1982, 1986 and 1996), the bedrock that may be encountered during construction of the alternatives is considered "soft", typically ripable and does not require blasting or special equipment to excavate.

Soils in Group 5 are hydric soils that are saturated long enough to periodically produce anaerobic conditions, which influences plant growth. Soils in this group would be classified as jurisdictional wetlands if they were within a characteristic wetland hydrologic system and support hydrophytic plants in sufficient quantity. These soils are rare in semi-arid areas and they typically support plant communities that provide important biological habitats and add to the landscapes diversity. Almost all of the soils in this group that would be crossed by the alternatives occur in South Dakota. Because of their wetness, adaptive species would be required on these soils during reclamation to ensure successful revegetation of these soils.

Prime farmland soils (Group 6) occur along each alternative in South Dakota. In Wyoming, prime farmland soils would only be affected by Alternative D. All of the prime farmland soils crossed by the alternatives are considered prime if they are irrigated. Although the quantity of prime farmland soils that are actually irrigated has not been determined, constructing on these highly productive soils by any of the alternatives or route variations would preclude them from being cultivated in the long-term.

Construction activities could also lower soil productivity by disrupting or damaging existing irrigation systems, canals, laterals or ditches. These potential impacts have not been quantified, however, DM&E is currently negotiating agreements with affected landowners regarding the measures or compensation that would be necessary to mitigate these potential impacts.

Soils in Group 7 may have slopes of 15 percent or greater. Construction on these slopes is of concern because cut and fill slopes generally require larger disturbed areas. Erosion potentials are higher on these slopes and additional reclamation or erosion control procedures are usually necessary to ensure that impacts do not occur. Soils on steep slopes typically have higher runoff rates and receive less effective moisture than soils on level or less sloping areas and can be difficult to reclaim because of their droughty character. These dry conditions can be compounded if the slope aspect is to the south or west because these aspects receive more

solar radiation. In addition, depending on the steepness of slope, some forms of seeding may be restricted, such as drill seeding, because typical equipment can not safely work on these slopes. Therefore, other seeding methods which are more expensive (hydroseeding) or may be less effective (broadcast seeding) would be required.

Construction may also result in the establishment of noxious weeds in areas where none or relatively few existed prior to construction. The clearing of existing vegetation would expose soils and reduce plant competition providing the opportunity for weeds to become established. Once weeds are established they may spread onto adjacent areas if they are not controlled. Weed seeds can be carried into or spread through the project area by construction equipment and vehicles when they pass through infested areas or if the equipment is transported in from other areas that are infested with weeds. Weeds can also be spread during construction activities when materials are hauled from cuts to fills or into borrow or waste areas. The magnitude of this impact would depend on weed species, their prevalence in the area prior to construction and the weed's effect on adjacent land uses.

4.13.3 Alternative A (No Action). Implementation of Alternative A would not disturb any of the sensitive soil groups described or cause any of the potential impacts to soil resources that are discussed above.

4.13.4 Alternative B (Proposed Action). Table 3-58 provides the miles of each soil group which would be crossed by Alternative B. As with all of the alternatives, impacts from disturbance (i.e., miles crossed) to limiting soil groups (Groups 1 through 7) would be markedly higher on private lands than on state or Federal lands because the route would mostly affect private lands.

With adequate mitigation measures to control erosion, prevention of topsoil loss, and control measures to prevent invasions of noxious weeds, impacts to soils should be short-term for all soil groups, except for Group 6 - prime farmland soils. In addition, mitigation measures will need to address the procedures to be taken to ensure that compacted soils or soils that are difficult to reclaim (Groups 1, 3, 4 and 7) are stabilized and revegetated as quickly as possible.

Impacts to prime farmlands would be considered a long-term impact because construction of the alternative would remove these soils from crop production. This alternative would cross approximately 27.6 miles of prime farmland soils in South Dakota. No prime farmland soils would be crossed by this alternative in Wyoming. Alternative B would cross the least amount of prime farmland soils (see Table 3-57).

As discussed above, soil mapping units SaE, SmE, SbF, SdF and ScE in Fall River, Custer and Pennington counties are prone to slumping and landslides. If slumps or landslides were to occur on these soils, it would be considered a long-term impact because these slumps can be difficult to stabilize. This alternative would cross approximately 36.4 miles of soils in these mapping units. Compared to the other alternatives, Alternative B would cross the largest amount of soils in these mapping units because the alignment is adjacent to the Cheyenne River for a longer distance.

Exposing rock outcrops in cuts on shallow soils would be a long-term impact since these outcrops would likely remain exposed after construction. Rock exposures would most likely occur where the alternative would traverse steep slopes and where cuts would be required. This alternative would cross 129.2 miles of soils that are shallow to moderately deep with bedrock at depths of 40 inches or less. In addition, this alternative would cross 103.8 miles of soils that may have slopes greater than 15 percent. Compared to the other alternatives, Alternative B could expose more bedrock because it crosses the greatest amount of shallow soils and soils with steep slopes (see Table 3-57 for comparison of alternatives).

4.13.5 Alternative C (Modified Proposed Action). Table 3-59 summarizes distances that Alternative C would cross in each soil group. Generally, Alternative C would have the same types of impacts as Alternatives B and D, however, this alternative is 22.3 miles shorter than Alternative B and 86.2 miles shorter than Alternative D. Therefore, impacts to soils would be less under this alternative. Likewise, impacts to soils which have a high water erosion hazard (Group 2) would be less with this alternative. For example, Alternative C would impact 95.4 miles of soils that have a high water erosion hazard compared to 112 miles impacted by Alternative B and 100 miles impacted by Alternative D.

This alternative would also cross less soils that have steep slopes in Group 7 (91.1 miles) than Alternative B (103.8 miles). However, Alternative D would cross the least amount of any alternative through soils in Group 7, affecting only 78 miles (see Table 3-57).

As indicated for Alternative B, impacts to soils from implementing this alternative would be short-term if adequate mitigation measures are implemented to control erosion, prevent the loss of topsoil and prevent invasion or spread of noxious weeds. In addition, mitigation measures will need to address the procedures that will be taken to ensure that soils that are compacted or difficult to reclaim (soils in Groups 1, 3, 4 and 7) are stabilized and revegetated as quickly as possible.

As with Alternative B, impacts to prime farmlands from implementing this alternative would be considered a long-term impact because construction would remove these soils from production. This alternative would cross approximately 30 miles of prime farmland soils in South Dakota. No prime farmlands would be crossed by this alternative in Wyoming. Compared to the other alternatives, this alternative would cross 1.3 miles more of prime farmland soils than Alternative B and 8.6 miles less than Alternative D (see Table 3-57).

Alternative C would cross approximately 21.1 miles of soils that are prone to slumping and landslides. If these events were triggered by construction of this alternative, it would be considered a long-term impact. This alternative would cross approximately 15.3 fewer miles of these soils than Alternative B. However, Alternative C would cross 2.7 more miles of these soils than Alternative D.

This alternative would have less of a potential to expose shallow bedrock during construction than Alternative B, and about the same potential as Alternative D. Compared to Alternative B, this alternative would cross about 11.4 fewer miles of soils that are shallow to bedrock (Soil Group 4) and about 12.7 fewer miles of soils that have steep slopes (Soil Group 7) where rock could be exposed during cut and fill operations (see Table 3-57).

Phiney Flat Route Variation. This route variation would have the same potential impacts as Alternative C in Wyoming and in Fall River County. Compared to Alternative C, the principle differences that this route variation would have would mainly occur on private lands in Custer County (see Table 3-60). In comparison to Alternative C, this route variation would have the following differences (see Table 3-57):

- It would impact about 1.2 miles less of soils in Group 2 that have a high water erosion hazard.
- It would impact 1.1 miles less of soils that are shallow to bedrock and 1.3 miles less of soil that have a low water holding capacity which are soils in Group 4.
- It would impact about 1.2 miles less of soils that may have steep slopes.
- It would cross approximately 1.3 miles more of prime farmland soils. These soils are only considered prime farmlands if they are irrigated.
- It would cross 20.3 miles of soils in mapping units SaE, SmE, SbF, SdF and ScE which are prone to slumping. This variation would cross 0.8 fewer miles of these soils than Alternative C.

W G Flat Route Variation. This route variation would have the same potential impacts as Alternative C in Wyoming and Pennington County. Compared to Alternative C, the primary difference that this route variation would have in the types of soils that would be crossed would occur on private lands in Fall River County (see Table 3-61). In comparison to Alternative C, this route variation would have the following differences (see Table 3-57):

- It would impact about 1.5 miles less of soils that have a high water erosion hazard, however, this variation would impact approximately 2.8 miles more of soils that have a high wind erosion hazard.
- It would impact about 1.6 miles less of soils that are shallow to bedrock.
- It would impact approximately 2.8 miles less of prime farmland soils.
- It would cross 21.2 miles of soils in mapping units SaE, SmE, SbF, SdF and ScE which is about the same as Alternative C.

4.13.6 Alternative D (Existing Corridors Alternative). Table 3-62 provides the distances which would be crossed by Alternative D in each soil group. Even though Alternative D is significantly longer than Alternatives B and C, it would be constructed within or adjacent to existing transportation corridors. That is expected to significantly reduce impact to soils. In addition, even though Alternative D is the longest alternative it does not have the greatest crossing lengths through all of the limiting soil groups (see Table 3-57).

This alternative would cross about 32.8 miles of saline soils in Group 1 which is 6.6 miles more than Alternative B and 11 miles more than Alternative C (see Table 3-57). Because these soils can be difficult to revegetate, the reclamation plan for this alternative would need to specify salt-tolerant seed mixtures on these soil types. Mulching or other moisture conserving reclamation techniques may be required to ensure that these soils are stabilized and revegetated adequately.

This alternative would affect the least amount (2.7 miles) of soils in South Dakota that are prone to slumping and landslides (soils in mapping units SaE, SmE, SbF, SdF and ScE). Therefore, this alternative should have the least potential to cause slumps over the long-term.

This alternative would cross more prime farmland soils (38.6 miles) than the other alternatives (see Table 3-57). However, some of these prime farmland soils have been previously impacted by the existing trans-portation corridor. In addition, this alternative would probably be the least disruptive to existing agricultural operations because the alignment would generally pass on the edges of cultivated fields adjacent to existing railroad rights-of-way. Because Alternatives B and C are cross-country alignments that would be constructed outside of existing

transportation corridors, they would tend to bisect cultivated fields.

4.13.7 Proposed Mine Loop Options. The primary difference in impacts to soils between the Black Thunder North and South mine loops is in their total overall length. The Black Thunder South Mine Loop is 2.6 miles longer than the Black Thunder North Mine Loop (7.1 miles compared to 4.5 miles). This additional length would cause more total soil disturbance and could cause more potential erosion. However, the Black Thunder North Mine Loop would cross about 1.9 miles more of steep soils in Group 7 than the Black Thunder South Mine Loop. Construction on steep soils typically requires larger disturbed areas and longer cut and fill slopes to achieve design grades. Therefore, disturbance to soils in Group 7 could increase the potential for erosion. The difference between the mine loop options for other limiting soil groups is generally not considerable.

The largest difference in impacts to soils with limiting characteristics between the North Antelope East and North Antelope West mine loops would occur to soils in Group 4 which have a low AWC. The North Antelope West Mine Loop would cross twice the amount of soils in this group as the North Antelope East Mine Loop (1.8 miles compared to 0.9 miles). Furthermore, the North Antelope West Mine Loop is 0.9 miles longer than the North Antelope East Mine Loop (2.4 miles compared to 1.5 miles) which would cause greater soil disturbance.

4.13.8 Proposed Yard Sites. The Wall Yard would cross soils in Group 1 that are saline, soils that are shallow to bedrock and have a low available water capacity in Group 4 and soils that are hydric in Group 5. The majority of the soils that would be affected by the Edgemont Interchange Yard are designated as prime farmland soils in Group 6. Other soil groups that would be crossed by this yard include soils that are saline and sodic in Group 1, soils that have a high wind erosion hazard in Group 3 as well as soils that are shallow and have a low available water capacity in Group 4. The Western Yard would cross soils that are saline and sodic in Group 1, soils that are shallow to bedrock and have a low available water capacity in Group 4, as well as soils that may have slopes greater than 15 percent in Group 7 and that have a high erosion hazard in Group 2.

The primary impacts to soils from these yards is that they would be taken out of production and converted to a long-term industrial use. These soils would not be available to produce crops or forage for livestock or wildlife. In addition, because the yards will encompass large areas and be constructed mostly with impervious surfaces, they could contribute large volumes of runoff to adjacent areas. This runoff could cause erosion to these adjacent areas unless proper drainage is provided. Construction of the yards would be considered a long-term impact to soils and an irreversible and irretrievable commitment of resources, particularly where prime farmlands are taken out of production.

4.14 Vegetation Resources

Issues related to potential impacts to vegetation resources were raised by USFWS, SDGFP, and WGFD as they were addressing wildlife and fisheries habitat issues and are summarized, below:

- Construction and disturbance impacts could reduce forage possibly leading to increased forage competition between big game and livestock.
- Loss of habitats and desirable vegetation could potentially reduce the biological diversity of the area.
- Potential loss of native vegetation communities and soil disturbance will lead to increased encroachment or invasion of noxious weeds and undesirable plant species.
- Impacts to riparian forest and woody draw habitats, including direct removal and fragmentation of these habitats, must be addressed as well as impacts to riparian oxbow wetlands along the Cheyenne River in South Dakota.
- Disturbance to existing vegetation cover may lead to increased soil erosion and stream sedimentation.
- Require revegetating disturbed sites with desirable native species and avoid planting species such as sweet clover or alfalfa that would attract grazing wildlife.

4.14.1 Significance Criteria. Impacts produced by alternatives would be considered significant if the following occurred:

- Within 5 years reclaimed areas do not attain adequate vegetation cover and species composition to stabilize revegetated sites and to support pre-existing land uses including livestock forage and wildlife habitat. This criteria is most important for areas disturbed outside the railroad right-of-way (i.e., waste and borrow areas).
- There is invasion and establishment of noxious or nonnative weeds.

Significant impacts could occur from any of the alternatives if adequate revegetation measures are not implemented and monitored to insure successful revegetation. In addition, SDGFP has a policy of no net loss of Resource Category 1 wildlife habitats that include woody draws, native grasslands, sagebrush-grasslands, riparian woodlands, and wetlands. Impacts to vegetation and associated wildlife species would be considered

significant if there was a net loss of any Resource Category 1 Habitat.

4.14.2 Summary of Impacts Common to All Alternatives (Except the No Action Alternative). Potential impacts to vegetation from the alternatives include crushing and/or mowing herbaceous species and shrubs, tree removal and removal of vegetation during construction. Although disturbed areas that are not required for operations of the railroad would be revegetated, the time required to return these areas to their preconstruction condition would vary depending on several factors. Vegetation recovery would also be dependent on treatment of topsoils which is a valuable seed sources for native plant species. Therefore, impacts to vegetation could be considered temporary, long-term or permanent. Temporary impacts would occur on construction sites that are successfully revegetated within 5 years of seeding. Long-term impacts to vegetation would occur where revegetation requires more than 5 years to become reestablished. Permanent impacts to vegetation would occur on areas that are converted into industrial use, such as the railroad bed, sidings and yards.

Long-term impacts to vegetation may occur on areas where edaphic conditions or weed invasions limits revegetation success or when the vegetation type disturbed requires more the 5 years to reestablish. Problem areas that may be difficult to revegetate include soils with limiting chemical or physical characteristics that restrict plant establishment because of nutrient imbalances or limits the soils moisture storage capacity. These soils would include shallow, saline or sodic soils. Where these soil types occur on south or west facing aspects their limiting characteristics would be compounded because these slopes receive more solar radiation which increases evaporations rates and decreases the moisture available to plants.

Impacts to vegetation communities dominated by shrub and tree species are more long-term since reestablishment of these species takes many more years compared to herbaceous or grassland type communities. For example, big sagebrush shrublands may take 10 to 20 years to become established to their preconstruction condition while the woodlands would take 25 to 75 years and the riparian and woody draws 10 to 60 years. Impacts to these vegetation types may adversely affect wildlife species that are, in some way, dependant for life history functions.

Disturbed areas that become heavily infested with weeds such as cheatgrass could also hinder successful revegetation causing long-term impacts. Cheatgrass is a winter annual that begins growth in the fall or early spring which gives it a competitive edge over many native species and once it is established it is a strong competitor with native species. In addition, the establishment of cheatgrass increases the fire hazard because it is a highly flammable fuel that can rapidly accumulate (Knight, 1994).

Most noxious weeds are opportunistic, introduced species which become particular problems when the native communities are disturbed. Perennial pepperweed, Russian knapweed, skeletonleaf bursage, yellow toadflax an dalmatian toadflax can form dense stands that are difficult to eliminate because of their deep and extensive root systems; Dyer's woad first invades disturbed soil then spreads to rangelands and regenerates from roots if mowed; hoary cress becomes established on disturbed alkaline soils and out-competes other species (Whitson *et al.,* 1996). There are some noxious weeds, including horsenettle and houndstongue, that contain toxic compounds and others like yellow starthistle and leafy spurge that cause physical irritation of herbivores' digestive tracts. Characteristics and measures that can be used to control other noxious weeds are provided in Table 4-4.

Some weeds can be effectively controlled through mechanical means (mowing, plowing) but others can only be eradicated by application of herbicides, including 2,4-D, Tordon, Banvel, or some combination of mechanical, chemical, and application of biological agents such as species-specific insect parasites (see Table 4-4). Herbicide application, however, has the potential to affect non-target species including Federally-listed threatened species (Ute ladies'-tresses), rare, and sensitive species (see Table 3-86).

Another impact common to all alternatives is the potential conversion of native vegetation to introduced species within construction sites where agencies do not stipulate or have the authority to stipulate (i.e., private lands) the use of native species in revegetation seed mixes. In these areas introduced grasses and forbs may dominate the species in seed mixes to ensure rapid establishment of vegetation cover for erosion control and to reduce weed competition. Although these areas would be revegetated with species that have similar structure, stature and functions they would not be native to the area. On NFS lands, all revegetation seed mixes would be approved by the Forest Service and would not contain non-native species. In addition, where mulching is done on NFS lands, weed-free hay would be required.

4.14.3 Alternative A (No Action). Implementation of the No Action Alternative would eliminate project-related impacts to vegetation.

4.14.4 Alternative B (Proposed Action). In South Dakota, Alternative B would pass through 114 miles of grasslands, 7 miles of riparian deciduous vegetation and

Table 4-4 Characteristics of Selected Noxious Weeds Known to Occur in the Vicinity of the Alternatives and Potential Control Measures		
Common Name	**Weed Characteristics (1)**	**Potential Control Measures (2)**
Canada thistle	Aggressive weed that is difficult to control; plowing roots increases propagation	Biological, chemical
Common burdock	Grows on roadsides, ditch banks, in pastures and waste areas; seeds distribute when burs become entangled in animal hair	Mechanical, chemical
Diffuse knapweed	Infests dry rangelands, roadsides, pastureland; may out compete and exclude desirable plants	Biological, chemical
Field bindweed	Adapts to different environmental conditions including cultivated fields; deep taproot generates many lateral roots; seeds viable to 50 years	Mechanical, biological, chemical
Horsenettle	In the Nightshade family; a persistent weed; poisonous to livestock	Mechanical, chemical
Leafy spurge	Irritates mouth and digestive tracts of cattle; has an extensive root system with nutrient reserves that make it difficult to control	Mechanical, biological, chemical
Musk thistle	Forms dense stands, crowding out desirable plants on range, pastures, roadsides, ditch banks, streambanks, waste areas, croplands	Mechanical, biological, chemical
Perennial sowthistle	Common were adequate water is present: ditch banks, cultivated cropland, fertile waste areas	Mechanical, chemical
Plumeless thistle	Locally abundant in pastures, stream banks, fields and roadsides	Mechanical, biological, chemical
Russian knapweed	Form colonies in cropland, pastures and roadsides; spreads by deep growing roots	Mechanical, biological, chemical
Scotch thistle	Aggressive plant forms dense stands that may be impenetrable to livestock; in waste areas and roadsides	Mechanical, chemical
Spotted knapweed	On disturbed soils, out compete desirable plants; allelopathic chemicals may inhibit growth of other plants	Biological, chemical

Notes:
1 = Source: Whitson, *et al.*, 1996.
2 = Source: Forest Service, 1996b.
Mechanical control includes mowing top growth, pulling or grubbing plant out of the ground, tillage and severing roots below ground.
Biological control includes use of species-specific invertebrate herbivores and plant allelopathic compounds.
Chemical control includes application of herbicides.

woody draws, over 2 miles of coniferous (ponderosa pine, juniper) woodlands, and approximately 2 miles of wetlands[4] (see Tables 3-63 and 3-74). Short-term impacts would therefore occur within 3 of SDGFP's Resource Category 1 habitats although the actual amount of short- and long-term disturbance to native grasslands is unknown: grasslands crossed by Alternative B - 92 miles of which are on private lands but only 2.5 miles of grasslands would be affected on state lands - have not been examined for plant species composition or evaluated as native grasslands. And, no wetlands, riparian or woody draws would be affected on state lands (see Tables 3-63 and 3-74). Nevertheless, there would be short- and long-term losses of Resource Category 1 habitats on and off state lands.

The alternative would cross 1.7 miles of wetlands in South Dakota, most of which are on private lands but 0.23 mile of riverine wetlands would be affected on BGNG (see Table 3-74). Also affected would be nearly 21 miles of cropland and pasture.

[4] Wetland estimates in this section are based on land use and land cover and are considered inaccurate. More accurate estimates are provided in Section 4.16.

Most of the vegetation affected by Alternative B in Wyoming is on private land (70 percent). The route would pass through 128 miles of grasslands and 15 miles of sagebrush steppe that includes mixed rangelands and shrub-dominated rangelands. Less than one mile of the route would pass through wetlands in Wyoming (see Tables 3-63 and 3-74). The route would affect 0.5 mile of deciduous woodlands and about 8 miles of croplands and/or pastures (see Table 3-63).

Once completed, vegetation would not be allowed to grow on the rail bed ballast and rails and probably be maintained to low-growing herbaceous forms within the rail bed grade and associated ditches. Those areas would be lost to reestablishment of native vegetation over the long-term. From the outer margins of the rail bed ditch to DM&E's right-of-way edge opportunities may exist for revegetating disturbed areas for native plant species as long as growth forms meet safety requirements for the operating railroad (adequate sight distances, access for track maintenance). If native plant species can become established within the railroad right-of-way, fencing the outer boundary to exclude livestock

from the tracks should enhance revegetation by native species.

But, from DM&E's right-of-way to the outer edge of disturbed construction zones, disturbed vegetation would be reclaimed to land owner specifications. Consequently, native species would be expected to become reestablished on only a fraction of the area disturbed since private lands account for 84 percent of Alternative B in South Dakota and 70 percent of the route in Wyoming. Existing land-use practices on those private lands are expected to continue, whether devoted to livestock grazing, crop production, other agricultural uses or industrial uses (including mining and quarrying). Where those situations exist there would be a long-term loss of the current vegetation cover type.

4.14.5 Alternative C (Modified Proposed Action). In South Dakota, Alternative C would pass through 110 miles of grasslands, nearly 6 miles of deciduous riparian vegetation, less than 1 mile of upland deciduous woodlands (including woody draws), 3 miles of coniferous woodlands (ponderosa pine, juniper), and approximately 1.3 miles of wetlands (see Tables 3-64 and 3-75). Short-term impacts would therefore occur within 4 of SDGFP's Resource Category 1 habitats although the actual amount of short- and long-term disturbance to native grasslands is unknown: grasslands crossed by Alternative C (101 miles of grasslands are on private lands but only 1.5 miles of grasslands would be affected on state lands) have not been examined for plant species composition or evaluated as native grasslands.

No wetlands or deciduous riparian vegetation would be affected on state lands (see Tables 3-64 and 3-75). Nevertheless, there would be short- and long-term losses of Resource Category 1 habitats on and off state lands. The route would cross 1.3 miles of wetlands in South Dakota, none of which are on BGNG (see Table 3-75). Also affected would be nearly 21 miles of cropland and pasture. Alternative C would affect nearly the same amounts of each kind of vegetation as Alternative B, except levels of affect would differ for different land owners.

Most of the vegetation affected by Alternative C in Wyoming would be on private land (67 percent). The route would pass through 110 miles of grasslands and 11 miles of sagebrush steppe that includes mixed rangelands and shrub-dominated rangelands. Only 0.3 mile of the route would pass through wetlands in Wyoming (see Tables 3-64 and 3-75). The route would also affect 0.3 mile of coniferous woodlands and about 9 miles of croplands and/or pastures (see Table 3-64). Since the length of Alternative C through Wyoming is less than the length of Alternative B, less vegetation in each category is affected, generally, by Alternative C.

Native species would be expected to become reestablished on only a fraction of the area disturbed since private lands account for 92 percent of Alternative C in South Dakota and 67 percent of the route in Wyoming. Existing land-use practices on those private lands are expected to continue, whether devoted to livestock grazing, crop production, other agricultural uses or industrial uses (including mining and quarrying). Where those situations exist there would be a long-term loss of the current vegetation cover type.

Phiney Flat Route Variation. Short-term effects described for Alternative C in Wyoming would be identical to those for the Phiney Flat Route Variation. In South Dakota, the Phiney Flat Route Variation would pass through 106 miles of grasslands, about 4 miles less than Alternative C. Approximately 6.1 miles would pass through deciduous riparian vegetation, less than 1 mile would pass through upland deciduous woodlands (including woody draws), 3 miles would affect coniferous woodlands (ponderosa pine, juniper), and 1.3 miles would pass through wetlands (see Tables 3-65 and 3-76). Similar to Alternative B and Alternative C, short-term impacts are likely within 4 of SDGFP's Resource Category 1 habitats. No wetlands or deciduous riparian vegetation would be affected on state lands (see Tables 3-61 and 3-76).

The route would not cross any wetlands on BGNG (see Table 3-76). Nearly 26 miles of cropland and pasture would be crossed - more than Alternative C. But the route would affect slightly less wetlands and less grasslands than Alternative C through South Dakota.

Long-term impacts along the Phiney Flat Route Variation are expected to be identical to those described for Alternative C, above, especially since the same relative amount of private lands (92 percent) in South Dakota would be disturbed by both alternatives. Existing land-use practices on those private lands are expected to continue.

W G Flat Route Variation. Since the W G Flat Route Variation in Wyoming would not change from Alternative C, short-term effects described for Alternative C in Wyoming would be identical to those for the W G Flat Route Variation. In South Dakota, the W G Flat Route Variation would pass through 107 miles of grasslands, about 3 miles less than Alternative C. Approximately 3.3 miles would pass through deciduous riparian vegetation, less than 1 mile would pass through upland deciduous woodlands (including woody draws), 3 miles would affect coniferous woodlands (ponderosa pine, juniper), and 1 mile would pass through wetlands (see Tables 3-66 and 3-77). Similarly to Alternative B and Alternative C, short-term impacts are likely within 4 of SDGFP's Resource Category 1 habitats. No wetlands

or deciduous riparian vegetation would be affected on state lands (see Tables 3-66 and 3-77).

The route would not cross any wetlands on BGNG (see Table 3-77). Nearly 25 miles of cropland and pasture would be crossed, more than Alternative C. But the W G Flat Route Variation would affect less wetlands and less grasslands than Alternative C through South Dakota.

Long-term impacts along the W G Flat Route Variation are expected to be identical to those described for Alternative C, above, especially since the same relative amount of private lands (92 percent) in South Dakota would be disturbed by both alternatives. Existing land-use practices on those private lands are expected to continue.

4.14.6 Alternative D (Existing Corridors Alternative). In South Dakota, Alternative D would be located almost entirely on private lands (98 percent), most of which is within DM&E's existing right-of-way. That route passes through 119 miles of grasslands, slightly less than 5 miles of deciduous riparian vegetation, less than 1 mile of upland deciduous woodlands (including woody draws), over 2 miles of coniferous woodlands (ponderosa pine, juniper), and approximately 0.5 mile of wetlands (see Tables 3-67 and 3-78). Short-term impacts might occur within 4 of SDGFP's Resource Category 1 habitats if those have regenerated within the existing railroad right-of-way. Otherwise, impacts would be restricted to those habitats between Smithwick and South Dakota-Wyoming state line.

No wetlands, deciduous riparian vegetation or woody draws would be affected on state lands (see Tables 3-67 and 3-78). Nevertheless, there might be short- and long-term losses of Resource Category 1 habitats off state lands. The route would not cross BGNG. But, Alternative D would possibly affect nearly 43 miles of cropland and pasture if those land uses overlap construction zones.

As in South Dakota, most of the vegetation which would be affected by Alternative D in Wyoming is on private land (79 percent), more than any other alternative. The route would pass through 69 miles of grasslands and 81 miles of sagebrush steppe that includes mixed rangelands and shrub-dominated rangelands. The route would pass through 1.3 miles of wetlands in Wyoming (see Tables 3-67 and 3-78). The route would potentially affect 7.0 miles of coniferous woodlands and about 8.5 miles of croplands and/or pastures if those were within potential construction zones (see Table 3-67).

4.14.7 Proposed Mine Loop Options. The Black Thunder mine loops would be within grasslands, developed land and strip mines. The Black Thunder South Mine Loop would also cross 0.3 miles of wet meadow wetland type. The Black Thunder North and South mine loops would cross 9 and 12 intermittent streams, respectively. The North Antelope mine loops would cross croplands and grassland. In addition, the North Antelope East Mine Loop would cross 0.06 miles of wet meadow. The North Antelope West and East mine loops would cross 4 and 2 intermittent streams, respectively.

4.14.8 Proposed Yard Sites. The proposed yard at Wall would be within croplands and intersect the I-90 corridor. The site contains 3 wetlands. Construction and operation of the Wall Yard would eliminate these vegetation types for the life of the project. The proposed Edgemont Interchange Yard would be within grassland vegetation, on soils designated as prime farmlands. That yard would cross 1 intermittent stream, a tributary to the Cheyenne River, and be within 0.5 mile of the river. The Western Yard would cross mostly grasslands. No wetlands would be affected.

4.15 Grazing Resources

The following issues relevant to grazing resources have been raised:

- Fragmentation of grazing allotments.
- Isolation of water sources.
- Reduced pasture/allotment sizes.
- Increased fence densities.
- Disruption of grazing operations/logistics/access.
- Livestock losses.
- Loss of AUMs.
- Increase in permit administration.
- Impacts to historic trailing of livestock.
- Impacts from construction.

4.15.1 Significance Criteria. Impacts produced by the alternatives would be considered significant if the following occurred:

- Loss of more than 10 percent of AUMs within any individual allotment.
- Separating livestock from water source either temporarily or permanently.
- Permanent obstruction of historic livestock trails.
- Loss of access to part of the allotment..

4.15.2 Summary of Impacts Common to All Alternatives (Except the No Action Alternative). Impacts to grazing resources are only described for Forest Service and BLM administered grazing allotments that would be directly affected by the alternatives. Although impacts to privately owned grazing lands crossed by the alternatives would be generally the same as those described for

Federal allotments, they are not quantified here. Impacts specific to privately-owned grazing lands would be mitigated according to agreements negotiated by DM&E and individual landowners. At this time, those agreements are confidential.

Table 4-5 provides a comparison of the number of Forest Service and BLM allotments which would be crossed by the alternatives. The table also provides the total acres of disturbance and AUMs that would be lost in the affected allotments. So that effects of alternatives could be compared, a 200-foot wide corridor centered on the railroad centerline was established in a GIS so acreage affected and AUMs potentially lost could be calculated within each allotment.

The impacts to grazing resources include: fragmentation of allotments caused by the railroad bisecting allotments or allotment pastures, isolation of water sources and supplies, loss of forage during construction, disruption of operations and blocking access to the allotments. These impacts are discussed in more detail below. Other potential direct and indirect impacts include: displacement of livestock from preferred grazing areas and stock watering facilities or ponds, damage to range improvements, disruption of livestock movements or trailing operations, spread of noxious weeds, and increased loss of livestock from vehicle-livestock collisions during the construction phase and collisions with trains during the operational phase.

Forage Loss. Construction and operation of the railroad would remove forage available for livestock use. The impact from this forage loss would depend on the amount actually lost in each allotment or pasture since allotments are managed according to their stocking rate. The loss in forage would be considered a long-term impact even though disturbed areas not needed for operation of the railroad would be revegetated after construction. Reclaimed areas would be within the railroad's fenced right-of-way and unavailable for livestock grazing. If the loss in AUMs is very large or significant, adjustments to allotment management plans may be necessary to prevent overgrazing. Management adjustments that may be necessary if AUM losses are significant include reducing the number of livestock grazed or reducing the length of the grazing period. In addition, forage could be lost indirectly if noxious weeds become established on disturbed areas and invade adjacent rangelands. Noxious weeds can lower stocking rates of rangelands if uncontrolled; weeds generally outcompete and replace desirable forage species.

Indirect short-term loss of forage could also result from fugitive dust generated by construction traffic settling on forage species. Heavy accumulations of dust on plants would likely reduce the palatability of forage species and would force livestock to use other areas in the allotment, away from construction sites. This impact should be temporary since precipitation would wash the dust off of the plants and new plant growth would not be affected after construction.

Fragmentation of Allotments. Construction of the railroad through an allotment could bisect it so that portions are unconnected and fragmented into small unmanageable parcels. Livestock and machinery crossings will reduce fragmentation to some degree. The significance of this impact would depend on the alignment of the railroad in each allotment, presence of range improvements or facilities (corrals, water sources, etc.) and size of the bisected allotment parcels. In some cases, fragmentation may only be a minor impact. But if numerous small and unmanageable parcels are created, management and physical changes within and adjacent to the allotment may be required. Such changes could include moving or modifying allotment fences to eliminate small unmanageable parcels and reallocating fragmented parcels to other pastures or allotments. Construction of additional fences within allotments to mitigate fragmentation impacts would increase fence densities in the area and could adversely affect big game movements.

Isolation of Water Sources. The semi-arid climate of the project area requires adequately distributed water sources so that livestock efficiently utilize range forage resources. Water sources in the project area include developed wells and springs which can supply a perennial water source or temporary sources such as ponds or impoundments that only hold water seasonally. Construction of the railroad could directly impact these water sources or could isolate a water source from livestock use since the railroad would be an impassible barrier. Impacts to water sources would depend on their proximity to the railroad, the type of water source (perennial or seasonal), and whether other water sources are in the area. Isolation of water sources could cause livestock distribution problems which could contribute to overgrazing in some areas of the allotment while other areas would remain under-utilized. Livestock and wildlife might also avoid water sources during operation if they are very near the railroad. However, it is unclear how severe this indirect impact would be or if effects would be greater during construction or during operation. Livestock and some wildlife may habituate to consistent train traffic.

Disruption of Operations or Access. Construction of the railroad through grazing allotments would create an impassible barrier that could disrupt operations or management. Access through or to allotments could be limited or restricted if roads or trails are cut off and alternative access across or under the railroad is not provided. Severity of this impact would depend on the alignment of the railroad through the allotments, the types

Table 4-5 Summary of Grazing Impacts to Federally Administered Allotments									
	Alternative B			Alternative C			Alternative D		
	South Dakota	Wyoming	Total	South Dakota	Wyoming	Total	South Dakota	Wyoming	Total
Forest Service Allotments Affected	25	57	82	13	43	56	0	38	38
BLM Allotments Affected	7	4	11	6	4	10	3	6	9
Total	32	65	97	19	49	68	3	44	47
Total Acres of Allotment Disturbance (1)	619.1	2,146.7	2,765.8	373.3	1,690.0	2,063.3	32.4	1,287.6	1,320.0
Total AUMs Lost in All Allotments	168.9	411.6	580.5	79.6	354.2	433.8	6.2	231.9	238.1
1 = For purposes of alternative comparison, an estimated 200-foot wide corridor centered on the alternative centerline was established to estimate acres affected by disturbance and to determine AUMs that could potentially be lost with in each allotment.									

of allotment improvements that are isolated by the railroad, roads or trails crossed by the railroad and whether those would remain open after construction, or if there is sufficient access from other existing roads. If these impacts are not adequately mitigated by providing appropriate crossing locations or alternate road access, fragmented allotment parcels could become inaccessible to livestock and permittees. If these impacts occur and allotment management adjustments are not made, overgrazing and deterioration in range condition may occur on some areas of the allotment.

4.15.3 Alternative A (No Action). Implementation of the No Action Alternative would eliminate potential project-related impacts to Forest Service and BLM administered grazing allotments.

4.15.4 Alternative B (Proposed Action). Alternative B would affect a total of 93 Forest Service and BLM administered allotments in South Dakota and Wyoming. In South Dakota, this alternative would impact 32 allotments (25 Forest Service and 7 BLM allotments). In Wyoming, 61 allotments would be affected by Alternative B (57 Forest Service and 4 BLM allotments - see Table 4-5). Fragmentation and the disruption of operations or access to these allotments and the impacts to water sources (destruction or isolation) by construction of this alternative would be considered a short-term impact as long as these impacts are adequately mitigated.

Each allotment listed in Table 4-6 would be crossed by Alternative B in Wyoming and South Dakota. Short-term impacts are indicated on the table. Mitigation measures that would be required to insure that potential allotment impacts are temporary or short-term are included in the table. Suggested mitigation measures should be verified in the field to determine if they are adequate or if other measures would be necessary and appropriate to minimize impacts.

Alternative B would disturb an estimated 2,766 acres within the 93 allotments. In South Dakota, 619 acres of disturbance would occur in 32 allotments while 2,147 acres of the total disturbance would occur in 61 allotments in Wyoming. This disturbance would result in the total loss of about 581 AUMs in these 93 allotments. Total forage loss from the South Dakota allotments would be approximately 169 AUMs; 412 AUMs would be lost in the Wyoming allotments (see Table 4-5). The loss in forage would be considered a long-term impact even though disturbed areas would be revegetated because reclaimed areas would mostly be within the railroad's fenced right-of-way and unavailable for livestock use. This alternative would cause more disturbance to Federally-administered grazing allotments than the other alternatives.

Estimates of total AUMs lost and percent of each allotment's total forage that loss represents are provided in Table 4-6. Assuming that the railroads fenced right-of-way would be 100 feet on either side of the railroad (a 200-foot wide corridor), computed forage lost indicates that only 4 of the 93 allotments crossed would have a 10 percent or greater loss in forage, considered to be a significant impact.

The 3 allotments in South Dakota that would be impacted to that level of forage loss are BLM allotments. It should be noted that the forage loss calculation on the BLM allotments is only based on the BLM lands within these allotments. Private lands within these allotments are not considered, and therefore the estimated impact on entire allotments would probably be less than the 10 percent forage loss threshold.

Table 4-6
Impacts to Federal Grazing Allotments From Alternative B

Allotment	Pasture	Total AUMs	Acres of Disturbance (1)	AUMs Lost (2)	Percentage AUMs Lost	Pasture Fragmentation	Isolation of Water	Disruption of Operation or Access	Potential Mitigation Measures
South Dakota									
Creston	FRRD 41	private	5.3	private	private	private	private	private	Private
Gilmore	FRRD 63	652.1	76.9	20.0	3.1	yes	no	significant	Cattle crossing
Reed	FRRD 98	406.2	16.5	5.6	1.4	no	possible	significant	Field verify water source - provide access across track
Circle C	FRRD 38	186.2	11.5	2.6	1.4	no	no	no	None
Reed	FRRD 97	188.6	23.7	8.0	4.2	yes	yes	significant	Cattle crossings, water source, adjust pasture fence boundary and reallocate bisected pasture to another allotment
Hardpan	FRRD 396	private	18.3	private	private	private	private	private	Private
Kaiser	FRRD 79	1,257.3	49.7	21.1	1.7	yes	yes	yes	Cattle crossing and access to water on Cheyenne River south of railroad
Hardpan	FRRD 397	638.4	60.4	15.3	2.4	yes	no	significant	Will have loss of pasture east of the railroad
Red Shirt	FRRD 100	331.6	29.9	6.7	2.0	significant	yes	significant	Loss of water along the Cheyenne River and disruption of future pipeline
Hardpan	FRRD 426	no grazing	25.6	no grazing	no grazing	no	no	no	Adjust pasture fence and reallocate bisected pasture area to FRRD 397
Red Shirt	FRRD 99	238.6	19.8	4.4	1.8	no	yes	yes	Extend existing pipeline to west of railroad
Chalk Hills	FRRD 8	832.0	1.1	0.2	0.02	no	no	yes	Need access and cattle underpass
Chalk Hills	FRRD 13	239.4	0.02	n/a	n/a	no	no	no	None. The right-of-way may clip a corner of the allotment
Likewise	FRRD 81	92.1	12.1	7.1	7.7	yes	yes	yes	Need water west of railroad from Cheyenne River
Chalk Hills	FRRD 14	37.3	1.8	0.4	1.1	not determined	not determined	not determined	Crosses mostly private and a private pipeline
Chalk Hills	FRRD 17	143.7	25.2	6.3	4.4	yes	yes	yes	Access to Cheyenne River and water
Likewise	FRRD 80	149.2	33.1	10.0	6.7	yes	yes	yes	Underpass
Chalk Hills	FRRD 11	48.9	8.7	1.9	3.9	yes	no	yes	None
Chalk Hills	FRRD 10	158.0	18.7	8.5	5.4	significant	significant	significant	Access to water on the Cheyenne River
Bondurant	FRRD 33	544.7	16.5	7.5	1.4	no	no	no	None

Table 4-6
Continued

Allotment	Pasture	Total AUMs	Acres of Disturbance (1)	AUMs Lost (2)	Percentage AUMs Lost	Pasture Fragmentation	Isolation of Water	Disruption of Operation or Access	Potential Mitigation Measures
ND Misc	FRRD 451	no authorized use	10.1	not determined	not determined	yes	no	yes	Not determined since no authorized use
Chalk Hills	FRRD 12	167.3	35.2	7.0	4.2	yes	yes	yes	Field verify water
Chalk Hills	FRRD 2	217.2	2.8	0.7	0.3	no	no	no	None
Chalk Hills	FRRD 1	387.9	29.2	17.2	4.4	yes	no	yes	Underpass and access
Stumer	FRRD 116	230.8	13.4	3.4	1.5	no	yes	yes	Main water access will need to be developed or water piped to the west side of the railroad.
DDD/Soderquist 8292 (3)		57.0 (2)	12.3	3.7	6.5	yes	yes	unknown	Cattle crossing to access water on the Cheyenne River
Maude, Walter 07266 (3)		20.0 (2)	13.3	2.1	10.5 (1)	yes	unknown	unknown	Not determined (4)
Mosier/Tepaske John/ 8428 (3)		32.0 (2)	8.7	1.0	3.1	yes	unknown	unknown	Not determined (4)
River Allotment/ Hinesley Ted 8133 (3)		98.0 (2)	26.1	5.3	5.4	yes	unknown	unknown	Not determined (4)
Wasta/Schell 8413 (3)		18.0 (2)	8.4	1.9	10.6 (2)	yes	unknown	unknown	Cattle crossing (4)
Breakneck Hill/ B&H Ranches (3)		8.0 (2)	4.8	1.0	12.5 (3)	yes	unknown	unknown	Cattle crossing (4)
Beaver Creek/ Andersen Edwin 8032 (3)		22.0 (2)	0.2	0.04	0.2	no	no	no	None
Wyoming									
Ostlund/270	Cottonwood	612.8	65.7	13.4	2.2	yes	yes	yes	Cattle crossing and water source
Keeline/271	Black Thunder	4,145.6	237.0	38.2	0.9	yes	yes	yes	Cattle crossing and water source north side of tracks
Ostlund/270	Castle Rock	140.1	29.2	5.8	4.1	yes	yes	yes	Cattle crossing and water source

Table 4-6
Continued

Allotment	Pasture	Total AUMs	Acres of Disturbance (1)	AUMs Lost (2)	Percentage AUMs Lost	Pasture Fragmentation	Isolation of Water	Disruption of Operation or Access	Potential Mitigation Measures
Ostlund/270	East	351.0	29.2	6.0	1.7	yes	yes	yes	Cattle crossing and water source
Ostlund/270	Diamond L	private	40.6	private	private	yes	yes	yes	Cattle crossing and water source
Keeline/271	East Black Thunder	1,419.1	64.6	9.9	0.7	yes	yes	yes	Cattle crossing and water source north of tracks
Kerr-McGee/214	Kerr-McGee Mine	0.0	69.4	mining permits					Not determined
West Cellars/10	South	551.3	32.3	6.5	1.2	yes	yes	yes	Cattle crossing
Kerr-McGee/214	6	113.0	4.9	1.2	1.1	no	no	yes	Cattle crossing and adjust pasture fence
Kerr-McGee/214	3, 4 and 5	458.9	49.4	9.9	2.2	yes	no	yes	Modify pasture fence and allocate small bisected pasture area to another pasture
Kerr-McGee/214	Kerr-McGee Mine	0.0	1.2	mining permits					Not determined
Gordon/262	Summer	960.6	84.3	15.1	1.6	yes	yes	yes	Cattle crossing and water source
Stringer/273	North Highway	36.0	13.5	2.0	5.6	yes	yes	yes	Cattle crossing and modify allotment/pasture fence boundary. Allocate small bisected pasture area to Kerr McGee allotment pasture #3.
Gordon/262	Private	private	7.8	private	private	no	no	no	Modify pasture fence and allocate small bisected pasture area to another pasture
Stringer/273	Stringer	184.4	21.2	4.7	2.5	yes	yes	no	Cattle/road crossing
School Creek/240	Little Thunder	1,276.4	27.1	7.7	0.6	yes	yes	yes	Cattle/road crossings. Alternative water sources (spring development) may be needed south of railroad.
School Creek/240	Lovin	553.1	63.3	14.7	2.7	yes	no	yes	Two cattle crossings.
School Creek/240	Mine	mining permits	10.5	mining permits					Active mining
School Creek/240	South Basin	440.0	126.6	22.0	5.0	no	no	no	Not determined
School Creek/240	South Pasture	mining permits	25.7	mining permits					Active mining
Gordon/262	Spring	408.2	33.0	10.6	2.6	yes	yes	yes	Cattle crossing and water source

Table 4-6
Continued

Allotment	Pasture	Total AUMs	Acres of Disturbance (1)	AUMs Lost (2)	Percentage AUMs Lost	Pasture Fragmentation	Isolation of Water	Disruption of Operation or Access	Potential Mitigation Measures
Gordon/262	South Winter	651.7	34.9	15.2	2.3	yes	yes	yes	Cattle crossing and water source
Gordon/262	North Winter	102.1	8.6	1.9	1.9	yes	yes	no	Modify pasture fence and allocate small bisected pasture area to another pasture
Sewell/394	Calving	773.4	49.9	13.5	1.7	yes	yes	yes	Cattle crossing and water source
Bruce/313	Calf	438.1	24.6	5.7	1.3	yes	yes	yes	Cattle crossing
Wildcat Creek/398	Shook	478.8	27.3	7.0	1.5	yes	yes	yes	Cattle crossing, fencing and water source
Lynch/222	Winter	327.2	34.7	7.7	2.3	yes	yes	yes	Cattle crossing and water source
Lynch/222	Yearling	private	25.3	private	private	yes	yes	not determined	Not determined
Lynch/222	Calf	private	24.0	private	private	yes	yes	not determined	Not determined
Wildcat Creek/398	Fisher	524.1	31.0	7.9	1.5	yes	yes	yes	Cattle crossing and water source.
Lynch/222	Heifer	115.7	15.2	2.1	1.8	yes	yes	yes	Cattle crossing
Lynch/222	Calving	404.8	24.9	7.3	1.8	yes	yes	yes	Cattle crossing
Lynch/222	Private	private	1.3	private	private	no	not determined	not determined	Not determined
Lynch/222	Private	private	3.4	private	private	yes	not determined	not determined	Not determined
Lynch/222	Field	private	2.6	private	private	no	not determined	not determined	Not determined
Lynch/222	Little Frog Creek	599.0	44.2	10.3	1.7	yes	yes	yes	Cattle crossing. Well TB44/(W14) less than 200 feet from railroad.
Lynch/222	Bull	77.9	7.4	1.8	2.3	no	no	no	Move fence
Grieves/352	Wildcat	673.5	70.1	17.5	2.6	yes	yes	yes	Cattle crossings, fence and water source.
Lynch/222	Big Frog Creek	411.7	32.4	7.7	1.9	yes	yes	yes	Cattle crossing
AU7/365	Lodgepole	1,453.6	83.1	19.8	1.4	yes	yes	yes	Cattle crossing
South Rochelle Hills/272	Dry Lake	195.6	34.4	3.4	1.7	yes	yes	yes	Cattle crossing

Table 4-6
Continued

Allotment	Pasture	Total AUMs	Acres of Disturbance (1)	AUMs Lost (2)	Percentage AUMs Lost	Pasture Fragmentation	Isolation of Water	Disruption of Operation or Access	Potential Mitigation Measures
Irwin/212	East	1,530.7	83.8	17.1	1.1	yes	yes	yes	Cattle crossing, restore water sources. One impoundment impacted and one well (TB65-W09) less than 50 feet from centerline.
Shaw/395	Summer	1,027.8	48.4	11.5	1.1	yes	yes	yes	Cattle crossing and water source
Rosecrans/299	Rochelle Hills	425.0	53.8	8.5	2.0	yes	no	yes	Cattle crossing
Rosecrans/299	Rough Draw Exclosure	0.0	0.1	n/a	n/a	n/a	n/a	n/a	Railroad would be immediately adjacent to this enclosure
Irwin/212	Winter	913.9	43.1	8.8	1.0	yes	yes	yes	Cattle crossing and water source
Shaw/395	North	385.8	24.5	5.8	1.5	yes	yes	yes	Cattle crossing and water source
AU7/365	Spring Creek	942.6	6.5	1.5	0.2	yes	yes	no	Adjust pasture fence. One impoundment would be directly impacted by alignment.
AU7/365	Stud	151.2	18.8	4.5	3.0	yes	yes	yes	Cattle crossing and adjust pasture fence
Irwin/ 212	Middle Beckwith	131.3	14.6	4.6	3.5	yes	yes	yes	Cattle crossing and water source
North Antelope/205	North Horse	69.4	18.2	7.6	11.0	yes	yes	yes	Cattle crossing, modify pasture fence and water source
North Antelope/205	South Horse	56.4	5.6	2.3	4.0	yes	yes	yes	Modify pasture fencing and allocate small bisected pasture area to another pasture
North Antelope/205	Meadow	113.2	20.0	8.3	7.3	yes	yes	yes	Move pasture fencing and allocate small bisected pasture area to another pasture
Irwin/212	House	146.8	45.3	9.6	6.5	yes	yes	yes	Cattle crossing, move pasture fencing and allocate small bisected pasture area to another pasture. Well TB66/(W17) less than 100 feet from railroad
North Antelope/205	Red Hills	762.0	50.5	13.3	1.7	yes	yes	yes	Cattle crossing and modify pasture fence
Jacob's/213	Railroad	mining permits	3.2	mining permits					None
Jacob's/213	Railroad	mining permits	37.1	mining permits					Cattle crossings and water source
Smith Claude (3)		18.0	0.02	n/a	n/a	no	no	no	None

Table 4-6
Concluded

Allotment	Pasture	Total AUMs	Acres of Disturbance (1)	AUMs Lost (2)	Percentage AUMs Lost	Pasture Fragmentation	Isolation of Water	Disruption of Operation or Access	Potential Mitigation Measures
Christensen Chris (3)		83.5	19.6	3.0	3.6	yes	unknown	unknown	Cattle crossing (4)
Michale Harris (3)		66.1	5.6	0.8	1.2	yes	unknown	unknown	Cattle crossing (4)
Dry Creek Ranch/7143 (3)		168.0	32.2	7.9	4.7	yes	unknown	unknown	Cattle crossing (4)

1 = For purposes of alternative comparison, an estimated 200-foot wide corridor centered on the alternative centerline was established to estimate acres affected by disturbance and to determine AUMs that could potentially be lost within each allotment.
2 = Based on acres per AUM provided in tables in Section 3.16.
3 = Information based on only the BLM parcels that are impacted by the alternative; private lands within the allotment are not included in the calculations.
4 = Because these small BLM parcels are surrounded by private lands, management is generally controlled by the allotment permittee.

Table 4-7
Impacts to Federal Grazing Allotments from Alternative C

Allotment	Pasture	Total AUMs	Acres of Disturbance (1)	AUMs Lost (2)	Percentage AUMs Lost	Pasture Fragmentation	Isolation of Water	Disruption of Operation or Access	Potential Mitigation Measures
South Dakota									
Gilmore	FRRD 63	651.9	65.2	16.9	2.6	yes	yes	significant	Cattle crossing and water source on west side of railroad
ND Misc	FRRD 420	65.7	13.4	5.0	7.6	no	no	no	None
Reed	FRRD 98	406.1	0.2	0.1	0.02	no	possible	significant	Field verify water source - provide access
Circle C	FRRD 38	186.2	2.8	0.6	0.3	no	no	no	None
Reed	FRRD 97	188.6	43.3	14.2	7.5	yes	yes	significant	Cattle crossings, water source, adjust pasture fence boundary and reallocate bisected pasture to another allotment
Red Shirt	FRRD 106	431.4	39.9	8.0	1.9	yes	yes	significant	Cattle crossing or land exchange
Red Shirt	UNKNOWN	8.0	5.8	1.2	15.0	yes	no	no	None
Triple Seven	FRRD 25	528.5	9.1	3.4	0.6	no	no	no	Allotment boundary adjustment and land exchange
South Fork	FRRD 115	private	27.7	private	private	no	no	no	None
Chalk Hills	FRRD 5	197.9	18.7	3.7	1.9	yes	yes	yes	Cattle crossing, crosses pipeline, move private fence and land exchange
Chalk Hills	FRRD 2	217.3	18.1	4.5	2.1	yes	yes	yes	Cattle crossing and crosses pipeline
Stumer	FRRD 116	230.8	24.2	6.1	2.6	yes	yes	yes	Need another water source west side of railroad
Sand Creek	FRRD 181	0.0	29.0	not grazed	not grazed	no	no	no	None
Wasta/Schell 8413 (3)		18.0	8.4	1.9	10.6	yes	unknown	unknown	Not determined (4)
DDD/Soderquist 8292 (3)		57.0	12.3	3.7	6.5	yes	yes	unknown	Cattle crossing to access water on the Cheyenne River
Maude, Walter/07266 (3)		20.0	9.1	1.4	7.0	yes	unknown	unknown	Not determined (4)
River Allotment/Hinesley Ted 8133 (3)		98.0	24.6	5.0	5.1	yes	unknown	unknown	Not determined (4)
Breakneck Hill/B&H Ranches (3)		8.0	4.1	0.8	10.3	yes	unknown	unknown	Cattle crossing (4)

Table 4-7
Continued

Allotment	Pasture	Total AUMs	Acres of Disturbance (1)	AUMs Lost (2)	Percentage AUMs Lost	Pasture Fragmentation	Isolation of Water	Disruption of Operation or Access	Potential Mitigation Measures
Beaver Creek/ Andersen Edwin 8032 (3)		18.0	17.4	3.1	17.2	no	no	no	none
Wyoming									
Ostlund/270	Thomas (NW)	280.4	35.9	6.6	2.4	yes	yes	yes	Two cattle/road crossings
Ostlund/270	Cottonwood	612.8	17.1	3.5	0.6	yes	yes	yes	Cattle crossing or modify pasture fence and allocate bisected pasture area to Thomas pasture.
Ostlund/270	Bull	265.5	24.8	4.1	1.5	yes	no	no	Modify pasture fence boundary to east side of railroad. Permittee owns land on the west side of the pasture.
Kerr-McGee/214	Kerr-McGee Mine	mining permits	64.2	mining permits					Cattle crossing and modify pasture fence on south end of allotment. Allocate bisected area to the Stringer allotment North Highway pasture.
Kerr-McGee/214	6	113.0	13.7	3.3	2.9	yes	yes	yes	Cattle crossing to access water source (pasture will be modified after reclamation according to mine plan). Allotment management is trying to maintain all Federal land in one pasture.
Kerr-McGee/214	3, 4 and 5	458.9	68.8	13.8	3.0	yes	yes	yes	Cattle crossing. Eliminate small pasture fragment by immediately paralleling Highway 450 with railroad alignment, if possible.
Stringer/273	North Highway	36.0	13.1	1.9	5.3	yes	yes	yes	Cattle crossing and modify allotment/pasture fence boundary. Allocate small bisected pasture area to Kerr-McGee allotment pasture #3.
Stringer/273	Stringer	184.4	21.5	4.8	2.6	yes	yes	no	Cattle/road crossing
School Creek/240	Little Thunder	1,276.4	104.5	29.8	2.3	yes	yes	yes	Cattle/road crossings. Alternative water sources (spring development) may be needed south of railroad.
School Creek/240	Lovin	553.1	73.5	17.1	3.1	yes	no	yes	Two cattle crossings
School Creek/240	Mine	mining permits	10.5	mining permits					Active mining

Table 4-7
Continued

Allotment	Pasture	Total AUMs	Acres of Disturbance (1)	AUMs Lost (2)	Percentage AUMs Lost	Pasture Fragmentation	Isolation of Water	Disruption of Operation or Access	Potential Mitigation Measures
School Creek/240	South Basin	440.0	126.6	22.0	5.0	no	no	no	Not determined
School Creek/240	South Pasture	mining permits	25.7	mining permits					Active mining
Keeline/271	South Burdwick	242.8	57.2	4.9	2.0	yes	yes	yes	Cattle crossing. Railroad approximately 100 feet from well TB71 (W17) - the yard (north alternative) would impact this well. Modify east side of pasture fence to encompass all of the proposed yard in this pasture.
Small/220	Little Thunder	171.1	24.7	6.7	3.9	yes	yes	yes	Cattle crossing and modify pasture fences. Allocate north part of the allotment to the north pasture and the south part to the Hanson Draw pasture.
Keeline/271	Bull	377.3	47.3	13.1	3.5	yes	yes	no	Cattle crossing and water source on south side of railroad. Modify west side of pasture fence to encompass main body of yard in the South Burdwick pasture.
Keeline/271	Piney Creek	1,595.0	72.9	33.1	2.1	yes	yes	no	Three cattle crossings
School Creek/240	Buck	58.5	12.5	1.2	2.0	no	no	no	Modify pasture fence to eliminate pasture fragment, have railroad be west boundary of pasture.
School Creek/240	Meadow	40.8	14.6	3.2	7.8	yes	no	no	Modify pasture boundaries and eliminate pasture. Allocate east side of pasture to the Buck pasture and the west side to Rock pasture. Coordinate with landowner for crossings.
School Creek/240	Rock	133.6	4.2	0.9	0.7	no	no	no	Modify pasture fence and have railroad be boundary between Buck and Rock pastures.
School Creek/240	Thornburg I	886.6	24.0	4.9	0.6	yes	yes	yes	Cattle/road crossings and modify pasture fence. Allocate bisected pasture areas to Thornberg II pasture.
School Creek/240	Thornburg II	131.9	4.0	0.5	0.4	yes	no	no	Modify allotment boundary fence to eliminate small fragment in southeast pasture corner.

Table 4-7
Continued

Allotment	Pasture	Total AUMs	Acres of Disturbance (1)	AUMs Lost (2)	Percentage AUMs Lost	Pasture Fragmentation	Isolation of Water	Disruption of Operation or Access	Potential Mitigation Measures
School Creek/240	Calf	219.6	25.5	5.1	2.3	yes	yes	no	Modify pasture fence and replace pond 240-6 (W06). Allocate bisected pasture area to Thornberg I pasture.
Sewell/394	Calving (winter)	773.4	49.4	13.4	1.7	yes	yes	yes	Three cattle/road crossings and water source on south side of railroad on Federal land. Provide wind break (structure on north side of railroad).
Bruce/313	Calf	438.1	24.3	5.7	1.3	yes	yes	yes	Two cattle/road crossings. Coordinate with landowner.
Wildcat Creek/398	Shook	478.8	29.7	7.6	1.6	yes	yes	yes	Two cattle crossings and water source. Replace impoundment directly impacted by railroad. Potential pipeline may be required from the windmill located on the south side of the railroad to the north side of the tracks. If windmill is impacted, replace/repair.
Wildcat Creek/398	Fisher	524.0	31.1	8.0	1.5	yes	yes	yes	Cattle/road crossing - based on landowner coordination.
Teckla/298	North	155.9	30.6	2.6	1.7	yes	yes	no	Cattle crossing and replace well TB 112 (W17) if impacted
Teckla/298	South	159.6	48.5	4.1	2.6	yes	yes	yes	Three cattle crossings. Railroad approximately 100 feet from well TB-73 (W15)
Grieves/352	Wildcat	673.5	69.3	17.3	2.6	yes	yes	yes	Cattle/road crossings. Modify allotment boundary and allocate Federal land in NE Section 27 to Wildcat allotments Shook pasture. Insure that impoundments 352-2 and the other unknown structure function as water sources. Need wind protection (structure) on north side of tracks.
AU7/365	Lodgepole	1,453.6	86.8	20.7	1.4	yes	yes	yes	Four cattle crossings. Coordinate crossing needs with landowner.
Teckla/298	West Beckwith Exclosure	n/a	0.1	n/a	n/a	no	no	no	Not determined

Table 4-7
Continued

Allotment	Pasture	Total AUMs	Acres of Disturbance (1)	AUMs Lost (2)	Percentage AUMs Lost	Pasture Fragmentation	Isolation of Water	Disruption of Operation or Access	Potential Mitigation Measures
North Antelope/205	Reno	435.6	48.4	10.5	2.4	yes	yes	yes	Cattle crossings. Move railroad alignment to fence boundary on the south end of the allotment to eliminate pasture fragment, if possible. Cannot relocate small pasture fragment to the adjacent Red Springs/School allotment/pasture because it is private land and the landowner is not a Forest Service permittee.
Shaw/395	Summer	1,027.8	48.9	11.6	1.1	yes	yes	yes	Cattle crossings approximately every 0.5 miles. Repair impoundment 395-1. Provide access to windmill on south side of railroad. Provide water source in Sections 8 and 9 because new well drilled in Section 17 on the south side of railroad would be isolated.
Irwin/212	Winter	913.9	78.1	15.9	1.7	yes	yes	yes	Cattle crossings. Modify pasture boundary between Irwin Winter and Irwin House pastures. May require potential pipeline to provide water into North Antelope, North Horse pasture from well in Irwin Winter pasture. Forest Service would like to contain all Federal lands together, therefore, they do no want to allocate Federal lands into the Irwin Upper Beckwith pasture which is all private.
Shaw/395	North	385.8	24.6	5.9	1.5	yes	yes	yes	Two cattle crossings.
AU7/365	Stud	151.2	26.1	6.2	4.1	yes	yes	yes	Cattle crossings on Federal land. Eliminate pasture and reallocate bisected pasture areas to other pastures (i.e. AU7 Spring Creek and AU7 Lodgepole pastures).
North Antelope/205	North Horse	69.4	12.8	5.3	7.6	yes	yes	yes	Modify pasture fence and provide water source. Allocate small pasture area south of tracks to Buck and South Horse pasture. Provide water by pipeline (0.5 miles) from well in Irwin Winter pasture.
North Antelope/205	South Horse	56.4	10.6	4.4	7.8	yes	yes	yes	Move fence to eliminate pasture fragment and allocate small bisected pasture area to another pasture (i.e., North Antelope North Horse pasture).

Table 4-7
Concluded

Allotment	Pasture	Total AUMs	Acres of Disturbance (1)	AUMs Lost (2)	Percentage AUMs Lost	Pasture Fragmentation	Isolation of Water	Disruption of Operation or Access	Potential Mitigation Measures
North Antelope/205	Meadow	113.2	21.4	8.9	7.8	yes	yes	yes	Cattle crossing. Modify pasture fence and allocate small bisected pasture area to North Antelope private pasture.
Irwin/212	House	146.8	26.9	5.7	3.9	yes	no	yes	Modify pasture fence to eliminate pasture fragment. Allocate small pasture area to Irwin Winter pasture area.
North Antelope/205	Red Hills	762.0	54.4	14.3	1.9	yes	yes	yes	Cattle crossing and modify pasture fence.
Jacob's/213	Railroad	mining permits	44.8	mining permits					Cattle crossing and water source
Smith Claude (3)		18.0 (2)	6.6	1.1	6.1	yes	unknown	unknown	Not determined (4)
Christensen Chris/4051 (3)		83.5 (2)	19.1	2.9	3.5	yes	unknown	unknown	Cattle crossing (4)
Michael Harris/4333 (3)		66.1 (2)	7.9	1.2	1.8	yes	unknown	unknown	Cattle crossing (4)
Dale Osborn/7410 (3)		6.0 (2)	2.8	0.4	6.7	yes	unknown	unknown	Not determined (4)

1 = For purposes of alternative comparison, an estimated 200-foot wide corridor centered on the alternative centerline was established to estimate acres affected by disturbance and to determine AUMs that could potentially be lost within each allotment.
2 = Based on acres per AUM provided in tables in Section 3.16.
3 = Information based on only the BLM parcels that are impacted by the alternative; private lands within the allotment are not included in the calculations.
4 = Because these small BLM parcels are surrounded by private lands, management is generally controlled by the allotment permittee.

Table 4-8
Impacts to Federal Grazing Allotments from Alternative D

Allotment	Pasture	Total AUMs	Acres of Disturbance (1)	AUMs Lost (2)	Percentage AUMs Lost	Pasture Fragmentation	Isolation of Water	Disruption of Operation or Access	Potential Mitigation Measures
South Dakota									
8377- 7274		16 (2)	3.7	0.7	4.4	no	no	no	Not determined (4)
River Allotment/ Hinesley Ted 8133		98.0 (2)	24.6	4.7	4.8	yes	unknown	unknown	Not determined (4)
Breakneck Hill/ B&H Ranchester		8.0 (2)	4.1	0.8	10.3	yes	unknown	unknown	Cattle crossing (4)
Wyoming									
East Upton-Osage Community - 4	South	532.3	4.8	0.8	0.2	no	no	no	Move fence
Middle Upton-Osage Community - 5	#3	604.3	71.0	10.3	1.7	no	dam 498-28 disrupted	no	Move fence, replace dam
Middle Upton-Osage Community - 5	#2	479.2	35.7	5.2	1.1	no	no	no	Move fence
West Upton-Osage #6	South	531.3	54.0	12.9	2.4	no	no	no	Move fence
Oliver - 380	North	108.1	14.0	3.3	3.1	no	no	no	Move Fence, field verify private well on centerline
Huckins - 397	1	15.8	18.5	3.0	19.0	no	no	no	Move fence
Mirich - 372	Railroad	17.4	45.7	10.2	58.6	possible pasture elimination	no	no	Move fence
Mirich - 372	Bush	32.1	25.0	5.5	17.1	no	no	no	Move fence
North Antelope/205	Meadow	113.2	21.4	8.9	7.9	yes	yes	yes	Cattle crossing. Modify pasture fence and allocate small bisected pasture area to North Antelope private pasture.

Table 4-8
Continued

Allotment	Pasture	Total AUMs	Acres of Disturbance (1)	AUMs Lost (2)	Percentage AUMs Lost	Pasture Fragmentation	Isolation of Water	Disruption of Operation or Access	Potential Mitigation Measures
North Antelope/205	North Horse	69.4	12.8	5.3	7.6	yes	yes	yes	Modify pasture fence and provide water source. Allocate small pasture area south of tracks to Buck and South Horse pasture. Provide water by pipeline (0.5 miles) from well in Irwin Winter pasture.
North Antelope/205	Red Hills	762.0	54.4	14.3	1.9	yes	yes	yes	Cattle crossing and modify pasture fence.
North Antelope/205	Reno	435.6	48.4	10.5	2.4	yes	yes	yes	Cattle crossings. Move railroad alignment to fence boundary on the south end of the allotment to eliminate pasture fragment, if possible. Cannot relocate small pasture fragment to the adjacent Red Springs/School allotment/pasture because it is private land and the landowner is not a Forest Service permittee.
North Antelope/205	South Horse	56.4	10.6	4.4	7.8	yes	yes	yes	Move fence to eliminate pasture fragment and allocate small bisected pasture area to another pasture (i.e., North Antelope North Horse pasture).
Irwin/212	House	146.8	26.9	5.7	3.9	yes	no	yes	Modify pasture fence to eliminate pasture fragment. Allocate small pasture area to Irwin Winter pasture area.
Irwin/212	Winter	913.9	78.2	16.0	1.8	yes	yes	yes	Cattle crossings. Modify pasture boundary between Irwin Winter and Irwin House pastures. May require potential pipeline to provide water into North Antelope, North Horse pasture from well in Irwin Winter pasture. Forest Service would like to contain all Federal lands together, therefore, they do no want to allocate Federal lands into the Irwin Upper Beckwith pasture which is all private.
Jacob's/213	Railroad	mining permits	44.8	mining permits					Cattle crossing and water source
Kerr-McGee/214	Kerr-McGee Mine	mining permits	64.2	mining permits					Cattle crossing and modify pasture fence on south end of allotment. Allocate bisected area to the Stringer allotment North Highway pasture.

Table 4-8
Continued

Allotment	Pasture	Total AUMs	Acres of Disturbance (1)	AUMs Lost (2)	Percentage AUMs Lost	Pasture Fragmentation	Isolation of Water	Disruption of Operation or Access	Potential Mitigation Measures
Kerr-McGee/214	6	113.0	13.7	3.3	2.9	yes	yes	yes	Cattle crossing to access water source (pasture will be modified after reclamation according to mine plan). Allotment management is trying to maintain all Federal land in one pasture.
Kerr-McGee/214	3, 4 and 5	458.9	68.8	13.8	3.0	yes	yes	yes	Cattle crossing. Eliminate small pasture fragment by immediately paralleling Highway 450 with railroad alignment, if possible.
School Creek/240	Buck	58.5	12.5	1.2	2.0	no	no	no	Modify pasture fence to eliminate pasture fragment. Have railroad be west boundary of pasture.
School Creek/240	Meadow	40.8	14.6	3.2	7.8	yes	no	no	Modify pasture boundaries and eliminate pasture. Allocate east side of pasture to the Buck pasture and the west side to Rock pasture. Coordinate with landowner for crossings.
School Creek/240	Rock	133.6	4.2	0.9	0.7	no	no	no	Modify pasture fence and have railroad be boundary between Buck and Rock pastures.
School Creek/240	Thornburg I	886.6	24.0	4.9	0.6	yes	yes	yes	Cattle/road crossings and modify pasture fence. Allocate bisected pasture areas to Thornberg II pasture.
School Creek/240	Thornburg II	131.9	4.0	0.5	0.4	yes	no	no	Modify allotment boundary fence to eliminate small fragment in southeast pasture corner.
School Creek/240	Calf	219.6	25.5	5.1	2.3	yes	yes	no	Modify pasture fence and replace pond 240-6 (W06). Allocate bisected pasture area to Thornberg I pasture.
School Creek/240	Lovin	553.1	73.5	17.1	3.1	yes	no	yes	Two cattle crossings.

Table 4-8
Continued

Allotment	Pasture	Total AUMs	Acres of Disturbance (1)	AUMs Lost (2)	Percentage AUMs Lost	Pasture Fragmentation	Isolation of Water	Disruption of Operation or Access	Potential Mitigation Measures
School Creek/240	Little Thunder	1,276.4	27.1	7.7	0.6	yes	yes	yes	Cattle/road crossings. Alternative water sources (spring development may be needed south of railroad).
School Creek/240	Mine	mining permits	10.5	mining permits					Active mining
School Creek/240	South Basin	440.0	126.6	22.0	5.0	no	no	no	Not determined
School Creek/240	South Pasture	mining permits	25.7	mining permits					Active mining
Ostlund/270	Thomas (NW)	280.4	35.9	6.6	2.4	yes	yes	yes	Two cattle/road crossings
Ostlund/270	Cottonwood	612.8	17.1	3.5	0.6	yes	yes	yes	Cattle crossing or modify pasture fence and allocate bisected pasture area to Thomas pasture.
Ostlund/270	Bull	265.5	24.8	4.1	1.5	yes	no	no	Modify pasture fence boundary to east side of railroad. Permittee owns land on the west side of the pasture.
Stringer/273	North Highway	36.0	13.1	1.9	5.3	yes	yes	yes	Cattle crossing and modify allotment/pasture fence boundary. Allocate small bisected pasture area to Kerr-McGee allotment pasture #3.
Stringer/273	Stringer	184.4	21.2	4.7	2.6	yes	yes	no	Cattle/road crossing
Teckla/298	West Beckwith Exclosure	n/a	0.1	n/a	n/a	no	no	no	Not determined
Teckla/298	North	155.9	30.6	2.6	1.7	yes	yes	no	Cattle crossing and replace well TB 112 (W17) if impacted.
Teckla/298	South	159.6	48.5	4.1	2.6	yes	yes	yes	Three cattle crossings. Railroad approximately 100 feet from well TB-73 (W15)
Fern Porter - 04281		12 (2)	1.1	0.2	1.7	no	unknown	unknown	Not determined(4)
True Ranches - 04337		25 (2)	7.4	2.3	9.2	yes	unknown	unknown	Not determined(4)
Barton Land & Livestock Co - 14016		40 (2)	14.4	3.6	9	yes	unknown	unknown	Not determined (4)

Table 4-8
Concluded

Allotment	Pasture	Total AUMs	Acres of Disturbance (1)	AUMs Lost (2)	Percentage AUMs Lost	Pasture Fragmentation	Isolation of Water	Disruption of Operation or Access	Potential Mitigation Measures
Steven Mirich - 04205		80 (2)	5.9	1.5	1.9	yes	unknown	unknown	Not determined (4)
West Timber Creek 12091		14 (2)	3.5	0.4	2.9	no	no	no	Move fence
Dale Osborn/7410 (3)		6.0 (2)	2.8	0.4	6.7	yes	unknown	unknown	Not determined (4)

1 = For purposes of alternative comparison, an estimated 200-foot wide corridor centered on the alternative centerline was established to estimate acres affected by disturbance and to determine AUMs that could potentially be lost within each allotment.
2 = Based on acres per AUM provided in tables in Section 3.16.
3 = Information based on only the BLM parcels that are impacted by the alternative; private lands within the allotment are not included in the calculations.
4 = Because these small BLM parcels are surrounded by private lands, management is generally controlled by the allotment permittee.

4.15.5 Alternative C (Modified Proposed Action). Alternative C, would affect 66 allotments in South Dakota and Wyoming, which is 27 fewer than Alternative B. In South Dakota, this alternative would impact 19 allotments (13 Forest Service and 6 BLM allotments). In Wyoming, 47 allotments would be affected (43 Forest Service and 4 BLM allotments - see Table 4-5). As with Alternative B, fragmentation and the disruption of operations or allotment access are possible effects from this alternative and would be considered short-term impacts as long as appropriate mitigation is applied. Impacts to water sources (destruction or isolation) would also be considered a short-term impact if mitigated.

Table 4-7 lists all allotments that would be crossed by this alternative in each state and indicates if short-term impacts would be expected. Mitigation measures that would be required to insure potential allotment impacts are either temporary or short-term are also specified in the table. If this alternative or the route variations are implemented, any recommended mitigation measure should be verified on-site to determine adequacy or if other measure would be more appropriate to minimize and/or insure impacts are short-term.

This alternative would disturb an estimated 2,063 acres within the 66 allotments crossed in South Dakota and Wyoming. In South Dakota, 373 acres of disturbance would occur in 19 allotments and the remaining disturbance of 1,690 acres would occur in 47 allotments in Wyoming. Surface disturbance would result in the loss of approximately 434 AUMs in the 66 allotments for the long-term, approximately 80 AUMs lost in South Dakota allotments and 354 AUMs lost in Wyoming allotments. Alternative C would disturb approximately 25 percent fewer acres in Forest Service and BLM allotments than Alternative B. In addition, Alternative C would reduce AUM loss in Forest Service and BLM allotments by about 25 percent, compared to Alternative B (see Table 4-5).

Estimates of total AUMs lost and percent of each allotment's total forage that loss represents are provided in Table 4-7. Computed forage lost indicates that only 4 of the 66 allotments crossed by this Alternative C would have a 10 percent or greater loss in forage which would be considered a significant impact.

Three of the allotments in South Dakota that would subject to this amount of forage loss are BLM allotments. It should be noted that the forage-loss calculation on the BLM allotments is only based on the BLM lands within these allotments. Private lands within these allotments are not considered so the impact on a whole allotment basis would probably be less than the 10 percent forage loss threshold.

Phiney Flat Route Variation. Compared to Alternative C, implementation of this route variation would prevent the impacts to 3 pastures in 2 allotments on the BGNG. The pastures that would not be impacted by this route variation include FRRD 97 and FRRD 98 in the Reed Allotment along with the FRRD 38 pasture in the Circle C Allotment. In addition, this route variation would have 10.8 fewer acres of impact to pasture FRRD 63 in the Gilmore Allotment compared to Alternative C. This would reduce the loss of AUMs in pasture FRRD 63 by approximately 2.8 AUMs.

W G Flat Route Variation. This route variation would affect all of the same allotments as Alternative C except it would not cross the Sand Creek Allotment (FRRD 181) on the BGNG. In addition, this variation would cross along the edge of BLM allotment 7329 (record number 8428) and would disturb approximately 1.3 acres of the Federal parcel within this allotment. This Federal parcel has 18 AUMs and is grazed from November through April by cattle.

4.15.6 Alternative D (Existing Corridors Alternative). Alternative D would affect 47 Forest Service and BLM allotments in South Dakota and Wyoming, 19 fewer than Alternative C and 46 fewer than Alternative B. In South Dakota, Alternative D would impact only 3 BLM allotments. In Wyoming, 44 allotments would be affected (38 Forest Service and 6 BLM allotments - see Table 4-5). As discussed for other alternatives, fragmentation, the disruption of operations or access to allotments caused by this alternative would be considered short-term impacts as long as there is adequate mitigation. Impacts to water sources would also be considered short-term impacts if mitigated. Table 4-8 lists the allotments that would be crossed. Mitigation measures that would be required for impacts to only be short-term are provided in the table for each allotment. If this alternative is implemented, these mitigation measures should be field verified to determine if they are adequate or if other measures would be needed minimize impacts or shorten duration.

This alternative would follow existing railroads for a large portion of its length in South Dakota and Wyoming. Therefore, potential fragmentation of pastures should not be as extensive as might be expected by other alternatives.

This alternative would disturb a total of 1,320 acres in the 47 allotments in South Dakota and Wyoming. In South Dakota, 32 acres of disturbance would occur in the 3 BLM allotments crossed while the remaining 1,288 acres disturbed would be in the 44 allotments crossed in Wyoming. Surface disturbances would produce estimated loss of approximately 238 AUMs in these 47 allot-

ments over the long-term with 6 AUMs lost in BLM allotments in South Dakota and 232 AUMs lost in Wyoming allotments. Alternative D would disturb approximately 342 fewer AUMs than Alternative B and about 196 fewer AUMs would be lost than Alternative C (see Table 4-5). However, this forage loss analysis only considers impacts to Forest Service and BLM administered grazing allotments and does not include impacts to private grazing lands. When considering private lands, this alternative may actually have greater impacts because this alternative is longer than either Alternative B or Alternative C.

Estimates of total AUMs lost and percent of each allotment's total forage that loss represents are provided in Table 4-8. Computed forage lost indicates that only 4 of the 47 allotments crossed by this alternative would have a 10 percent or greater loss in forage. One small Forest Service allotment pasture in Wyoming, the Mirich-Railroad Allotment, would have approximately 60 percent of the total allotment forage lost due to implementation of this alternative. This impact would most likely cause this pasture to be eliminated.

4.15.7 Proposed Mine Loop Options. The Black Thunder North Mine Loop would cross 5 pastures in 3 allotments. These include: the Stringer Allotment's North Highway pasture, the Little Thunder Allotment's Mine pasture as well as the two Kerr-McGee Mine pastures and the #4 pasture in the Kerr-McGee Allotment. This option would reduce the total AUMs in these pastures by approximately 2 AUMs. Reductions in AUMs for the 2 Kerr McGee allotment pastures were not calculated because these pastures are in a mine permit area and are currently not being used.

The Black Thunder South Mine Loop would cross 3 pastures in two allotments. These include: the Stringer Allotment's North Highway pasture and the Little Thunder Allotment's Mine and West Peck pastures. This option would impact a total of approximately 45.1 AUMs in these allotments with the Little Thunder Allotment's Mine pasture having the largest AUM loss with about 37.6.

The North Antelope West Mine Loop would only affect the North Antelope Allotment's Red Hills pasture. Approximately 7.8 AUMs would be lost from this pasture if this option is implemented. The North Antelope East Mine Loop would affect 4 pastures in the North Antelope Allotment. These pastures include: Buck Draw, meadow, South Horse and Private. Implementation of this option would reduce total AUMs in these pastures by approximately 6.7.

4.15.8 Proposed Yard Sites. Only the Western Yard would impact Federal grazing allotments. The Western Yard would be constructed within the following allotments and pastures: School Creek Allotment - Little Thunder pasture; Small allotment - Little Thunder pasture; and Keeline Allotment South Burdwick and Bull pastures.

4.16 Wetland and Riparian Resources

DM&E is currently preparing an application for the COE and state 401 water quality certification agencies which requests approval to dredge and fill waters of the United States including wetlands. Information contained in that application is not repeated here. Rather, this section focuses on a comparison of potential impacts to wetlands and riparian resources between the alternatives. It will be left to the COE and others with proper regulatory authority to determine whether alternative impacts are significant.

4.16.1 Summary of Impacts Common to All Alternatives (Except the No Action Alternative). Resource recovery time is considered an important factor in determining and evaluating impacts to wetlands and riparian areas. Impact is considered to be either temporary, long-term, or permanent depending on the amount of time it would take for the reestablishment of a wetland or riparian area's functions. Recovery within a period of 3 years after construction is considered temporary while a recovery period of greater than 3 years is considered long-term. The non-recoverable loss of a particular wetland or riparian areas functions is considered permanent. Because the railroad would be a permanent aboveground facility impacts to wetlands are considered long-term.

Construction of the alternatives would have the following impacts on wetland and riparian resources:

- Wetland and riparian areas would be permanently filled or altered, resulting in a permanent or temporary change of hydrology, soils or the composition of vegetation.
- Permanent or temporary degradation in the functions of wetlands or riparian resources would occur.

Potential impacts to wetlands from discharges of fill materials are described in 40 CFR Part 230.41. The possible impacts to wetland functions from the discharge of fill material in wetlands may include: damage or destruction of habitat which adversely affects the biological productivity of wetland ecosystems by smothering, or altering the hydrology by dewatering, by permanently flooding, or by altering substrate elevation which effects water flow. The addition of fill material may destroy wetland vegetation or result in advancement of

succession to dry land species. It may reduce or eliminate nutrient exchange by a reduction of the system's productivity, or by altering current patterns and velocities.

Disruption or elimination of wetland systems can degrade water quality by obstructing circulation patterns that flush wetland systems, by interfering with the filtration function of wetlands, or by changing the aquifer recharge capability of a wetland. Filling activities can also change the wetland habitat value for fish and wildlife. Discharging fill material in wetlands may modify the capacity of wetlands to retain and store floodwaters and to serve as a buffer zone shielding upland areas from erosion. Secondary impacts may result when disruption of flow or circulation patterns occur even if there is an apparently minor loss of wetland acreage. Similar to wetlands, the alteration of riparian ecosystems may prevent them from maintaining water quality, flood water storage and providing important fish and wildlife habitat.

To quantify potential impacts to wetlands by each of the alternatives and route variations the wetland crossing length in miles was determined based on USFWS NWI mapping (see Section 3-17). Tables 3-69 through 3-73 provide the potential crossing length by wetland type by landowner and state for each of the alternatives.

Impacts to wetlands and riparian areas from implementation of the alternatives would be considered an irreversible and irretrievable commitment of the resource since construction of the railroad would require filling and excavating wetlands to achieve the design grade and since the railroad would be a permanent aboveground structure. Although, permitting requirements would require mitigation to compensate for wetlands lost from project construction activities, such compensation often is some distance away from the impacted wetlands. Therefore, wetlands or riparian areas that would be lost or altered and the functions that they provide would be lost locally.

4.16.2 Alternative A (No Action). Implementation of Alternative A would not disturb any wetlands or riparian areas or cause any of the potential impacts to these resources that are discussed above.

4.16.3 Alternative B (Proposed Action). Impacts to wetlands from this alternative would be permanent or long-term since construction activities would require the filling or excavation of wetlands to achieve the railroad design grade. The length of each wetland type which would be crossed by Alternative B is provided in Table 3-74. Approximately 2.32 miles of this alternative would cross wetlands (i.e., 1.68 miles in South Dakota and 0.64 miles in Wyoming). In South Dakota, about 86 percent of the wetland impact would occur on private lands with the remaining impact on NFS lands. In Wyoming, about 92 percent of the wetlands that would be crossed occur on private lands with the remaining wetlands being crossed on NFS lands. In South Dakota, 0.78 mile of the wet meadow type would be affected, the most of any wetland type. Effect to other wetlands are summarized in Table 3-74. Alternative B would cross more wetlands than any other alternative.

Alternative B would cross 41 perennial streams (35 in South Dakota and 6 in Wyoming) and 671 intermittent streams. Fifteen of the perennial stream crossings in South Dakota would occur on Spring Creek. All of the perennial streams have riparian characteristics and would support most of the riparian functions. Impacts to riparian areas on Spring Creek would be significant because of the number of stream crossing and channel alterations proposed for Alternative B. Indirect impacts may include increased flows and sedimentation which could also affect aquatic habitats. Although, the intermittent streams that would be crossed by this alternative have not been evaluated for their riparian characteristics, some of these streams would exhibit riparian characteristics and would provide some of their functions.

4.16.4 Alternative C (Modified Proposed Action). Effects of Alternative C to wetlands are summarized in Table 3-75. This alternative would cross approximately 1.58 miles of wetlands in South Dakota and Wyoming. All of the wetlands that would be crossed by this alternative in South Dakota are on private lands. In Wyoming, approximately 57 percent of the wetlands crossed by this alternative would occur on private lands with the remainder on NFS and state lands. Alternative C would mostly affect wet meadows in South Dakota but also the aquatic bed type, associated with impoundments. In Wyoming, this alternative would cross only 2 wetland types: wet meadows (0.16 miles) and aquatic beds (0.12 miles).

Alternative C would cross 40 perennial streams (36 in South Dakota and 4 in Wyoming) and 637 intermittent streams. Twenty-one perennial stream crossings in South Dakota would occur on Spring Creek, 6 more than Alternative B. Impacts to riparian areas on Spring Creek would be significant because of the number of stream crossings and channel alterations proposed. Altered riparian and wetland ecosystems along this stream would degrade or impair functions of these and may contribute to indirect down-stream impacts.

Although all of the intermittent streams that would be crossed by this alternative have not been evaluated for their riparian characteristics, some of these streams do exhibit riparian characteristics and would provide important riparian functions. Alternative C would make a number of crossing of intermittent streams in South

Dakota within Hay Canyon. Although this stream is designated as an intermittent stream, it has perennial characteristics and supports riparian and wetland communities with high functions and values. Construction of this alternative would require significant stream channel alterations which would cause significant impacts to wetland and riparian resources within Hay Canyon. Impacts associated with implementing this alternative would be long-term and would be an irreversible and irretrievable commitment of resource.

Phiney Flat Route Variation. This route variation would eliminate 20 crossings of Spring Creek. This stream supports woody riparian areas and numerous wetlands. Wetland types mapped along Spring Creek are either riverine or riparian forest and have high functional values. Other wetland types cross by this route variation are summarized in Table 3-76.

W G Flat Route Variation. This route variation avoids Hay Canyon and eliminates the 30 crossing of the streams in this canyon that would be affected by Alternative C. This route variation would prevent significant impacts to riparian and wetland resources within Hay Canyon as well as eliminating any indirect impacts downstream due to stream channel alterations. Wetland types associated with Hay Canyon are either riverine or palustrine emergent and have relatively high functional values, especially for wildlife. Other wetland types crossed by this route variation are summarized in Table 3-77.

4.16.5 Alternative D (Existing Corridors Alternative). A total of 1.81 miles of wetlands would be crossed by Alternative D (0.50 miles in South Dakota and 1.31 miles in Wyoming), 0.51 mile less than would be affected by Alternative B but 0.23 mile more than Alternative C (see Tables 3-74, 3-75 and 3-78). Unlike Alternatives B and C, most of the wetlands affected by this alternative would be in Wyoming. All wetlands crossed in South Dakota are on private lands. The predominate wetland type affected in both states are wet meadows. Affected aquatic bed wetland types are associated with impoundments on intermittent drainages. Alternative D would not cross any forested wetlands and would only cross 0.03 miles of scrub shrub wetlands in South Dakota.

A total of 57 perennial streams (38 in South Dakota and 19 in Wyoming) and 707 intermittent streams may be crossed by this alternative. In South Dakota there would be numerous crossing of Boxelder and Beaver Creek but these stream crossings are at existing railroad crossing locations. Impacts to riparian areas or wetlands crossed by this alternative have been previously impacted by past railroad construction and maintenance activities. Functions and values of these wetlands or riparian systems would likely be less affected than at sites with no previous impact. Most of the intermittent streams which would be crossed by Alternative D have been previously disturbed by existing railroad crossings.

4.16.6 Proposed Mine Loop Options. The Black Thunder South Mine Loop would cross 0.30 miles of privately-owned wet meadow. The North Antelope East Mine Loop would cross 0.06 miles of aquatic bed wetland types. The Black Thunder North and North Antelope West mine loops would not cross wetlands.

4.16.7 Proposed Yard Sites. The Edgemont Yard would not intersect any wetlands. The West Staging Yard would intersect one aquatic bed wetland on NFS land which is associated with a water well and is considered nonjurisdictional. The Wall Yard would intersect 3 separate wet meadow wetlands on private land.

4.17 Threatened, Endangered and Special Status Species

Public and agency scoping responses requested full analyses of project impacts to threatened, endangered and sensitive species. However, concern was raised that there is insufficient data to conduct impact analyses on these species. These issues are addressed in the following sections. General habitat issues and species-specific issues raised by USFWS, SDGFP, WGFD and private organizations from their written and oral comments are summarized, below:

- Increased train traffic and new tracks paralleling or crossing major rivers in Wyoming and South Dakota will increase the potential for derailments with spills and discharge of diesel fuel into surface waters. Such spills could adversely affect water quality and fish and wildlife resources locally and downstream. A spill contingency plan, along with disclosure of chemicals likely to be present was requested.
- Chemical treatment of railroad ties may be a contamination hazard.
- Construction crossing numerous wetlands, riparian areas and streams can impact those habitats. Specific mitigation was recommended to avoid taking any Federal trust wildlife resources or contamination of water sources.

The following are species-specific issues raised by Federal and state agencies:

- Consider all prairie dog colonies as potential habitat for the black-footed ferret. Surveys for ferrets, following established guidelines, should be

conducted in prairie dog colonies prior to construction.

- Construction on portions of the TBNG in Wyoming could impact an area proposed for reintroduction of black-footed ferrets. Ferrets already reintroduced into the Conata Basin/Badlands site could be affected if prairie dog colonies are located in the project area; the potential for colonization by black-footed ferrets of colonies affected by the project must be evaluated.
- Consider any habitat in South Dakota with significant humus and/or topsoil (mixed agricultural lands - mowed fields, pastures - grasslands, and second growth timber) as suitable for the American burying beetle.
- Ute ladies'-tresses potentially occurs in moist soils near wetland meadows, springs, lakes and perennial streams in alluvial substrates. Prior to construction, surveys by a qualified botanist should be conducted when it is flowering, between mid-July and mid-September.
- Interior least terns are fairly common, nesting on sand and gravel bars of the Cheyenne River. Spills on the floodplain or in the river may lead to direct mortality or cause abandonment of nesting areas downstream.
- Bald eagles concentrate in winter along the Cheyenne River below Angostura Reservoir and nesting along river corridors in South Dakota is expected in the future. Disturbance from trains along the Cheyenne River corridor will probably eliminate the area as potential nesting habitat. Pollution could have an impact on bald eagle food sources and might accumulate in the food chain. And, there is potential for bald eagles to be killed by trains while feeding on carrion along the tracks.
- There is a historic record of Topeka shiners from the Cheyenne River and other tributaries to the Missouri River. Habitat destruction, degradation, modification, and fragmentation from siltation, reduced water quality, tributary impoundment, stream channelization, stream dewatering and piscivorus fish introductions are primary threats to the species.
- Sturgeon chubs (candidate species) and plains topminnow (formerly a South Dakota State-threatened species) are known to occur in the Cheyenne River in South Dakota. The USFWS determined that listing sturgeon chub is warranted but precluded by higher priority species. Spills and pollution from trains and maintenance work (including creosote treatment of ties, oil and fuel leaks from trains, use of herbicides, and other potential sources) may have cumulative effects on these and other fishes of the Cheyenne River.
- Spiny soft-shell turtles are rare in South Dakota but, partially because of its abundance along the Cheyenne River, it was removed from the South Dakota State threatened and endangered species list. Effects of pollution and contaminants, as above, are a concern for this species.
- Analysis of potential impacts of the project to swift fox was recommended. Although a candidate species, the USFWS determined that listing is warranted but precluded at this time and the agency remains concerned about the status of the species. Swift fox are found throughout the project area and are vulnerable to vehicular traffic, including train traffic.
- The USFWS recommends surveys for mountain plovers to minimize impacts to nesting birds. Mountain plover populations are declining throughout their range and available data suggests that listing as threatened or endangered is warranted.
- Many species of birds, including raptors and eagles, are protected under the Migratory Bird Treaty Act and Bald Eagle and Golden Eagle Protection Act. Activities that may adversely affect a migratory bird or eagle, their young, eggs or nests should be coordinated with the USFWS before any actions are taken. Removal or destruction of nests, or causing abandonment of a nest could constitute violation of these statutes. The USFWS recommended surveys for raptor nests and roost sites in the project area.
- Several non-game species of special concern in Wyoming (burrowing owls, mountain plovers, prairie falcons, golden eagles, bald eagles) have been documented in the project area and could be negatively impacted by direct and indirect loss of habitats used for different life history functions, direct mortality, and illegal harvest.
- The USFWS encouraged consideration of sensitive and at-risk plant species to prevent their inclusion on the endangered species list.

4.17.1 Significance Criteria. Impacts to Federally-listed threatened and endangered species, species proposed for listing, candidate species, and species with special status recognized by the USFWS, Forest Service, BLM, WGFD and SDGFP would be considered significant if any of the following occurred:

- The death of any individual due to project-related activities.
- Reduced recruitment and/or survival of individuals that would impede species' recovery or maintenance of current populations.
- Loss of Federally-designated critical habitats.
- Contributing causes to warrant an unlisted species to be proposed for listing as threatened or endangered under the Endangered Species Act.

Section 7(a) of the Endangered Species Act (ESA) requires Federal agencies to insure that actions which they authorize or permit are not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat for such species. CEQ regulations for implementing NEPA (40 CFR Parts 1500-1508) suggest that impacts of such intensity that "*adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the (ESA) of 1973*" would be considered significant.

In their Mitigation Policy, the Wyoming Game and Fish Commission (1998) identified all Federally-listed species and their delineated critical habitats as "*irreplaceable*": any impact would be excluded to avoid any loss of habitat (see Table 4-9). No critical habitat for any Federally-listed species would be affected by any of the proposed alternatives.

Candidate species do not receive protection under ESA unless they are the subject of a published proposed rule determining endangered or threatened status. However, the USFWS monitors the status of all candidates, especially those for which available information indicates an imminent threat and the USFWS encourages consideration of these during long-range environmental planning. Forest Service and BLM policy does not allow actions that would change the status of candidate species under the ESA. In addition, the Wyoming Game and Fish Commission (1998) Mitigation Policy recommends no loss of habitat function for any Federal candidate species (see Table 4-9).

4.17.2 Summary of Impacts Common to All Alternatives (Except the No Action Alternative). Impacts on Federally-listed endangered or threatened species were considered and evaluated if a species potentially occurs in the vicinity of the proposed alternatives or if any of the criteria listed below are met:

- Potential for direct mortality of individuals (fish, wildlife, or plants).
- Potential for long-term or permanent loss or alteration of existing or potential fish or wildlife habitat supporting significant life history functions (e.g., breeding, wintering or migration).
- Potential for temporary alteration or disturbance of habitat that may result in avoidance by listed fish or wildlife species and increased mortality or lowered reproductive success.

Impacts common to all alternatives, discussed in Section 4.18 for Wildlife and Aquatic Resources, also apply to listed endangered and threatened fish and wildlife and other sensitive species (see Table 4-10). Since the distribution and abundance of threatened and endangered species are limited or in decline, any impact could have a greater effect on the size or viability of these populations than on populations of non-endangered or non-threatened species. In addition, habitat availability is often a limiting factor for endangered and threatened species and the short- or long-term loss of suitable habitat can contribute to the decline of populations. Direct short-term impacts such as mortality and displacement can be much more devastating than with other, more common species since displacement from suitable to less-suitable habitats in surrounding areas may decrease reproductive success and individual survival. Mortality of a single individual could be a highly significant loss to the species and most certainly to the local population.

Black-footed Ferret. Black-footed ferrets inhabited the project area and vicinity historically. They have been reintroduced to the Conata Basin/Badlands in South Dakota as a nonessential experimental population. Similarly, black-footed ferrets are being considered for reintroduction to TBNG in Wyoming. There are approximately 15,000 acres of prairie dog colonies within the TBNG reintroduction area, known as the Rosecrans Area (Byer and Luce, no date), but only 5,502 acres of that complex on TBNG have been managed to exclude poisoning with rodenticides and recreational shooting (Byer and Luce, no date). Elsewhere on TBNG, prairie dogs continue to be subject to recreational shooting although control through poisoning has been temporarily halted on NFS lands.

Recreational shooting can reduce local prairie dog populations by 35 to 69 percent (Knowles, 1988; Vosburgh and Irby, 1998). County weed and pest control agents provided locations of scattered prairie dog colonies along the alternatives in Wyoming and South Dakota and indicated many have been treated by them or by landowners with poisoned grain during the past decade. Typically, prairie dog populations can recover from shooting in one year (B. Perry, Forest Service, Wall Ranger District, personal communication with PIC Technologies, Inc.) while recovery following cessation of poisoning can take one to two years (Knowles, 1986; Cincotta *et al.*, 1987; Apa *et al., 1990).* Recovery of populations following plague, however, occurs much slower and some populations may never recover to pre-epizootic levels (Mulhern and Knowles, 1997). And, sylvatic plague is fatal to black-footed ferrets (Williams *et al.*, 1994).

Except for a 1983 record judged as confirmed (Jobman and Anderson, 1991) found in the vicinity of Edgemont, a ferret skull found in Converse County, Wyoming in 1979, 2 records judged as confirmed (1974

Table 4-9 Summary of Wyoming Game and Fish Commission Mitigation Policy as it Applies to Wildlife Species and Wildlife Habitats		
Mitigation Category	**Recommended Mitigation Objective**	**Applicable Species and/or Habitats**
Irreplaceable Species/Habitats	No loss of habitat or habitat function: the impact is excluded	•Federally Listed Threatened and Endangered Species •Federally Delineated Critical Habitat
Vital Species/Habitats	No loss of habitat function (arrangement and capability of habitat components to sustain species, populations, and wildlife diversity over time); species supported by the habitat are unchanged.	•Federal Candidate Species •Wyoming Native Species of Special Concern Status 1 & 2 •Wyoming Crucial Habitats •Wetlands •Stream Class 1 (premium trout waters, fishery of national importance)
High Species/Habitats	No net loss of habitat function for biological community encompassing project area. The area will support species' populations by maintaining habitat function	•Wyoming Native Species of Special Concern Status 3 •Trophy Game Animal •Big Game, Trophy Game Winter-Yearlong Range •Parturition Areas •Riparian Habitats •Other Important or Limited Habitat (aspen, old growth, snags, cliffs, caves) •Stream Class 2 (very good trout waters, fishery of statewide importance) •Trophy Fisheries (managed for angling larger than average fish) •Special Fisheries (managed for angling unique fish species)
Moderate Species/Habitats	No net loss of habitat value (relative importance of habitat type and conditions to sustain socially or ecologically significant wildlife populations)	•Game Fish •Furbearing Animal •Wyoming Native Species Status 4 •Big Game Animal •Game Birds •Other Big Game and Trophy Game Seasonal Ranges •Stream Class 3 (important trout waters, fishery of regional importance) •Wild Fisheries (managed for angling non-stocked, natural reproducing fishery) •Basic Yield Fisheries (managed for angling opportunities, stocked or not)
Low Species/Habitats	Minimize reduction of habitat value (habitat is abundant or not essential to sustain community, population, or sub-population).	•Native Species Status 5-7 •Small Game •Stream Class 4 (low production trout waters, no sustained fishing pressure) •Stream Class 5 (very low production waters, often without trout fishery) •Put-and-Take Fisheries (angling for hatchery-raised fish)

and 1981) in Campbell County and 1 confirmed historical report from Niobrara County (all within 16 miles of the alternatives), there is no recent documented evidence that ferrets presently occur within the project area or would be adversely affected by any of the alternatives.

Of primary concern for this species is the potential impacts Alternative B could have on the Rosecrans Area's suitability as a black-footed ferret recovery site. Currently, the Black-footed Ferret Recovery Implementation Team considers the Rosecrans Area as one of the top ten ferret recovery sites in North America and is developing a rule that would allow ferret reintroduction. Alternative B could adversely affect the suitability of portions of the Rosecrans Area by introducing noise, vibration, night lighting and other obstacles to ferret movement and dispersal. If Alternative B is selected additional planning would be required to minimize impacts to the ferret reintroduction site.

Whooping Crane. No impacts to whooping cranes are anticipated because their occurrence within the project area is highly sporadic. In the past, very few reports of whooping cranes document their limited presence in the project area and vicinity in South Dakota during migrations. Because their occurrence within the project area is unlikely in the foreseeable future, impacts due to any of the alternatives are unlikely.

Interior Least Tern. The decline of interior least terns throughout their breeding range in the Mississippi and Missouri river basins has been related to construction of dams and reservoirs that alter water flows making nesting habitat unavailable; river channelization that alters river hydraulics that likewise adversely affect nesting sites on nonvegetated islands and sandbars; and human recreational use of those sites during the breeding period [5] (Erwin, 1983).

Interior least terns are known to nest along the Cheyenne River, upstream from its embayment at Oahe Reservoir to the middle reaches in Pennington County. Their occurrence farther upstream where the alternatives are routed parallel to the river has been observed. Mud, sand and gravel bars in the Cheyenne River have been

[5] Federal Register, May 28, 1985, 50(102):21874-21792.

Table 4-10
Summary of Primary and Secondary Impacts to Wildlife

Impact Type	Species-Group-Habitat	Documented or Inferred Effects	Circumstances - Location	Sources
Primary Impacts				
wildlife-train and wildlife-vehicle collisions	mule deer	mortality increases in confined areas with limited escape from trains; mortality on highways increases with traffic volume and winter severity; construction of new highways through deer travel lanes leads to substantial mortality	deer migration to and from winter range in SW Wyoming; NE Utah	Reeve, 1990; Romin & Bissonette, 1996
		summary of deer mortality on highways; collisions increase with traffic and vehicle speed	highways nation-wide; western US	Arnold, 1978; Reed, 1981; Reeve, 1986
	wildlife in habitats adjacent to roads	mortality of nocturnal, slow moving mammals, birds found in right-of-way vegetation, reptiles and amphibians in habitats adjacent to highways	highways nation-wide; Texas	Leedy, 1978; Case, 1978; Wilkins & Schmidly, 1980; Adams & Geis, 1984
wildlife mortality during construction	burrowing animals and wildlife using burrows	inferred from studies showing numerous vertebrate species use burrows made by burrowing mammals	prairie dog colonies, western US	Chase *et al*, 1982; Clark *et al*, 1982
	ground nesting birds, sage/sharp-tailed grouse, mountain plover	inferred from vulnerability to trampling of birds nesting on beaches and crushed nests from ORV use in deserts	beaches on New Jersey coast; deserts in California	Burger, 1995; Luckenbach, 1978
mortality from toxic compounds	waterfowl, muskrats	inferred from increased metabolic rates due to increased thermal conductivity of oiled fur or feathers	laboratory studies	McEwan & Koelink, 1973; McEwan *et al.*, 1974
	waterfowl eggs, adult waterfowl, domestic livestock	petroleum intoxication is fatal to waterfowl, cattle and presumably wild ruminants; petroleum coating waterfowl eggs is toxic to embryos	field and laboratory studies	Hartung & Hunt, 1966; Leepen, 1976; Edwards *et al.*, 1979; Peterle, 1991
	aquatic insects, fish	diesel fuels and lube oils are much more toxic to aquatic organisms than more volatile gasoline and jet fuel or heavier crude oil	nationwide and laboratory studies	Markarian *et al*, 1994
bioaccumulation of toxic metals in rock/soils	least terns, piping plovers	selenium concentrations in least tern and piping plover eggs was above background levels at nest sites and potentially accumulated from selenium in shales along Missouri River; embryo toxicity inferred from other species	Missouri River, South Dakota	Ohlendorf *et al.*, 1986; Ruelle, 1993
degradation of aquatic habitats	aquatic insects, fish, amphibians	inferred from studies showing accumulation of organic materials in water leads to decay, oxygen depletion; erosion increases sediments that reduce light penetration and photosynthesis by aquatic plants; sediments fill substrate interstices, detrimental to macroinvertebrates, spawning habitat and egg survival	aquatic habitats in western US	Burns, 1972; Megahan & Kidd, 1972; Ringler & Hall, 1975; Patton, 1973; Reid & Dunne, 1984; Bilby *et al.*, 1989; Eaglin & Hubert, 1993; Reid, 1993; Brown, 1994
fragmentation of habitats	breeding passerine birds	habitat occupancy by obligate shrub-steppe bird species declines with reduced shrub (sagebrush) cover and reduced shrub patch size	sagebrush steppe in western US, southern Idaho	Braun *et al*, 1976; Knick & Rotenberry, 1995
fragmentation of habitats	small mammals	roads act as filters or barriers to animal movements by dividing habitats, especially wide roads with high speeds, high traffic volume	highways worldwide	Bennett, 1991; Forman & Alexander, 1998

Table 4-10
Continued

Impact Type	Species-Group-Habitat	Documented or Inferred Effects	Circumstances - Location	Sources
impedance of migration	elk, deer, moose	berms and large diameter pipelines on ground or set on blocks are visual and physical barrier to movements	oil and gas developments in Alberta	Morgantini, 1985
	pronghorn	4-strand and net-wire fencing associated with railroad or highway rights-of-way can prohibit pronghorns from reaching winter range and lead to significant winter mortality	Interstate 80, southcentral Wyoming	Buechner, 1947; Sundstrom & Hepworth, 1967; ZoBell, 1968; Riddle & Oakley, 1973; Bruns, 1977; Yoakum, 1978
	small mammals, reptiles, amphibians	railroads and highways can be barriers to crossing by small terrestrial vertebrates; animals will utilize culverts to cross railroads and highways	Europe	Yanes *et al.*, 1995
increased nest predation with carrion and garbage concent-rated along tracks as travel corridors	ground nesting birds, sage/sharp-tailed grouse, piping/mountain plover, interior least tern	inferred from potential for wildlife-train collisions, attraction to carrion by predators (coyotes), and relatively high risk of nest predation to ground nesting birds. Predators attracted to garbage are likely to predate nesting birds, and predators use roads, probably railroads to travel	western Wyoming, Colorado, Massachusetts, Washington	Reeve, 1990; Hein & Andelt, 1996; Yahner & Mahan, 1997; Danielson *et al.* , 1997; Baker *et al.*, 1999
loss of forage	herbivores	once removed, shrub-dominated vegetation may take decades to revegetate; shrub species do no readily regenerate from seed in topsoil	sagebrush steppe in intermountain west	Beauchamp *et al.*, 1975; West, 1988
diminished use of habitats - interruption of life history functions	mule deer	areas within 0.125 mile of roads tend to be avoided; mule deer density was less (not significantly) within 0.6-mile radius of oil and gas well drilling; mule deer mostly vacated a 0.5-mile area around well recompletion activities during winter; migratory mule deer avoid human disturbances more than resident deer	front range of Colorado; oil fields in central and western Wyoming; southern California	Rost & Baily, 1979; Easterly *et al*, 1991; Reeve, 1996; Nicholson *et al*, 1997
	pronghorn	effects of roads inferred from study showing pronghorn does with fawns escape from vehicles more than other groups; pronghorn density was lower within 0.6 mile of well drilling than beyond that distance	construction in southcentral Wyoming; oil field in central Wyoming	Reeve, 1984; Easterly *et al.*, 1991
	elk	hunted elk avoid roads; unhunted elk are more sensitive to people on foot than vehicles; elk tend to avoid forest roads and highways from 0.12 to 0.25 miles, elk cows are especially sensitive during calving; in sagebrush elk escape from humans 0.6 mile away; elk escape up to 2 miles from visible seismic operations in sagebrush and more than 1 mile from pedestrians	forests in Montana, Wyoming, Washington; sagebrush-steppe in Wyoming	Markum, 1976; Ward, 1976; Schultz & Bailey, 1978; Ward & Cupal, 1979; Witmer & deCalesta, 1985; Ryder & Petch, 1988
	sage grouse, sharp-tailed grouse	inferred from observations and studies emphasizing importance of sound and auditory stimuli produced by males to attract females: noise pollution could diminish lek attendance and reproduction	coal mines in Montana, behavioral studies in intermountain west	Eng *et al.*, 1979; Vehrencamp & Bradbury, 1989; Gibson & Bradbury, 1985; Gibson, 1989, 1992, 1996; Gratson, 1993

Table 4-10
Concluded

Impact Type	Species-Group-Habitat	Documented or Inferred Effects	Circumstances - Location	Sources
diminished use of habitats - interruption of life history functions	nesting and wintering raptors	disturbance during nesting may cause nest abandonment, egg and/or chick mortality. Some species (red-tailed hawk, golden eagles, prairie falcons) are more tolerant than others (ferruginous hawks, bald eagles). Wintering rough-legged are more sensitive to vehicles within 550 feet of perch than wintering golden eagles	studies of effects of various impact sources throughout western US	Fyfe & Olendorff, 1976; GYE Bald Eagle Working Team, 1983; White & Thurow, 1985; Grier & Fyfe, 1987; Andersen *et al.*, 1990; Holthuijzen *et al.*, 1990; Holmes *et al.*, 1993
	breeding passerines	documented in studies showing effects of well-traveled highways on diminished breeding bird density; inferred from dust-shadow associated with dirt roads reduced densities of ground nesting birds	highways in the Netherlands; oil pipeline studies in Alaska	Hanley *et al.*, 1980; van der Zande *et al.*, 1980; Forman and Alexander, 1998
	amphibians	traffic intensity on roads influence local frog density and traffic-related mortality	roads near Ottawa, Canada; Europe	Fahrig *et al.*, 1995; Forman & Alexander, 1998
Secondary Impacts				
increased recreational use	various wildlife species	extensive reviews indicate a wide variety of human recreational activities impact wildlife causing death, displacement, habitat modification, and pollution	summaries of studies done nationwide	Knight & Gutzwiller, 1995
	piping plover, least tern	recreational use (camping, picnicking, swimming, sunbathing, fishing) at least tern and piping plover nesting areas adversely affected productivity	Missouri River, South Dakota and North Dakota	Carreker, 1985; Kruse *et al.*, 1993; Mayer, 1993
recreational ORV use	various wildlife species	off-road vehicles in desert ecosystems reduce numbers of breeding birds, small mammals and reptiles	deserts in southwest US	Carter, 1974; Luckenbach, 1978; Bury, 1980
encroachment in winter range by subdivisions	big game	development of residential areas, resorts, campgrounds, summer and winter homes degrade lower elevation big game winter ranges	big game winter ranges in intermountain west	Mower & Smith, 1989; Henderson & O'Herren, 1992
domestic dogs and cats	various wildlife species	domestic dogs and cats directly kill wildlife ranging from rodents to big game; wildlife alarm responses to dogs may be greater than native predators	nationwide	Hamerstrom *et al.*, 1965; George, 1974; Lowry & McArthur, 1978; Bangs *et al.*, 1982
poaching	big game, furbearers	poaching big game and furbearers appears to increase concurrent with industrialization, influx of people	oil pipeline in Alaska; phosphate mines in SE Idaho	Klein, 1979; Kuck, 1986

mapped from 1:2,400 scale aerial photographs in the area where the river is adjacent to Alternatives B and C. The suitability of those sites for nesting by interior least terns is possible, but only during years of low water flows during late May, June and July that limit inundation of nesting islands and river bars prior to and during the nesting period.

Other factors determining potential site suitability include the amount of vegetation cover established on bars and islands, local abundance of food fish (fish less than 4 inches long) and concentration of predators (Carreker, 1985). Minimum habitat areas required for nesting sites are unknown but small colonies of interior least terns have nested on a 0.22-acre island and 0.45-acre sandbar (Carreker, 1985) - larger than most but not all sites in the project area.

Nesting least terns appear tolerant of vehicular traffic, whether on highways or trains, but abandon nests and colonies if directly disturbed by pedestrians, off-road vehicles, pets and livestock (Carreker, 1985), and recreational use such as camping, picnicking, swimming, sunbathing, and fishing (Kruse *et al.*, 1993; Mayer, 1993). Mammalian and avian predators, including coyotes, skunks, foxes, raptors, crows and gulls, prey on eggs and chicks (Carreker, 1985; Kruse *et al.*, 1993). Carrion is expected along the operational railroad and, if allowed to persist, could attract predators (Hein and Andelt, 1996). Local concentrations of predators are likely to impact ground nesting birds (Baker *et al.*, 1999), including interior least terns.

Bioaccumulation of contaminants, particularly of selenium derived from seleniferous soils and shales along the Missouri River, may be sufficient to cause embryo death or deformities of least terns (Ruelle, 1993). Selenium concentrations in subbituminous coal from the Powder River Basin (0.73 ppm in coal) are far below concentrations found in bituminous coals of the midwest and Appalachian basins (range of 2.5 to 5.7 ppm; Ensminger, 1977). Thus, elevated selenium levels due to coal dust contamination of water or soils is unlikely. However, if present in similar concentrations to those found in marine shales along the Missouri River (4.79-13.60 mg/kg dry weight; Ruelle, 1993), increased selenium loads in the Cheyenne River could occur following erosion and runoff from construction sites.

Other environmentally hazardous trace elements found in coals from the Powder River Basin include antimony (0.67 ppm in coal), arsenic (3 ppm), beryllium (0.7 ppm), cadmium (2.1 ppm), mercury (0.1 ppm), lead (7.2 ppm), and zinc (33 ppm), all in concentrations lower than coals of the midwest and Appalachian basins (Ensminger, 1977). Arsenic may become biologically concentrated in aquatic food chains. Cadmium, mercury, and zinc can be adsorbed through the digestive and respiratory tracts of invertebrates and vertebrates. Exposure to cadmium may lead to direct toxicity or may bioaccumulate in such organisms as aquatic molluscs while mercury, depending on its form in chemical compounds, can accumulate in aquatic invertebrates and fish. Zinc can accumulate in aquatic organisms and produce chronic and acute toxicity. Bioaccumulation of lead can progress from herbivores to carnivores as well as adsorption through body surfaces of fish and aquatic invertebrates (Wilkes, 1977). Whether any of these hazardous trace elements would bioaccumulate to toxic levels from fugitive coal dust is unknown but, given the low concentrations in Powder River Basin coal, such effects appear highly unlikely.

Construction adjacent to the Cheyenne River may require bank armoring (such as riprap or more substantial structures) to stabilize the riverbank. If that was necessary, changes in river flow dynamics would be expected thus altering existing deposition and erosion regimes that created local mud, sand, or gravel bars (Reid, 1993) that might serve as suitable nesting habitats.

Traditionally, wood treated with creosote used to inhibit wood-destroying fungi, has been the principal material for rail ties and bridge construction where small drainages were crossed. Coal tar creosote is heavier than water and practically insoluble (Budavari *et al.*, 1989). However, phenols, which may be components of creosote, are highly toxic by ingestion, inhalation or skin adsorption (Talmage, 1977) as are cresols and creosote components (Fraser *et al.*, 1991) and which are soluble in water (Budavari *et al.*, 1989).

Pallid Sturgeon. Construction of dams on the Missouri River with elimination of riverine habitats, alteration of water flows and blockage of spawning migration is believed to be the chief cause of decline of the pallid sturgeon (Dryer and Sandvol, 1993). Spawning habitats are unknown, but may be similar to those used by other sturgeons (Kallemeyn, 1983): spawning occurs in unchannelized main channels with relatively swift flow over substrates of rock, rubble or gravel. Hydroelectric dams have caused reduced flows during April to July which coincides with pallid sturgeon spawning. Higher flows appear to be necessary to stimulate sturgeon spawning migrations (Dryer and Sandvol, 1993).

The alternatives will not likely contribute to further degradation of riverine habitats inhabited by pallid sturgeons. Sturgeons are adapted to turbid waters, possibly depending on turbidity as cover from predators and feeding on fish species likewise adapted to turbid water. Consequently, sedimentation in the Cheyenne River due to construction and operation of the railroad is not likely to pose a hazard to pallid sturgeon in Lake Oahe or at the Cheyenne River confluence. Contamination of eggs by selenium, mercury, and cadmium could

occur if soils disturbed during construction contained high amounts of these trace elements.

Pallid sturgeons downstream from the project area could be adversely affected if petroleum products were accidently discharged into aquatic environments. Such materia ls are toxic to algae, invertebrates, and fish. Of the products likely to be present during railroad construction and operation, data compiled from a wide range of sources indicate that diesel fuels and lube oils are considerably more toxic to aquatic organisms than other, more volatile products (gasoline) or heavier crude oil (Markarian *et al.*, 1994). However, crude oils and heavier asphalt residues will persist in aquatic environments longer than lube oils, fuel oil and gasoline but their bioavailability diminishes over time, mostly due to physical aggregation, precipitation, or emulsification (Markarian *et al.*, 1994). Impacts of such residuals to aquatic habitats that primarily affect aquatic substrates (hence, sturgeon food sources), can remain for much longer periods (Markarian *et al.*, 1994).

Topeka Shiner. Although Topeka shiners were collected in the Cheyenne River embayment in the 1960's, none have been reported in collections made since then and their occurrence in the project area is unlikely. If they did occur, increased sedimentation during construction could adversely affect water and substrate quality: Topeka shiners inhabit cool, low order prairie streams with good water quality and mostly with silt-free substrates of gravel, cobble, and sand[6]. Sedimentation of inhabited streams would adversely affect Topeka shiners. Accidental release of petroleum products, discussed above, would also adversely affect Topeka shiners but, until they are documented inhabiting aquatic habitats that would be potentially affected by the new railroad, there is no reason to anticipate that the species would be impacted by these or other sources.

American Burying Beetle. Reasons for decline of American burying beetles are not clear. Loss of climax forests with deep litter, humus and soils has been postulated (Anderson, 1982) but the species has been found in areas never covered with forests such as the Nebraska Sandhills (Ratcliffe and Jameson, 1992) and grasslands in southern South Dakota (Backlund and Marrone, 1997). Other hypotheses include wide-spread use of ultra-violet light attractants with electronic bug-zappers, introduction of exotic species-specific disease and use of DDT for mosquito control[7].

There is no indication that the species presently or has historically occurred along the proposed new railroad alternatives and the extent of potential habitats that would be affected are unknown: while they may depend on suitable soils and/or litter for burying vertebrate carcasses, the presence of carcasses of up to 7 ounces (mouse-size mammals and sparrow-size birds) appear to be at least as critical to their presence in an area (Holloway and Schnell, 1997). Mammalian and avian species within similar size categories are likely to occur along all the alternatives. While wildlife mortality is expected due to collision with trains, deaths of mice and passerine birds is not expected to be substantial and are not likely to be attractants to American burying beetles once the railroad is operational. More likely are impacts due to construction, but only if beetles are present at construction sites. Maintenance of vegetation by mowing or herbicide application and the possibility of localized brush or grass fires from trains once the railroad becomes operational could impact burying beetles if they actually occur.

Impact projections are impossible because of inadequate information about the beetles' distribution in the project area and vicinity of each alternative. However, estimates of potential habitats affected can be made, based on general soils types where suitable soils are assumed to include sandy soils (those with high wind erosion potential) and prime farmland soils (those with relatively well developed top soils). These soils would be crossed by all of the alternatives in South Dakota. Potential for alternatives to impact American burying beetles was considered if proposed routes would pass through these two soil types where they coincide with riparian, grasslands, and/or deciduous woodlands. Recent collections of the species in South Dakota were made in these habitats (Backlund and Marrone, 1997).

Piping Plover. As discussed for interior least terns, decline of piping plovers in the Missouri River basin has been related to construction of dams and reservoirs that alter water flows making nesting habitat unavailable, river channelization that alters river hydraulics that likewise adversely affect nesting sites on nonvegetated islands and sandbars, and human recreational use of those sites during the breeding period[8] (Dinsmore, 1983a; Kruse, *et al.,* 1993.). Similar problems exist on the Cheyenne River where water releases from Angostura Reservoir can often flood potential nesting habitats downstream. Bioaccumulation of selenium in piping plover eggs from the Missouri River in South Dakota is higher (range 4.9-13.0 mg/kg dry weight) than in least tern eggs (range 2.9 to 11.1 mg/kg dry weight; Ruelle, 1993). Piping plover nests are similarly vulnerable to predation by crows, fox, opossum, Norway rat and gulls (Dinsmore, 1983a).

The state of knowledge about the local occurrence of piping plovers and risks they may face during project construction and operation is the same as that discussed for interior least terns, above. They may not, though, be

[6] Federal Register, December 15, 1988, 63(240):69008-69021.

[7] Federal Register, July 13, 1989, 54(133):29652-29655.

[8] Federal Register, December 11, 1985, 50(238):50726-50734

as tolerant of vehicular traffic as terns (Dinsmore, 1983a) but most reports of plovers vacating nests have focused on humans approaching nests on foot rather than noise levels and vehicular frequencies associated railroads or highways. Only one observation of a piping plover within the vicinity of the alternatives has been recorded and they appear less likely to be present along the middle and upper reaches of the Cheyenne River than interior least terns. Further, available data suggests water flows in the Cheyenne River during May and June of most years are likely to inundate and/or scour islands and river bars, thus making them unsuitable as nest sites.

Bald Eagle. Bald eagles have been documented wintering within the project area and 4 unsuccessful nesting attempts have been observed in Wyoming on TBNG. Sources of direct mortality of bald eagles include intentional or accidental shooting (USFWS, 1986) and collisions of eagles with vehicles. Since wintering bald eagles in some areas feed on big game carrion, they sometimes suffer direct mortalities when struck by vehicles while feeding at roadsides. It is unlikely that slow moving construction vehicles would inadvertently kill eagles feeding on carcasses but personnel vehicles driven to and from construction sites could kill eagles feeding on road killed carrion. Trains, too, kill bald eagles that have gorged themselves feeding on deer carcasses. Such mortalities have been recorded elsewhere in Wyoming where bald eagles feed on big game carcasses along highways and railroads (B. Rudd, 1999. WGFD, personal communication with PIC Technologies, Inc.; A. Reeve, PIC Technologies, Inc., unpublished data). In the project area, such bald eagle mortalities would be most likely where the alternatives pass through big game winter ranges, areas were elk, white-tailed deer, mule deer and/or pronghorn are expected to congregate.

Studies on the effects of human activities on bald eagles have focused on toxicity of environmental contaminants, habitat losses and alterations, and behavioral responses by eagles to disturbances. Since bald eagles tend to avoid human activities during all times of year, construction activities can temporarily displace eagles during their migration, wintering, and nesting periods. However, disturbances to eagles when they are migrating will probably not displace them from habitats that are key to their survival since other equally suitable habitats are available.

During winter, bald eagles perch near food sources (Stalmaster and Newman, 1979; DellaSala *et al.*, 1989) and displacement from perches may cause them to occupy less optimal foraging habitats and increase their energy expenditures due to flight (Stalmaster and Gessaman, 1984). The USFWS (1986) has recommended that key bald eagle habitats be protected from disturbances from November 15 to March 15 with a 0.25-mile buffer zones around nests, nocturnal roosts, and shorelines of feeding waters. Buffer zones of 0.50-mile (2,640 feet) at nest and roost sites were recommended to regulate activities if eagles at those sites had line-of-sight views of the activities (USFWS, 1986). Currently, the Forest Service requires spatial buffers of 1 mile around winter roosts from November 1 through April 1.

Bald eagle nesting territories in the Greater Yellowstone Ecosystem (GYE) and elsewhere have been abandoned as a result of human activities (GYE Bald Eagle Working Team, 1983). One study indicated that nesting bald eagles flushed from nests when approaching humans were an average of 1,500 feet (range of 187 feet to 3,250 feet) from the nest (Fraser *et al.*, 1979 cited in GYE Bald Eagle Working Team, 1983). On NFS lands, zones excluding surface disturbances or occupancy within 0.5-mile of bald eagle nests and exclusion of any construction activities within 1 mile of nests during the nesting period, February 1 through July 31, will probably provide sufficient protection for nesting eagles. Annual monitoring of potential nesting habitats for establishment of nest site(s) will be necessary before such measures can be implemented.

Ute Ladies'-tresses. This plant species has been subject to habitat losses and alterations[9] through stream and wetland modifications, land-use changes to agriculture and domestic livestock grazing, urbanization, water project diversions to agriculture and urban use, human recreational use leading to trampling and introduction of exotic weeds that compete for resources (USFWS, 1995). There are known populations of Ute Ladies'-tresses south of the project area, one straddles Niobrara County, Wyoming and Sioux County, Nebraska and the other is in extreme southeastern Goshen County, Wyoming. Both populations occur on private land in wetlands that are subject to moderate-heavy livestock grazing and/or mowed as native hay meadows (Hazlett, 1996; Fertig, 1998).

Limited examination of 21 potential sites within the project area indicated there are at least 4 locations where the species could occur along the proposed alternatives in Wyoming and South Dakota (Kass, 1998). Direct impacts to this species, as well as other plant species of concern (see Table 3-86), would be most likely during construction if machinery and surface disturbances obliterated local populations. Too, impacts to this species could occur if the railroad track bed altered local conditions that contribute to wetland hydrology.

Canada Lynx. No impacts to lynx are anticipated due to any of the new railroad alternatives since their occurrence within the project area is highly unpredictable and unlikely.

[9] Federal Register, January 17, 1992, 57(12):2048-2053.

Proposed, Candidate and Petitioned Wildlife Species

Mountain Plover. Mountain plovers occur along the proposed alternative routes in Wyoming. Conversion of rangeland and prairies to agriculture, mortality incurred during agricultural practices and operations in cultivated fields, and practices designed to emphasize grazing by domestic livestock over maintaining presence of other organisms (introduction of exotic plant species, eradication of burrowing mammals) on which mountain plovers are somewhat dependent during the nesting period have been cited as factors contributing to their decline[10].

Since mountain plovers nest on the ground, adult birds, young and eggs are susceptible to mortality by vehicles and construction equipment, especially along 2-track roads and undeveloped areas within the project area. They are also vulnerable to predation by a variety of mammals, raptors and loggerhead shrikes (Dinsmore, 1983b). Presence of carrion along the railroad, once it is operational, is likely to attract predators to the vicinity. For the same reasons discussed under interior least terns, concentrations of predators could devastate local productivity of ground nesting birds, including mountain plovers.

Sturgeon Chub. Sturgeon chubs inhabit the Cheyenne River in South Dakota. In the Missouri River, creation of reservoirs and stream channelization altered water temperature, flow regimes and reduced turbidity (USFWS, 1993b) to which sturgeon chubs are adapted[11] (Hesse, 1994). Even though turbidity is a habitat component, these chubs appear to prefer gravel bottoms and consequently are found where high velocity flows keep fine sediments from accumulating (Hesse, 1994). Thus, they may be susceptible to increased sedimentation of the Cheyenne River if that occurred during and following construction of the proposed project. Further, changes in stream flow due to bank stabilization structures could impact downstream habitats as could accidental release of petroleum products (see discussion under pallid sturgeon, above).

Water depletions from the Cheyenne River could impact the species during construction. Sturgeon chubs probably spawn in late spring to midsummer (Lee *et al.,* 1980) and may depend on swift currents to allow eggs and larva to be carried downstream (USFWS, 1993b). Since flows in the Cheyenne River are highly variable, dependent in part on water released from Angostura Reservoir, water withdrawals for project construction could locally exacerbate existing limiting flow regimes.

Sicklefin Chub. Declines of this species appears to be related to diminished turbidity and flows in large rivers, principally the Missouri River, where series of dams have substantially altered the species' habitat (Hesse, 1994). Although sicklefin chubs were collected in the Missouri River in the 1950's downstream from the new railroad alternatives, they are believed extirpated there now (USFWS, 1999c). Because their occurrence within the project area is doubtful in the foreseeable future, impacts due to any of the alternatives are unlikely.

Swift Fox. Swift fox are probably found using all upland habitats in the vicinity of the proposed project in Wyoming and South Dakota. Removal of vegetation from the project area may reduce prey species and potential swift fox habitat. This species is occasionally killed by vehicular traffic which has been estimated as contributing 5 percent of annual swift fox mortality in one study, but most swift fox mortality is from coyotes (Rongstad *et al.*, 1989). Like other fox species, swift foxes will consume carrion (Samuel and Nelson, 1994; Uresk and Sharps, 1986; Scott-Brown *et al.*, 1987) and so are vulnerable to being struck by trains if they feed on carcasses along the railroad. But, they will not approach carrion that are being utilized by coyotes (Rongstad *et al.*, 1989).

Black-tailed Prairie Dog. The distribution of these colonial rodents has diminished as land has been converted to agriculture and by urbanization (Knowles, 1995; Wuerthner, 1997). Indiscriminate shooting (Vosburgh and Irby, 1998) and intentional poisoning (Roemer and Forrest, 1996) have impacted colonies on a local scale. Exotic disease epizootic episodes have eliminated black-tailed prairie dogs from larger areas (Mulhern and Knowles, 1995). Though not specifically documented, they are killed on highways by vehicles and may be killed by trains since black-tailed prairie dogs use roads for dispersal (Knowles, 1985; Reading and Matchett, 1997). However, the principal impact by the alternatives is expected to occur during ground clearing and construction of the rail bed. Whether the presence of an operating railroad would inhibit their movements from one side to another is unknown.

Since the USFWS received a petition to list the black-tailed prairie dog under the ESA, the Acting Deputy Chief, National Forest System instructed (May 27, 1999) the Regional Forester of Region 2 to cease poisoning prairie dogs on NFS lands while the USFWS conducts a status review. Two situations warranted exceptions: where poisoning is the only alternative to reduce risks of plague to humans and where plague-infested colonies are proximate to plague-free black-footed ferret reintroduction sites. Plague has been a major factor in the decline of prairie dogs and the only plague-free state remaining in the species' historic range is South Dakota.

[10] Federal Register, February 16, 1999, 64(30):7587-7601.

[11] Federal Register, January 18, 1995, 60(11):3613-3615.

Other Species with Special Status. Species with some form of special status other than those Federally listed threatened, endangered, proposed and candidate species and which could occur in the vicinity of the project alternatives are listed in Table 3-86, in the preceding chapter. Some are aquatic species (fish, amphibians), many are wetland-dependent but others could be or have been found in the various upland habitats present on the project area. Impacts anticipated for other wildlife and aquatic resources and summarized in Table 4-10 could apply to species with special status. For species most likely to occur on the project area, specific impact descriptions follow:

Burrowing owls have been documented nesting in the project area vicinity where they are probably found in low vegetation (low density sagebrush and desert shrub). Since they nest in burrows dug by mammals (prairie dogs and badgers), burrowing owls are susceptible to mortality by vehicles and excavation machinery. They appear to tolerate many types of human activities including vehicular traffic and construction noise (Marks and Ball, 1983) but it is assumed that disturbances near nest sites during the nesting period will influence nesting success. Burrowing owls have suffered from indiscriminate shooting where prairie dogs and ground squirrels are used for target practice (Marks and Ball, 1983).

Long-billed curlews and loggerhead shrikes could be impacted if nests, eggs, or birds are destroyed by vehicles or foot traffic. Construction activities in dense sagebrush, conifer-sagebrush and greasewood vegetation could adversely impact nests and nesting activities of loggerhead shrikes while activities in low vegetation (dry playas, low density sagebrush, saltbush) could impact nests of long-billed curlews.

Along with surface disturbances associated with all the alternatives, increased use of existing roads by project-related vehicles and ORV use by the public could eventually lead to secondary impacts (mortality and habitat loss) to black-tailed prairie dogs, eastern spotted skunks, river otters and eastern short-horned lizards. Changes in water flows on the Cheyenne River and/or reduced water quality could have adverse effects on resident spiny softshell turtles.

American bitterns, great blue heron, black terns, and many other bird species of concern so classified by the USFWS, Forest Service, WGFD and SDGFP would be expected to occur in wetlands, waterbodies and riparian cottonwood habitats in the project area. Compliance with Federal regulations (i.e., Section 404 of the Clean Water) would insure that any loss of these habitats would be replaced and thus minimize impacts to these species. However, many other sensitive bird species such as Baird's sparrow, Brewer's sparrow, loggerhead shrike, lark bunting, and chestnut-collared longspur inhabit upland shrublands and grasslands which have no specific protection. These species are susceptible to removal of nesting habitats, habitat degradation due to train traffic and noise during operations, and potential increased nest predation if predators are attracted to carrion along the tracks.

Plants. Except for Ute ladies'-tresses discussed above, there are no other Federally-listed threatened or endangered plant species that would be affected by any alternatives in Wyoming and western South Dakota. Nineteen plant species of concern (so classified by the Forest Service and/or BLM) potentially occur within the project area (see Table 3-86). Coordination with the Forest Service, BLM and botanical experts will be necessary to determine whether surveys for these species are warranted prior to implementation of the alternatives. Without the benefit of such surveys it is impossible to accurately estimate potential impacts to these species.

4.17.3 Alternative A (No Action). Implementation of the No Action Alternative would eliminate potential project-related impacts to threatened, endangered, proposed, and candidate wildlife and plant species and species with special status that have been described, above.

4.17.4 Alternative B (Proposed Action). Short-term impacts due to construction of Alternative B to Federally-listed threatened or endangered species, species proposed for listing, candidate species, species petitioned for listing, and species with special status include direct mortality by field vehicles and construction machinery, avoidance of habitats that are utilized near construction sites and/or temporary habitat loss, and potential short-term degradation of habitats, especially aquatic habitats at sites where sediment discharge and accidental release of toxic substances occurs as well as habitats downstream. With a few exceptions, specific locations of habitats that are occupied by these species are not defined.

Active prairie dog colonies may be suitable habitat or provide important habitat components for listed, proposed and candidate species including black-footed ferrets, bald eagles, mountain plovers and swift fox. Alternative B would cross 4.9 miles of the proposed black-footed ferret reintroduction site - the Rosecrans Area - on TBNG. Construction and long-term operational impacts to this area would likely make the area unsuitable for reintroduction of the species.

Other species with special status that are known to occur in the project area and which are included in Table 3-86 also are associated with black-tailed prairie dog colonies during some time within the annual cycle. Included are the following mammals: shrews, various

vespertilionid bat species, and eastern spotted skunk (Clark *et al.*, 1982; Sharps and Uresk, 1990). Numerous bird species are also associated with prairie dog colonies and include ferruginous hawk, upland sandpiper, long-billed curlew, burrowing owl, Brewer's sparrow, lark bunting, grasshopper sparrow, chestnut-collared longspur and bobolink (Clark *et al.*, 1982; Agnew *et al.*, 1986; Sharps and Uresk, 1990). Some amphibians and reptiles included in Table 3-86 also occur on prairie dog colonies (tiger salamander, eastern short-horned lizard).

Several sources have contributed locations of black-tailed prairie dog colonies in the project area and vicinity of Alternative B. Mapped prairie dog colonies intersected by Alternative B are not as complete as for Alternative C since, except for those sections that coincide with or closely parallel Alternative C, no recent low-level aerial photo-graphy exists along Alternative B. Therefore, most of the colonies included in Table 3-85 were obtained from TBNG, BGNG, and WGFD data sets. Table 3-85 provides estimates of short-term and long-term disturbances within prairie dog colonies due to Alternative B: at least 11.6 miles of Alternative B would pass through prairie dog colonies in South Dakota and Wyoming compared to at least 17.5 miles of Alternative C (including the Phiney Flat and W G Flat Route Variations) and 6.2 miles of Alternative D. Beyond these comparisons, levels of short-term impacts to any of the terrestrial vertebrate species likely to occur in black-tailed prairie dog colonies can not be estimated.

Construction of Alternative B during winter within TBNG and along the Cheyenne River in South Dakota and its major tributaries in Wyoming (Black Thunder Creek, Little Thunder Creek and Antelope Creek) is likely to displace wintering bald eagles from perches and feeding areas or make those sites temporarily unsuitable within at least a 0.5-mile zone and perhaps up to 1 mile surrounding construction activities. Estimates of potential bald eagle wintering habitats within 0.5- and 1-mile zones of the Cheyenne River and major tributaries that could be affected by Alternative B are provided in Table 4-11.

Alternative B passes within 0.5-mile of potential bald eagle wintering habitat for approximately 85 miles in the affected counties (see Table 4-11). Nearly 129 miles of Alternative B is within 1 mile of potential wintering habitat. Most of the same areas where there are trees in riparian cottonwood zones are also potential bald eagle nesting habitats. Disturbances to wintering bald eagles could thus occur along 85 to 129 miles of Alternative B during the short-term (construction) as well as the long-term (operation). The Forest Service and BLM both have policies to protect bald eagle winter roosts from November 1 to April 1 and bald eagle nests from February 1 to July 31 by imposing a 1-mile buffer around nests and roosts, within which no surface disturbance would be allowed in those periods.

Construction of Alternative B during spring and early summer along the Cheyenne River corridor, primarily in Pennington County, could displace interior least terns if they select sand bars or islands within the river to nest. The actual amount of nesting habitat available will change from year to year since water flows in the Cheyenne River some years would inundate or scour sand bars and islands, making them unsuitable for nesting. If that was the case during construction, there would be no short-term impacts to interior least terns In years with low water flows, construction activities prior to nesting may cause terns to avoid the area, if they are present. But, since least terns appear to tolerate distant noise associated with highways and railroads, they may nest anyway.

Though not documented in the vicinity of Alternative B in South Dakota, American burying beetles could occur in suitable soils that include those with high sand content (soils with high wind erosion potential) and those with relatively well developed topsoil (soils with the best combination of physical characteristics for producing a sustained high yield of crops with adequate moisture). Soils in both groups would be crossed by Alternative B. Given the recent collections of American burying beetles in southern South Dakota in riparian areas, grasslands, and grasslands with interspersed stands of cottonwoods (Backlund and Marrone, 1997), Alternative B could affect similar potentially suitable habitats along the route in South Dakota. Over 3 miles of forested (cottonwood riparian) wetlands and 113 miles of herbaceous rangeland (grasslands) would be affected. Also, the route would pass through 20.5 miles of cropland and pasture that could also serve as suitable habitats.

The amount of disturbances by Alternative B in these suitable soil types where they occur in grasslands and other potential habitat for the species, are provided in Table 4-12. Surface disturbances to these soils during construction would probably contribute short- and long-term impacts to burying beetles if they actually occur. There are approximately 32 miles in South Dakota where Alternative B would pass through soils and habitats that might be used by American burying beetles for burying carrion and reproduction. The majority of those soils, 25 miles, are potentially prime farmland soils but it is unknown whether all or some are irrigated and/or cultivated. It is assumed that either farming treatment would make a site unsuitable for American burying beetles. If those prime farmland soils are taken out of production by Alternative B, they would probably be more suitable for use by the beetles, if they occur and if appropriate sized carrion is available. But without verification that the species actually occurs, short-term

Table 4-11 Miles of Alternative B Within 0.5 and 1 Mile of the Cheyenne River, Black Thunder Creek, Little Thunder Creek and Antelope Creek That Are Potential Bald Eagle Wintering Habitats		
County, State (ordered west to east)	**Miles Within 0.5 Mile of Potential Habitat**	**Miles Within 1 Mile of Potential Habitat**
Campbell, WY	8.7	13.2
Converse, WY	6.5	8.1
Weston, WY	14.2	24.8
Niobrara, WY	4.3	7.1
Fall River, SD	17.3	28.3
Custer, SD	21.6	24.3
Pennington, SD	12.4	23.0
Alternative B Total	85.0	128.8

Table 4-12 Number of Miles Where Alternative B Intersects Suitable Soils and Habitats Potentially Inhabited by American Burying Beetles in South Dakota						
South Dakota County (ordered west to east)	**Suitable Soil Type**	**Distance (miles) Crossed in Potential Habitats per Suitable Soil Type**				
		Cropland, Pasture	**Herbaceous Rangeland**	**Forested Wetland**	**Deciduous Forest**	**County Total**
Fall River	Sandy, Erosive	0.5	5.0	0.3	0	5.8
	Prime Farmland	7.8	10.5	0.5	0	18.8
Custer	Sandy, Erosive	0	1.1	0.5	0	1.6
	Prime Farmland	1.0	2.5	0.7	0	4.2
Pennington	Sandy, Erosive	0	0.1	0	0	0.1
	Prime Farmland	0.8	1.1	0	0	1.9
Alternative B Total		10.1	20.3	2.0	0	32.4

and long-term impacts to American burying beetles are not anticipated.

Short-term impacts to candidate (sturgeon chub) and sensitive (plains topminnow, flathead chub, finescale dace, longnose sucker) fish species could occur during construction from increased sedimentation due to runoff from construction sites near waterways. During construction and operation, short- or long- term impacts could occur to pallid sturgeon and other candidate and sensitive fish species as well as spiny softshell turtles if there were derailments and accidental release of diesel fuels or other petroleum products into the Cheyenne River or its tributaries. Both types of impacts would be most likely if potential discharge sites are within 500 feet of surface waters where there may be insufficient riparian vegetation to prevent spills from entering drainages. In addition, bald eagles and least terns could be impacted by widespread fish-kills that would adversely affect food sources and piping plovers nesting downstream could be affected if aquatic and burrowing invertebrate were killed.

Table 4-13 indicates the number of sites and/or distances at which the Alternative B route would be within 500 feet of the Cheyenne River or tributary streams with perennial flow. There are 177 total sites where Alternative B is within 500 feet of the Cheyenne River and perennial tributary streams. Alternative B would pass within 500 feet of these drainages for a total of 21.9 miles. These sites are believed to be those most likely where sediments and/or accidentally released toxic compounds could be discharged into the Cheyenne River system, both in the short-term and long-term.

In addition, water withdrawals from the Cheyenne River during construction could reduce water flows downstream, at least temporarily. Reduced flows during key periods including spawning and migration could produce localized short-term impact to candidate and sensitive fish species.

As a result of past surveys, 2 sites along Alternative B that have been evaluated as potential habitat for Ute ladies'-tresses, 1 site in Wyoming (Lodgepole Creek) and 1 site in South Dakota (Dry Creek). One other site in South Dakota (Plum Creek) and 3 in Wyoming (East Fork Coal Creek, Dry Creek, and Caballo Creek) could not be evaluated because access was denied.

Table 4-13 Number of Sites and Total Distance (Miles) Where Alternative B Is Within 500 Feet of the Cheyenne River or Tributary Streams				
County, State	Cheyenne River		Perennial Tributary Streams	
	Number of Sites	Total Distance	Number of Sites	Total Distance
Campbell, WY	0	0	11	1.4
Converse, WY	0	0	0	0
Niobrara, WY	0	0	0	0
Weston, WY	0	0	0	0
Custer, SD	42	4.3	79	7.7
Fall River, SD	5	1.0	27	5.4
Pennington, SD	2	0.1	11	2.0
Alternative B Total	49	5.4	128	16.5

In Wyoming, Alternative B would cross a total of 0.14 mile of wet meadows, palustrine emergent wetland temporarily and seasonally flooded, that could be potential habitat for the orchid (see Table 3-74). The route in South Dakota would cross 0.78 mile of the same wetland type. In both states, all wet meadow wetlands impacted by the alternative are on private lands. Occurrence along Alternative B of other sensitive plant species that are included in Table 3-86 is unknown. Individuals of any sensitive plant species inhabiting construction sites would be eliminated, at least for the short-term.

Long-term impacts due to the presence, operation and maintenance of Alternative B to Federally-listed threatened or endangered species, species proposed for listing, candidate species, species petitioned for listing, and species with special status are expected to be similar to short-term impacts, described above. They include direct mortality by trains and maintenance vehicles, avoidance of habitats that are near the tracks, and potential long-term deterioration of habitats, especially aquatic habitats at sites subject to sediment discharge and accidental release of toxic substances and aquatic habitats downstream.

For the life of the project, there is the potential for direct mortalities to terrestrial vertebrates by trains. Those threatened, endangered, proposed, candidate, petitioned and species with special status most likely to be impacted directly by train traffic include bald eagles, swift fox, black bear, mountain lion, golden eagles, ferruginous hawks, northern harriers, peregrine falcons, merlins, and short-eared owls. These species are those most likely to feed on carrion of other animals, such as big game species, that are killed by trains. These could be drawn to close proximity of the tracks, thereby increasing their risk of being killed.

Locations and numbers of mortalities are impossible to estimate except where tracks would intersect suitable habitats that are known to be used or may potentially be used. Thus, swift fox, ferruginous hawks and other raptors are most at risk where tracks intersect prairie dog colonies; bald eagles, merlins, northern harriers are most at risk where tracks would cross or closely parallel wooded riparian zones and/or ponderosa pine woodlands that coincide with areas of concentrated carrion. Those sites are predicted to include big game wintering ranges or other ranges where big game animals congregate and cross tracks. Potential indirect long-term impacts to ground nesting birds (interior least terns, piping plovers, mountain plovers) and nests of spiny softshell turtles could also occur if predators are drawn to a nesting area because of carrion concentrations along tracks.

Long-term impacts to habitats used by terrestrial and aquatic species due to surface disturbances are expected to be similar to those described under short-term impacts, above. However, once construction activities are complete and revegetation is successful, the total amount of some habitats affected by surface disturbance is expected to be less over the long-term. For example, where prairie dog colonies are crossed, black-tailed prairie dogs are likely to invade newly reclaimed ground up to some unknown distance from the tracks. While prairie dogs may repopulate disturbed areas within their colonies, the likelihood for their mortal-ity and mortality of scavengers would be expected to increase the closer burrows are to train traffic.

Noise due to train traffic is expected to be a long-term impact to some species. Background noise on the project area in both states is similar to EPA's "farm in valley" noise category which is about 39 dBA in daytime and 32 dBA at night. Estimates of distances at which noise attenuation from train whistles and locomotives diminishes to background daytime noise levels ranges from 39,000 feet - 7.4 miles (whistles) to 23,000 feet - 4.4 miles (locomotives). Attenuation distances are much greater for noise to diminish to nighttime background levels: 49,000 feet - 9.3 miles for whistles and 32,000 feet - 6.1 miles for locomotives. Noise levels of 60 dBA are comparable to EPA's "noisy urban residential"

category and noise from locomotives would reach that level at 5,700 feet - 1.1 mile from the tracks while whistle sound would attenuate to 60 dBA 3 miles away (16,000 feet).

The degree to which these noise levels would displace species is unknown and undoubtedly varies by species and local conditions. Abandonment of occupied habitats within some distance of the railroad is likely, particularly by nesting birds. For example, densities of nesting birds inhabiting woodlands begins to decline when noise levels form highways reaches 42 dBA and densities of grassland species declines when noise levels reach 48 dBA (Forman and Alexander, 1998). For noise of locomotives pulling cars, attenuation to 48 dBA may not occur for over 2.5 miles while attenuation to 42 dBA may be over 4 miles (see data in Table 2-6). Sound attenuation though, is likely to be greater in woods than grasslands and the distance of noise effects on breeding birds will probably be greater in grasslands than in woodlands. However, these noise effects on bird densities have been documented for vehicle traffic on highways with substantially higher traffic volume which is also a factor depressing densities of birds (Forman and Alexander, 1998). Whether the relatively low train traffic volume but with much greater noise per train would produce similar effects as highways in lowering bird densities in the project vicinity can not be predicted.

If they inhabit nest sites near Alternative B, bald eagles, interior least terns, piping plovers and mountain plovers could avoid those sites or other, potential nest sites during the long-term. Likewise, wintering bald eagles may avoid suitable feeding and perch sites if long-term noise levels are too high. It is possible that between 85 miles and 129 miles of potential bald eagle winter habitats could be affected by Alternative B (see Table 4-11). Though no bald eagles are currently nesting in the project area, they may in the future as nesting populations expand their range. However, the degree to which Alternative B limits future nesting by this species can not be determined.

Long-term runoff of sediments and toxic compounds could impact aquatic organisms downstream in much the same way as described under short-term impacts. Those same sites that were evaluated in Table 4-13 are likely to be those where chronic discharges occur with risk to listed and sensitive fish species, spiny softshell turtles, and other aquatic vertebrates and organisms that are components of aquatic food chains downstream.

Wildlife management indicator species (MIS) identified on BGNG include pronghorn antelope, mule deer, sharp-tailed grouse, black-footed ferret, and wild turkey. The Nebraska Forest Plan recognizes the black-footed ferret as the only Federally-listed endangered species that may inhabit the BGNG yearlong but that peregrine falcon, bald eagle, and whooping cranes are Federally-listed species that could occur as seasonal migrants and swift fox (South Dakota State-threatened species), and spiny soft-shelled turtles (formerly listed by South Dakota as State-threatened species) also occur.

Nebraska Forest Plan management area prescriptions that would be affected by Alternative B are provided in Table 1-2 and discussed in detail in Table 1 through Table 5 in Appendix A. Estimates of where and how much of Alternative B would impact known or potential habitats utilized by MIS species are provided in Table 4-14. Effects of Alternative B on the remaining MIS are discussed in Section 4.18.

Wildlife MIS identified on TBNG include featured species (pronghorn antelope, mule deer, and elk), recovery species (bald eagle, black-footed ferret, and peregrine falcon), and ecological indicator species (prairie vole, black-tailed prairie dog, yellow-breasted chat, sage grouse, golden eagle, Brewer's sparrow, willow flycatcher, mountain plover, upland sandpiper, ferruginous hawk, red crossbill, house wren, long-billed curlew, red-headed woodpecker, and Woodhouse's toad). One of the management requirements for the Medicine Bow National Forest is to manage and provide habitat for recovery of endangered and threatened species. Alternative B would cross land designated for reintroduction of black-footed ferrets and so would be inconsistent with the Forest Plan. Unless adequate mitigation could be developed, it is anticipated that the railroad passing through prairie dog colonies at the Rosecrans Area would render the site unsuitable for reintroduction of black-footed ferrets because of habitat fragmentation and noise (see Table 4-15). While Alternative B would not affect peregrine falcons, it would possibly affect wintering bald eagle habitats along the Cheyenne River, Black Thunder Creek, Little Thunder Creek and Antelope Creek (see Table 4-11).

Medicine Bow Forest Plan management area prescriptions that would be affected by Alternative B are provided in Table 1-2 and discussed in detail in Table 6 through Table 12 in Appendix A. Estimates of where and how much of Alternative B would impact known or potential habitats utilized by recovery and ecological indicator species are provided in Table 4-15. Effects of Alternative B on the remaining MIS will be discussed in Section 4.18.

The only Nebraska Forest Plan general direction that would be affected by Alternative B with some certainty would be disturbances to prairie dog colonies that would diminish the amount and suitability of essential habitat for the black-footed ferret. Other MIS that are somewhat dependant on prairie dog colonies for nesting habitat or

Table 4-14 Forest Service Management Indicator Species and Species with Special Designations on BGNG That Could be Impacted by Alternative B in Potential Habitats				
Species	**Species Designation**	**Miles of Alternative in Potential Habitat on BGNG**	**Evidence for Occurrence in Project Area by Habitat**	**Potential for Impact by Alternative (1)**
Black-footed Ferret	Federally Listed Endangered	prairie dog colonies - 0.2 mi	Introduced in black-tailed prairie dog complex in Conata Basin/Badlands	Unknown
Peregrine Falcon	Delisted as Endangered	None	None	No
Whooping Crane	Federally Listed Endangered	None	None	No
Bald Eagle	Federally Listed Threatened	forested wetland - 0.8 mi	Documented wintering habitat and potential nesting habitat in riparian cottonwood woodland	Probably
Swift Fox	Federal Candidate Forest Service Sensitive SD Threatened	prairie dog colonies - 0.2 mi herbaceous range - 15.3 mi	Documented denning habitats in short-grass prairie, unlikely occurrence in cottonwood riparian woodlands	Possibly
Spiny Softshell Turtle	Formerly SD Threatened	forested wetland - 0.8 mi nonforested wetland - 0.2 mi	Documented occurrence in mud flats, sandbars, soft sand-mud bottoms with aquatic vegetation in lakes, rivers, streams	Probably

1 = Potential for impact by Alternative B was judged as:
No: the species is not likely to occur on BGNG.
Unknown: although the management indicator species may occur on BGNG, there is no documented occurrence of the species within specified habitats or the presence of those habitats have not been documented in areas crossed by Alternative B.
Possibly: the management indicator species is known to occur in specified habitats on BGNG that would be crossed by Alternative B but the species has not been documented proximate to the alternative.
Probably: Alternative B crosses specified habitat on BGNG with documented use by the management indicator species.
Yes: Alternative B crosses the specified habitat on BGNG and would directly impact the management indicator species.

on prairie dogs as prey could also be impacted by Alternative B. These include the mountain plover, long-billed curlew, and ferruginous hawk. Impacts from Alternative B to other species, including upland sandpiper, red-headed woodpecker and Brewer's sparrow are possible but unknown with any certainty since the distribution of those species in suitable habitats are unknown.

Management area prescriptions under the recently proposed grassland plans for TBNG and BGNG (Forest Service 1999a and 1999b) that would be affected by Alternative B are provided in Table 1-2 and discussed in detail in Table 13 through Table 23 in Appendix A. In the process of updating plans to manage national grasslands, the Forest Service prepared a Draft Biological Assessment and Evaluation that included analyses of effects of their plans on numerous plant and animal species.

Animal and plant species that are likely to inhabit TBNG and/or BGNG and which have been identified as at-risk of range-wide imperilment (extinction or extirpation) or at-risk of local or region imperilment were assessed by the Forest Service (1999c) in the Draft Biological Assessment and Evaluation. Estimates of where and how much of Alternative B would impact known or potential habitats utilized by those imperilled plant and animal species are provided in Table 4-16. In some instances, the species probably does not occur on either TBNG or BGNG but rather occurs in habitats directly adjacent to the national grasslands. One example would be the sturgeon chub which is found in the Cheyenne River in South Dakota but not on BGNG, per se.

4.17.5 Alternative C (Modified Proposed Action). Short-term impacts due to construction of Alternative C to Federally-listed threatened or endangered species, species proposed for listing, candidate species, species petitioned for listing, and species with special status are anticipated to be similar to those described for Alternative B. They include direct mortality by field vehicles and construction machinery, avoidance of habitats that are utilized near construction sites and/or temporary habitat loss, and potential short-term degradation of habitats, especially aquatic habitats at sites and downstream from sediment discharge and accidental release of toxic substances. As noted earlier, locations of habitats known to be occupied by these species are not defined with a few exceptions.

Known prairie dog colonies crossed by Alternative C are more complete than for either Alternatives B or D since colonies were mapped from recent aerial photo-

Table 4-15
Forest Service Management Indicator Species on TBNG That Could be Impacted by Alternative B in Potential Habitats

Forest Management Indicator Species	Species Designation	Miles of Alternative in Potential Habitat on TBNG	Evidence for Occurrence in Project Area by Habitat	Potential for Impact by Alternative (1)
Recovery Species				
Black-footed Ferret	Federally Listed Endangered	prairie dog colonies - 1.8 mi	Habitat suitable for reintroduction	Yes
Peregrine Falcon	Delisted as Endangered	None	None	No
Bald Eagle	Federally Listed Threatened	None	Documented wintering and potential nesting habitat in ponderosa pine woodlands and riparian cottonwood woodland	Unknown
Ecological Indicator Species				
Mountain Plover	Federal Proposed for Listing as Threatened Forest Service Sensitive	prairie dog colonies - 1.8 mi herbaceous range - 34.5 mi mixed rangeland - 0.2 mi cropland/pasture - 0.7 mi	Documented nesting habitats in short-grass prairie and black-tailed prairie dog colonies	Possibly
Black-tailed Prairie Dog	Federal Candidate	prairie dog colonies - 1.8 mi	Documented prairie dog colonies in project area	Yes
Upland Sandpiper	USFWS Species of Concern; Forest Service Sensitive	herbaceous range - 34.5 mi mixed rangeland - 0.2 mi cropland/pasture - 0.7 mi	Documented occurrence during breeding on short-grass prairie	Possibly
Long-billed Curlew	USFWS Species of Concern; Forest Service Sensitive	herbaceous range - 34.5 mi shrub/brush range - 0.1 mi mixed rangeland - 0.2 mi cropland/pasture - 0.7 mi	Documented presence - possibly nesting - in sagebrush steppe, meadow, grasslands, native hay meadow	Possibly
Ferruginous Hawk	USFWS Species of Concern; Forest Service Sensitive	herbaceous range - 34.5 mi shrub/brush range - 0.1 mi mixed rangeland - 0.2 mi cropland/pasture - 0.7 mi	Documented nesting habitat in short-grass prairie and sagebrush steppe	Probably
Red-headed Woodpecker	USFWS Species of Concern	None	Possible occurrence during breeding, probably in riparian cottonwood woodland	Unknown
Brewer's Sparrow	USFWS Species of Concern	shrub/brush range - 0.1 mi mixed rangeland - 0.2 mi	Documented occurrence during breeding in sagebrush steppe	Possibly

1 = Potential for impact by Alternative B was judged as:
No: the species is not likely to occur on TBNG.
Unknown: although the management indicator species may occur on TBNG, there is no documented occurrence of the species within specified habitats or the presence of those habitats have not been documented in areas crossed by Alternative B.
Possibly: the management indicator species is known to occur in specified habitats on TBNG that would be crossed by Alternative B but the species has not been documented proximate to the alternative.
Probably: Alternative B crosses specified habitat on TBNG with documented use by the management indicator species.
Yes: Alternative B crosses the specified habitat on TBNG and would directly impact the management indicator species.

graphy along the length of Alternative C. Results of that mapping effort are included in Table 3-85. However, those colonies have not been field-checked to determine whether they are currently active. Likewise, activity status is unknown for the colonies tabulated from TBNG, BGNG, and WGFD data sets for Alternative B, above. At least 17.5 miles of Alternative C would pass through prairie dog colonies in South Dakota and Wyoming compared to at least 11.5 miles of Alternative B and 6.2 miles of Alternative D. Beyond these comparisons, levels of short-term impacts to any of the terrestrial vertebrate species likely to occur in black-tailed prairie dog colonies can not be estimated.

Construction during winter within TBNG and along the Cheyenne River corridor in South Dakota and its major tributaries in Wyoming (Black Thunder Creek, Little Thunder Creek and Antelope Creek) is likely to displace

Table 4-16
Animal and Plant Species Identified as at Risk by the Forest Service in the Northern Great Plains That Potentially Occur on TBNG and BGNG and Could Be Impacted by Alternative B in Potential Habitats

Species At -Risk (1)	National Grasslands Occurrence	Miles of Alternative in Potential Habitat in National Grasslands	Evidence for Occurrence in Project Area by Habitat	Potential for Impact by Alternative (2)
Species Protected Under the ESA and at Risk of Rangewide Imperilment:				
Ute ladies'-tresses	TBNG	None	No known occurrence or recent observations although potential habitat is possible on TBNG and BGNG	Unknown
	BGNG	None		
Whooping crane	BGNG	None	Known occurrences but only incidentally during migrations	No
Bald eagle	TBNG	None	Documented wintering and potential nesting habitat in ponderosa pine woodlands and riparian cottonwood woodland	Probably
	BGNG	forested wetland - 0.8 mi		
Peregrine falcon (before delisting)	TBNG	None	Known occurrences but only incidentally during migrations.	No
	BGNG	None		
Black-footed ferret	TBNG	prairie dog colonies - 1.8 mi	Introduced in black-tailed prairie dog complex in Conata Basin, potential habitat for reintroduction on TBNG	Possibly
	BGNG	prairie dog colonies - 0.2 mi		
Mountain plover	TBNG	prairie dog colonies - 1.8 mi herbaceous rangeland - 34.5 mi mixed rangeland - 0.2 mi cropland/pasture - 0.7 mi	Documented nesting habitats in short-grass prairie and black-tailed prairie dog colonies on TBNG, unknown occurrence on BGNG but potential habitat exists	Probably
	BGNG	prairie dog colonies - 0.2 mi herbaceous rangeland - 15.3 mi		
Species That may be at Risk of Rangewide Imperilment but are not Protected Under the ESA:				
Dakota buckwheat	BGNG	Unknown	Known occurrence in badlands, barren clay mounds and outwash in BGNG	Unknown
Barr orphacea	TBNG	Unknown	Known occurrence on clay hills in NE WY and present in Custer and Shannon Cos., SD	Unknown
	BGNG	Unknown		
Sturgeon Chub	TBNG	None	Documented in Cheyenne River, Custer, Pennington Cos., SD; appears absent in WY	Possibly
	BGNG	forested wetland - 0.8 mi nonforested wetland - 0.2 mi		
Swift Fox	TBNG	prairie dog colonies - 1.8 mi herbaceous rangeland - 34.5 mi mixed rangeland - 0.2 mi	Documented denning habitats in short-grass prairie on TBNG and BGNG	Possibly
	BGNG	prairie dog colonies - 0.2 mi herbaceous rangeland - 15.3 mi		
Species That may be at Risk of Regional or More Local Imperilment:				
Marsh bellflower	BGNG	forested wetland - 0.8 mi nonforested wetland - 0.2 mi	Suspected to occur in suitable habitats in wetlands and riparian zones on BGNG	Unknown
Nodding buckwheat	TBNG	Unknown	Suspected to occur in suitable habitats on buttes in TBNG and BGNG	Unknown
	BGNG	Unknown		
Lanceleaf cottonwood	TBNG	None	Suspected to occur in suitable habitats in wetlands and riparian zones on TBNG and BGNG	Unknown
	BGNG	forested wetland - 0.8 mi nonforested wetland - 0.2 mi		
Torrey's crypthantha	TBNG	Unknown	Suspected to occur in suitable habitats on Buttes in TBNG	Unknown

Table 4-16 Continued				
Species At -Risk (1)	**National Grasslands Occurrence**	**Miles of Alternative in Potential Habitat in National Grasslands**	**Evidence for Occurrence in Project Area by Habitat**	**Potential for Impact by Alternative (2)**
Marsh fern	BGNG	forested wetland - 0.8 mi nonforested wetland - 0.2 mi	Suspected to occur in suitable habitats in wetlands and riparian zones on BGNG	Unknown
Lady-fern	BGNG	None	Suspected to occur in suitable habitats in deciduous woodlands on BGNG	Unknown
Frostweed	BGNG	Unknown	Suspected to occur in suitable habitats in sandhills on BGNG	Unknown
Meadow horsetail	BGNG	forested wetland - 0.8 mi nonforested wetland - 0.2 mi	Suspected to occur in suitable habitats in wetlands and riparian zones on BGNG	Unknown
Sand lily	TBNG	Unknown	Suspected occurrence on TBNG and BGNG on sandy areas on mixed grass prairie, on hillsides, open coniferous woods	Unknown
	BGNG	Unknown		
Blue lips	TBNG	None	Suspected to occur in suitable habitats in wetlands and riparian zones on TBNG and BGNG	Unknown
	BGNG	forested wetland - 0.8 mi nonforested wetland - 0.2 mi		
Alyssum-leaf phlox	TBNG	Unknown	Suspected to occur in suitable habitats on buttes in TBNG and BGNG	Unknown
	BGNG	Unknown		
Alkali sacaton	TBNG	Unknown	Suspected to occur in suitable habitats in wetlands and riparian zones on TBNG	Unknown
Tawny Crescent Butterfly	TBNG	None	Suspected occurrence on TBNG in ponderosa pine savannah with riparian habitats	Unknown
Flathead Chub	TBNG	None	Documented occurrence in Cheyenne River, BGNG and Antelope Creek, TBNG	Possibly
	BGNG	forested wetland - 0.8 mi nonforested wetland - 0.2 mi		
Plains topminnow	TBNG	None	Documented occurrence in tributaries to Cheyenne River on BGNG and TBNG	Possibly
	BGNG	forested wetland - 0.8 mi nonforested wetland - 0.2 mi		
Northern leopard frog	TBNG	None	Known to occur in emergent wetland vegetation on TBNG and BGNG	Possibly
	BGNG	forested wetland - 0.8 mi nonforested wetland - 0.2 mi		
American bittern	BGNG	forested wetland - 0.8 mi nonforested wetland - 0.2 mi	Known to occur in emergent wetland vegetation on BGNG	Possibly
Yellow-billed cuckoo	TBNG	None	Known occurrence on TBNG and BGNG in woody shrub/tree overstory riparian vegetation	Possibly
	BGNG	forested wetland - 0.8 mi		
Long-billed curlew	TBNG	herbaceous rangeland - 34.5 mi mixed rangeland - 0.2 mi	Known occurrence on TBNG and BGNG in short-grass and low mixed-grass prairie	Possibly
	BGNG	herbaceous rangeland - 15.3 mi		
Disckcissel	TBNG	herbaceous rangeland - 34.5 mi mixed rangeland - 0.2 mi	Known occurrence on TBNG in moderately tall mixed-grass/ tall-grass prairie	Possibly
Northern Goshawk	TBNG	None	Possible nesting on TBNG in ponderosa pine, may be on BGNG during migrations	Unknown
	BGNG	None		

Table 4-16 Continued				
Species At -Risk (1)	**National Grasslands Occurrence**	**Miles of Alternative in Potential Habitat in National Grasslands**	**Evidence for Occurrence in Project Area by Habitat**	**Potential for Impact by Alternative (2)**
Sage Grouse	TBNG	shrub/brush rangeland - 0.1 mi mixed rangeland - 0.2 mi	Documented occurrence in sagebrush steppe on TBNG and BGNG with leks present	Yes
	BGNG	None		
Ferruginous hawk	TBNG	herbaceous rangeland - 34.5 mi shrub/brush rangeland - 0.1 mi mixed rangeland - 0.2 mi	Documented nesting on TBNG and BGNG in trees, on ground and rocks in grasslands and shrublands	Probably
	BGNG	herbaceous rangeland - 15.3 mi		
Swainson's hawk	TBNG	herbaceous rangeland - 34.5 mi shrub/brush rangeland - 0.1 mi mixed rangeland - 0.2 mi	Documented nesting on TBNG and BGNG in trees in grasslands and shrublands	Probably
	BGNG	herbaceous rangeland - 15.3 mi forested wetland - 0.8 mi		
Merlin	BGNG	forested wetland - 0.8 mi	Moist habitats below 8,500 feet, cottonwood-riparian and ponderosa pine	Unknown
Short-eared owl	TBNG	herbaceous rangeland - 34.5 mi mixed rangeland - 0.2 mi	Known occurrence on TBNG and BGNG in moderately tall mixed-grass/ tall-grass prairie	Possibly
	BGNG	herbaceous range - 15.3 mi		
Burrowing Owl	TBNG	prairie dog colonies - 1.8 mi herbaceous rangeland - 34.5 mi mixed rangeland - 0.2 mi	Prairie dog colonies, grasslands, basin-prairie shrublands, agricultural areas documented on BGNG and TBNG	Possibly
	BGNG	prairie dog colonies - 0.2 mi herbaceous rangeland - 15.3 mi		
Loggerhead shrike	TBNG	shrub/brush rangeland - 0.1 mi	Known occurrence on TBNG and BGNG in woody shrub/tree overstory riparian vegetation	Possibly
	BGNG	forested wetland - 0.8 mi		
Baird's sparrow	TBNG	herbaceous rangeland - 34.5 mi mixed rangeland - 0.2 mi	Known occurrence on TBNG in moderately tall mixed-grass/tall-grass prairie	Possibly
Fox sparrow	TBNG	shrub/brush rangeland - 0.1 mi	Known occurrence on TBNG and BGNG in woody shrub/tree overstory riparian vegetation	Possibly
Trumpeter swan	BGNG	forested wetland - 0.8 mi nonforested wetland - 0.2 mi	Known to occur in emergent wetland vegetation on BGNG	Possibly
Black tern	TBNG	None	Known to occur in emergent wetland vegetation on TBNG and BGNG	Possibly
	BGNG	forested wetland - 0.8 mi nonforested wetland - 0.2 mi		
Lewis' Woodpecker	TBNG	None	Ponderosa pine savannah and cottonwood-riparian floodplains	Unknown
Fringe-tailed myotis	TBNG	None	Known to occur near emergent wetland vegetation & woody shrub/tree overstory riparian vegetation on TBNG and BGNG	Possibly
	BGNG	forested wetland - 0.8 mi nonforested wetland - 0.2 mi		
Black-tailed prairie dog	TBNG	prairie dog colonies - 1.8 mi	Prairie dog colonies	Yes
	BGNG	prairie dog colonies - 0.2 mi		

Table 4-16 Concluded				
Species At -Risk (1)	National Grasslands Occurrence	Miles of Alternative in Potential Habitat in National Grasslands	Evidence for Occurrence in Project Area by Habitat	Potential for Impact by Alternative (2)

Notes:
1 = Species at-risk were included if they were identified on BGNG and TBNG and analyzed by the Forest Service in the Draft Biological Assessment and Evaluation for Proposed Land and Resource Management Plans, Dakota Prairie Grasslands, Nebraska National Forest and Associated Units, Thunder Basin National Grassland.
2 = Potential for impact by Alternative B was judged as:
No: the at-risk species is not likely to occur on TBNG and/or BGNG.
Unknown: although the at-risk species may occur on TBNG and/or BGNG, there is no documented occurrence of the species within specified habitats or the presence of those habitats have not been documented in areas crossed by Alternative B.
Possibly: the at-risk species is known to occur in specified habitats on TBNG and/or BGNG that would be crossed by Alternative B but the species has not been documented proximate to the alternative.
Probably: Alternative B crosses specified habitat on TBNG and/or BGNG with documented use by the at-risk species.
Yes: Alternative B crosses the specified habitat on TBNG and/or BGNG and would directly impact the at-risk species.

Table 4-17
Miles of Alternative C Within 0.5 and 1 Mile of the Cheyenne River, Black Thunder Creek, Little Thunder Creek and Antelope Creek That Are Potential Bald Eagle Wintering Habitats

County, State (ordered west to east)	Miles Within 0.5 Mile of Potential Habitat	Miles Within 1 Mile of Potential Habitat
Campbell, WY	10.0	12.7
Converse, WY	6.4	8.6
Weston, WY	12.8	19.0
Niobrara, WY	4.2	7.1
Fall River, SD	11.0	21.2
Custer, SD	0	2.0
Pennington, SD	14.1	22.8
Alternative C Total	58.5	93.4

Table 4-18
Number of Miles Where Alternative C Intersects Suitable Soils and Habitats Potentially Inhabited by American Burying Beetles in South Dakota

South Dakota County (ordered west to east)	Suitable Soil Type	Distance (miles) Crossed in Potential Habitats per Suitable Soil Type				
		Cropland, Pasture	Herbaceous Rangeland	Forested Wetland	Deciduous Forest	County Total
Fall River	Sandy, Erosive	1.2	5.0	0.1	0	6.3
	Prime Farmland	5.8	13.8	0.7	0	20.3
Custer	Sandy, Erosive	0	0	0	0	0
	Prime Farmland	2.9	1.0	0	0	3.9
Pennington	Sandy, Erosive	0	0.8	0	0.5	1.3
	Prime Farmland	0.9	1.6	0	0	2.5
Alternative C Total		10.8	22.2	0.8	0.5	34.3

wintering bald eagles from perches and feeding areas or make those sites temporarily unsuitable within at least a 0.5-mile up to a 1-mile zone surrounding construction activities. Estimates of potential bald eagle wintering habitats within 0.5-mile and 1-mile zones of the Cheyenne River and major tributaries that could be affected by Alternative C are provided in Table 4-17. Over 58 miles of Alternative C passes within 0.5-mile of potential bald eagle winter habitats in the affected counties in Wyoming and South Dakota. This is less than the 85 miles for Alternative B that is estimated to be within 0.5-mile of potential winter habitats. If short-term construction related disturbances affected wintering bald eagles 1 mile away, almost 94 miles of Alternative C would be within that distance from potential habitats (see Table 4-17), which is less than the 129 miles of Alternative B that would be located within the 1-mile zone. Disturbances to wintering bald eagles could thus occur

along 58 to 94 miles of Alternative C during the short-term and long-term if bald eagles are affected by noise associated with train traffic 0.5 mile to 1 mile away. Potential bald eagle nest-ing habitats are within the same areas where there are cottonwood riparian woodlands. Though no bald eagles are currently nesting in the project area, they may in the future as nesting populations expand their range. How-ever, the degree to which Alternative C limits future nesting by this species can not be determined.

Construction of Alternative C during spring and early summer along the Cheyenne River corridor, primarily in Pennington County, could displace interior least terns if they select sand bars or islands within the river to nest. The actual amount of nesting habitat available will change from year to year. As in the past, high water flows in the Cheyenne River during some years would obliterate any potential nesting habitats. If that was the case during construction, there would be no short-term impacts to interior least terns.

American burying beetles could occur in suitable soils along Alternative C in South Dakota that include those with high sand content and those with relatively deep topsoil. The amount of these soils which would be crossed by Alternative C are provided in Table 4-18. Surface disturbances to these soils during construction would probably contribute short- and long-term impacts to burying beetles if they actually occur.

There are approximately 34 miles in South Dakota where Alternative C would pass through suitable soils in potential habitats that might be used by American burying beetles, 2 miles more than Alternative B. Nearly 27 miles of Alternative C passes through soils with prime farmland characteristics, but whether all or some are irrigated and/or cultivated is unknown. If those prime farmland soils are taken out of production by Alternative C, they would probably be more suitable for use by burying beetles, if they occur and if appropriate sized carrion is available.

Short-term impacts to listed (pallid sturgeon), candidate (sturgeon chub) and sensitive (plains topminnow, flathead chub, finescale dace, longnose sucker) fish species could occur during construction with increased sedimentation due to runoff from construction sites near waterways. During operation, short-term impacts could occur downstream if there were derail-ments and accidental release of diesel fuels and other petroleum products into the Cheyenne River or its tributaries. Both types of impacts would be most likely if potential discharge sites are within 500 feet of surface waters. In addition, bald eagles and least terns could be impacted by widespread fish-kills that would adversely affect food sources and piping plovers nesting down-stream could be affected if aquatic invertebrates were killed.

There are 206 sites on the Cheyenne River and perennial tributary streams, combined, where Alternative C is within 500 feet of the river/stream (see Table 4-19). More than 20 miles of Alternative C is within 500 feet of the Cheyenne River and tributaries, only 1 mile less than Alternative B. These sites are believed to be those most likely where sediments and/or accidental releases of toxic compounds could be discharged.

As a result of past surveys, there are 4 sites along Alternative C that have been evaluated as potential habitat for Ute ladies'-tresses, 2 sites in Wyoming (Lodgepole Creek and School Creek) and 2 sites in South Dakota (Hay Canyon South and Dry Creek). Two other sites in South Dakota (French Creek and Plum Creek) and 3 in Wyoming (East Fork Coal Creek, Belle Fourche River, and Caballo Creek) could not be evaluated because access was denied. In Wyoming, Alternative C would cross a total of 0.16 mile of wet meadows, palustrine emergent wetland temporarily and seasonally flooded, that could be potential habitat for the orchid (see Table 3-75). In South Dakota, Alternative C would cross 0.7 mile of the same wetland type. In both states, most all wet meadows impacted by the alternative are on private lands. Individuals of Ute ladies'-tresses inhabiting construction sites would be eliminated, at least for the short-term. Occurrence along Alternative C of other sensitive plant species that are included in Table 3-86 is unknown. Individuals of any sensitive plant species inhabiting construction sites would be eliminated, at least during the short-term.

Long-term impacts due to the presence, operation and maintenance of Alternative C to Federally-listed threatened or endangered species, species proposed for listing, candidate species, species petitioned for listing, and species with special status are similar to short-term impacts described above and are expected to be nearly identical to those described under Alternative B. They include direct mortality by trains and maintenance vehicles, avoidance of habitats that are near the tracks, and potential long-term deterioration of habitats, especially aquatic habitats at sites and downstream from sediment discharge and accidental release of toxic sub-stances.

For the life of the project, there is the potential for direct mortalities to terrestrial vertebrates by trains. Locations and numbers of mortalities are impossible to estimate except where tracks would intersect suitable habitats that are known to be used or may potentially be used. Potential indirect long-term impacts to ground nesting birds (interior least terns, piping plovers, mountain plovers) could also occur if predators are drawn to a nesting area because of carrion concentrations along

Table 4-19 Number of Sites and Total Distance (miles) Where Alternative C is Within 500 Feet of the Cheyenne River or Tributary Streams				
County, State	Cheyenne River		Perennial Tributary Streams	
	Number of Sites	Total Distance	Number of Sites	Total Distance
Campbell, WY	0	0	17	1.1
Converse, WY	0	0	0	0
Niobrara, WY	1	0.3	0	0
Weston, WY	0	0	0	0
Custer, SD	0	0	31	6.6
Fall River, SD	3	0.9	20	3.0
Pennington, SD	62	4.0	72	4.9
Alternative C Total	66	5.2	140	15.6

Table 4-20 Forest Service Management Indicator Species and Species with Special Designations on BGNG That Could be Impacted by Alternative C in Potential Habitats				
Species	Species Designation	Miles of Alternative in Potential Habitat on BGNG	Evidence for Occurrence in Project Area by Habitat	Potential for Impact by Alternative (1)
Black-footed Ferret	Federally Listed Endangered	None	Introduced in black-tailed prairie dog complex in Conata Basin/Badlands	No
Peregrine Falcon	Delisted as Endangered	None	None	No
Whooping Crane	Federally Listed Endangered	None	None	No
Bald Eagle	Federally Listed Threatened	None	Documented wintering habitat and potential nesting habitat in riparian cottonwood woodland	No
Swift Fox	Federal Candidate Forest Service Sensitive SD Threatened	herbaceous range - 5.2 mi	Documented denning habitats in short-grass prairie, unlikely occurrence in cottonwood riparian woodlands	Possibly
Spiny Softshell Turtle	Formerly SD Threatened	None	Documented occurrence in mud flats, sandbars, soft sand-mud bottoms with aquatic vegetation in lakes, rivers, streams	No

1 = Potential for impact by Alternative C was judged as:
No: the species is not likely to occur on BGNG.
Unknown: although the management indicator species may occur on BGNG, there is no documented occurrence of the species within specified habitats or the presence of those habitats have not been documented in areas crossed by Alternative C.
Possibly: the management indicator species is known to occur in specified habitats on BGNG that would be crossed by Alternative C but the species has not been documented proximate to the alternative.
Probably: Alternative C crosses specified habitat on BGNG with documented use by the management indicator species.
Yes: Alternative C crosses the specified habitat on BGNG and would directly impact the management indicator species.

the tracks. Again, locations and intensities of that potential impact are impossible to predict.

Long-term impacts to habitats used by terrestrial and aquatic species due to surface disturbances are expected to be similar to those described under short-term impacts, above. However, once construction activity is complete and revegetation is successful, the total amount of some habitats affected by surface disturbance is expected to be less over the long-term.

The degree to which anticipated noise levels displace species is unknown and undoubtedly varies by species and local conditions. Abandonment of occupied habitats within some distance of the railroad is likely, particularly by nesting birds. If they inhabit nest sites near Alternative C in the future, bald eagle, interior least terns, piping plovers and mountain plovers could avoid those sites or other, potential nest sites. Wintering bald eagles may avoid suitable feeding and perch sites if long-term noise levels are too high. It is possible that between 58

miles and 94 miles of potential bald eagle winter habitats could be affected by Alternative C (see Table 4-17).

Long-term runoff of sediments and toxic compounds could impact aquatic organisms downstream in much the same way as described under short-term impacts. Those same sites that were evaluated in Table 4-19 are likely to be those where chronic discharges occur with risk to listed and sensitive fish species, other aquatic vertebrates and organisms that are components of aquatic food chains downstream.

Wildlife MIS identified on BGNG were noted above. Nebraska Forest Plan management area prescriptions that would be affected by Alternative C are provided in Table 1-2 and discussed in detail in Appendix A. Estimates of where and how much of Alternative C would impact known or potential habitats utilized by MIS species are provided in Table 4-20. Alternative C would only cross 5.2 miles of herbaceous rangeland in BGNG, potential habitat for swift fox. Unlike Alternative B, no other habitats potentially used by other species in Table 4-17 would be directly disturbed. Effects of Alternative C on the remaining MIS will be discussed and evaluated in Section 4.18.

Wildlife MIS identified on TBNG were listed above under Alternative B. Alternative C would not cross land designated for reintroduction of black-footed ferrets and so would not be inconsistent with the Forest Plan. While Alternative C would not affect peregrine falcons, it would possibly affect wintering bald eagle habitats along the Cheyenne River, Black Thunder Creek, Little Thunder Creek and Antelope Creek.

Medicine Bow Forest Plan Management Area Prescriptions that would be affected by Alternative C are provided in Table 1-2 and discussed in detail in Appendix A. Estimates of where and how much of Alternative C would impact known or potential habitats utilized by recovery and ecological indicator species are provided in Table 4-21. Effects of Alternative C on the remaining MIS will be discussed and evaluated in Section 4.18.

Management area prescriptions under the proposed grassland plans for TBNG and BGNG that would be affected by Alternative C are provided in Table 1-2 and discussed in detail in Table 13 through Table 23 in Appendix A. Animal and plant species that are likely to inhabit the TBNG and/or BGNG and which have been identified as at-risk of range-wide imperilment (extinction or extirpation) or at-risk of local or region imperilment were assessed by the Forest Service (1999c) in the Draft Biological Assessment and Evaluation. Estimates of where and how much of Alternative C would impact known or potential habitats utilized by those imperilled plant and animal species are provided in Table 4-22.

4.17.6 Alternative C With the Phiney Flat Route Variation. Short-term impacts due to construction of Alternative C with the Phiney Flat Route Variation to Federally-listed threatened or endangered species, species proposed for listing, candidate species, species petitioned for listing, and species with special status are anticipated to be nearly identical to those described for Alternative C. The amount of habitats potentially utilized by least terns, American burying beetles, piping plovers, bald eagle, mountain plovers, sturgeon chub, swift fox and black-tailed prairie dogs that would be crossed or affected by this route variation in South Dakota barely differs from the Alternative C route.

Prairie dog colonies mapped along the Alternative C (see Table 3-85), potentially inhabited by mountain plovers and swift fox, would be similarly affected by the Phiney Flat Route Variation in South Dakota.

Twenty-six miles of Alternative C with the Phiney Flat Route Variation passes within 0.5-mile of potential bald eagle winter habitats in affected counties in South Dakota, nearly 1 mile more than Alternative C where it passes through the same counties. If short-term construction related disturbances affected wintering bald eagles 1 mile away, 50 miles of Alternative C with the Phiney Flat Route Variation would be within that distance from potential habitats in South Dakota (see Table 4-23), nearly 4 miles more than Alternative C in South Dakota.

Construction of Alternative C with the Phiney Flat Route Variation during spring and early summer along the Cheyenne River, primarily in Pennington County, could displace interior least terns if they select sand bars or islands within the river to nest. American burying beetles could occur in suitable soils along route in South Dakota that include those with high sand content and those with relatively deep topsoil. The amount of disturbances by Alternative C with the Phiney Flat Route Variation in these soils and potentially suitable habitats is provided in Table 4-24.

Overall disturbance by Alternative C with the Phiney Flat Route Variation to suitable soils and potential habitats used by American burying beetles is over 3 miles more than disturbance by Alternative B but about 1.3 miles more than Alternative C.

Short-term impacts to listed, candidate, and sensitive fish species could occur during construction with increased sedimentation due to runoff from construction sites near waterways. During operation, short-term impacts could occur downstream if there were derailments and accidental release of diesel fuels and other petroleum products into the Cheyenne River or its tributaries. Both types of impacts would be most likely

Table 4-21
Forest Service Management Indicator Species on TBNG That Could be Impacted by the Location of Alternative C in Potential Habitats

Forest Management Indicator Species	Species Designation	Miles of Alternative in Potential Habitat on TBNG	Evidence for Occurrence in Project Area by Habitat	Potential for Impact by Alternative C (1)
Recovery Species				
Black-footed Ferret	Federally Listed Endangered	prairie dog colonies - 1.7 mi	Habitat suitable for reintroduction	Unknown
Peregrine Falcon	Delisted as Endangered	None	None	No
Bald Eagle	Federally Listed Threatened	evergreen forest - 0.3 mi	Documented wintering and potential nesting habitat in ponderosa pine woodlands and riparian cottonwood woodland	Probably
Ecological Indicator Species				
Mountain Plover	Federal Proposed for Listing as Threatened Forest Service Sensitive	prairie dog colonies - 1.7 mi herbaceous range - 31.8 mi cropland/pasture - 0.7 mi	Documented nesting habitats in short-grass prairie and black-tailed prairie dog colonies	Possibly
Black-tailed Prairie Dog	Federal Candidate	prairie dog colonies - 1.7 mi	Documented colonies in project area	Yes
Upland Sandpiper	USFWS Species of Concern; Forest Service Sensitive	herbaceous range - 31.8 mi cropland/pasture - 0.7 mi	Documented occurrence during breeding on short-grass prairie	Possibly
Long-billed Curlew	USFWS Species of Concern; Forest Service Sensitive	herbaceous range - 31.8 mi cropland/pasture - 0.7 mi	Documented presence - possibly nesting - in sagebrush steppe, meadow, grasslands, native hay meadow	Possibly
Ferruginous Hawk	USFWS Species of Concern; Forest Service Sensitive	herbaceous range - 31.8 mi cropland/pasture - 0.7 mi evergreen forest - 0.3 mi	Documented nesting habitat in short-grass prairie and sagebrush steppe	Probably
Red-headed Woodpecker	USFWS Species of Concern	None	Possible occurrence during breeding, probably in riparian cottonwood woodland	No
Brewer's Sparrow	USFWS Species of Concern	None	Documented occurrence during breeding in sagebrush steppe	No

1 = Potential for impact by Alternative C was judged as:
No: the species is not likely to occur on TBNG.
Unknown: although the management indicator species may occur on TBNG, there is no documented occurrence of the species within specified habitats or the presence of those habitats have not been documented in areas crossed by Alternative C.
Possibly: the management indicator species is known to occur in specified habitats on TBNG that would be crossed by Alternative C but the species has not been documented proximate to the alternative.
Probably: Alternative C crosses specified habitat on TBNG with documented use by the management indicator species.
Yes: Alternative C crosses the specified habitat on TBNG and would directly impact the management indicator species.

if potential discharge sites are within 500 feet of surface waters. In addition, bald eagles and least terns could be impacted by widespread fish-kills that would adversely affect food sources and piping plovers nesting downstream could be affected if aquatic and burrowing invertebrate were killed. Table 4-25 indicates the number of sites and/or distances at which Alternative C with the Phiney Flat Route Variation would be within 500 feet of the Cheyenne River or tributary stream with perennial flows.

In South Dakota there are 164 sites on the Cheyenne River and perennial tributary streams, combined, where the Phiney Flat Route Variation is within 500 feet of the drainages where impacts to aquatic resources could occur. That would be 2 sites fewer than Alternative B

Table 4-22
Animal and Plant Species Identified as At Risk by the Forest Service in the Northern Great Plains That Potentially Occur on TBNG and BGNG and Could be Impacted by Alternative C in Potential Habitats

Species At -Risk (1)	National Grasslands Occurrence	Miles of Alternative in Potential Habitat in National Grasslands	Evidence for Occurrence in Project Area by Habitat	Potential for Impact by Alternative (2)
Species Protected Under the ESA and at Risk of Rangewide Imperilment:				
Ute ladies'-tresses	TBNG	wet meadow - 0.04 mi	No known occurrence or recent observations although potential habitat is possible on TBNG and BGNG	Unknown
	BGNG	None		
Whooping crane	BGNG	None	Known occurrences but only incidentally during migrations	No
Bald eagle	TBNG	evergreen forest land - 0.3 mi	Documented wintering and potential nesting habitat in ponderosa pine woodlands and riparian cottonwood woodland	Probably
	BGNG	None		
Peregrine falcon (before delisting)	TBNG	None	Known occurrences but only incidentally during migrations.	No
	BGNG	None		
Black-footed ferret	TBNG	prairie dog colonies - 1.7 mi	Introduced in black-tailed prairie dog complex in Conata Basin, potential habitat for reintroduction on TBNG	Possibly
	BGNG	None		
Mountain plover	TBNG	prairie dog colonies - 1.7 mi herbaceous rangeland - 31.8 mi cropland/pasture - 0.7 mi	Documented nesting habitats in short-grass prairie and black-tailed prairie dog colonies on TBNG, unknown occurrence on BGNG but potential habitat exists	Probably
	BGNG	herbaceous rangeland - 5.2 mi		
Species That may be at Risk of Rangewide Imperilment but are not Protected Under the ESA:				
Dakota buckwheat	BGNG	Unknown	Known occurrence in badlands, barren clay mounds and outwash in BGNG	Unknown
Barr orphacea	TBNG	Unknown	Known occurrence on clay hills in NE WY and present in Custer and Shannon Cos., SD	Unknown
	BGNG	Unknown		
Sturgeon Chub	TBNG	None	Documented in Cheyenne River, Custer, Pennington Cos., SD; appears absent in WY	Possibly
	BGNG	None		
Swift Fox	TBNG	prairie dog colonies - 1.7 mi herbaceous rangeland - 31.8 mi	Documented denning habitats in short-grass prairie on TBNG and BGNG	Possibly
	BGNG	herbaceous rangeland - 5.2 mi		
Species That may be at Risk of Regional or More Local Imperilment:				
Marsh bellflower	BGNG	None	Suspected to occur in suitable habitats in wetlands and riparian zones on BGNG	Unknown
Nodding buckwheat	TBNG	Unknown	Suspected to occur in suitable habitats on buttes in TBNG and BGNG	Unknown
	BGNG	Unknown		
Lanceleaf cottonwood	TBNG	None	Suspected to occur in suitable habitats in wetlands and riparian zones on TBNG and BGNG	Unknown
	BGNG	None		
Torrey's crypthantha	TBNG	Unknown	Suspected to occur in suitable habitats on buttes in TBNG	Unknown

Table 4-22 Continued				
Species At -Risk (1)	**National Grasslands Occurrence**	**Miles of Alternative in Potential Habitat in National Grasslands**	**Evidence for Occurrence in Project Area by Habitat**	**Potential for Impact by Alternative (2)**
Marsh fern	BGNG	None	Suspected to occur in suitable habitats in wetlands and riparian zones on BGNG	Unknown
Lady-fern	BGNG	None	Suspected to occur in suitable habitats in deciduous woodlands on BGNG	Unknown
Frostweed	BGNG	Unknown	Suspected to occur in suitable habitats in sandhills on BGNG	Unknown
Meadow horsetail	BGNG	None	Suspected to occur in suitable habitats in wetlands and riparian zones on BGNG	Unknown
Sand lily	TBNG	Unknown	Suspected occurrence on TBNG and BGNG on sandy areas on mixed grass prairie, on hillsides, open coniferous woods	Unknown
	BGNG	Unknown		
Blue lips	TBNG	None	Suspected to occur in suitable habitats in wetlands and riparian zones on TBNG and BGNG	Unknown
	BGNG	None		
Alyssum-leaf phlox	TBNG	Unknown	Suspected to occur in suitable habitats on buttes in TBNG and BGNG	Unknown
	BGNG	Unknown		
Alkali sacaton	TBNG	Unknown	Suspected to occur in suitable habitats in wetlands and riparian zones on TBNG	Unknown
Tawny Crescent Butterfly	TBNG	None	Suspected occurrence on TBNG in ponderosa pine savannah with riparian habitats	Unknown
Flathead Chub	TBNG	None	Documented occurrence in Cheyenne River, BGNG and Antelope Creek, TBNG	Possibly
	BGNG	None		
Plains topminnow	TBNG	None	Documented occurrence in tributaries to Cheyenne River on BGNG and TBNG	Possibly
	BGNG	None		
Northern leopard frog	TBNG	None	Known to occur in emergent wetland vegetation on TBNG and BGNG	Possibly
	BGNG	None		
American bittern	BGNG	None	Known to occur in emergent wetland vegetation on BGNG	Possibly
Yellow-billed cuckoo	TBNG	None	Known occurrence on TBNG and BGNG in woody shrub/tree overstory riparian vegetation	Possibly
	BGNG	None		
Long-billed curlew	TBNG	herbaceous rangeland - 31.8 mi	Known occurrence on TBNG and BGNG in short-grass and low mixed-grass prairie	Possibly
	BGNG	herbaceous rangeland - 5.2 mi		
Disckcissel	TBNG	herbaceous rangeland - 31.8 mi	Known occurrence on TBNG in moderately tall mixed-grass/ tall-grass prairie	Possibly

Table 4-22 Continued				
Species At -Risk (1)	**National Grasslands Occurrence**	**Miles of Alternative in Potential Habitat in National Grasslands**	**Evidence for Occurrence in Project Area by Habitat**	**Potential for Impact by Alternative (2)**
Northern Goshawk	TBNG	evergreen forest 0.3 mi	Possible nesting on TBNG in ponderosa pine, may be on BGNG during migrations	Possibly
	BGNG	None		
Sage Grouse	TBNG	None	Documented occurrence in sagebrush steppe on TBNG and BGNG with leks present	Yes
	BGNG	None		
Ferruginous hawk	TBNG	herbaceous rangeland - 31.8 mi	Documented nesting on TBNG and BGNG in trees, on ground and rocks in grasslands and shrublands	Probably
	BGNG	herbaceous rangeland - 5.2 mi		
Swainson's hawk	TBNG	herbaceous rangeland - 31.8 mi	Documented nesting on TBNG and BGNG in trees in grasslands and shrublands	Probably
	BGNG	herbaceous rangeland - 5.2 mi		
Merlin	BGNG	None	Moist habitats below 8,500 feet, cottonwood-riparian and ponderosa pine	Unknown
Short-eared owl	TBNG	herbaceous rangeland - 31.8 mi	Known occurrence on TBNG and BGNG in moderately tall mixed-grass/ tall-grass prairie	Possibly
	BGNG	herbaceous rangeland - 5.2 mi		
Burrowing Owl	TBNG	prairie dog colonies - 1.7 mi herbaceous rangeland - 31.8 mi	Prairie dog colonies, grasslands, basin-prairie shrublands, agricultural areas documented on BGNG and TBNG	Possibly
	BGNG	herbaceous rangeland - 5.2 mi		
Loggerhead shrike	TBNG	None	Known occurrence on TBNG and BGNG in woody shrub/tree overstory riparian vegetation	Possibly
	BGNG	None		
Baird's sparrow	TBNG	herbaceous rangeland - 31.8 mi	Known occurrence on TBNG in moderately tall mixed-grass/ tall-grass prairie	Possibly
Fox sparrow	TBNG	None	Known occurrence on TBNG and BGNG in woody shrub/tree overstory riparian vegetation	Possibly
Trumpeter swan	BGNG	None	Known to occur in emergent wetland vegetation on BGNG	Possibly
Black tern	TBNG	None	Known to occur in emergent wetland vegetation on TBNG and BGNG	Possibly
	BGNG	None		
Lewis' Woodpecker	TBNG	evergreen forest 0.3 mi	Ponderosa pine savannah and cottonwood-riparian floodplains	Possibly
Fringe-tailed myotis	TBNG	None	Known to occur near emergent wetland vegetation & woody shrub/tree overstory riparian vegetation on TBNG and BGNG	Possibly
	BGNG	None		
Black-tailed prairie dog	TBNG	prairie dog colonies - 1.7 mi	Prairie dog colonies	Yes
	BGNG	None		

Table 4-22
Concluded

Species At -Risk (1)	National Grasslands Occurrence	Miles of Alternative in Potential Habitat in National Grasslands	Evidence for Occurrence in Project Area by Habitat	Potential for Impact by Alternative (2)

Notes:
1 = Species at-risk were included if they were identified on BGNG and TBNG and analyzed by the Forest Service in the Draft Biological Assessment and Evaluation for Proposed Land and Resource Management Plans, Dakota Prairie Grasslands, Nebraska National Forest and Associated Units, Thunder Basin National Grassland.
2 = Potential for impact by Alternative C was judged as:
No: the at-risk species is not likely to occur on TBNG and/or BGNG.
Unknown: although the at-risk species may occur on TBNG and/or BGNG, there is no documented occurrence of the species within specified habitats or the presence of those habitats have not been documented in areas crossed by Alternative C.
Possibly: the at-risk species is known to occur in specified habitats on TBNG and/or BGNG that would be crossed by Alternative C but the species has not been documented proximate to the alternative.
Probably: Alternative C crosses specified habitat on TBNG and/or BGNG with documented use by the at-risk species.
Yes: Alternative C crosses the specified habitat on TBNG and/or BGNG and would directly impact the at-risk species.

Table 4-23
Miles of Alternative C With the Phiney Flat Route Variation Within 0.5 and 1 mile of the Cheyenne River That is Potential Bald Eagle Wintering Habitat in South Dakota

County, State (ordered west to east)	Miles Within 0.5 Mile of Potential Habitat	Miles Within 1 Mile of Potential Habitat
Fall River, SD	11.0	21.2
Custer, SD	0.8	5.6
Pennington, SD	14.1	23.4
Phiney Flat Route Variation Total	25.9	50.2

Table 4-24
Number of Miles Where Alternative C With the Phiney Flat Route Variation Intersects Suitable Soils and Habitats Potentially Inhabited by American Burying Beetles in South Dakota

South Dakota County (ordered west to east)	Suitable Soil Type	Distance (miles) Crossed in Potential Habitats per Suitable Soil Type				
		Cropland, Pasture	Herbaceous Rangeland	Forested Wetland	Deciduous Forest	County Total
Fall River	Sandy, Erosive	1.2	5.0	0.1	0	6.3
	Prime Farmland	5.8	13.8	0.7	0	20.3
Custer	Sandy, Erosive	0	0	0	0	0
	Prime Farmland	3.8	1.4	0	0	5.2
Pennington	Sandy, Erosive	0	0.8	0	0.5	1.3
	Prime Farmland	0.9	1.6	0	0	2.5
Phiney Flat Route Variation Total		11.7	22.6	0.8	0.5	35.6

Table 4-25
Number of Sites and Total Distance (miles) Where Alternative C With the Phiney Flat Route Variation is Within 500 Feet of the Cheyenne River or Tributary Streams in South Dakota

County, State	Cheyenne River		Perennial Tributary Streams	
	Number of Sites	Total Distance	Number of Sites	Total Distance
Custer, SD	0	0	5	1.5
Fall River, SD	3	0.9	20	3.0
Pennington, SD	62	4.0	74	5.0
Phiney Flat Route Variation Total	65	4.9	99	9.5

Table 4-26 Forest Service Management Indicator Species and Species with Special Designations on BGNG That Could be Impacted by Alternative C With the Phiney Flat Route Variation in Potential Habitats				
Species	**Species Designation**	**Miles of Alternative in Potential Habitat on BGNG**	**Evidence for Occurrence in Project Area by Habitat**	**Potential for Impact by Alternative (1)**
Black-footed Ferret	Federally Listed Endangered	None	Introduced in black-tailed prairie dog complex in Conata Basin/Badlands	No
Peregrine Falcon	Delisted as Endangered	None	None	No
Whooping Crane	Federally Listed Endangered	None	None	No
Bald Eagle	Federally Listed Threatened	None	Documented wintering habitat and potential nesting habitat in riparian cottonwood woodland	No
Swift Fox	Federal Candidate Forest Service Sensitive SD Threatened	herbaceous range - 4.4 mi	Documented denning habitats in short-grass prairie, unlikely occurrence in cottonwood riparian woodlands	Possibly
Spiny Softshell Turtle	Formerly SD Threatened	None	Documented occurrence in mud flats, sandbars, soft sand-mud bottoms with aquatic vegetation in lakes, rivers, streams	No

1 = Potential for impact by Alternative C with the Phiney Flat Route Variation was judged as:
No: the species is not likely to occur on BGNG.
Unknown: although the management indicator species may occur on BGNG, there is no documented occurrence of the species within specified habitats or the presence of those habitats have not been documented in areas crossed by Alternative C with the Phiney Flat Route Variation.
Possibly: the management indicator species is known to occur in specified habitats on BGNG that would be crossed by Alternative C with the Phiney Flat Route Variation but the species has not been documented proximate to the alternative.
Probably: Alternative C with the Phiney Flat Route Variation crosses specified habitat on BGNG with documented use by the management indicator species.
Yes: Alternative C with the Phiney Flat Route Variation crosses the specified habitat on BGNG and would directly impact the management indicator species.

and 24 fewer sites than Alternative C in the same South Dakota counties.

As a result of past surveys, there are 3 sites along Alternative C with the Phiney Flat Route Variation in South Dakota that have been evaluated as potential habitat for Ute ladies'-tresses. Those sites are Hay Canyon South and Dry Creek. Occurrence of other sensitive plant species along the Phiney Flat Route Variation is unknown. In South Dakota, the Phiney Flat Route Variation would cross a total of 0.7 mile of wet meadows, palustrine emergent wetland temporarily and seasonally flooded, that could be potential habitat for the orchid (see Table 3-76). The route in Wyoming would cross 0.16 mile of the same wetland type. In both states, most all wet meadows impacted by the alternative are on private lands. Individuals of Ute ladies'-tresses or other sensitive plant species inhabiting the construction sites would be eliminated, at least in the short-term.

Long-term impacts due to the presence, operation and maintenance of Alternative C with the Phiney Flat Route Variation to Federally-listed threatened or endangered species, species proposed for listing, candidate species, species petitioned for listing, and species with special status are similar to short-term impacts described above and are expected to be nearly identical to those described under Alternative C.

Wildlife MIS identified on BGNG were noted above. Nebraska Forest Plan management area prescriptions that would be affected by Alternative C with the Phiney Flat Route Variation are provided in Table 1-2 and discussed in detail in Appendix A. Estimates of where and how much of the Phiney Flat Route Variation would impact known or potential habitats utilized by MIS species are provided in Table 4-26. The route would only cross 4.4 miles of herbaceous rangeland in BGNG, potential habitat for swift fox. Unlike Alternative B, no other habitats potentially used by other species in Table 4-26 would be directly disturbed. Effects of the Phiney Flat Route Variation on the remaining MIS will be discussed and evaluated in Section 4.18.

Alternative C with the Phiney Flat Variation would not affect TBNG differently than Alternative C discussed above. Management area prescriptions under the proposed grassland plans for TBNG and BGNG that

Table 4-27
Animal and Plant Species Identified as At Risk by the Forest Service in the Northern Great Plains That Potentially Occur on TBNG and BGNG and Could be Impacted by Alternative C With the Phiney Flat Route Variation in Potential Habitats

Species At -Risk (1)	National Grasslands Occurrence	Miles of Alternative in Potential Habitat in National Grasslands	Evidence for Occurrence in Project Area by Habitat	Potential for Impact by Alternative (2)
Species Protected Under the ESA and at Risk of Rangewide Imperilment:				
Ute ladies'-tresses	TBNG	wet meadow - 0.04 mi	No known occurrence or recent observations although potential habitat is possible on TBNG and BGNG	Unknown
	BGNG	None		
Whooping crane	BGNG	None	Known occurrences but only incidentally during migrations	No
Bald eagle	TBNG	evergreen forest land - 0.3 mi	Documented wintering and potential nesting habitat in ponderosa pine woodlands and riparian cottonwood woodland	Probably
	BGNG	None		
Peregrine falcon (before delisting)	TBNG	None	Known occurrences but only incidentally during migrations.	No
	BGNG	None		
Black-footed ferret	TBNG	prairie dog colonies - 1.7 mi	Introduced in black-tailed prairie dog complex in Conata Basin, potential habitat for reintroduction on TBNG	Possibly
	BGNG	None		
Mountain plover	TBNG	prairie dog colonies - 1.7 mi herbaceous rangeland - 31.8 mi cropland/pasture - 0.7 mi	Documented nesting habitats in short-grass prairie and black-tailed prairie dog colonies on TBNG, unknown occurrence on BGNG but potential habitat exists	Probably
	BGNG	herbaceous rangeland - 4.4 mi		
Species That may be at Risk of Rangewide Imperilment but are not Protected Under the ESA:				
Dakota buckwheat	BGNG	Unknown	Known occurrence in badlands, barren clay mounds and outwash in BGNG	Unknown
Barr orphacea	TBNG	Unknown	Known occurrence on clay hills in NE WY and present in Custer, Shannon Cos., SD	Unknown
	BGNG	Unknown		
Sturgeon Chub	TBNG	None	Documented in Cheyenne River, Custer, Pennington Cos., SD; appears absent in WY	Possibly
	BGNG	None		
Swift Fox	TBNG	prairie dog colonies - 1.7 mi herbaceous rangeland - 31.8 mi	Documented denning habitats in short-grass prairie on TBNG and BGNG	Possibly
	BGNG	herbaceous rangeland - 4.4 mi		
Species That may be at Risk of Regional or More Local Imperilment:				
Marsh bellflower	BGNG	None	Suspected to occur in suitable habitats in wetlands and riparian zones on BGNG	Unknown
Nodding buckwheat	TBNG	Unknown	Suspected to occur in suitable habitats on buttes in TBNG and BGNG	Unknown
	BGNG	Unknown		
Lanceleaf cottonwood	TBNG	None	Suspected to occur in suitable habitats in wetlands and riparian zones on TBNG and BGNG	Unknown
	BGNG	None		
Torrey's crypthantha	TBNG	Unknown	Suspected to occur in suitable habitats on buttes in TBNG	Unknown
Marsh fern	BGNG	None	Suspected to occur in suitable habitats in wetlands and riparian zones on BGNG	Unknown

Table 4-27 Continued				
Species At -Risk (1)	**National Grasslands Occurrence**	**Miles of Alternative in Potential Habitat in National Grasslands**	**Evidence for Occurrence in Project Area by Habitat**	**Potential for Impact by Alternative (2)**
Lady-fern	BGNG	None	Suspected to occur in suitable habitats in deciduous woodlands on BGNG	Unknown
Frostweed	BGNG	Unknown	Suspected to occur in suitable habitats in sandhills on BGNG	Unknown
Meadow horsetail	BGNG	None	Suspected to occur in suitable habitats in wetlands and riparian zones on BGNG	Unknown
Sand lily	TBNG	Unknown	Suspected occurrence on TBNG and BGNG on sandy areas on mixed grass prairie, on hillsides, open coniferous woods	Unknown
	BGNG	Unknown		
Blue lips	TBNG	None	Suspected to occur in suitable habitats in wetlands and riparian zones on TBNG and BGNG	Unknown
	BGNG	None		
Alyssum-leaf phlox	TBNG	Unknown	Suspected to occur in suitable habitats on buttes in TBNG and BGNG	Unknown
	BGNG	Unknown		
Alkali sacaton	TBNG	Unknown	Suspected to occur in suitable habitats in wetlands and riparian zones on TBNG	Unknown
Tawny Crescent Butterfly	TBNG	None	Suspected occurrence on TBNG in ponderosa pine savannah with riparian habitats	Unknown
Flathead Chub	TBNG	None	Documented occurrence in Cheyenne River, BGNG and Antelope Creek, TBNG	Possibly
	BGNG	None		
Plains topminnow	TBNG	None	Documented occurrence in tributaries to Cheyenne River on BGNG and TBNG	Possibly
	BGNG	None		
Northern leopard frog	TBNG	None	Known to occur in emergent wetland vegetation on TBNG and BGNG	Possibly
	BGNG	None		
American bittern	BGNG	None	Known to occur in emergent wetland vegetation on BGNG	Possibly
Yellow-billed cuckoo	TBNG	None	Known occurrence on TBNG and BGNG in woody shrub/tree overstory riparian vegetation	Possibly
	BGNG	None		
Long-billed curlew	TBNG	herbaceous rangeland - 31.8 mi	Known occurrence on TBNG and BGNG in short-grass and low mixed-grass prairie	Possibly
	BGNG	herbaceous rangeland - 4.4 mi		
Disckcissel	TBNG	herbaceous rangeland - 31.8 mi	Known occurrence on TBNG in moderately tall mixed-grass/ tall-grass prairie	Possibly
Northern Goshawk	TBNG	evergreen forest 0.3 mi	Possible nesting on TBNG in ponderosa pine, may be on BGNG during migrations	Possibly
	BGNG	None		
Sage Grouse	TBNG	None	Documented occurrence in sagebrush steppe on TBNG and BGNG with leks present	Yes
	BGNG	None		
Ferruginous hawk	TBNG	herbaceous rangeland - 31.8 mi	Documented nesting on TBNG and BGNG in trees, on ground and rocks in grasslands and shrublands	Probably
	BGNG	herbaceous rangeland - 4.4 mi		

Table 4-27
Continued

Species At -Risk (1)	National Grasslands Occurrence	Miles of Alternative in Potential Habitat in National Grasslands	Evidence for Occurrence in Project Area by Habitat	Potential for Impact by Alternative (2)
Swainson's hawk	TBNG	herbaceous rangeland - 31.8 mi	Documented nesting on TBNG and BGNG in trees in grasslands and shrublands	Probably
	BGNG	herbaceous rangeland - 4.4 mi		
Merlin	BGNG	None	Moist habitats below 8,500 feet, cottonwood-riparian and ponderosa pine	Unknown
Short-eared owl	TBNG	herbaceous rangeland - 31.8 mi	Known occurrence on TBNG and BGNG in moderately tall mixed-grass/ tall-grass prairie	Possibly
	BGNG	herbaceous rangeland - 4.4 mi		
Burrowing Owl	TBNG	prairie dog colonies - 1.7 mi herbaceous rangeland - 31.8 mi	Prairie dog colonies, grasslands, basin-prairie shrublands, agricultural areas documented on BGNG and TBNG	Possibly
	BGNG	herbaceous rangeland - 4.4 mi		
Loggerhead shrike	TBNG	None	Known occurrence on TBNG and BGNG in woody shrub/tree overstory riparian vegetation	Possibly
	BGNG	None		
Baird's sparrow	TBNG	herbaceous rangeland - 31.8 mi	Known occurrence on TBNG in moderately tall mixed-grass/tall-grass prairie	Possibly
Fox sparrow	TBNG	None	Known occurrence on TBNG and BGNG in woody shrub/tree overstory riparian vegetation	Possibly
Trumpeter swan	BGNG	None	Known to occur in emergent wetland vegetation on BGNG	Possibly
Black tern	TBNG	None	Known to occur in emergent wetland vegetation on TBNG and BGNG	Possibly
	BGNG	None		
Lewis' Woodpecker	TBNG	evergreen forest 0.3 mi	Ponderosa pine savannah and cottonwood-riparian floodplains	Possibly
Fringe-tailed myotis	TBNG	None	Known to occur near emergent wetland vegetation & woody shrub/tree overstory riparian vegetation on TBNG and BGNG	Possibly
	BGNG	None		
Black-tailed prairie dog	TBNG	prairie dog colonies - 1.7 mi	Prairie dog colonies	Yes
	BGNG	None		

Notes:
1 = Species at-risk were included if they were identified on BGNG and TBNG and analyzed by the Forest Service in the Draft Biological Assessment and Evaluation for Proposed Land and Resource Management Plans, Dakota Prairie Grasslands, Nebraska National Forest and Associated Units, Thunder Basin National Grassland.
2 = Potential for impact by Alternative C with the Phiney Flat Route Variation was judged as:
No: the at-risk species is not likely to occur on TBNG and/or BGNG.
Unknown: although the at-risk species may occur on TBNG and/or BGNG, there is no documented occurrence of the species within specified habitats or the presence of those habitats have not been documented in areas crossed by Alternative C with the Phiney Flat Route Variation.
Possibly: the at-risk species is known to occur in specified habitats on TBNG and/or BGNG that would be crossed by Alternative C with the Phiney Flat Route Variation but the species has not been documented proximate to the alternative.
Probably: Alternative C with the Phiney Flat Route Variation crosses specified habitat on TBNG and/or BGNG with documented use by the at-risk species.
Yes: Alternative C with the Phiney Flat Route Variation crosses the specified habitat on TBNG and/or BGNG and would directly impact the at-risk species.

would be affected by Alternative C with the Phiney Flat Route Variation are provided in Table 1-2 and discussed in detail in Table 13 through Table 23 in Appendix A.

Animal and plant species that are likely to inhabit TBNG and/or BGNG and which have been identified as at-risk of range-wide imperilment (extinction or extirpation) or at-risk of local or region imperilment were assessed by the Forest Service (1999c) in the Draft Biological Assessment and Evaluation. Estimates of where and how much of Alternative C with the Phiney Flat Route Variation would impact known or potential habitats utilized by those imperilled plant and animal species are provided in Table 4-27.

4.17.7 Alternative C with the W G Flat Route Variation. Short-term impacts due to construction of Alternative C with the W G Flat Route Variation to Federally-listed threatened or endangered species, species proposed for listing, candidate species, species petitioned for listing, and species with special status are anticipated to be nearly identical to those described for Alternative C. The amount of habitats potentially utilized by least terns, American burying beetles, piping plovers, bald eagle, mountain plovers, sturgeon chub, swift fox and black-tailed prairie dogs that would be crossed or affected by this route variation in South Dakota barely differs from Alternative C. Prairie dog colonies mapped along Alternative C (see Table 3-85), potentially inhabited by mountain plovers and swift fox, would be similarly affected by the W G Flat Route Variation in South Dakota.

Nearly 26 miles of the W G Flat Route Variation passes within 0.5-mile of potential bald eagle winter habitats in the counties in South Dakota, the same as Alternative C with the Phiney Flat Route Variation and about 1 mile more than Alternative C where it passes through the same counties. If short-term construction-related disturbances affected wintering bald eagles 1 mile away, over 48 miles of the W G Flat Route Variation would be within that distance from potential habitats (see Table 4-28), almost 2 miles less than Alternative C with the Phiney Flat Route Variation but 2 miles more than Alternative C in South Dakota.

Construction of the Alternative C with the W G Flat Route Variation during spring and early summer along the corridor of the Cheyenne River, primarily in Pennington County could displace interior least terns if they select sand bars or islands within the river to nest. American burying beetles could occur in suitable soils and potentially suitable habitats along the W G Flat Route Variation in South Dakota. Those potentially affected areas are provided in Table 4-29. Overall disturbance by the W G Flat Route Variation to suitable soils and potential habitats used by American burying beetles is nearly 5 miles more than disturbance by Alternative B, about 3 miles more than Alternative C and 1.7 miles more than Alternative C with the Phiney Flat Route Variation.

Short-term impacts to listed, candidate, and sensitive fish species could occur during construction with increased sedimentation due to runoff from construction sites near waterways. During operation, short-term impacts could occur downstream if there were derailments and accidental release of diesel fuels and other petroleum products into the Cheyenne River or its tributaries. Both types of impacts would be most likely if potential discharge sites are within 500 feet of surface waters. In addition, bald eagles and least terns could be impacted by widespread fish-kills that would adversely affect food sources and piping plovers nesting downstream could be affected if aquatic and burrowing invertebrate were killed. Table 4-30 indicates the number of sites and/or distances at which the W G Flat Route Variation would be within 500 feet of the Cheyenne River or tributary stream with perennial flows in South Dakota.

In South Dakota there are 192 sites on the Cheyenne River and perennial tributary streams, combined, where Alternative C with the W G Flat Route Variation is within 500 feet of the drainages where impacts to aquatic resources could occur. That would be 28 sites more than Alternative C with the Phiney Flat Route Variation and 26 sites fewer than Alternative B and about 4 sites more than Alternative C in the same South Dakota counties.

As a result of past surveys, there is only 1 site along Alternative C with the W G Flat Route Variation in South Dakota that was been evaluated as potential habitat for Ute ladies'-tresses. That site is at Dry Creek. In South Dakota, Alternative C with the W G Flat Route Variation would cross a total of 0.57 mile of wet meadows, palustrine emergent wetland temporarily and seasonally flooded, that could be potential habitat for the orchid (see Table 3-77). The route in Wyoming would cross 0.16 mile of that wetland type, the same amount affected as Alternative C, above. In both states, most all wet meadows impacted by the alternative are on private lands. Occurrence of other sensitive plant species along Alternative C with the W G Flat Route Variation is unknown but individuals of any sensitive plant species, including Ute ladies'-tresses, that inhabit construction sites would be eliminated, at least in the short-term.

Long-term impacts due to the presence, operation and maintenance of Alternative C with the W G Flat Route Variation to Federally-listed threatened or endangered species, species proposed for listing, candidate species, species petitioned for listing, and species with special status are similar to short-term impacts described above are expected to be nearly identical to those described under Alternative C.

Wildlife MIS identified on BGNG were noted above. Nebraska Forest Plan management area prescriptions that would be affected by Alternative C with the W G Flat Route Variation are provided in Table 1-2 and discussed in detail in Table 1 through Table 5 in Appendix A.

Table 4-28 Miles of Alternative C With the W G Flat Route Variation Within 0.5 and 1 mile of the Cheyenne River That is Potential Bald Eagle Wintering Habitats in South Dakota		
County, State (ordered west to east)	**Miles Within 0.5 Mile of Potential Habitat**	**Miles Within 1 Mile of Potential Habitat**
Fall River, SD	11.5	23.4
Custer, SD	0	2.0
Pennington, SD	14.1	22.8
W G Flat Route Variation Total	25.6	48.2

Table 4-29 Number of Miles Where Alternative C With the W G Flat Route Variation Intersects Suitable Soils and Habitats Potentially Inhabited by American Burying Beetles in South Dakota.						
South Dakota County (ordered west to east)	**Suitable Soil Type**	**Distance (miles) Crossed in Potential Habitats per Suitable Soil Type**				
		Cropland, Pasture	**Herbaceous Rangeland**	**Forested Wetland**	**Deciduous Forest**	**County Total**
Fall River	Sandy, Erosive	1.5	6.9	0.1	0	8.5
	Prime Farmland	8.0	11.8	0.7	0	20.5
Custer	Sandy, Erosive	0	0	0	0	0
	Prime Farmland	3.3	1.2	0	0	4.5
Pennington	Sandy, Erosive	0	0.8	0	0.5	1.30
	Prime Farmland	0.9	1.6	0	0	2.5
W G Flat Route Variation Total		13.7	22.3	0.8	0.5	37.3

Table 4-30 Number of Sites and Total Distance (miles) Where Alternative C With the W G Flat Route Variation is Within 500 Feet of the Cheyenne River or Tributary Streams in South Dakota.				
County, State	**Cheyenne River**		**Perennial Tributary Streams**	
	Number of Sites	**Total Distance**	**Number of Sites**	**Total Distance**
Custer, SD	0	0	31	6.6
Fall River, SD	5	0.9	22	3.0
Pennington, SD	62	4.0	72	4.9
W G Flat Route Variation Total	67	4.9	125	14.5

Estimates of where and how much of the W G Flat Route Variation would impact known or potential habitats utilized by MIS species are provided in Table 4-31. The route would only cross 5.2 miles of herbaceous rangeland in BGNG, potential habitat for swift fox. Unlike Alternative B, no other habitats potentially used by other species in Table 4-31 would be directly disturbed. Effects of the W G Flat Route Variation on the remaining MIS will be discussed and evaluated in Section 4.18.

Alternative C with the W G Flat Route Variation would not affect TBNG differently than Alternative C. Proposed grassland management area prescriptions under the proposed grassland plans for TBNG and BGNG that would be affected by Alternative C with the W G Flat Route Variation are provided in Table 1-2 and discussed in detail in Table 13 through Table 23 in Appendix A. Animal and plant species that are likely to inhabit the TBNG and/or BGNG and which have been identified as at-risk of range-wide imperilment (extinction or extirpation) or at-risk of local or region imperilment were assessed by the Forest Service (1999c) in the Draft Biological Assessment and Evaluation. Estimates of where and how much of Alternative C with the W G Flat Route Variation would impact known or potential habitats utilized by those imperilled plant and animal species are provided in Table 4-32.

4.17.8 Alternative D (Existing Corridors Alternative). Short-term impacts due to construction of Alternative D to Federally-listed threatened or endangered species, species proposed for listing, candidate species, species petitioned for listing, and species with special status are anticipated to be similar to those described for Alternative B even though Alternative D would be located, for the most part, within and existing

Table 4-31 Forest Service Management Indicator Species and Species with Special Designations on BGNG That Could be Impacted by Alternative C with the W G Flat Route Variation in Potential Habitats				
Species	**Species Designation**	**Miles of Alternative in Potential Habitat on BGNG**	**Evidence for Occurrence in Project Area by Habitat**	**Potential for Impact by Alternative (1)**
Black-footed Ferret	Federally Listed Endangered	None	Introduced in black-tailed prairie dog complex in Conata Basin/Badlands	No
Peregrine Falcon	Delisted as Endangered	None	None	No
Whooping Crane	Federally Listed Endangered	None	None	No
Bald Eagle	Federally Listed Threatened	None	Documented wintering habitat and potential nesting habitat in riparian cottonwood woodland	No
Swift Fox	Federal Candidate Forest Service Sensitive SD Threatened	herbaceous range - 5.2 mi	Documented denning habitats in short-grass prairie, unlikely occurrence in cottonwood riparian woodlands	Possibly
Spiny Softshell Turtle	Formerly SD Threatened	None	Documented occurrence in mud flats, sandbars, soft sand-mud bottoms with aquatic vegetation in lakes, rivers, streams	No

Notes:
1 = Potential for impact by Alternative C with the W G Flat Route Variation was judged as:
No: the species is not likely to occur on BGNG.
Unknown: although the management indicator species may occur on BGNG, there is no documented occurrence of the species within specified habitats or the presence of those habitats have not been documented in areas crossed by Alternative C with the W G Flat Route Variation.
Possibly: the management indicator species is known to occur in specified habitats on BGNG that would be crossed by Alternative C with the W G Flat Route Variation but the species has not been documented proximate to the alternative.
Probably: Alternative C with the W G Flat Route Variation crosses specified habitat on BGNG with documented use by the management indicator species.
Yes: Alternative C with the W G Flat Route Variation crosses the specified habitat on BGNG and would directly impact the management indicator species.

rail corridor. Short-term impacts include direct mortality by field vehicles and construction machinery, avoidance of habitats that are utilized near construction sites and/or temporary habitat loss, and potential short-term degradation of habitats, especially aquatic habitats at sites and downstream from sediment discharge and accidental release of toxic substances. As noted earlier, locations of habitats known to be occupied by these species are not defined except for a few exceptions.

Known prairie dog colonies crossed by Alternative D are less complete than for either Alternatives B or C since only those colonies that were mapped by state or Federal agencies have been identified in Table 3-85. However, those colonies have not been field-checked to determine whether they are currently active. Likewise, activity status is unknown. At least 6.2 miles of Alter-native D would pass through prairie dog colonies in South Dakota and Wyoming compared to at least 11.6 miles of Alternative B and 17.5 miles of Alternative C. Beyond these comparisons, levels of short-term impacts to any of the terrestrial vertebrate species likely to occur in black-tailed prairie dog colonies can not be estimated. But since Alternative D is mostly within an existing railroad corridor, few prairie dog colonies may be affected, particularly if vegetation growth within the existing corridor has been minimized by maintenance and/or prairie dog colonies have subjected to treatments with rodenticides.

Construction during winter within TBNG and along the Cheyenne River in South Dakota and its major tributaries in Wyoming (Black Thunder Creek, Little Thunder Creek and Antelope Creek) is likely to displace wintering bald eagles from perches and feeding areas or make those sites temporarily unsuitable within at least a 0.5-mile up to a 1-mile zone surrounding construction activities. Estimates of potential bald eagle wintering habitats within 0.5-mile and 1-mile zones of the Cheyenne River and major tributaries that could be affected by Alternative D are provided in Table 4-33.

Nearly 30 miles of Alternative D passes within 0.5-mile of potential bald eagle winter habitats in two counties in Wyoming and two in South Dakota. This is less than

Table 4-32
Animal and Plant Species Identified as At Risk by the Forest Service in the Northern Great Plains That Potentially Occur on TBNG and BGNG and Could be Impacted by Alternative C With the W G Flat Route Variation in Potential Habitats

Species At -Risk (1)	National Grasslands Occurrence	Miles of Alternative in Potential Habitat in National Grasslands	Evidence for Occurrence in Project Area by Habitat	Potential for Impact by Alternative (2)
Species Protected Under the ESA and at Risk of Rangewide Imperilment:				
Ute ladies'-tresses	TBNG	wet meadow - 0.04 mi	No known occurrence or recent observations although potential habitat is possible on TBNG and BGNG	Unknown
	BGNG	None		
Whooping crane	BGNG	None	Known occurrences but only incidentally during migrations	No
Bald eagle	TBNG	evergreen forest land - 0.3 mi	Documented wintering and potential nesting habitat in ponderosa pine woodlands and riparian cottonwood woodland	Probably
	BGNG	None		
Peregrine falcon (before delisting)	TBNG	None	Known occurrences but only incidentally during migrations.	No
	BGNG	None		
Black-footed ferret	TBNG	prairie dog colonies - 1.7 mi	Introduced in black-tailed prairie dog complex in Conata Basin, potential habitat for reintroduction	Possibly
	BGNG	None		
Mountain plover	TBNG	prairie dog colonies - 1.7 mi herbaceous rangeland - 31.8 mi cropland/pasture - 0.7 mi	Documented nesting habitats in short-grass prairie and black-tailed prairie dog colonies on TBNG, unknown occurrence on BGNG but potential habitat exists	Probably
	BGNG	herbaceous rangeland - 5.2 mi		
Species That may be at Risk of Rangewide Imperilment but are not Protected Under the ESA:				
Dakota buckwheat	BGNG	Unknown	Known occurrence in badlands, barren clay mounds and outwash in BGNG	Unknown
Barr orphacea	TBNG	Unknown	Known occurrence on clay hills in ne WY and present in Custer, Shannon Cos., SD	Unknown
	BGNG	Unknown		
Sturgeon Chub	TBNG	None	Documented in Cheyenne River, Custer, Pennington Cos., SD; appears absent in WY	Possibly
	BGNG	None		
Swift Fox	TBNG	prairie dog colonies - 1.7 mi herbaceous rangeland - 31.8 mi	Documented denning habitats in short-grass prairie on TBNG and BGNG	Possibly
	BGNG	herbaceous rangeland - 5.2 mi		
Species That may be at Risk of Regional or More Local Imperilment:				
Marsh bellflower	BGNG	None	Suspected to occur in suitable habitats in wetlands and riparian zones on BGNG	Unknown
Nodding buckwheat	TBNG	Unknown	Suspected to occur in suitable habitats on buttes in TBNG and BGNG	Unknown
	BGNG	Unknown		
Lanceleaf cottonwood	TBNG	None	Suspected to occur in suitable habitats in wetlands and riparian zones on TBNG and BGNG	Unknown
	BGNG	None		
Torrey's crypthantha	TBNG	Unknown	Suspected to occur in suitable habitats on buttes in TBNG	Unknown
Marsh fern	BGNG	None	Suspected to occur in suitable habitats in wetlands and riparian zones on BGNG	Unknown

Table 4-32 Continued				
Species At -Risk (1)	**National Grasslands Occurrence**	**Miles of Alternative in Potential Habitat in National Grasslands**	**Evidence for Occurrence in Project Area by Habitat**	**Potential for Impact by Alternative (2)**
Lady-fern	BGNG	None	Suspected to occur in suitable habitats in deciduous woodlands on BGNG	Unknown
Frostweed	BGNG	Unknown	Suspected to occur in suitable habitats in sandhills on BGNG	Unknown
Meadow horsetail	BGNG	None	Suspected to occur in suitable habitats in wetlands and riparian zones on BGNG	Unknown
Sand lily	TBNG	Unknown	Suspected occurrence on TBNG and BGNG on sandy areas on mixed grass prairie, on hillsides, open coniferous woods	Unknown
	BGNG	Unknown		
Blue lips	TBNG	None	Suspected to occur in suitable habitats in wetlands and riparian zones on TBNG and BGNG	Unknown
	BGNG	None		
Alyssum-leaf phlox	TBNG	Unknown	Suspected to occur in suitable habitats on buttes in TBNG and BGNG	Unknown
	BGNG	Unknown		
Alkali sacaton	TBNG	Unknown	Suspected to occur in suitable habitats in wetlands and riparian zones on TBNG	Unknown
Tawny Crescent Butterfly	TBNG	None	Suspected occurrence on TBNG in ponderosa pine savannah with riparian habitats	Unknown
Flathead Chub	TBNG	None	Documented occurrence in Cheyenne River, BGNG and Antelope Creek, TBNG	Possibly
	BGNG	None		
Plains topminnow	TBNG	None	Documented occurrence in tributaries to Cheyenne River on BGNG and TBNG	Possibly
	BGNG	None		
Northern leopard frog	TBNG	None	Known to occur in emergent wetland vegetation on TBNG and BGNG	Possibly
	BGNG	None		
American bittern	BGNG	None	Known to occur in emergent wetland vegetation on BGNG	Possibly
Yellow-billed cuckoo	TBNG	None	Known occurrence on TBNG and BGNG in woody shrub/tree overstory riparian vegetation	Possibly
	BGNG	None		
Long-billed curlew	TBNG	herbaceous rangeland - 31.8 mi	Known occurrence on TBNG and BGNG in short-grass and low mixed-grass prairie	Possibly
	BGNG	herbaceous rangeland - 5.2 mi		
Disckcissel	TBNG	herbaceous rangeland - 31.8 mi	Known occurrence on TBNG in moderately tall mixed-grass/tall-grass prairie	Possibly
Northern Goshawk	TBNG	evergreen forest 0.3 mi	Possible nesting on TBNG in ponderosa pine, may be on BGNG during migrations	Possibly
	BGNG	None		
Sage Grouse	TBNG	None	Documented occurrence in sagebrush steppe on TBNG and BGNG with leks present	Yes
	BGNG	None		
Ferruginous hawk	TBNG	herbaceous rangeland - 31.8 mi	Documented nesting on TBNG and BGNG in trees, on ground and rocks in grasslands and shrublands	Probably
	BGNG	herbaceous rangeland - 5.2 mi		

Table 4-32
Continued

Species At -Risk (1)	National Grasslands Occurrence	Miles of Alternative in Potential Habitat in National Grasslands	Evidence for Occurrence in Project Area by Habitat	Potential for Impact by Alternative (2)
Swainson's hawk	TBNG	herbaceous rangeland - 31.8 mi	Documented nesting on TBNG and BGNG in trees in grasslands and shrublands	Probably
	BGNG	herbaceous rangeland - 5.2 mi		
Short-eared owl	TBNG	herbaceous rangeland - 31.8 mi	Known occurrence on TBNG and BGNG in moderately tall mixed-grass/ tall-grass prairie	Possibly
	BGNG	herbaceous rangeland - 5.2 mi		
Burrowing Owl	TBNG	prairie dog colonies - 1.7 mi herbaceous rangeland - 31.8 mi	Prairie dog colonies, grasslands, basin-prairie shrublands, agricultural areas documented on BGNG and TBNG	Possibly
	BGNG	herbaceous rangeland - 5.2 mi		
Loggerhead shrike	TBNG	None	Known occurrence on TBNG and BGNG in woody shrub/tree overstory riparian vegetation	Possibly
	BGNG	None		
Baird's sparrow	TBNG	herbaceous rangeland - 31.8 mi	Known occurrence on TBNG in moderately tall mixed-grass/tall-grass prairie	Possibly
Fox sparrow	TBNG	None	Known occurrence on TBNG and BGNG in woody shrub/tree overstory riparian vegetation	Possibly
Trumpeter swan	BGNG	None	Known to occur in emergent wetland vegetation on BGNG	Possibly
Black tern	TBNG	None	Known to occur in emergent wetland vegetation on TBNG and BGNG	Possibly
	BGNG	None		
Lewis' Woodpecker	TBNG	evergreen forest 0.3 mi	Ponderosa pine savannah and cottonwood-riparian floodplains	Possibly
Fringe-tailed myotis	TBNG	None	Known to occur near emergent wetland vegetation & woody shrub/tree overstory riparian vegetation on TBNG and BGNG	Possibly
	BGNG	None		
Black-tailed prairie dog	TBNG	prairie dog colonies - 1.7 mi	Prairie dog colonies	Yes
	BGNG	None		

Notes:
1 = Species at-risk were included if they were identified on BGNG and TBNG and analyzed by the Forest Service in the Draft Biological Assessment and Evaluation for Proposed Land and Resource Management Plans, Dakota Prairie Grasslands, Nebraska National Forest and Associated Units, Thunder Basin National Grassland.
2 = Potential for impact by Alternative C with the W G Flat Route Variation was judged as:
No: the at-risk species is not likely to occur on TBNG and/or BGNG.
Unknown: although the at-risk species may occur on TBNG and/or BGNG, there is no documented occurrence of the species within specified habitats or the presence of those habitats have not been documented in areas crossed by Alternative C with the W G Flat Route Variation.
Possibly: the at-risk species is known to occur in specified habitats on TBNG and/or BGNG that would be crossed by Alternative C with the W G Flat Route Variation but the species has not been documented proximate to the alternative.
Probably: Alternative C with the W G Flat Route Variation crosses specified habitat on TBNG and/or BGNG with documented use by the at-risk species.
Yes: Alternative C with the W G Flat Route Variation crosses the specified habitat on TBNG and/or BGNG and would directly impact the at-risk species.

Table 4-33 Miles of Alternative D Within 0.5 and 1 mile of the Cheyenne River, Black Thunder Creek, Little Thunder Creek and Antelope Creek That are Potential Bald Eagle Wintering Habitats		
County, State (ordered west to east)	**Miles Within 0.5 Mile of Potential Habitat**	**Miles Within 1 Mile of Potential Habitat**
Campbell, WY	4.4	7.1
Converse, WY	6.4	8.6
Weston, WY	0	0
Niobrara, WY	0	0
Fall River, SD	11.2	20.0
Custer, SD	0	0
Pennington, SD	7.9	9.4
Alternative D Total	29.9	45.1

Table 4-34 Number of Miles Where Alternative D Intersects Suitable Soils and Habitats Potentially Inhabited by American Burying Beetles in South Dakota						
South Dakota County (ordered west to east)	**Suitable Soil Type**	**Distance (miles) Crossed in Potential Habitats per Suitable Soil Type**				
		Cropland, Pasture	**Herbaceous Rangeland**	**Forested Wetland**	**Deciduous Forest**	**County Total**
Fall River	Sandy, Erosive	0.8	5.1	0.1	0	6.0
	Prime Farmland	7.9	14.0	0.7	0	22.6
Custer	Sandy, Erosive	0	0	0	0	0
	Prime Farmland	2.0	4.8	0	0	6.8
Pennington	Sandy, Erosive	0.1	0	0	0	0.1
	Prime Farmland	3.1	0.8	0	0	3.9
Alternative D Total		13.9	24.7	0.8	0	39.4

Table 4-35 Number of Sites and Total Distance (miles) Where Alternative D is Within 500 Feet of the Cheyenne River or Tributary Streams				
County, State	**Cheyenne River**		**Tributary Streams**	
	Number of Sites	**Total Distance**	**Number of Sites**	**Total Distance**
Campbell, WY	0	0	18	1.8
Converse, WY	0	0	0	0
Niobrara, WY	0	0	0	0
Weston, WY	0	0	0	0
Custer, SD	0	0	0	0
Fall River, SD	3	0.7	22	5.70
Pennington, SD	3	2.0	30	3.3
Alternative D Total	6	2.7	70	10.8

the 85 miles of Alternative B and 58 miles of Alternative C that are estimated to be within 0.5-mile of potential winter habitats. If short-term construction related disturbances affected wintering bald eagles 1 mile away, 45 miles of Alternative D would be within that distance from potential habitats identified in Table 4-33, less than the 129 miles of Alternative B and 93 miles of Alternative C within the 1-mile zone. Specifically in South Dakota, Alternative D would affect less potential habitats along the Cheyenne River than either Alternative C routes with the Phiney Flat or W G Flat route variations.

Disturbances to wintering bald eagles could occur along 30 to 45 miles of Alternative D during the short-term and long-term if eagles are affected by noise associated with train traffic 0.5-mile to 1 mile away. Potential bald eagle nesting habitats are within the same areas where there are cottonwood riparian woodlands.

Though no bald eagles are currently nesting in the project area, they may in the future as nesting populations expand their range. However, the degree to which Alternative D limits future nesting by this species can not be determined.

Construction of Alternative D during spring and early summer along the Cheyenne River, primarily in Pennington County, could displace interior least terns if they select sand bars or islands within the river to nest. However, Alternative D would cross the Cheyenne River once, between the confluence of Spring Creek and Wasta, and be within 0.5 mile of the river for only 8 miles in Pennington County, approximately half the distance of any other alternative.

American burying beetles could occur in suitable soils along Alternative D in South Dakota. The amount of disturbances by Alternative D in these soils, potential substrates for the species, and where these soils coincide with potentially suitable habitats are provided in Table 4-34. Surface disturbances to these soils during construction would probably contribute short- and long-term impacts to burying beetles, if they actually occur.

There are approximately 39 miles in South Dakota where Alternative D would pass through suitable soils in potential habitats that might be used by American burying beetles, 7 miles more than Alternative B and between 2 and 5 miles more than Alternative C including either of the route variations. Over 33 miles of Alternative D passes through soils with characteristics to be prime farmlands, but whether all or some are irrigated and/or cultivated is unknown. If those prime farmland soils are taken out of production by Alternative D, they would probably be more suitable for use by burying beetles, if they occur and if appropriate sized carrion is available.

Short-term impacts to listed (pallid sturgeon), candidate (sturgeon chub) and sensitive (plains topminnow, flathead chub, finescale dace, longnose sucker) fish species could occur during construction with increased sedimentation due to runoff from construction sites near waterways. During operation, short-term impacts could occur downstream if there were derailments and accidental release of diesel fuels and other petroleum products into the Cheyenne River or its tributaries. Both types of impacts would be most likely if potential discharge sites are within 500 feet of surface waters. In addition, bald eagles and least terns could be impacted by widespread fish-kills that would adversely affect food sources and piping plovers nesting down-stream could be affected if aquatic and burrowing invertebrate were killed. Table 4-35 indicates the number of sites and/or distances at which Alternative D would be within 500 feet of the Cheyenne River or tributary streams with perennial flows.

There are 76 sites on the Cheyenne River and perennial tributary streams, combined, where Alternative D is within 500 feet of the drainages, fewer than the 177 sites and 206 sites intersected by Alternative B and Alternative C, respectively. Less than 14 miles of Alternative D is within 500 feet of the Cheyenne River and tributaries, 8 miles less than Alternative B and nearly 7 miles less than Alternative C. These sites are believed to be those most likely where sediments and/or accidental releases of toxic compounds could be discharged.

As a result of past surveys, there is 1 site along Alternative D that has been evaluated as potential habitat for Ute ladies'-tresses. That site is in South Dakota where Alternative D and Alternative C coincide and cross Dry Creek. One other site in South Dakota (Plum Creek) and 3 in Wyoming (East Fork Coal Creek, Belle Fourche River, and Caballo Creek) could not be evaluated because access to the site was denied. In South Dakota, Alternative D would cross a total of 0.29 mile of wet meadows, palustrine emergent wetland temporarily and seasonally flooded, that could be potential habitat for the orchid (see Table 3-78). The route in Wyoming would cross 0.8 mile of that wetland type, more than affected by Alternative B and Alternative C. In both states, almost all wet meadows impacted by the alternative are on private lands (see Table 3-78). Occurrence of other sensitive plant species along Alternative D is unknown but individuals of any sensitive plant species, including Ute ladies'-tresses, that inhabit construction sites would be eliminated, at least for the short-term.

Long-term impacts due to the presence, operation and maintenance of Alternative D to Federally-listed threatened or endangered species, species proposed for listing, candidate species, species petitioned for listing, and species with special status are similar to short-term impacts described above and are expected to be fewer than those described under Alternatives B and C. They include direct mortality by trains and maintenance vehicles, avoidance of habitats that are near the track, and potential long-term deterioration of habitats, especially aquatic habitats at sites where sediment discharge and accidental release of toxic substances occur.

Alternative D would not affect BGNG. Wildlife MIS identified on TBNG were listed under Alternative B, above. Alternative D would not cross land designated for reintroduction of black-footed ferrets and so would not be inconsistent with the Forest Plan. While Alternative D would not affect peregrine falcons, it would possibly affect wintering bald eagle habitats along the Cheyenne River, Black Thunder Creek, Little Thunder Creek and Antelope Creek.

Medicine Bow Forest Plan management area prescriptions that would be affected by Alternative C are provided in Table 1-2 and discussed in detail in Table 6 through Table 12 in Appendix A. Estimates of where and how much of Alternative D would impact known or potential habitats utilized by recovery and ecological indicator species are provided in Table 4-36. Effects of Alternative D on the remaining MIS will be discussed and evaluated in Section 4.18.

Grassland management area prescriptions under the proposed grassland plan for TBNG that would be affected by Alternative D are provided in Table 1-2 and discussed in detail in Table 13 through Table 23 in Appendix A. Animal and plant species that are likely to inhabit TBNG and which have been identified as at-risk of range-wide imperilment (extinction or extirpation) or at-risk of local or region imperilment were assessed by the Forest Service (1999c) in the Draft Biological Assessment and Evaluation. Estimates of where and how much of Alternative D would impact known or potential habitats utilized by those imperilled plant and animal species are provided in Table 4-37.

4.17.9 Proposed Mine Loop Options. The North Antelope West Mine Loop would pass through prairie dog colonies for 0.6 miles. Surface disturbances to prairie dog colonies will affect some individual prairie dogs and can potentially impact nesting mountain plovers and swift fox over the short- and long-term if either species inhabits the area. All 4 proposed mine loops would be within 1 mile of Antelope Creek and Little Thunder Creek for a total of 7.3 miles. Consequently, construction and operation of the loops could displace bald eagles wintering along those riparian zones over the long-term.

4.17.10 Proposed Yard Sites. The proposed yard near Wall would be within croplands and intersect the I-90 corridor. Soils at the site are shallow and would probably not be suitable for American burying beetles. No other Federally-listed threatened and endangered species, candidate wildlife species, and special status species is likely to be affected by the Wall Yard.

The proposed Edgemont Interchange Yard would be within grassland vegetation. That yard would cross 1 intermittent stream, a tributary to the Cheyenne River, and be within 0.5 mile of the river. Because the site is adjacent to the existing BNSF railroad, construction and operation of the yard are unlikely to affect wintering bald eagles if they occur along the Cheyenne River east of Edgemont. No eagles were observed there during recent winter surveys. However, since the yard crosses an intermittent stream, potential exists for accidental discharge of toxic materials and sediments into the Cheyenne River that could affect Federally-listed threatened and endangered species, candidate wildlife species, and special status species downstream.

The proposed Western Yard in Wyoming would cross mostly grasslands but also 21 intermittent streams which are tributary to Little Thunder Creek. No wetlands would be affected. For most of its length, the yard would be within 0.5 mile of Little Thunder Creek. Consequently, const-ruction and operation of the Western Yard are likely to displace bald eagles wintering along Little Thunder Creek and make that riparian zone unsuitable for wintering eagles over the long-term. The yard site also coincides with numerous black-tailed prairie dog colonies. Surface disturbances to prairie dog colonies will affect some individual prairie dogs and can potentially impact nesting mountain plovers and swift fox over the short- and long-term if either species inhabits the area. With the proximity of the yard to Little Thunder Creek and numerous intermittent streams crossed, the potential exists for accidental discharge of toxic materials and sediments into the Cheyenne River system that could affect Federally-listed threatened and endangered species, candidate wildlife species, and special status species downstream.

4.18 Wildlife and Aquatic Resources

Game and non-game wildlife and fisheries habitat issues and species-specific issues were raised by USFWS, SDGFP, and WGFD in written and oral comments and are summarized, below:

- If the project leads to decreased quality and quantity of big game habitat, the potential exists for big game populations to also decrease making management at population objective levels difficult and potentially reducing hunter opportunities and enjoyment.
- Construction activities and disturbances and persistent human activity and noise for the life of the project can lead to direct and indirect loss of big game habitats including foraging areas, fawning and parturition areas, hiding and thermal cover, winter/yearlong range and yearlong ranges.
- Existence of the rail line and right-of-way fences can lead to potential loss of big game seasonal migration and daily movement routes. Specifically, migration patterns of pronghorn can be altered by fences and fencing, using Federal guidelines to facilitate passage of big game, mule deer and pronghorn, must be addressed.
- Possible big game mortality caused by train/animal collisions and work force influences such as illegal harvest.
- Displacement of big game away from suitable habitats due to human and construction activity as

Table 4-36
Forest Service Management Indicator Species on TBNG That Could be Impacted by Alternative D in Potential Habitats

Forest Management Indicator Species	Species Designation	Miles of Alternative in Potential Habitat on TBNG	Evidence for Occurrence in Project Area by Habitat	Potential for Impact by Alternative (1)
Recovery Species				
Black-footed Ferret	Federally Listed Endangered	prairie dog colonies - 0.3 mi	Habitat suitable for reintroduction	Yes
Peregrine Falcon	Delisted as Endangered	None	None	No
Bald Eagle	Federally Listed Threatened	evergreen forest - 1.1 mi	Documented wintering and potential nesting habitat in ponderosa pine woodlands and riparian cottonwood woodland	Probably
Ecological Indicator Species				
Mountain Plover	Federal Proposed for Listing as Threatened Forest Service Sensitive	prairie dog colonies - 0.3 mi herbaceous range - 20.0 mi mixed rangeland - 5.5 mi	Documented nesting habitats in short-grass prairie and black-tailed prairie dog colonies	Possibly
Black-tailed Prairie Dog	Federal Candidate	prairie dog colonies - 0.3 mi	Documented colonies in project area	Yes
Upland Sandpiper	USFWS Species of Concern; Forest Service Sensitive	herbaceous range - 20.0 mi mixed rangeland - 5.5 mi	Possible occurrence during breeding on short-grass prairie	Possibly
Long-billed Curlew	USFWS Species of Concern; Forest Service Sensitive	herbaceous range - 20.0 mi mixed rangeland - 5.5 mi	Documented presence - possibly nesting - in sagebrush steppe, meadow, grasslands, native hay meadow	Possibly
Ferruginous Hawk	USFWS Species of Concern; Forest Service Sensitive	herbaceous range - 20.0 mi mixed rangeland - 5.5 mi evergreen forest - 1.1 mi	Documented nesting habitat in short-grass prairie and sagebrush steppe	Probably
Red-headed Woodpecker	USFWS Species of Concern	None	Possible occurrence during breeding, probably in riparian cottonwood woodland	Unknown
Brewer's Sparrow	USFWS Species of Concern	mixed rangeland - 5.5 mi	Documented occurrence during breeding in sagebrush steppe	Possibly

1 = Potential for impact by Alternative D was judged as:
No: the species is not likely to occur on TBNG.
Unknown: although the management indicator species may occur on TBNG, there is no documented occurrence of the species within specified habitats or the presence of those habitats have not been documented in areas crossed by Alternative D.
Possibly: the management indicator species is known to occur in specified habitats on TBNG that would be crossed by Alternative D but the species has not been documented proximate to the alternative.
Probably: Alternative D crosses specified habitat on TBNG with documented use by the management indicator species.
Yes: Alternative D crosses the specified habitat on TBNG and would directly impact the management indicator species.

Table 4-37 Animal and Plant Species Identified as At Risk by The Forest Service in the Northern Great Plains That Potentially Occur on TBNG and Could be Impacted by Alternative D in Potential Habitats			
Species At-Risk (1)	**Miles of Alternative in Potential Habitat in National Grasslands**	**Evidence for Occurrence in Project Area by Habitat**	**Potential for Impact by Alternative (2)**
Species Protected Under the ESA and at Risk of Rangewide Imperilment:			
Ute ladies'-tresses	wet meadow - 0.10 mi	No known occurrence or recent observations although potential habitat is possible on TBNG and BGNG	Unknown
Bald eagle	evergreen forest land - 1.1 mi	Documented wintering and potential nesting habitat in ponderosa pine woodlands and riparian cottonwood woodland	Probably
Peregrine falcon (before delisting)	None	Known occurrences but only incidentally during migrations.	No
Black-footed ferret	prairie dog colonies - 0.3 mi	Introduced in black-tailed prairie dog complex in Conata Basin, potential habitat for reintroduction	Possibly
Mountain plover	prairie dog colonies - 0.3 mi herbaceous rangeland - 20.0 mi mixed rangeland - 5.5 mi	Documented nesting habitats in short-grass prairie and black-tailed prairie dog colonies on TBNG, unknown occurrence on BGNG but potential habitat exists	Probably
Species That may be at Risk of Rangewide Imperilment but are not Protected Under the ESA:			
Barr orphacea	Unknown	Known occurrence on clay hills in ne WY and present in Custer, Shannon Cos., SD	Unknown
Swift Fox	prairie dog colonies - 0.3 mi herbaceous rangeland - 20.0 mi mixed rangeland - 5.5 mi	Documented denning habitats in short-grass prairie on TBNG and BGNG	Possibly
Species That may be at Risk of Regional or More Local Imperilment:			
Nodding buckwheat	Unknown	Suspected to occur in suitable habitats on buttes in TBNG and BGNG	Unknown
Lanceleaf cottonwood	None	Suspected to occur in suitable habitats in wetlands and riparian zones on TBNG and BGNG	Unknown
Torrey's crypthantha	Unknown	Suspected to occur in suitable habitats on buttes in TBNG	Unknown
Sand lily	Unknown	Suspected occurrence on TBNG and BGNG on sandy areas on mixed grass prairie, on hillsides, open coniferous woods	Unknown
Blue lips	None	Suspected to occur in suitable habitats in wetlands and riparian zones on TBNG and BGNG	Unknown
Alyssum-leaf phlox	Unknown	Suspected to occur in suitable habitats on buttes in TBNG and BGNG	Unknown
Alkali sacaton	Unknown	Suspected to occur in suitable habitats in wetlands and riparian zones on TBNG	Unknown
Tawny Crescent Butterfly	None	Suspected occurrence on TBNG in ponderosa pine savannah with riparian habitats	Unknown
Flathead Chub	None	Documented occurrence in Cheyenne River, BGNG and Antelope Creek, TBNG	Possibly
Plains topminnow	None	Documented occurrence in tributaries to Cheyenne River on BGNG and TBNG	Possibly
Northern leopard frog	None	Known to occur in emergent wetland vegetation on TBNG and BGNG	Possibly

Table 4-37 Concluded			
Species At-Risk (1)	**Miles of Alternative in Potential Habitat in National Grasslands**	**Evidence for Occurrence in Project Area by Habitat**	**Potential for Impact by Alternative (2)**
Yellow-billed cuckoo	None	Known occurrence on TBNG and BGNG in woody shrub/tree overstory riparian vegetation	Possibly
Long-billed curlew	herbaceous rangeland - 20.0 mi mixed rangeland - 5.5 mi	Known occurrence on TBNG and BGNG in short-grass and low mixed -grass prairie	Possibly
Disckcissel	herbaceous rangeland - 20.0 mi mixed rangeland - 5.5 mi	Known occurrence on TBNG in moderately tall mixed-grass/ tall -grass prairie	Possibly
Northern Goshawk	evergreen forest 0.3 mi	Possible nesting on TBNG in ponderosa pine, may be on BGNG during migrations	Possibly
Sage Grouse	None	Documented occurrence in sagebrush steppe on TBNG and BGNG with leks present	Yes
Ferruginous hawk	herbaceous rangeland - 20.0 mi mixed rangeland -5.5 mi	Documented nesting on TBNG and BGNG in trees, on ground and rocks in grasslands and shrublands	Probably
Swainson's hawk	herbaceous rangeland - 20.0 mi mixed rangeland - 5.5 mi	Documented nesting on TBNG and BGNG in trees in grasslands and shrublands	Probably
Short-eared owl	herbaceous rangeland - 20.0 mi mixed rangeland - 5.5 mi	Known occurrence on TBNG and BGNG in moderately tall mixed-grass/ tall -grass prairie	Possibly
Burrowing Owl	prairie dog colonies - 0.3 mi herbaceous rangeland - 20.0 mi mixed rangeland - 5.5 mi	Prairie dog colonies, grasslands, basin-prairie shrublands, agricultural areas documented on BGNG and TBNG	Possibly
Loggerhead shrike	None	Known occurrence on TBNG and BGNG in woody shrub/tree overstory riparian vegetation	Possibly
Baird's sparrow	herbaceous rangeland - 20.0 mi mixed rangeland - 5.5 mi	Known occurrence on TBNG in moderately tall mixed-grass/ tall -grass prairie	Possibly
Fox sparrow	None	Known occurrence on TBNG and BGNG in woody shrub/tree overstory riparian vegetation	Possibly
Black tern	None	Known to occur in emergent wetland vegetation on TBNG and BGNG	Possibly
Lewis' Woodpecker	evergreen forest 0.3 mi	Ponderosa pine savannah and cottonwood-riparian floodplains	Possibly
Fringe-tailed myotis	None	Known to occur near emergent wetland vegetation & woody shrub/tree overstory riparian vegetation on TBNG and BGNG	Possibly
Black-tailed prairie dog	prairie dog colonies - 0.3 mi	Prairie dog colonies	Yes

1 = Species at-risk were included if they were identified on TBNG and analyzed by the Forest Service in the Draft Biological Assessment and Evaluation for Proposed Land and Resource Management Plan, Thunder Basin National Grassland.

2 = Potential for impact by Alternative D was judged as:

No: the at-risk species is not likely to occur on TBNG.

Unknown: although the at-risk species may occur on TBNG, there is no documented occurrence of the species within specified habitats or the presence of those habitats have not been documented in areas crossed by Alternative D.

Possibly: the at-risk species is known to occur in specified habitats on TBNG would be crossed by Alternative D but the species has not been documented proximate to the alternative.

Probably: Alternative D crosses specified habitat on TBNG with documented use by the at-risk species.

Yes: Alternative D crosses the specified habitat on TBNG and would directly impact the at-risk species.

well as persistent noise disturbance for the life of the project.

- Potential decrease in hunter harvest and opportunity due to reduced hunter access and displacement of animals caused by habitat losses, fragmentation of private property and continued noise and human disturbance for the life of the project.
- Construction and disturbance impacts could reduce forage possibly leading to increased forage competition between big game and livestock.
- Disruption or fragmentation of established territories and routines of secretive species such as the mountain lion, a South Dakota State-threatened species, and bobcat.
- Potential direct loss and indirect loss of sage grouse leks due to the loss of suitable habitat types from construction disturbances and human activity.
- Potential direct loss of sage grouse nesting sites due to the loss of suitable habitat cover from construction and human activity.
- Potential reduction in sage grouse numbers caused by habitat losses, human disturbances and possible work force influences such as illegal harvest.
- Possible declines in hunter harvest and opportunity due to reduced hunter access and displacement of sage grouse.
- Direct and indirect loss of non-game wildlife habitats including nesting and young rearing areas, foraging and watering sites, escape, thermal and hiding cover, and resting or loafing areas due to project construction and continual human disturbance.
- Displacement of wildlife away from suitable or preferred habitats due to construction and human disturbance.
- Adverse effects to nesting birds, including raptors, by disturbance and disruption due to train traffic.
- Many species of birds, including raptors and eagles, are protected under the Migratory Bird Treaty Act and Bald Eagle and Golden Eagle Protection Act. Activities that may adversely affect a migratory bird or eagle, their young, eggs or nests) should be coordinated with USFWS before any actions are taken. Removal or destruction of nests, or causing abandonment of a nest could constitute violation of these statutes. USFWS recommended surveys for raptor nests and roost sites in the project area.
- Several non-game species of special concern in Wyoming (burrowing owls, mountain plovers, prairie falcons, golden eagles, bald eagles) have been documented along the proposed project route and could be negatively impacted by direct and indirect loss of habitats used for different life history functions, direct mortality, and illegal harvest by the work force.
- Decline in animal numbers due to lost habitat, fragmented habitat, train/animal collisions, and/or work force influences such as illegal harvest.
- Direct and indirect loss of hunter numbers (issued licenses), reduced hunter success and hunting opportunities due to loss of game wildlife species caused by construction, train/animal collisions, habitat loss, human activity and noise levels.
- Decreased hunter access due to rail line existence, fragmentation of property, and right-of-way fences.
- Increased train traffic across Game Production Areas owned by South Dakota Game, Fish and Parks located 2 miles south of Oral, South Dakota will disrupt wildlife and recreation uses - hunting, wildlife watching - on this tract of public lands. Evaluation of applicability of existing easements will have to be completed.
- Decreased quality of hunting experiences and enjoyment with continual noise disturbances that would include disruption of aesthetics and serenity of a tranquil and virtually undisturbed river valley from Wasta, South Dakota south for 66 miles.
- Loss of habitats and desirable vegetation could potentially reduce the biological diversity of the area.
- Fragmentation of habitat types may potentially affect wildlife use and movement patterns within the area.
- Effects to fish and wildlife of environmental contaminants in coal dust, whether by contaminant uptake by vegetation, consumption of vegetation by wildlife, or incidental direct consumption of coal dust or soils by wildlife.
- Increased traffic and new rail lines may increase the potential for derailments and diesel fuel spills. Additionally, railroad ties treated with certain chemical may pose a contamination hazard. Identify the chemicals used in treatment of the ties as well as any environmental impacts that could be associated with the chemicals.
- Potential loss of native vegetation communities and soil disturbance will lead to increased encroachment or invasion of noxious weeds and undesirable plant species.
- Impacts to riparian forest and woody draw habitats, including direct removal and fragmentation of these habitats, must be addressed as well as impacts to riparian oxbow wetlands along the Cheyenne River in South Dakota.
- Disturbance to existing vegetation cover may lead to increased soil erosion and stream sedimentation.
- Require revegetating disturbed sites with desirable native species and avoid planting species such as sweet clover or alfalfa on grade slopes and borrow areas that would attract grazing wildlife.
- Potential exists to impact numerous plains streams in eastern Wyoming. The project should be

designed to traverse an upland route and avoid riparian corridors wherever possible.

- Changes to the capacity of the Cheyenne River floodplain due to construction of the rail grade within and across the flood plain can potentially alter natural erosion patterns and increase bank erosion due to diminished flood plain capacity.
- Instream construction restrictions may be required at certain stream crossings and fish passage should be allowed at all crossings, at all times during and after project construction. Potential effects to fish migration in tributary streams due to construction of crossings that may increase flow velocities or, in the long-term, cause changes in the channel bed elevations or cause physical obstructions to migrating fish.
- Decreased water quality from sediments and other pollutants can be avoided by implementing best management practices, servicing and fueling construction and maintenance machinery away from streams and riparian areas, locating equipment staging areas as far away as possible from riparian areas, and promptly revegetating disturbed areas that contribute sediment to surface waters.
- Both TBNG and BGNG have been identified as important grassland habitat areas for neotropical migratory birds by the National Partners-In-Flight Program. Conservation measures have been recommended that the Forest Service has accepted as best management practices.

4.18.1 Significance Criteria. The Wyoming Game and Fish Commission (1998) established a mitigation policy in which they recommend objectives for managing unavoidable adverse impacts to different categories of wildlife and wildlife habitats (see Table 4-9). Wildlife habitats are evaluated by their function (the arrangement of habitat features that sustain species, populations and wildlife diversity over time), and their value (the relative importance of habitat types and conditions in sustaining wildlife populations). Based on the commission's mitigation policy, impacts to wildlife and fisheries would be considered significant if any of the following occurred (refer to Table 4-9):

- Increased mortality and/or decreased survival of native wildlife species considered as Vital, High, or Moderate under the Mitigation Policy.
- Loss of habitat function and/or habitat value for habitats classified as Vital or High under the Mitigation Policy.
- Net loss of habitat value with alterations in habitat function for habitats classified as Moderate under the Mitigation Policy.

Similarly, the South Dakota Game, Fish and Parks Department has a policy of no net loss of Resource Category 1 Habitats that include woody draws, native grasslands, sagebrush-grasslands, riparian woodlands, and wetlands. Impacts to wildlife would be considered significant if there was a net loss of any Resource Category 1 Habitat.

4.18.2 Summary of Issues and Impacts Common to All Alternatives (Except the No Action Alternative). Direct or primary impacts to wildlife are explicitly related to the action and include mortality of individuals, loss of habitat quantity and functional quantity and ultimately, diminished population-sustaining functions: individuals' survival and reproductive capacity are adversely affected. With respect to the proposed alternatives (except the No Action - Alternative A), direct impacts include:

- Mortality from wildlife-vehicle collisions on or off project sites.
- Mortality during railroad construction and other surface-disturbing actions.
- Mortality due to consumption of or exposure to toxic compounds.
- Fragmentation of connected habitats.
- Removal of vegetation and other features such as rock-outcrops that provide habitat.
- Degradation of terrestrial habitats from erosion and introduction of non-native vegetation.
- Degradation of aquatic habitats due to altering stream banks, siltation and decreased water quality.
- Loss of forage for herbivores.
- Diminished animal use of habitats due to effects of noise, dust, emissions and human presence.
- Interruption or interference with life history functions including courtship, nesting and parturition, migration, and winter survival.

For some species, these direct impacts are expected to be interrelated such as the effects of habitat fragmentation on interference with life history functions. In addition, there will probably be indirect or secondary impacts that ensue with increased human population and/or increased human use (access) of an area. These evolve during and after a project but are functionally related: secondary impacts would not have occurred without the project. Once initiated though, secondary impacts may continue well beyond the time-frame and develop independently of the project (Comer, 1982). While the effects on wildlife of secondary impacts may be the same as primary, direct impacts, the sources of those impacts vary and include (Comer, 1982 page 18):

- Increased recreation, especially off-road vehicles.
- Increased habitat conversion, especially urban/suburban sprawl.

- Habitat degradation by human encroachment.
- Increased noise, air and water pollution.
- Increased game poaching.
- Increased wildlife road kill.
- Increased harassment of wildlife by uncontrolled pets, especially dogs.

Summarized in Table 4-9 are the Wyoming Game and Fish Commission's mitigation categories related to the relative importance of habitats to fish and wildlife species. These mitigation categories and associated mitigation objectives provide the basis for judging levels of impact significance.

Applications of the policy to Federally-listed threatened and endangered species and their critical habitats were discussed above. State rare wildlife species, Federal candidate species, State native species with status 1 and 2, species' crucial habitats, wetlands, and stream class 1 waterways (premium trout waters with fisheries of national importance) are identified as "vital": habitats may be modified but no loss of habitat function is recommended since these habitats directly limits communities and populations and it may not be possible to restore or replace the habitat once impacted.

State priority 2 species, raptors, migratory birds of high Federal interest, trophy game animals (mountain lions, black bears), big game and trophy game winter-yearlong ranges, parturition areas, raptor nesting habitats, riparian habitats, and other important or limited habitats have been identified as "high" importance: if impacts occur the commission's Mitigation Policy would recommend replacement of affected habitats or enhancement of similar habitats to achieve no net loss of habitat function of the community impacted by a project. Similarly, high values to fishery management include native game fish, stream class 2 waterways, and fisheries management programs emphasizing trophy species and wild native game fish.

Wildlife and fish habitats identified in the "moderate" category may be common or of intermediate importance but the Wyoming Game and Fish Commission's Mitigation Policy recommends no loss of habitat values (the relative importance necessary to sustain socially or ecologically significant wildlife populations) and minimal loss of habitat function (capability of the habitat to sustain species, populations, wildlife diversity over time). Habitats in the "low" importance category are abundant or not essential to sustain wildlife populations or communities.

While the list of impacts identified by the public and agencies (most of them direct or primary) seems to grow with every project, analysis must base impact evaluations on assumption, conjecture and inference derived from studies of similar types of actions but in diverse locations and on different but similar species. Documented or implied impacts that are applicable to the alternatives are summarized in Table 4-10. These do not include effects of railroad developments on species' populations; none have been studied or documented and hence the emphasis of impact analyses is on projected effects to wildlife habitat.

Big Game. In Wyoming, WGFD biologists have mapped seasonal ranges used by big game species. Similarly, SDGFP biologists provided information about big game use along portions of each alternative. The only measurable direct impact to big game is the amount of surface disturbance in each delineated seasonal range that would be produced by the proposed alternatives. In Wyoming, pronghorn, mule deer, white-tailed deer and elk populations and their respective seasonal ranges would be affected by each of the alternatives. Likewise, habitats used by pronghorn and deer (white-tailed deer and mule deer) would be affected in South Dakota.

Of particular concern to biologists in Wyoming are potential impacts to elk during parturition, when elk calves are born. During the parturition period, elk cows are especially sensitive to disturbance and will move to 0.75 mile away or farther from preferred calving sites if subjected to construction workers and equipment (Brekke, 1988). In that study conducted in Colorado, the function of that elk parturition range had been diminished, impacted by oil and gas development but graveled roads and highways also cause significant avoidance with decreased habitat use by elk during parturition (Bian and West, 1997).

Functions of other seasonal big game ranges may be impaired by construction and operation of the proposed project through other means. Winter ranges (crucial WIN, WYL and SWR) provide habitat components that sustain animals through periods of maximum thermal and energy-intake stress. Disturbances during winter stress periods can lead to increased energy expense and increased mortality (Hobbs, 1989). For example, data related to over-winter mortality of mule deer fawns and adults has been collected in western Wyoming (McWhirter, 1998). Using techniques developed by White *et al.* (1996), these empirical data provide estimates of fawn and adult mortality which show a strong relationship to winter precipitation (Reeve and Smith, 1999): as total winter precipitation (November through March) increases, so do mule deer fawn and adult mortality rates. Winter precipitation explains 62 percent of the observed variation in fawn mortality rates. Not surprisingly, fawn mortality increases at a greater rate than adult mortality with increasing winter precipitation.

In part, overwinter mortality of mule deer is due to snow depth since deep snow covers forage and increases

energy expense for movements. Parker *et al.* (1984) clearly demonstrated that energy costs associated with deer moving through snow increased exponentially as snow depth increased relative to the height of a deer or relative sinking depth of an animal in snow. Therefore, fawns expend more energy than adults moving through snow with similar depth and consistency (as dense vs. powdered snow). Increased energy expense or metabolic rate during winter is also promoted by operative temperatures (including combined effects of ambient temperature, wind, and solar radiation) that are below mule deer thermal neutral zones, below -2.2°F. The combined effects of precipitation and temperature on deer winter survival have been discussed by numerous investigators (Roper and Lipscomb, 1973; Bartmann, 1984; Leckenby and Adams, 1986; Hobbs, 1989) and these are undoubtedly related to the differential observed winter mortality of fawn and adult deer. Human-related factors or events on winter ranges that cause mule deer (or other big game) to expend energy during winter, in addition to "natural" environmental factors (severe weather causing migration, competition with conspecifics and/or other ungulates, predators) will increase their over-winter mortality (Hobbs, 1989) and consequently diminish the function of those winter ranges.

In addition to potential project impacts to big game habitats, big game are likely to be killed by train traffic once the project is operational. Most studies of big game-vehicle mortality have been conducted on highways where the number of animals killed increases as traffic volume and vehicle speeds increase (see Table 4-10). New highways constructed through deer movement corridors can lead to substantial mortality (Romin and Bissonette, 1996). One study of mule deer mortality due to highway traffic and trains in western Wyoming showed that more deer were killed on the highway than on the railroad (Reeve, 1990). There, the railroad closely followed the highway. When a deer-proof fence was constructed along 8 miles on each side of the highway, the number of deer collisions decreased on the highway but deer mortality increased significantly on the railroad where the tracks coincided with the deer-proof fence (Reeve, 1990).

From this study and others conducted on big game-vehicle mortalities, it is apparent that a new railroad passing through big game habitats in Wyoming and South Dakota will lead to mortalities. More mortalities are expected during winter when animals are concentrated in large groups than summer when they are dispersed, more with higher train traffic volume than with fewer trains, more during night when animals may be more mobile than during daytime, and more mortalities are expected with higher train speeds (as with empty west-bound trains) than slower trains loaded with coal.

Also, big game are most likely to be killed in areas where they have little or no escape away from tracks. Such situations could include areas between cut slopes and tracks and where right-of-way fences are constructed close to tracks. While fences may inhibit some animals from moving on to the tracks, they also inhibit animals from reaching areas on the other side, thereby isolating and fragmenting habitats. Fences could especially limit big game use of habitats along the Cheyenne River where animals are expected to be highly motivated to move to water from feeding areas or shelter/cover in upland habitats. Pronghorns, in particular, are impeded by certain types of fences (see Table 4-10). Fences can lead to under-utilization of habitat, leading to loss of habitat function. Such impact would be especially acute if animals were prevented from reaching winter or severe winter relief ranges during critical winter periods. Functional loss of important seasonal habitats would also occur in animals are displaced from those areas. Elk in particular could be displaced from wintering habitat in the vicinity of Sunny Draw on TBNG.

Waterfowl, Upland Game Birds, Furbearers, Small Game. Potential impacts to waterfowl due to construction and operation would be most likely during the nesting period where the proposed route is near the Cheyenne River in Wyoming and South Dakota. A study of impacts to nesting waterfowl by oil well drilling indicated some species (43 percent) moved away from or avoided the concentrated activity site while others (52 percent) were unaffected and 5 percent of the species increased abundance near the activity (Barry and Spencer, 1976). Effects of disturbance were observed as far away 1.5 mile from the drilling rig. Increased predation of nests from which adults were disturbed was also reported (Barry and Spencer, 1976).

Accidental release of oils and other petroleum products into the Cheyenne River or tributaries also would adversely affect waterfowl. Toxicity of petroleum products discharged to aquatic habitats was discussed, above under pallid sturgeon (also Table 4-10). Waterfowl could also be affected if feathers became oiled since that would increase thermal conductivity of the feathers and birds would become susceptible to hypothermia (McEwan and Koelink, 1973).

The decline of sage grouse throughout the west has been of increasing concern (Heath *et al.*, 1996; Heath *et al.*, 1997; Braun, 1998). Such a decline in northeastern Wyoming is evident from recent harvest data (see Table 3-99). Reasons for their decline have been attributed to conversion of sagebrush-grasslands to agriculture, herbicide and mechanical treatments to convert sagebrush to pastureland for livestock, livestock grazing that removes concealing vegetation at nest sites thus exposing them to predation, mining and energy

developments, creation of reservoirs that eliminate riparian zones utilized by sage grouse broods, expansion of human settlements into sage grouse habitats, and fragmentation of habitats by fence lines, highways, and powerlines (Heath *et al.*, 1996; Braun, 1998).

The degree to which any or all of these potential factors have affected sage grouse has yet to be determined. Nevertheless, construction and operation of the railroad through South Dakota and Wyoming will contribute to existing habitat fragmentation. Also, noise from vehicles on highways has been suggested as having an adverse impact on sage grouse lek attendance (Braun, 1998).

Mating displays by male sage grouse as well as male sharp-tailed grouse involve acoustic signals coupled with visual displays (Eng *et al.*, 1979; Vehrencamp and Bradbury, 1989; Gibson and Bradbury, 1985; Gibson, 1989, 1992, 1996; Gratson, 1993) so that constant noise could interfere with females' attraction to males' displays. Existing background noise in the project area in both states is expected to be similar to EPA's "farm in valley" noise category which is about 39 dBA in daytime and 32 dBA at night.

Noise levels associated with construction work and effects on sage grouse and other wildlife are unknown but can be inferred from limited available data. Reports indicate that mammals and birds will consistently escape from noises between 75 and 85 dBA (Golden *et al.*, 1980). Heavy machinery, such as scrapers and dozers, typically emit noise levels within the 75 to 85 dBA range at distances beyond 200 feet (Golden *et al.*, 1980). Noises associated with construction will be temporary impacts but those associated with train traffic will be long-term for the life of the project. Estimates of distances at which noise attenuation from train whistles and from locomotives pulling cars diminishes to background daytime noise levels ranges from 39,000 feet - 7.4 miles (whistles) to 23,000 feet - 4.4 miles (locomotives with cars). Attenuation distances are much greater for noise to diminish to nighttime background levels: 49,000 feet - 9.3 miles for whistles and 32,000 feet - 6.1 miles for locomotives pulling cars.

Noise levels of 60 dBA are comparable to EPA's "noisy urban residential" category and noise from locomotives pulling cars would reach that level at 5,700 feet - 1.1 mile from the tracks while whistle sound would attenuate to 60 dBA 3 miles away (16,000 feet). There are numerous sage grouse leks but fewer known sharp-tailed grouse leks within those distances of the proposed routes in both states. In addition, there are wild turkey roosts along the Cheyenne River in South Dakota and mourning doves that are likely to nest anywhere along the alternative routes. Wild turkey strutting and courtship areas during the toms' "gobbling" season exist throughout woody draws (for example, juniper woodlands on Wall Hill), the Cheyenne River corridor and riparian zones of tributaries in South Dakota including Battle Creek, Spring Creek, Rapid Creek and Box Elder Creek. Responses by these upland game bird species to the levels of noise associated with the proposed project can not be predicted but abandonment of areas within some distance of the railroad is likely.

Game birds can also be subject to direct mortality during construction and operation of the alternatives. Sage grouse, pheasants, wild turkeys, mourning doves and sharp-tailed grouse nest on the ground in situations varying in degrees of vegetation cover. Birds incubating eggs and broods of chicks would be killed if projected-related vehicles drove over nests. Birds could also be struck by trains as they are by vehicles on highways (Bennett, 1991).

Desert cottontails are most likely to be impacted during construction. Since they are relatively small and nocturnal, they are susceptible to being killed by vehicles. Once constructed, the railroad grade could be a barrier to cottontail movements, particularly with high train volumes. Since terrestrial furbearers are carnivores, they are likely to be attracted to carrion of big game and other wildlife killed by trains. Animals attracted to or feeding on the railroad are likely to likewise become casualties. As aquatic animals, river otter, beaver and muskrat could be adversely affected by accidental release of petroleum products; their abilities to thermoregulate are severely hampered if fur becomes coated with oil (McEwan *et al.*, 1974).

Nongame Wildlife

Raptors. Construction and operation activities could affect the productivity of nesting raptors in the project area. In their study of responses by nesting ferruginous hawks to human disturbances, White and Thurow (1985) concluded that 90 percent of all nesting adults would not flush from nests if the disturbance was more than 250 meters (820 feet) away. The researchers cautioned, though, that distances of effect would expand when prey are scarce, when ferruginous hawks must spend more time searching for prey and appear to be less tolerant of disturbances (White and Thurow, 1985).

Impacts to nesting golden eagles, prairie falcons, red-tailed hawks, northern harriers and American kestrels would be similar to those discussed for ferruginous hawks. However, all of these raptor species are somewhat adaptable to human disturbance: red-tailed hawks and golden eagles remained in home ranges when exposed to military training activities (Andersen *et al.*, 1990) and blasting did not adversely affect prairie falcon

productivity (Holthuijzen *et al.*, 1990). Parent birds can desert eggs or young but the potential for nest desertion varies between raptor species and is more likely early in the nesting season than after young have hatched (Suter and Jones, 1981). Other potential effects of disturbance include damage to eggs and young by frightened adults, cooling, overheating and loss of moisture from eggs or young if adult birds remain away from nests for too long, missed feedings of chicks, premature fledging of older nestlings, and increased exposure to predators if adults leave nests unattended (Fyfe and Olendorff, 1976; Grier and Fyfe, 1987).

Project activities are not expected to displace wintering golden eagles and rough-legged hawks from available hunting grounds. However, these species show greater flushing response to humans walking than to approaching vehicles and wintering rough-legged hawks when perched are most sensitive to vehicles within 550 feet while wintering golden eagles tended to not respond to vehicles (Holmes *et al.*, 1993). Impacts to wintering raptors are expected to be minor since prey is expected to remain available throughout the area. However, if they focused on carrion along the railroad, winter raptors could be killed such as described for bald eagles.

No impacts to peregrine falcons are anticipated since there is no documentation of their occurrence within the project area except infrequently during migrations. Peregrines could be migrants in the area but their occurrence near any project component under any alternative would indicate their tolerance for the activity. Peregrines occasionally consume waterfowl carrion (Buchanan, 1991) and there is an extremely remote possibility that a peregrine falcon could be killed while feeding on bird carcasses if they occur along the railroad where it parallels the Cheyenne River in South Dakota.

Other Nongame Wildlife. The only certain impact to other terrestrial wildlife by construction and operation of the alternatives is loss of vegetation and habitats. Effects would be especially acute for those species restricted to very limited habitats, including cottonwood-riparian, shrub-dominated woody draws, and coniferous woodlands in the project area. Passerine birds that are obligate shrub-steppe nesting species would be most affected by loss of shrubs and fragmentation of shrub-dominated habitats would be short- and long-term impacts to these birds and possibly to some small mammal species as well. In addition to lost habitat due to physical removal, noise associated with project construction and operation is expected to displace nongame species from physically undisturbed habitats adjacent to the railroad. The extent to which displacement occurs is unknown for any of the species likely to be present.

The degree to which anticipated noise levels displace game and non-game birds from habitats adjacent to the railroad is unknown and undoubtedly varies by species and local conditions. Abandonment of occupied habitats within some distance of the railroad is likely, particularly by nesting birds. For example, densities of nesting birds inhabiting woodlands begins to decline when noise levels form highways reach 42 dBA and densities of grassland species declines when noise levels reach 48 dBA (Forman and Alexander, 1998). For noise of locomotives pulling cars, attenuation to 48 dBA may not occur for over 2.5 miles while attenuation to 42 dBA may be over 4 miles (see data in Table 2-6). Sound attenuation though, is likely to be greater in woods than grasslands and the distance of noise effects on breeding birds will probably be greater in grasslands than in woodlands.

Aquatic Resources. There are no important trout fisheries where the proposed project and any of the alternatives cross or parallel the Cheyenne River and its tributaries in Wyoming and South Dakota. Warm water game fish species are mostly present in South Dakota and include black bullhead, channel catfish, sauger, bluegill, green sunfish, and freshwater drum as well as those preferring cooler water (white bass, smallmouth bass, northern pike and sauger-walleye hybrid or saugeye). Many of these species are tolerant of relatively high turbidity that periodically occurs in the Cheyenne River and also tolerant of low or no flows in the river during summers of drought years. Because of frequent limited flows below Angostura Reservoir, channel catfish are the principal recreational fishery there (USFWS, 1993a). In the region, Angostura Reservoir is the most important fishery with a variety of introduced game fish (largemouth and smallmouth bass, walleye, black crappie, northern pike, channel catfish, yellow perch, rock bass and green sunfish). Degradation to water quality by erosion and/or discharge of toxic compounds would be a significant impact to the Angostura Reservoir fishery.

4.18.3 Alternative A (No Action). Implementation of the No Action Alternative would eliminate project-related impacts to wildlife that have been described, above. However, impacts described as secondary or indirect in Table 4-10 would be expected to continue with any additional population growth in the region.

4.18.4 Alternative B (Proposed Action)

4.18.4.1 Short-Term Impacts

Big Game. Estimates of linear distances associated with Alternative B within Wyoming big game seasonal ranges are provided in Table 3-88. Pronghorn yearlong ranges (YRL) in 3 herd units (Highlight, Thunder Basin and Lance Creek) are most affected by Alternative B with 109.3 miles of the herd units crossed. Although there are

no pronghorn crucial winter ranges that would be affected by Alternative B, the alternative would cross 39.6 miles of ranges used during winter and throughout the year (WYL) and 2.3 miles of severe winter relief range (SWR) in the Lance Creek Herd Unit. SWR ranges are used by that pronghorn population during extremely severe winter conditions.

Alternative B would also affect 123.5 miles of YRL range and 11.0 miles of WYL range used by mule deer in the Thunder Basin Herd Unit but only 3.7 miles would coincide with white-tailed deer YRL ranges. A total of 31.9 miles of Alternative B would affect elk ranges in the Rochelle Hills Herd Unit. While no elk calving or parturition areas would be directly affected by construction of Alternative B, 0.4 miles would pass through elk crucial winter range, 9.7 miles through winter-yearlong range, and 21.8 miles through ranges used throughout the year (YRL).

During the calving (parturition) period, elk cows are especially sensitive to disturbance and will move to 0.75 mile away or farther from preferred calving sites if subjected to construction workers and equipment (Brekke, 1988). Approximately 9.9 miles of Alternative B would pass within 0.75 mile of known elk parturition ranges.

In Wyoming, big game WYL and parturition ranges are classified as "high", no net loss of habitat function is recommended although loss of function may be mitigated through habitat improvements elsewhere. Crucial ranges, however, are "vital": No loss of habitat function is acceptable so that species (here, elk) supported by the habitat are unchanged (see Table 4-9). Passage of Alternative B through crucial elk winter range, pronghorn and mule deer WYL range, and proximity to elk parturition ranges would be expected to impose significant impacts to those habitats over the short-term. Poaching (illegal harvest) would be an additional short-term impact to big game that could be committed by individuals in the temporary work force.

Collisions of big game with construction vehicles are possible short- and long-term impacts. Although locations of big game migration corridors are unknown in Wyoming and South Dakota, mortalities would be most likely where concentrations of animals coincide with construction activities and where animals move across the construction right-of-way as they travel between seasonally used ranges. In Wyoming, most big game mortalities are expected to occur within the portion of Alternative B that crosses 10.1 miles of elk crucial WIN and WYL ranges, 11.0 miles of mule deer WYL range and 39.6 miles of pronghorn WYL range, and within 2.3 miles of pronghorn SWR range during particularly severe winter weather. Similarly, 12 miles of construction in Custer County, South Dakota would occur within pronghorn winter ranges and pronghorn mortalities would be most likely occur there. Because mule deer and white-tailed deer ranges are used yearlong, mortalities due to collisions with vehicles would probably occur throughout, albeit not in concentrations that are expected to occur in deer WYL ranges in Wyoming.

Big game ranges affected by Alternative B in South Dakota are provided in Table 3-92. Available information indicates that 12.2 miles of this alternative would pass through pronghorn winter ranges and 10.4 miles would affect pronghorn yearlong ranges in Custer County. Approximately 2.4 miles of Alternative B would affect pronghorn winter ranges in Pennington County. Undoubtedly, Alternative B would also affect pronghorn seasonal ranges in Fall River County but apparently not those that are used by significant numbers of animals. Mule deer and white-tailed deer ranges used throughout the year would also be affected by Alternative B in each of the South Dakota counties (see Table 3-92) with 135 miles of the alternative passing through winter and/or yearlong ranges used by one or both deer species.

Waterfowl, Upland Game Birds, Furbearers, Small Game. The portion (in miles) of Alternative B that is within 0.5 mile and 1 mile of the Cheyenne River and tributaries (see Table 4-11) and number of sites and total distance where Alternative B would be within 500 feet of the Cheyenne River and its tributaries (see Table 4-13) in Wyoming and South Dakota provide some indication of the level of impact construction could have to waterfowl inhabiting these drainages. Approximately 129 miles of Alternative B would be within 1 mile of a perennial stream or river, 85 miles would be within 0.5 mile, and 22 miles would be within 500 feet of these. There is no information about the levels of actual waterfowl use of these drainages but observations indicate they are used by various species during migrations and for nesting.

There are 2 known sage grouse lek within 0.25 mile and 26 within 2.0 miles of Alternative B in Wyoming (see Table 4-38). Likewise there are 2 sage grouse or sharp-tailed grouse leks within 0.25 mile and 30 leks within 2.0 miles of this alternative in South Dakota (see Table 4-38). Short-term construction surface disturbances and associated noise occurring when sage grouse and sharp-tailed grouse are attending leks could inhibit courtship and reproduction, especially on leks that are 0.25 mile away or less but noise could possibly affect birds on leks as far away as 2 miles or farther. Also, grouse nesting habitats within 2.0 miles of leks could be adversely affected by construction noise.

In South Dakota, wild turkeys utilize the riparian zones along the Cheyenne River and its tributaries during courtship: 8 "gobbling" toms with harems were observed within 0.5 to 1 mile of Alternative B during 1999 aerial

Table 4-38 Number of Known Sage Grouse and Sharp-tailed Grouse Leks Within Various Distances of Alternative B in Wyoming and South Dakota					
State and Managed Area	**Grouse Species**	**Number of Leks**			
		0.25 mile	**2.0 miles**	**4.4 miles**	**6.1 miles**
Wyoming - Upland and Small Game Management Areas					
USGMA 36 Niobrara	Sage Grouse	1	6	12	14
	Sharp-tailed Grouse	0	0	0	0
	Not Identified	0	0	0	0
	Total	1	6	12	14
USGMA 39 Belle Fourche	Sage Grouse	1	20	32	35
	Sharp-tailed Grouse	0	0	0	0
	Not Identified	0	0	0	0
	Total	1	20	32	35
South Dakota - Counties:					
Fall River	Sage Grouse	0	12	12	13
	Sharp-tailed Grouse	0	0	0	0
	Not Identified	0	0	0	1
	Total	0	12	12	14
Custer	Sage Grouse	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0
	Not Identified	0	6	12	13
	Total	0	6	12	13
Pennington	Sage Grouse	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0
	Not Identified	2	12	14	14
	Total	2	12	14	14
Alternative B Total		4	56	82	90

surveys for raptors. More than those gobbling sites probably occur along the route, however. There are approximately 76 miles of Alternative B within 1 mile of the Cheyenne River and tributaries, while 51 miles are within 0.5 mile and 21 miles are within 500 feet of these drainages. The response of wild turkeys during courtship and nesting to construction activities and noises are unknown but impacts, if they occur, will most likely be at sites proximate to or through riparian zones and ponderosa pine-juniper woodlands. Nesting wild turkeys, sage grouse, pheasants, mourning doves and sharp-tailed grouse could be impacted by construction within the various undisturbed habitats that occur along the alternative.

Short-term impacts to furbearers and small game include habitat loss and direct mortality from construction machinery. Poaching (illegal harvest) would be an additional short-term impact to waterfowl, upland game birds, furbearers and small game species that could be committed by individuals in the temporary work force.

Raptors. Available data indicates there are 71 raptor nests within 0.5 mile of Alternative B in Wyoming and 12 nests within that distance of Alternative B in South Dakota (see Table 3-108). Most of the definable potential nesting habitats for golden eagles, red-tailed hawks, Swainson's hawks, and great horned owls are in trees associated with the Cheyenne River and tributaries. Nearly 85 miles of Alternative B would pass within 0.5 mile of potential nesting habitats in those riparian zones in both states (see Tables 4-11 and 4-39).

Raptors nesting within 0.25 mile of the alternative are most likely to be adversely affected by short-term construction impacts during the nesting season. In South Dakota, there are 5 red-tailed hawk nests within 0.25 mile of Alternative B but in Wyoming, there are 7 red-tailed hawk nests, 5 golden eagle nests, 1 great horned owl nest, and 17 ferruginous hawk nests within that distance (see Table 4-39). Of those species, ferruginous hawks are most likely to abandon nests if disturbed during the nesting period since they are more sensitive to disturb-

Table 4-39 Number of Known Raptor Nests Within Varying Distances from Alternative B in Wyoming and South Dakota										
State	Distance (miles)	Number of Nests for Each Species within Distance (1)								
		GE	FH	RT	SW	PF	KE	GHO	BO	Other
Wyoming	0.25	5	17	7	1	0	0	1	0	2
	0.50	10	34	13	2	0	0	8	0	4
	1.0	17	46	20	2	1	0	14	0	4
South Dakota	0.25	0	0	5	0	0	0	0	0	1
	0.50	0	0	9	0	0	0	0	0	3
	1.0	0	0	13	0	0	0	0	0	4

1 = Species coeds are: GE, golden eagle; FH, ferruginous hawk; RT, red-tailed hawk; SW, Swainson's hawk; PF, prairie falcon; KE, American kestrel; GHO, great horned owl; BO, burrowing owl; Other includes northern harrier, long-eared owl, short-eared owl, and unknown species.

ance than other species. However, many ferruginous hawk nests and nests of other species that are within 0.25 mile of the alternative have not been active recently. As evident in Table 4-39, there are many more raptor nests within distances of 0.5 and 1 mile from the proposed route and it is possible that some of those more distant nest could be affected either during construction or during the long-term project operation. Nests closest to the alternative could be most at-risk if individuals in the temporary work force were involved in illegal shooting, an additional potential short-term impact to raptors.

Other Nongame Wildlife. Short-term disturbances to nongame birds, mammals, amphibians and reptiles would occur during construction as vegetation and other habitat features are destroyed at construction sites. Data collected from NBS breeding bird surveys indicate that riparian zones associated with the Cheyenne River and its tributaries tend to support a large number of nongame bird species (see Table 3-98). Approximately 7 miles of Alternative B would pass through forested (3.4 miles) and non-forested (3.5 miles) wetlands that are associated with riparian habitats, but all are within South Dakota. Coniferous woodlands also support a relatively high diversity of nongame bird species. Nearly 2.4 miles of Alternative B would affect evergreen forested lands, again all in South Dakota.

In addition to short-term impacts due to disturbances within occupied habitats, terrestrial nongame species are also likely to be killed by construction vehicles within work zones and possibly off-site by personnel vehicles en route to construction sites.

Aquatic Resources There are 177 total sites where Alternative B is within 500 feet of the Cheyenne River and perennial tributary streams in Wyoming and South Dakota (see Table 4-13). Alternative B would pass within 500 feet of these drainages for a total of 21.9 miles. These sites are believed to be those most likely where sediments and/or accidentally released toxic compounds could be discharged into the Cheyenne River system, both in the short- and long-term.

4.18.4.2 Long-Term Impacts. Long-term impacts due to the presence, operation and maintenance of Alternative B to game and nongame wildlife are expected to be similar to short-term impacts, described above. They include direct mortality by trains and maintenance vehicles, species' avoidance of habitats that are near the tracks, and potential long-term deterioration of habitats, especially aquatic habitats at sites subject to sediment discharge and accidental release of toxic substances and aquatic habitats downstream.

For the life of the project, there is the potential for direct mortalities to terrestrial vertebrates by trains. Big game are likely to be killed by trains, especially where the tracks cross wintering areas and migration corridors, sites where pronghorn, mule deer, white-tailed deer and elk are concentrated and/or would be more likely to cross the tracks. Although specific big game migration pathways are not known, Alternative B would cross through 41.9 miles of pronghorn WYL and SWR ranges, 11.0 miles of mule deer WYL ranges, and 10.1 miles of elk crucial WIN and WYL ranges in Wyoming. In South Dakota, 14.6 miles of Alternative B would cross through pronghorn winter ranges in Custer and Pennington counties and also for some distance in Fall River County. In addition to being areas where big game mortalities are expected, impacts from Alternative B to these seasonal ranges include physical loss of habitats and habitat fragmentation over the long-term. Such long-term impacts are expected to reduce the functions of those habitats so that they may not provide as much food and shelter to wintering big game as they do currently. Loss of function in these habitats from Alternative B would be a significant impact to big game.

In addition to lost habitats, big game in both states will be impacted over the long-term by fencing on one or both sides of the railroad. Depending on design, fencing will impede if not prohibit pronghorn movements. Mule deer, white-tailed deer, and occasionally elk and pronghorns will jump over typical range fences but sometimes individuals of each species become entangled in fences and inevitably die. Fenced right-of-way increases habitat fragmentation by limiting animals' movements, whether daily or seasonally, from one habitat to another or to access a limited resource. On a daily time scale, fencing will limit big game from accessing water - a limited resource - from the Cheyenne River and tributaries where Alternative B parallels these drainages in both states. On a seasonal scale, fencing will limit big game migrations from summer to winter ranges thereby rendering parts or all of winter range inaccessible. Alternatively, if fences retain big game on winter ranges too long, they may over-utilize vegetation there and reduce the amount of forage needed by wintering animals. In either case, the habitat function of winter ranges will be diminished.

Noise due to train traffic is expected to be a long-term impact to some species. Background noise on the project area in both states is similar to EPA's "farm in valley" noise category which is about 39 dBA in daytime and 32 dBA at night. Estimates of distances at which noise attenuation from train whistles and from locomotives pulling cars diminishes to background daytime noise levels ranges from 7.4 miles for whistles to 4.4 miles for locomotives pulling cars. Attenuation distances are much greater for noise to diminish to nighttime background levels: 9.3 miles for whistles and 6.1 miles for locomotives pulling cars. Locations of where whistles would be sounded in relation to wildlife habitats are unknown so estimates of noise disturbances associated with trains moving on tracks are the only component analyzed for long-term effects.

If sage grouse and sharp-tailed grouse are sensitive to noise above background levels during courtship on leks, grouse on leks may be affected from 4.4 miles up to 6.1 miles away from the railroad. These are computed distances at which noise from locomotives pulling cars would attenuate to expected background levels during the day and night, respectively. There are 44 known leks within 4.4 miles and 49 known leks within 6.1 miles of Alternative B in Wyoming and 38 to 41 grouse leks within those distances in South Dakota (see Table 4-38) and which could be impacted by noise during train operations.

The degree to which these anticipated noise levels displace species is unknown and undoubtedly varies by species and local conditions. Abandonment of occupied habitats within some distance of the railroad is likely, particularly by nesting birds. For example, densities of nesting birds inhabiting woodlands begins to decline when noise levels form highways reaches 42 dBA and densities of grassland species declines when noise levels reach 48 dBA (Forman and Alexander, 1998). For noise of train locomotives pulling cars, attenuation to 48 dBA may not occur for over 2.5 miles while attenuation to 42 dBA may be over 4 miles (see data in Table 2-6). Sound attenuation though, is likely to be greater in woods than grasslands and the distance of noise effects on breeding birds will probably be greater in grasslands than in woodlands. Whether noise from relatively infrequent train traffic causes decreased densities of birds comparable to the effects of noise on high traffic volume highways is unknown; traffic volume on highways influences bird densities as well as noise (Forman and Alexander, 1998). In Wyoming, Alternative B would pass through 128 miles of grasslands (herbaceous rangeland) and 14.6 miles of sagebrush steppe (shrub and brush rangeland, mixed rangeland) as well as 113 of grasslands in South Dakota. If noise from operating trains causes lower densities of grassland bird species within some distance from the railroad, nearly 250 miles of grasslands and sagebrush steppe could be affected.

Foxes, raptors, and other carnivores and scavengers that are game (weasels, badgers, mountain lions in Wyoming) and nongame (coyotes, magpies) species are those most likely to feed on carrion of other animals that are killed by trains. These scavengers could be drawn near to the tracks, thereby increasing their risk of being killed. Locations and numbers of mortalities are impossible to estimate except where tracks would intersect suitable habitats that are known to be used or may potentially be used. Those high risk areas include where tracks intersect prairie dog colonies and big game wintering ranges or other ranges where big game animals congregate and cross tracks. Potential indirect long-term impacts to ground nesting birds (waterfowl, upland game birds, numerous passerine birds) could also occur if predators are drawn to a nesting area because of nearby carrion concentrations along tracks.

Long-term impacts to habitats used by terrestrial and aquatic species due to surface disturbances are expected to be similar to those described under short-term impacts, above. However, once construction machinery is with-drawn from the construction sites and revegetation is successful, the total amount of some habitats affected by surface disturbance is expected to be less over the long-term. Some species of birds that nest in grasslands may utilize revegetated portions of the right-of-way. However, if that vegetation is mowed or sprayed with herbicides during maintenance or if fires were ignited by sparks from train operations, nesting bird species and others inhabiting the right-of-way would be impacted throughout the life of the project.

Long-term runoff of sediments and toxic compounds could impact aquatic organisms downstream in much the same way as described under short-term impacts. Those same sites that were evaluated in Table 4-13 are likely to be those where chronic discharges occur with risk to game and nongame fish as well as amphibians and other aquatic animals. Over 22 miles of Alternative B would be within 500 feet of rivers and perennial streams in both states, combined.

Surface disturbance associated with the completed rail bed and rail sidings through habitats utilized by game and nongame wildlife species would be irretrievably lost to those species' uses. Direct mortality of any of these species would constitute an irreversible loss of a resource. For species' habitats not directly affected by mortality or habitat loss by surface disturbance, effects of human activities associated with construction and operational actions and noise associated with trains could cause long-term avoidance of habitats adjacent to Alternative B. Those habitats, however, would probably be eventually utilized once the project is abandoned, assuming that species would reoccupy those areas in the future.

4.18.4.3 Forest Plan Consistency Review

Existing Nebraska Forest Plan. Wildlife MIS identified on BGNG include pronghorn antelope, mule deer, sharp-tailed grouse, black-footed ferrets and wild turkey. Effects of Alternative B on black-footed ferrets were discussed previously. Nebraska Forest Plan management area prescriptions that would be affected by Alternative B are provided in Table 1-2 and discussed in detail in Table 1 through Table 5 in Appendix A. Estimates of where and how much of Alternative B would impact known or potential habitats utilized by MIS species are provided in Table 4-40.

Alternative B would cross approximately 7 miles of pronghorn ranges and 31.5 miles of mule deer and white-tailed deer ranges within BGNG in Custer and Pennington counties. No sharp-tailed grouse leks are known to be within distances up to 1 mile from Alternative B on BGNG. However, leks possibly do occur proximate to the 15.3 miles of herbaceous rangeland in BGNG that would be affected by Alternative B. And wild turkey gobbling sites and roosts may be present in BGNG particularly near the 0.8 mile of forested riparian vegetation that would be affected.

Existing Medicine Bow Forest Plan. Wildlife MIS identified on TBNG include featured species (pronghorn antelope, mule deer, elk), recovery species (bald eagle, black-footed ferret, and peregrine falcon), and ecological indicator species (prairie vole, black-tailed prairie dog, yellow-breasted chat, sage grouse, golden eagle, Brewer's sparrow, willow flycatcher, mountain plover, upland sandpiper, ferruginous hawk, red crossbill, house wren, long-billed curlew, red-headed woodpecker, and Woodhouse's toad). Management requirements on the Medicine Bow National Forest and TBNG related to recovery species and many of the ecological indicator species that are identified as sensitive were discussed above.

It is likely that Alternative B would not comply with the Forest Plans' standards and guidelines restrictions pertaining to ferruginous hawks since 6 nests within TBNG would be within 0.25 mile of Alternative B. Similarly, Alternative B would pass within 1 mile of 3 sage grouse leks on TBNG As discussed in Chapter 2, at peak operation nearly 40 coal trains would pass along the track daily. Train traffic would occur 24 hours a day. Consequently, sage grouse nesting habitats could be adversely affected by noise, train movements, and removal of shrub-dominated vegetation that is a key habitat component for nesting sage grouse. Alternative B could affect habitat capabilities for several MIS that potentially inhabit riparian zones along Little Thunder Creek, particularly nesting raptors.

Alternative B is not expected to decrease habitat capability for big game species on TBNG to below levels needed to support the State of Wyoming population goals for each species. Pronghorn, mule deer, white-tailed deer and elk are the only MIS with state population goals. Alternative B would, however, affect seasonal ranges used by different big game species on TBNG (see Table 3-88). The following pronghorn seasonal ranges on TBNG would be affected: 17 miles of WYL, 17 miles of YRL and 2 miles of SWR. For mule deer 5 miles of WYL and 28 miles of YRL would be affected on TBNG while 1 mile of white-tailed deer YRL would be crossed. Elk ranges affected by Alternative B on TBNG include 0.3 mile of crucial WIN, 3 miles of WYL and 13 miles of YRL ranges.

Medicine Bow Forest Plan management area prescriptions that would be affected by Alternative B are provided in Table 1-2 and discussed in detail in Table 6 through Table 12 in Appendix A. Estimates of where and how much of Alternative B would impact known or potential habitats utilized by management indicator species are provided in Table 4-41.

Northern Great Plains Management Plans Revision. Recently proposed grassland management area prescriptions under the proposed grassland plans for TBNG and BGNG that would be affected by Alternative B are provided in Table 1-2 and discussed in detail in Table 13 through Table 23 in Appendix A.

Table 4-40 Miles of Alternative B That Affect Land Use Cover Types (Potential Wildlife Habitats) That May Be Inhabited by the Forest Service Management Indicator Species on BGNG in South Dakota			
Land Use Cover Types Potential Wildlife Habitats	**Miles**	**Forest Service Management Indicator Species Possibly Occurring in Land Use Cover Types on BGNG**	**Potential for Impacts to Species by Alternative B (1)**
Cropland, Pasture	None	Antelope, Mule Deer, Sharp-tailed Grouse, Wild Turkey	No
Other Agricultural Land	None	Antelope, Mule Deer, Sharp-tailed Grouse, Wild Turkey	No
Herbaceous Rangeland	15.3	Antelope, Sharp-tailed Grouse	Yes
Shrub and Brush Rangeland	None	Antelope, Mule Deer, Sharp-tailed Grouse, Wild Turkey	No
Mixed Rangeland	None	Antelope, Mule Deer, Sharp-tailed Grouse, Wild Turkey	No
Deciduous Forest Land	None	Mule Deer, Wild Turkey	No
Evergreen Forest Land	None	Mule Deer, Wild Turkey	No
Forested Wetlands	0.8	Mule Deer, Wild Turkey	Limited
Nonforested Wetlands	0.2	Antelope, Mule Deer, Sharp-tailed Grouse, Wild Turkey	Limited
Bare Exposed Rock	None	None	No

1 = Potential for impacts by Alternative B were judged as:
No: the Land Use Cover Type is not affected by the alternative
Limited: the alternative passes through the Land Use Cover Type for less than one mile, impact potential to management indicator species is possible but unlikely.
Yes: the alternative will pass through the Land Use Cover Type for more than one mile and the management indicator species are known to occur on BGNG in that cover type.

The proposed grassland management plan specifies standards and guidelines that would be applicable to species at-risk as well as game and nongame wildlife species and fisheries. The applicability of those standards and guidelines to implementation of the new railroad alternatives is discussed in Table 13 in Appendix A. Conflicts between Alternative B and wildlife management on TBNG and BGNG have been analyzed in that table.

4.18.5 Alternative C (Modified Proposed Action)

4.18.5.1 Short-Term Impacts

Big Game. Estimates of linear distances affected by Alternative C during construction in Wyoming big game seasonal ranges are provided in Table 3-89. Nearly 88 miles of pronghorn yearlong ranges (YRL) in 2 herd units (Highlight and Lance Creek) would be crossed by the alternative. Although there are no pronghorn crucial winter ranges crossed by this alternative, 41 miles of ranges used during winter and throughout the year (WYL) and 2.4 miles of SWR range in the Lance Creek Herd Unit would be crossed. For the most part, Alternative C would affect pronghorn ranges in Wyoming similarly or slightly less than Alternative B, but only 2 herd units would be affected compared to 3 affected by Alternative B.

Alternative C would also cross 103.4 miles of YRL range and 9.0 miles of WYL range used by mule deer in the Thunder Basin Herd Unit but only 1.4 miles would coincide with white-tailed deer YRL range. Alternative C is expected to have slightly less impact to mule deer and white-tailed deer in the Thunder Basin Herd Unit than Alternative B.

A total of 28.6 miles of Alternative C would cross elk ranges in the Rochelle Hills Herd Unit. While no elk calving or parturition areas would be crossed by Alternative C, 2.5 miles would pass through elk crucial WIN range. However, that portion of Alternative C would be within an existing railroad corridor and, except for the increased volume of trains, would not represent a new impact to elk crucial WIN. However, elk may disperse from the range because of increased traffic. Nearly 5 miles of Alternative C would go through elk WYL range, and 21 miles would pass through YRL ranges. Alternative C would impact less elk crucial WIN range than Alternative B because surface disturbances would be contained within already disturbed land. Alternative C would affect nearly the same amount of elk YRL ranges as Alternative B but less WYL range.

During the calving (parturition) period, elk cows are especially sensitive to disturbance and will move to 0.75

Table 4-41
Miles of Alternative B That Affect Land Use Cover Types (Potential Wildlife Habitats) That May Be Inhabited by Forest Service Management Indicator Species (Featured Species and Some Ecological Indicator Species) on TBNG in Wyoming

Land Use Cover Types Potential Wildlife Habitats	Miles	Forest Service Management Indicator Species Possibly Occurring in Land Use Cover Types on TBNG	Potential for Impacts to Species by Alternative B (1)
Cropland, Pasture	0.7	Antelope, Mule Deer, Prairie Vole, Black-tailed Prairie Dog, Golden Eagle, Upland Sandpiper, Mountain Plover, Longbilled Curlew	Limited
Other Agricultural Land	None	Prairie Vole, Upland Sandpiper, Mountain Plover, Longbilled Curlew	No
Herbaceous Rangeland	34.5	Antelope, Mule Deer, Elk, Prairie Vole, , Black-tailed Prairie Dog, Golden Eagle, Ferruginous Hawk, Upland Sandpiper, Mountain Plover, Longbilled Curlew	Yes
Shrub and Brush Rangeland	0.1	Antelope, Mule Deer, Elk, Prairie Vole, Black-tailed Prairie Dog, Sage Grouse, Golden Eagle, Brewer's Sparrow, Ferruginous Hawk	Limited
Mixed Rangeland	0.2	Antelope, Mule Deer, Elk, Prairie Vole, Black-tailed Prairie Dog, Sage Grouse, Golden Eagle, Brewer's Sparrow, Ferruginous Hawk, Mountain Plover	Limited
Deciduous Forest Land	None	Mule Deer, Elk, Golden Eagle, House Wren, Red-headed Woodpecker	No
Evergreen Forest Land	None	Mule Deer, Elk, Golden Eagle, Red Crossbill, Red-headed Woodpecker	No
Forested Wetlands	None	Mule Deer, Elk. Golden Eagle, Willow Flycatcher, House Wren, Red-headed Woodpecker, Woodhouse's Toad	No
Nonforested Wetlands	None	Mule Deer, Elk, Yellow Breasted Chat, Willow Flycatcher, Woodhouse's Toad	No
Bare Exposed Rock	None	Golden Eagle, Ferruginous Hawk	No

1 = Potential for impacts by Alternative B were judged as:
No: the Land Use Cover Type is not affected by the alternative
Limited: the alternative passes through the Land Use Cover Type for less than one mile, impact potential to management indicator species is possible but unlikely.
Yes: the alternative will pass through the Land Use Cover Type for more than one mile and the management indicator species are known to occur on TBNG in that cover type.

mile away or farther from preferred calving sites if subjected to construction workers and equipment (Brekke, 1988). Alternative C would not pass within 0.75 mile of any known elk parturition ranges. However, construction of Alternative C through crucial elk WIN range and pronghorn and mule deer WYL range would be expected to result in significant impacts to those habitats over the short-term. Poaching (illegal harvest) would be an additional short-term impact to big game that could be committed by individuals in the temporary work force.

Collisions of big game with construction vehicles are possible short-term and long-term impacts. In Wyoming, most big game mortalities are expected to occur within the portion of Alternative C that crosses 7 miles of elk crucial WIN and WYL ranges, 9 miles of mule deer WYL range and 41 miles of pronghorn WYL range, and within 2.4 miles of pronghorn SWR range during particularly severe winter weather. Except for potential effects to pronghorn on WYL ranges, these estimates of extent for potential big game mortalities are less than estimates made for Alternative B.

Pronghorn winter ranges would be affected by 14 miles of construction in Custer and Pennington counties, South Dakota and pronghorn mortalities would be most likely to occur there. That is nearly the same as the estimated effects of Alternative B on pronghorn winter ranges. Alternative C would also cross 33 miles of winter ranges used by mule deer and white-tailed deer in all South Dakota counties. Additional areas in South Dakota that are used by mule deer and white-tailed deer yearlong would be crossed for 70 miles (see Table 3-94), less than the possible effects by Alternative B.

Waterfowl, Upland Game Birds, Furbearers, Small Game. The distance (in miles) that Alternative C is within 0.5 mile and 1 mile of the Cheyenne River and tributaries (see Table 4-17) and number of sites and total distance where Alternative C would be within 500 feet of the Cheyenne River and its tributaries (see Table 4-19) in Wyoming and South Dakota provide some indication of the level of impact construction could have to waterfowl using those drainages during nesting and/or migration. Approximately 93 miles of Alternative C would be within

1.0 mile of a perennial stream or river, 58 miles would be within 0.5 mile, and 21 miles would be within 500 feet of these. Each of these zones of potential effects to waterfowl is less than estimates made for Alternative B.

There are 2 known sage grouse leks within 0.25 mile and 19 within 2 miles of Alternative C in Wyoming (see Table 4-42). Likewise, there are 4 sage grouse or sharp-tailed grouse leks within 0.25 mile and 34 leks within 2 miles of this alternative in South Dakota (see Table 4-42). Short-term construction surface disturbances and associated noise occurring when sage grouse and sharp-tailed grouse are attending leks could inhibit courtship and reproduction, especially on leks that are 0.25 mile away or less but noise could possibly affect birds on leks as far away as 2 miles or farther. Also, grouse nesting habitats within 2.0 miles of leks could be adversely affected by construction noise.

In South Dakota, wild turkeys utilize the riparian zones along the Cheyenne River and its tributaries during courtship: 6 "gobbling" toms with harems were observed within 0.5 to 1 mile of Alternative C during 1999 aerial surveys for raptors. More than those surely occur along the alternative, however. There are approximately 46 miles of Alternative C within 1 mile of the Cheyenne River and tributaries, while 25 miles are within 0.5 mile and 19 miles are within 500 feet of these drainages, areas with potential habitat for use by wild turkeys during courtship and nesting in South Dakota. Intersection of Alternative C with each of these zones of potential effects to turkeys is less than estimates made for Alternative B.

Short-term impacts to furbearers and small game are the same as discussed for Alternative B. No quantitative, comparative evaluations of potential impacts to furbearers and small game can be made among alternatives.

Raptors. Available data indicates there are 67 raptor nests within 0.5 mile of Alternative C in Wyoming and 12 nests within that distance of Alternative C in South Dakota (see Table 4-43). Most of the definable potential nesting habitats for golden eagles, red-tailed hawks, Swainson's hawks, and great horned owls are in trees associated with the Cheyenne River and tributaries. Over 58 miles of Alternative C would pass within 0.5 mile of potential nesting habitats in those riparian zones in both states (see Table 4-17) compared to 85 miles similarly affected by Alternative B (see Table 4-11).

Other Nongame Wildlife. Short-term disturbances to nongame birds, mammals, amphibians and reptiles would occur during construction as vegetation and other habitat features are destroyed within construction sites. Data collected from NBS breeding bird surveys indicate that riparian zones associated with the Cheyenne River and its tributaries tend to support a large number of nongame bird species (see Table 3-98). Approximately 6 miles of Alternative C would pass through forested (1.8 miles) and non-forested (4.3 miles) wetlands that are associated with riparian habitats, but all are within South Dakota. Coniferous woodlands also support a relatively high diversity of nongame bird species. Three miles of Alternative C would affect evergreen forested lands in South Dakota and 0.3 mile would pass through evergreen forest in Wyoming. Fewer miles of Alternative C would affect wetlands than Alternative B but Alternative C would affect slightly more evergreen forests in South Dakota and Wyoming.

Generally, there have been more nongame bird species observed in grasslands than in shrublands (see Table 3-98) in both states. In Wyoming, over 110 miles of Alternative C would pass through grasslands (18 fewer miles than Alternative B passing through herbaceous rangeland) while 11 miles would affect shrublands (3 fewer miles than Alternative B passing through shrub/brush rangelands and mixed rangelands). Alternative C would pass through 110 miles of grasslands in South Dakota (3 miles less than Alternative B) but would not coincide with any shrublands there. Although the differences are not great, construction of Alternative C is expected to have slightly less impact to breeding birds than Alternative B simply because there would be less disturbance in grasslands and less noise effects to those grassland species.

Aquatic Resources. There are 206 total sites (29 more than Alternative B) where Alternative C is within 500 feet of the Cheyenne River and perennial tributary streams in Wyoming and South Dakota (see Table 4-19). Alternative C would pass within 500 feet of these drainages for a total of 20.8 miles. These sites are believed to be those most likely where sediments and/or accidentally released toxic compounds could be discharged into the Cheyenne River system, both in the short-term and long-term.

4.18.5.2 Long-Term Impacts. Long-term impacts due to the presence, operation and maintenance of Alternative C to game and nongame wildlife are expected to be similar to short-term impacts described for Alternative B.

Raptors nesting within 0.25 mile of the alternative are most likely to be adversely affected by short-term construction impacts during the nesting season. In South Dakota, there are 6 red-tailed hawk nests, 2 golden eagle nests, and 1 great horned owl nest all within 0.25 mile of Alternative C. But in Wyoming, there are 7 red-tailed hawk nests, 6 golden eagle nests, 2 great horned owl nests, 1 Swainson's hawk nest and 22 ferruginous hawk nests within that distance (see Table 4-43). Alternative

Table 4-42
Number of Known Sage Grouse and Sharp-tailed Grouse Leks Within Various Distances of Alternative C in Wyoming and South Dakota

State and Managed Area	Grouse Species	Number of Leks within Distance			
		0.25 mile	2.0 miles	4.4 miles	6.1 miles
Wyoming - Upland and Small Game Management Areas					
USGMA 36 Niobrara	Sage Grouse	0	6	9	14
	Sharp-tailed Grouse	0	0	0	0
	Not Identified	0	0	0	0
	Total	0	6	9	14
USGMA 39 Belle Fourche	Sage Grouse	2	13	26	31
	Sharp-tailed Grouse	0	0	0	0
	Not Identified	0	0	0	0
	Total	2	13	26	31
South Dakota - Counties:					
Fall River	Sage Grouse	1	11	12	13
	Sharp-tailed Grouse	0	0	0	0
	Not Identified	0	1	1	2
	Total	1	12	13	15
Custer	Sage Grouse	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0
	Not Identified	1	10	12	13
	Total	1	10	12	13
Pennington	Sage Grouse	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0
	Not Identified	2	12	14	14
	Total	2	12	14	14
Alternative C Total		6	53	74	87

Table 4-43
Number of Known Raptor Nests Within Varying Distances from Alternative C in Wyoming and South Dakota

State	Distance From (miles)	Number of Nests for Each Species within Distance (1)								
		GE	FH	RT	SW	PF	KE	GHO	BO	Other
Wyoming	0.25	6	22	7	1	0	0	2	0	2
	0.50	11	34	10	2	0	0	6	1	3
	1.0	21	56	20	2	1	0	12	2	4
South Dakota	0.25	2	0	6	0	0	0	1	0	0
	0.50	2	0	7	0	0	0	2	0	1
	1.0	2	0	11	0	0	0	2	0	2

1 = Species coeds are: GE, golden eagle; FH, ferruginous hawk; RT, red-tailed hawk; SW, Swainson's hawk; PF, prairie falcon; KE, American kestrel; GHO, great horned owl; BO, burrowing owl; Other includes northern harrier, long-eared owl, short-eared owl, and unknown species.

C would affect more known raptor nests than Alternative B within 0.25 miles of the alternatives.

There are many more raptor nests within distances of 0.5 and 1 mile from the alternative and it is possible that some of those more distant nest could be affected either during construction or during the long-term project operation. Nests closest to the alternative could be most at-risk if individuals in the temporary work force were involved in illegal shooting, an additional potential short-term impact to raptors.

Big game are likely to be killed by trains, especially where the tracks cross wintering areas and migration corridors. Although specific big game migration pathways are not known, Alternative C would pass for 43 miles through pronghorn WYL and SWR ranges (1 mile more than Alternative B), 9.1 miles of mule deer WYL ranges (2 miles less than Alternative B), and 7.2 miles of elk crucial WIN and WYL ranges (2.9 miles less than Alternative B) in Wyoming. In South Dakota, 14.2 miles of Alternative C would pass through pronghorn winter ranges in Custer and Pennington counties (0.4 mile less than Alternative B). Over 33 miles of Alternative C would affect mule deer and white-tailed deer wintering areas in South Dakota compared to nearly 40 miles affected by Alternative B. In addition to being areas where big game mortalities are expected, impacts by Alternative C to these seasonal ranges include physical loss of habitats and habitat fragmentation over the long-term. Such long-term impacts with loss of function in these habitats due to Alternative C would be a significant impact to big game.

Fenced right-of-way along Alternative C would increase fragmentation of habitats use by big game, further reducing habitat functions over the long-term in ways similar to those described for Alternative B. Too, fences are expected to contribute to big game mortalities if animals become entangled.

Noise due to train traffic under Alternative C is expected to be a long-term impact to some species in the same way that was described for Alternative B. Courtship and reproduction by sage grouse and sharp-tailed grouse may be affected by noise, probably more from locomotives pulling cars than whistles because those sources will be more widespread than localized whistle points. Since sage grouse and sharp-tailed grouse courtship on leks includes early morning before sunrise, they may be affected by noise from trains up to 6.1 miles away.

If sage grouse and sharp-tailed grouse are sensitive to noise above background levels during courtship on leks, grouse on leks may be affected from 4.4 miles up to 6.1 miles away from the railroad. These are computed distances at which noise from engines pulling cars would attenuate to expected background levels during the day and night, respectively. There are 35 known leks within 4.4 miles and 45 known leks within 6.1 miles of Alternative C in Wyoming (see Table 4-42) with 39 and 42 grouse leks within those distances in South Dakota (see Table 4-42) and which could be impacted by noise during train operations.

The degree to which these anticipated noise levels displace species is unknown and undoubtedly varies by species and local conditions. Abandonment of occupied habitats within some distance of the railroad is likely, particularly by nesting birds. Densities of nesting birds inhabiting woodlands begins to decline when noise levels form highways reaches 42 dBA and densities of grassland species declines when noise levels reach 48 dBA. For noise of train engines pulling cars, attenuation to 48 dBA may not occur for over 2.5 miles while attenuation to 42 dBA may be over 4 miles (see Table 2-6). In Wyoming, Alternative C would pass through 110 miles of grasslands (herbaceous rangeland) and 11 miles of sagebrush steppe (shrub and brush rangeland, mixed rangeland) as well as 110 of grasslands in South Dakota. If noise from operating trains causes lower densities of grassland bird species within some distance from the railroad, 231 miles of grasslands and sagebrush steppe could be affected, 25 miles less than Alternative B.

Impacts by Alternative C to foxes, raptors, and other carnivores and scavengers that are game (weasels, badgers, mountain lions in Wyoming) and nongame (coyotes, magpies) species are those most likely to feed on carrion of other animals and if they are drawn near to the tracks, their risk of being killed would increase. As described for Alternative B, high risk areas for wildlife mortalities due to trains include locations where tracks intersect prairie dog colonies and big game wintering ranges or other ranges where big game animals congregate and cross tracks. Potential indirect long-term impacts to ground nesting birds (waterfowl, upland game birds, numerous passerine birds) could also occur if predators are drawn to a nesting area because of carrion concentrations along tracks.

Long-term impacts to habitats used by terrestrial and aquatic species due to surface disturbances are expected to be similar to those described under short-term impacts, above. However, once construction machinery is withdrawn from the construction site and revegetation is successful, the total amount of some habitats affected by surface disturbance is expected to be less over the long-term. Some species of birds that nest in grasslands may utilize revegetated portions of the right-of-way. However, if that vegetation is mowed or sprayed with herbicides during maintenance operations or if localized fires were ignited by sparks from train operations, nesting bird

species and others inhabiting the right-of-way would be impacted throughout the life of the project.

Long-term runoff of sediments and toxic compounds could impact aquatic organisms downstream in much the same way as described under short-term impacts. Those same sites along Alternative C that were evaluated in Table 4-19 are likely to be those where chronic discharges occur with risk to game and non-game fish as well as amphibians and other aquatic animals. Over 20 miles of Alternative C would be within 500 feet of rivers and perennial streams in both states, combined.

4.18.5.3 Forest Plan Consistency Review

Existing Nebraska Forest Plan. MIS identified on BGNG include pronghorn antelope, mule deer, sharp-tailed grouse, black-footed ferrets and wild turkey. Effects of Alternative C on black-footed ferrets were discussed above. Nebraska Forest Plan management area prescriptions that would be affected by Alternative C are provided in Table 1-2 and discussed in detail in Table 1 through Table 5 in Appendix A. Estimates of where and how much of Alternative C would impact known or potential habitats utilized by MIS species are provided in Table 4-44.

Alternative C would cross approximately 5 miles of pronghorn ranges and over 8 miles of mule deer and white-tailed deer ranges within BGNG in Custer and Pennington counties. No sharp-tailed grouse leks are known to be within distances up to 1 mile from Alternative C on BGNG. However, leks possibly do occur proximate to the 5 miles of herbaceous rangeland in BGNG that would be affected by Alternative C. And wild turkey gobbling sites and roosts may be present in BGNG but Alternative C would not directly affect any forested riparian vegetation potentially inhabited by turkeys.

Existing Medicine Bow Forest Plan. MIS identified on TBNG include featured species (pronghorn antelope, mule deer, elk), recovery species (bald eagle, black-footed ferret, and peregrine falcon), and ecological indicator species (prairie vole, black-tailed prairie dog, yellow-breasted chat, sage grouse, golden eagle, Brewer's sparrow, willow flycatcher, mountain plover, upland sandpiper, ferruginous hawk, red crossbill, house wren, long-billed curlew, red-headed woodpecker, and Woodhouse's toad). Management requirements on the Medicine Bow National Forest and TBNG related to recovery species and many of the ecological indicator species that are identified as sensitive were discussed above.

It is likely that Alternative C would not comply with the Forest Plans' standards and guidelines restrictions pertaining to raptors since 1 golden eagle nest, 1 Swainson's hawk nest and 8 ferruginous hawk nests within TBNG would be within 0.25 mile of Alternative C. Similarly, Alternative C would pass within 1 mile of 2 sage grouse leks on TBNG As discussed in Chapter 2, at peak operation nearly 40 coal trains would pass along the track daily. Train traffic would occur 24 hours a day. Consequently, sage grouse nesting habitats could be adversely affected by noise, train movements, and removal of shrub-dominated vegetation that is a key habitat component for nesting sage grouse. Alternative C could affect habitat capabilities for several MIS that potentially inhabit riparian zones along Little Thunder Creek, particularly nesting raptors.

Alternative C is not expected to decrease habitat capability for big game species on TBNG to below levels needed to support the State of Wyoming population goals for each species Alternative C would, however, affect seasonal ranges used by different big game species on TBNG (see Table 3-89). The following pronghorn seasonal ranges on TBNG would be affected: 12.5 miles of WYL, 18.2 miles of YRL and 2.1 miles of SWR. For mule deer, 2.5 miles of WYL and 26.3 miles of YRL would be affected on TBNG while only 0.2 mile of white-tailed deer YRL would be crossed. Elk ranges affected by Alternative C on TBNG include 2.3 mile of crucial WIN, 3.7 miles of WYL and 12 miles of YRL ranges.

The Medicine Bow Forest Plan management area prescriptions that would be affected by Alternative C are provided in Table 1-2 and discussed in detail in Table 6 through Table 12 in Appendix A. Estimates of where and how much of Alternative C would impact known or potential habitats utilized by management indicator species are provided in Table 4-45.

Northern Great Plains Management Plans Revision. Management area prescriptions recently proposed under the proposed land and resource management plans for TBNG and BGNG that would be affected by Alternative C are provided in Table 1-2 and discussed in detail in Table 13 through Table 23 in Appendix A.

The grassland plans specify standards and guidelines that would be applicable to species at-risk as well as game and nongame wildlife species and fisheries. The applicability of those standards and guidelines to implementation of the new railroad alternatives is discussed in Table 13, Appendix A. Conflicts between Alternative C and wildlife management on TBNG and BGNG have been analyzed in that table.

Table 4-44 Miles of Alternative C That Affect Land Use Cover Types (Potential Wildlife Habitats) That May Be Inhabited by the Forest Service Management Indicator Species on BGNG in South Dakota			
Land Use Cover Types Potential Wildlife Habitats	**Miles**	**Forest Service Management Indicator Species Possibly Occurring in Land Use Cover Types on BGNG**	**Potential for Impacts to Species by Alternative C (1)**
Cropland, Pasture	None	Antelope, Mule Deer, Sharp-tailed Grouse, Wild Turkey	No
Other Agricultural Land	None	Antelope, Mule Deer, Sharp-tailed Grouse, Wild Turkey	No
Herbaceous Rangeland	5.2	Antelope, Sharp-tailed Grouse	Yes
Shrub and Brush Rangeland	None	Antelope, Mule Deer, Sharp-tailed Grouse, Wild Turkey	No
Mixed Rangeland	None	Antelope, Mule Deer, Sharp-tailed Grouse, Wild Turkey	No
Deciduous Forest Land	None	Mule Deer, Wild Turkey	No
Evergreen Forest Land	None	Mule Deer, Wild Turkey	No
Forested Wetlands	None	Mule Deer, Wild Turkey	No
Nonforested Wetlands	None	Antelope, Mule Deer, Sharp-tailed Grouse, Wild Turkey	No
Bare Exposed Rock	0.9	None	No

Notes: /1 Potential for impacts by Alternative C were judged as:
No: the Land Use Cover Type is not affected by the alternative
Limited: the alternative passes through the Land Use Cover Type for less than one mile, impact potential to management indicator species is possible but unlikely.
Yes: the alternative will pass through the Land Use Cover Type for more than one mile and the management indicator species are known to occur on BGNG in that cover type.

4.18.6 Alternative C With the Phiney Flat Route Variation

4.18.6.1Short-Term Impacts

Big Game. Estimates of Alternative C with the Phiney Flat Route Variation within Wyoming big game seasonal ranges are the same as described above. Pronghorn winter ranges would be affected by 6 miles in Custer and Pennington counties, South Dakota and pronghorn mortalities would be most likely occur there. That is less than effects by either Alternative B or Alternative C on pronghorn winter ranges. Alternative C with the Phiney Flat Route Variation would also cross 27 miles of winter ranges used by mule deer and white-tailed deer in South Dakota counties. Additional areas in South Dakota that are used by mule deer and white-tailed deer yearlong would be crossed for 70 miles (see Table 3-95), less than the possible effects by Alternative B but the same as affected by Alternative C.

Waterfowl, Upland Game Birds, Furbearers, Small Game. The distance (in miles) of Alternative C with the Phiney Flat Route Variation that is within 0.5 mile and 1.0 mile of the Cheyenne River and tributaries in South Dakota (see Table 4-23) and number of sites and total distance where the route variation would be within 500 feet of the Cheyenne River and its tributaries (see Table 4-25) in South Dakota provide some indication of the level of impact construction could have to waterfowl using those drainages during nesting and/or migration. Approximately 50 miles of Alternative C with the Phiney Flat Route Variation would be within 1.0 mile of a perennial stream or river, 26 miles would be within 0.5 mile, and 14 miles would be within 500 feet of these. Each of these zones of potential effects to waterfowl is less than estimates made for Alternative B in South Dakota.

Discussions of sage grouse leks in Wyoming that would be affected by Alternative C also apply to the Wyoming portion of this route variation. In South Dakota there are 5 known grouse leks within 0.25 mile and 32 leks within 2.0 miles of the Phiney Flat Route Variation (see Table 4-46). Short-term construction surface disturbances and associated noise occurring when sage grouse and sharp-tailed grouse are attending leks could inhibit courtship and reproduction, especially on leks that are 0.25 mile away or less but noise could possibly affect birds on leks as far away as 2 miles or farther. Also, grouse nesting habitats within 2.0 miles of leks could be

Table 4-45 Miles of Alternative C That Affect Land Use Cover Types (Potential Wildlife Habitats) That May Be Inhabited by the Forest Service Management Indicator Species (Featured Species and Some Ecological Indicator Species) on TBNG in Wyoming			
Land Use Cover Types Potential Wildlife Habitats	**Miles**	**Forest Service Management Indicator Species Possibly Occurring in Land Use Cover Types on TBNG**	**Potential for Impacts to Species by Alternative C (1)**
Cropland, Pasture	0.7	Antelope, Mule Deer, Prairie Vole, Black-tailed Prairie Dog, Golden Eagle, Upland Sandpiper, Mountain Plover, Longbilled Curlew	Limited
Other Agricultural Land	None	Prairie Vole, Upland Sandpiper, Mountain Plover, Longbilled Curlew	No
Herbaceous Rangeland	31.8	Antelope, Mule Deer, Elk, Prairie Vole, , Black-tailed Prairie Dog, Golden Eagle, Ferruginous Hawk, Upland Sandpiper, Mountain Plover, Longbilled Curlew	Yes
Shrub and Brush Rangeland	None	Antelope, Mule Deer, Elk, Prairie Vole, Black-tailed Prairie Dog, Sage Grouse, Golden Eagle, Brewer's Sparrow, Ferruginous Hawk	No
Mixed Rangeland	None	Antelope, Mule Deer, Elk, Prairie Vole, Black-tailed Prairie Dog, Sage Grouse, Golden Eagle, Brewer's Sparrow, Ferruginous Hawk, Mountain Plover	No
Deciduous Forest Land	None	Mule Deer, Elk, Golden Eagle, House Wren, Red-headed Woodpecker	No
Evergreen Forest Land	0.3	Mule Deer, Elk, Golden Eagle, Red Crossbill, Red-headed Woodpecker	Limited
Forested Wetlands	None	Mule Deer, Elk. Golden Eagle, Willow Flycatcher, House Wren, Red-headed Woodpecker, Woodhouse's Toad	No
Nonforested Wetlands	None	Mule Deer, Elk, Yellow Breasted Chat, Willow Flycatcher, Woodhouse's Toad	No
Bare Exposed Rock	None	Golden Eagle, Ferruginous Hawk	No

1 = Potential for impacts by Alternative C were judged as:
No: the Land Use Cover Type is not affected by the alternative
Limited: the alternative passes through the Land Use Cover Type for less than one mile, impact potential to management indicator species is possible but unlikely.
Yes: the alternative will pass through the Land Use Cover Type for more than one mile and the management indicator species are known to occur on TBNG in that cover type.

adversely affected by construction noise could inhibit courtship and reproduction, especially on leks that are 0.25 mile away or less but noise could possibly affect birds on leks as far away as 2 miles or farther. Also, grouse nesting habitats within 2.0 miles of leks could be adversely affected by construction noise.

In South Dakota, wild turkeys utilize the riparian zones along the Cheyenne River and its tributaries during courtship. There are approximately 50 miles of this alternative within 1 mile of the Cheyenne River and tributaries, while 26 miles are within 0.5 mile and 14 miles are within 500 feet of these drainages, areas with potential habitat for use by wild turkeys during courtship and nesting in South Dakota. Intersection of Alternative C with the Phiney Flat Route Variation with each of these zones of potential effects to wild turkeys is less than estimates made for Alternative B but not Alternative C.

Short-term impacts to furbearers and small game are the same as discussed above for Alternative B. No quantitative, comparative evaluations of potential impacts to furbearers and small game can be made among alternatives.

Raptors. Discussions of raptor nests in Wyoming that would be affected by Alternative C also apply to the Wyoming portion of Alternative C with the Phiney Flat Route Alternative. Available data indicates there are 11 raptor nests within 0.5 mile of the alternative in South Dakota (see Table 4-44). Most of the definable potential nesting habitats for golden eagles, red-tailed hawks, Swainson's hawks, and great horned owls are in trees associated with the Cheyenne River and tributaries. Nearly 26 miles of Alternative C with the Phiney Flat Route Variation would pass within 0.5 mile of potential nesting habitats in those riparian zones in South Dakota (see Table 4-23) compared to 51 miles similarly affected by Alternative B (see Table 4-11) and 25 miles of Alternative C (see Table 4-17) in South Dakota, only.

Raptors nesting within 0.25 mile of the alternative are most likely to be adversely affected by short-term construction impacts during the nesting season. In South

Table 4-46 Number of Known Sage Grouse and Sharp-tailed Grouse Leks Within Various Distances of Alternative C with the Phiney Flat Route Variation in South Dakota					
South Dakota County	Grouse Species	Number of Leks within Distance			
		0.25 mile	2.0 miles	4.4 miles	6.1 miles
Fall River	Sage Grouse	1	11	12	13
	Sharp-tailed Grouse	0	0	0	0
	Not Identified	0	1	1	2
	Total	1	12	13	15
Custer	Sage Grouse	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0
	Not Identified	2	9	12	13
	Total	2	9	12	13
Pennington	Sage Grouse	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0
	Not Identified	2	11	14	14
	Total	2	11	14	14
Alternative C with the Phiney Flat Route Variation in South Dakota Total		5	32	39	42

Table 4-47 Number of Known Raptor Nests Within Varying Distances from Alternative C with the Phiney Flat and W G Flat Route Variations South Dakota										
Alternative C Route Variation	Distance From (miles)	Number of Nests for Each Species within Distance (1)								
		GE	FH	RT	SW	PF	KE	GHO	BO	Other
Phiney Flat	0.25	2	0	5	0	0	0	1	0	0
	0.50	0	0	9	0	0	0	0	0	2
	1.0	0	0	13	0	0	0	0	0	4
W G Flat	0.25	2	0	6	0	0	0	0	0	0
	0.50	2	0	7	0	0	0	1	0	1
	1.0	2	0	11	0	0	0	1	0	2

1 = Species coeds are: GE, golden eagle; FH, ferruginous hawk; RT, red-tailed hawk; SW, Swainson's hawk; PF, prairie falcon; KE, American kestrel; GHO, great horned owl; BO, burrowing owl; Other includes northern harrier, long-eared owl, short-eared owl, and unknown species.

Dakota, there are 5 red-tailed hawk nests, 2 golden eagle nests, and 1 great horned owl nest all within 0.25 mile of Alternative C with the Phiney Flat Route Variation (see Table 4-47). As evident in Table 4-47, there are more raptor nests within distances of 0.5 and 1 mile from the alternative and it is possible that some of those more distant nest could be affected either during construction or during the long-term project operation.

Other Nongame Wildlife. Short-term disturbances to nongame birds, mammals, amphibians and reptiles would occur during construction as vegetation and other habitat features are destroyed at construction sites. Data collected from NBS breeding bird surveys indicate that riparian zones associated with the Cheyenne River and its tributaries tend to support a large number of nongame bird species (see Table 3-98). Approximately 6 miles of Alternative C with the Phiney Flat Route Variation would pass through forested (1.6 miles) and non-forested (4.3 miles) wetlands that are associated with riparian habitats within South Dakota. Coniferous woodlands also support a relatively high diversity of nongame bird species. Three miles of the route variation would affect evergreen forested lands in South Dakota.

Generally, there have been more nongame bird species observed in grasslands than in shrublands (see Table 3-98) in both states. Alternative C with the Phiney

Flat Route Variation would pass through 106 miles of grasslands in South Dakota (is 4 miles less than Alternative C and 7 miles less than Alternative B) but would not coincide with any shrublands there. Although the differences are not great, construction of Alternative C with the Phiney Flat Route is expected to have slightly less impact to breeding birds than Alternative B simply because there would be less disturbance in grasslands and less noise effects to those grassland species.

Aquatic Resources There are 164 total sites in South Dakota (3 more than Alternative B and 24 fewer than Alternative C) where Alternative C with the Phiney Flat Route Variation is within 500 feet of the Cheyenne River and perennial tributary streams. (see Table 4-25). The route would pass within 500 feet of these drainages for a total of 14.4 miles in South Dakota. These sites are believed to be those most likely where sediments and/or accidentally released toxic compounds could be discharged into the Cheyenne River system, both in the short-term and long-term.

4.18.6.2 Long-Term Impacts. Long-term impacts due to the presence, operation and maintenance of Alternative C with the Phiney Flat Variation to game and nongame wildlife are expected to be similar to short-term impacts, described above for Alternatives B and C. Discussions of long-term impacts to wildlife in Wyoming that would be affected by Alternative C also apply to the Wyoming portion of this alternative.

Big game are likely to be killed by trains, especially where the tracks cross wintering areas and migration corridors. Although specific big game migration pathways are not known, Alternative C with the Phiney Flat Route would cross through 42 miles of pronghorn ranges, 6 miles in winter range and 36 miles in yearlong range. Over 27 miles would affect mule deer and white-tailed deer wintering areas in South Dakota compared to nearly 40 miles affected by Alternative B. Seventy miles would pass through deer yearlong ranges. In addition to being areas where big game mortalities are expected, impacts by Alternative C with the Phiney Flat Route Variation to these seasonal ranges include physical loss of habitats and habitat fragmentation over the long-term. Such long-term impacts with loss of function in these habitats would be a significant impact to big game.

Fenced right-of-way along the alternative would increase fragmentation of habitats use by big game, further reducing habitat functions over the long-term in ways similar to those described above for Alternative B. Too, fences are expected to contribute to big game mortalities if animals become entangled.

Noise due to train traffic is expected to be a long-term impact to some species in the same way that was described for Alternative B. Courtship and reproduction by sage grouse and sharp-tailed grouse may be affected by noise, probably more from locomotives pulling cars than whistles because those sources will be more widespread than localized whistle points. Since sage grouse and sharp-tailed grouse courtship on leks includes early morning before sunrise, they may be affected by noise from trains up to 6.1 miles away. There are 39 known leks within 4.4 miles and 42 known leks within 6.1 miles of Alternative C with the Phiney Flat Route Variation in South Dakota (see Table 4-46) that could be impacted by noise during train operations.

Impacts from this alternative to foxes, raptors, and other carnivores and scavengers that are game (weasels, badgers, mountain lions in Wyoming) and nongame (coyotes, magpies) species are those most likely to feed on carrion of other animals and if they are drawn near to the tracks, their risk of being killed would increase. As described for Alternative B, high risk areas for wildlife mortalities due to trains include locations where tracks intersect prairie dog colonies and big game wintering ranges or other ranges where big game animals congregate and cross tracks. Potential indirect long-term impacts to ground nesting birds (waterfowl, upland game birds, numerous passerine birds) could also occur if predators are drawn to a nesting area because of carrion concentrations along tracks.

Long-term impacts to habitats used by terrestrial and aquatic species due to surface disturbances are expected to be similar to those described under short-term impacts, above. However, once construction machinery is withdrawn from construction sites and revegetation is successful, the total amount of some habitats affected by surface disturbance is expected to be less over the long-term. Some species of birds that nest in grasslands may utilize revegetated portions of the right-of-way. However, if that vegetation is mowed or sprayed with herbicides during maintenance or if fires were ignited by sparks from train operations, nesting bird species and others inhabiting the right-of-way would be impacted throughout the life of the project.

Long-term runoff of sediments and toxic compounds could impact aquatic organisms downstream in much the same way as described under short-term impacts. Those same sites along Alternative C with the Phiney Flat Route Variation that were evaluated in Table 4-25 are likely to be those where chronic discharges occur with risk to game and non-game fish as well as amphibians and other aquatic animals. Over 14 miles of the alternative would be within 500 feet of rivers and perennial streams in South Dakota.

4.18.6.3 Forest Plan Consistency Review

Existing Nebraska Forest Plan. MIS identified on BGNG include pronghorn antelope, mule deer, sharp-tailed grouse, black-footed ferrets and wild turkey. Effects of Alternative C on black-footed ferrets were previously discussed. Nebraska Forest Plan management area prescriptions that would be affected by the Alternative C with the Phiney Flat Route Variation are provided in Table 1-2 and discussed in detail in Table 1 through Table 5 in Appendix A. Estimates of where and how much of Alternative C with the Phiney Flat Route Variation would impact potential habitats utilized by MIS species are provided in Table 4-48.

Alternative C with the Phiney Flat Route Variation would cross approximately 5 miles of pronghorn ranges and nearly 7 miles of mule deer and white-tailed deer ranges within BGNG in Custer and Pennington counties. No sharp-tailed grouse leks are known to be within distances up to 1 mile from the route variation on BGNG. However, leks possibly do occur proximate to the 5 miles of herbaceous rangeland in BGNG that would be affected by Alternative C with the Phiney Flat Route Variation. And wild turkey gobbling sites and roosts may be present in BGNG but the Phiney Flat Route Variation would not directly affect any forested riparian vegetation potentially inhabited by turkeys.

Existing Medicine Bow Forest Plan. Alternative C With the Phiney Flat Route Variation would not affect TBNG differently than Alternative C discussed above.

Northern Great Plains Management Plans Revision. Management area prescriptions under the recently proposed land and resource management plans for TBNG and BGNG that would be affected by Alternative C with the Phiney Flat Route Variation are provided in Table 1-2 and discussed in detail in Table 13 through Table 23 in Appendix A.

The proposed grassland plans specify standards and guidelines that would be applicable to species at-risk as well as game and nongame wildlife species and fisheries. The applicability of those standards and guidelines to implementation of the new railroad alternatives is discussed in Table 13, Appendix A. Conflicts between Alternative C with the Phiney Flat Route Variation and wildlife management on TBNG and BGNG have been analyzed in that table.

4.18.7 Alternative C With the W G Flat Route Variation

4.18.7.1 Short-Term Impacts

Big Game. Estimates of linear distances affected by Alternative C with the W G Flat Route Variation within Wyoming big game seasonal ranges are the same as described for Alternative C. Pronghorn winter ranges would be affected by 15 miles of construction in Custer and Pennington counties, South Dakota and pronghorn mortalities would be most likely occur there. That is about the same as effects by Alternative B and Alternative C on pronghorn winter ranges. Alternative C with the W G Flat Route Variation would also cross 33 miles of winter ranges used by mule deer and white-tailed deer in South Dakota, less than Alternative B but more than Alternative C. Additional areas in South Dakota that are used by mule deer and white-tailed deer yearlong would be crossed for 77 miles (see Table 3-93), less than the possible effects by Alternative B but more than affected by Alternative C.

Waterfowl, Upland Game Birds, Furbearers, Small Game. Approximately 48 miles of the W G Flat Route Variation would be within 1.0 mile of a perennial stream or river, 26 miles would be within 0.5 mile, and 19 miles would be within 500 feet of these. Each of these zones of potential effects to waterfowl is less than estimates made for Alternative B in South Dakota but not Alternative C.

Discussions of sage grouse leks in Wyoming that would be affected by Alternative C also apply to the Wyoming portion of Alternative C with the W G Flat Route Variation. In South Dakota there are 3 known grouse leks within 0.25 mile and 32 within 2.0 miles of the W G Flat Route Variation (see Table 4-49). Short-term construction surface disturbances and associated noise occurring when sage grouse and sharp-tailed grouse are attending leks could inhibit courtship and reproduction, especially on leks that are 0.25 mile away or less but noise could possibly affect birds on leks as far away as 2 miles or farther.

Also, grouse nesting habitats within 2.0 miles of leks could be adversely affected by construction noise could inhibit courtship and reproduction, especially on leks that are 0.25 mile away or less but noise could possibly affect birds on leks as far away as 2 miles or farther. Also, grouse nesting habitats within 2.0 miles of leks could be adversely affected by construction noise.

Table 4-48
Miles of Alternative C with the Phiney Flat Route Variation That Affect Land Use Cover Types (Potential Wildlife Habitats) That May Be Inhabited by Forest Service Management Indicator Species on BGNG in South Dakota

Land Use Cover Types Potential Wildlife Habitats	Miles	Forest Service Management Indicator Species Possibly Occurring in Land Use Cover Types on BGNG	Potential for Impacts to Species by the Phiney Flat Route (1)
Cropland, Pasture	None	Antelope, Mule Deer, Sharp-tailed Grouse, Wild Turkey	No
Other Agricultural Land	None	Antelope, Mule Deer, Sharp-tailed Grouse, Wild Turkey	No
Herbaceous Rangeland	4.4	Antelope, Sharp-tailed Grouse	Yes
Shrub and Brush Rangeland	None	Antelope, Mule Deer, Sharp-tailed Grouse, Wild Turkey	No
Mixed Rangeland	None	Antelope, Mule Deer, Sharp-tailed Grouse, Wild Turkey	No
Deciduous Forest Land	None	Mule Deer, Wild Turkey	No
Evergreen Forest Land	None	Mule Deer, Wild Turkey	No
Forested Wetlands	None	Mule Deer, Wild Turkey	No
Nonforested Wetlands	None	Antelope, Mule Deer, Sharp-tailed Grouse, Wild Turkey	No
Bare Exposed Rock	0.9	None	No

1 = Potential for impacts by the Phiney Flat Route Variation were judged as:
No: the Land Use Cover Type is not affected by the alternative
Limited: the alternative passes through the Land Use Cover Type for less than one mile, impact potential to management indicator species is possible but unlikely.
Yes: the alternative will pass through the Land Use Cover Type for more than one mile and the management indicator species are known to occur on BGNG in that cover type.

Table 4-49
Number of Known Sage Grouse and Sharp-tailed Grouse Leks Within Various Distances of Alternative C with the W G Flat Route Variation in South Dakota

South Dakota County	Grouse Species	Number of Leks within Distance			
		0.25 mile	2.0 miles	4.4 miles	6.1 miles
Fall River	Sage Grouse	0	10	13	13
	Sharp-tailed Grouse	0	0	0	0
	Not Identified	0	0	0	2
	Total	0	10	13	15
Custer	Sage Grouse	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0
	Not Identified	1	10	12	13
	Total	1	10	12	13
Pennington	Sage Grouse	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0
	Not Identified	2	12	14	14
	Total	2	12	14	14
Alternative C with W G Flat Route Variation in South Dakota Total		3	32	39	42

There are approximately 48 miles of Alternative C with the W G Flat Route Variation within 1 mile of the Cheyenne River and tributaries, while 26 miles are within 0.5 mile and 19 miles are within 500 feet of these drainages, areas with potential habitat for use by wild turkeys during courtship and nesting in South Dakota. Intersection of Alternative C with the W G Flat Route Variation with each of these zones of potential effects to wild turkeys is less than estimates made for Alternative B but not Alternative C.

Raptors. Discussions of raptor nests in Wyoming that would be affected by Alternative C also apply to the Wyoming portion of Alternative C with the W G Flat Route

Variation. Available data indicates there are 11 raptor nests within 0.5 mile of Alternative C with the W G Flat Route Variation in South Dakota (see Table 4-47). Over 26 miles of Alternative C with the W G Flat Route Variation would pass within 0.5 mile of potential nesting habitats in riparian zones in South Dakota (see Table 4-28) compared to 51 miles similarly affected by Alternative B (see Table 4-11) and 25 miles of Alternative C (see Table 4-17) in South Dakota, only. In South Dakota, there are 6 red-tailed hawk nests and 2 golden eagle nests within 0.25 mile of Alternative C with the W G Flat Route Variation (see Table 4-47).

Other Nongame Wildlife. Alternative C with the W G Flat Route Variation would pass through 107 miles of grasslands in South Dakota (less than Alternative B and Alternative C) but would not coincide with any shrublands there. Although the differences are not great, construction of Alternative C with the W G Flat Route Variation is expected to have slightly less impact to breeding birds than Alternative B and Alternative C simply because there would be less disturbance in grasslands and less noise effects to those grassland species.

Aquatic Resources There are 192 total sites in South Dakota (15 more than Alternative B and 14 less than Alternative C) where Alternative C with the W G Flat Route Variation is within 500 feet of the Cheyenne River and perennial tributary streams. (see Table 4-30). The route would pass within 500 feet of these drainages for a total of 19 miles in South Dakota. These sites are believed to be those most likely where sediments and/or accidentally released toxic compounds could be discharged into the Cheyenne River system, both in the short-term and long-term.

4.18.7.2 Long-Term Impacts. Long-term impacts due to the presence, operation and maintenance of the W G Flat Variation to game and nongame wildlife are expected to be similar to short-term impacts, described above for Alternatives B and C. Discussions of long-term impacts to wildlife in Wyoming that would be affected by Alternative C also apply to the Wyoming portion of the W G Flat Route Alternative.

Although specific big game migration pathways are not known, Alternative C with the W G Flat Route Variation would cross 43 miles of pronghorn ranges, 15 miles of winter range and 28 miles of yearlong range. Over 33 miles would affect mule deer and white-tailed deer wintering areas in South Dakota compared to nearly 40 miles affected by Alternative B. Seventy-seven miles would pass through deer yearlong ranges. In addition to being areas where big game mortalities are expected, impacts by the route variation to these seasonal ranges include physical loss of habitats and habitat fragmentation over the long-term. Such long-term impacts with loss of function in these habitats due to the W G Flat Route Variation would be a significant impact to big game.

Fenced right-of-way along the route would increase fragmentation of habitats use by big game, further reducing habitat functions over the long-term in ways similar to those described for Alternative B. Too, fences are expected to contribute to big game mortalities if animals become entangled.

If sage grouse and sharp-tailed grouse are sensitive to noise above background levels during courtship on leks, grouse on leks may be affected from 4.4 miles up to 6.1 miles away from the railroad. These are computed distances at which noise from locomotives pulling cars would attenuate to expected background levels during the day and night, respectively. There are 39 known leks within 4.4 miles and 42 known leks within 6.1 miles of the Alternative C with the W G Flat Route Variation in South Dakota (see Table 4-49) that could be impacted by noise during train operations. If noise from operating trains causes lower densities of grassland bird species within some distance from the railroad, Alternative C with the W G Flat Route Variation could affect 107 miles of grasslands (herbaceous rangeland) in South Dakota.

4.18.7.3 Forest Plan Consistency Review

Existing Nebraska Forest Plan. MIS identified on BGNG include pronghorn antelope, mule deer, sharp-tailed grouse, black-footed ferrets and wild turkey. Effects of Alternative C on black-footed ferrets were previously discussed. Nebraska Forest Plan management area prescriptions that would be affected by Alternative C with W G Flat Route Variation are provided in Table 1-2 and discussed in detail in Table 1 through Table 5 in Appendix A. Estimates of where and how much of the route variation would impact potential habitats utilized by MIS species are provided in Table 4-50.

Alternative C with W G Flat Route Variation would cross approximately 5 miles of pronghorn ranges and over 8 miles of mule deer and white-tailed deer ranges within BGNG in Custer and Pennington counties. No sharp-tailed grouse leks are known to be within distances up to 1 mile from Alternative C with W G Flat Route Variation on BGNG. However, leks possibly do occur proximate to the 5 miles of herbaceous rangeland in BGNG that would be crossed by the alternative. And wild turkey gobbling sites and roosts may be present in BGNG but Alternative C with W G Flat Route Variation would not directly affect any forested riparian vegetation potentially inhabited by turkeys.

Existing Medicine Bow Forest Plan. Alternative C with the W G Flat Variation would not affect TBNG differently than Alternative C.

Table 4-50 Miles of Alternative C with the W G Flat Route Variation That Affect Land Use Cover Types (Potential Wildlife Habitats) That May Be Inhabited by the Forest Service Management Indicator Species on BGNG in South Dakota			
Land Use Cover Types Potential Wildlife Habitats	**Miles**	**Forest Service Management Indicator Species Possibly Occurring in Land Use Cover Types on BGNG**	**Potential for Impacts to Species by the W G Flat Route (1)**
Cropland, Pasture	None	Antelope, Mule Deer, Sharp-tailed Grouse, Wild Turkey	No
Other Agricultural Land	None	Antelope, Mule Deer, Sharp-tailed Grouse, Wild Turkey	No
Herbaceous Rangeland	5.2	Antelope, Sharp-tailed Grouse	Yes
Shrub and Brush Rangeland	None	Antelope, Mule Deer, Sharp-tailed Grouse, Wild Turkey	No
Mixed Rangeland	None	Antelope, Mule Deer, Sharp-tailed Grouse, Wild Turkey	No
Deciduous Forest Land	None	Mule Deer, Wild Turkey	No
Evergreen Forest Land	None	Mule Deer, Wild Turkey	No
Forested Wetlands	None	Mule Deer, Wild Turkey	No
Nonforested Wetlands	None	Antelope, Mule Deer, Sharp-tailed Grouse, Wild Turkey	No
Bare Exposed Rock	0.9	None	No

1 = Potential for impacts by the W G Flat Route Variation were judged as:
No: the Land Use Cover Type is not affected by the alternative
Limited: the alternative passes through the Land Use Cover Type for less than one mile, impact potential to management indicator species is possible but unlikely.
Yes: the alternative will pass through the Land Use Cover Type for more than one mile and the management indicator species are known to occur on BGNG in that cover type.

Northern Great Plains Management Plans Revision. Recently proposed grassland plans management area prescriptions for TBNG and BGNG that would be affected by Alternative C with the W G Flat Route Variation are provided in Table 1-2 and discussed in detail in Table 13 through Table 23 in Appendix A. Standards and guidelines that would be applicable to species at-risk as well as game and nongame wildlife species and fisheries are in Table 13, Appendix A. Conflicts between Alternative C with the W G Flat Route Variation and wildlife management on TBNG and BGNG have been analyzed in that table.

4.18.8 Alternative D (Existing Corridors Alternative)

4.18.8.1 Short-Term Impacts

Big Game. Estimates of linear distances affected by Alternative D during construction within existing right-of-way that, although within Wyoming big game seasonal ranges, would not create new impacts to pronghorns and their seasonal ranges. Those distances of seasonal ranges adjacent to existing railroad rights-of-way are provided in Table 3-90. Pronghorn yearlong ranges (YRL) in 4 herd units (Highlight, Thunder Basin, South Black Hills and Lance Creek) are those that most coincide with existing right-of-way for 84 miles. WYL ranges in 4 pronghorn herd units (North Black Hills, Highlight, Thunder Basin, and Lance Creek) coincide with Alternative D and existing right-of-way for 74 miles. In addition, 5.2 miles of existing tracks coincide with WIN range used by pronghorn in the South Black Hills Herd Unit and 2.5 miles coincide with SWR in the Lance Creek Herd Unit. Although nearly 166 miles of Alternative D would coincide with pronghorn seasonal ranges in Wyoming (compared to 151 miles for Alternative B and 131 miles for Alternative C), surface disturbances would occur on land already disturbed and seldom used, if at all, by pronghorns in these herd units.

Alternative D would pass through 108.3 miles of YRL range used by mule deer in the Thunder Basin and Powder River herd units and pass though 36.8 miles WYL range used by mule deer in the Thunder Basin and Black Hills herd units. Although nearly 145 miles of Alternative D would coincide with mule deer seasonal ranges in Wyoming (compared to 135 miles for Alternative B and 112 miles for Alternative C), surface disturbances would occur on land already disturbed and seldom used, if at all, by mule deer in these herd units. Likewise, existing right-of-way within which Alternative D would occur coincides with 27.7 miles of WYL range used by white-tailed deer in the Black Hills and Thunder Basin herd units. Ten miles also pass through YRL range used by white-tailed deer in the Thunder Basin Herd Unit. In all, Alternative D would coincide with 37 miles of white-tailed deer seasonal ranges in Wyoming but because all surface disturbances would occur on land already disturbed, the impact to white-tailed deer is expected to be less than Alternative B (would affect 3.7 miles of YRL range) and Alternative C (would affect 1.4 miles of YRL range).

A total of 23.7 miles of Alternative D would coincide with elk ranges in the Rochelle Hills Herd Unit. While no elk calving or parturition areas would be directly adjacent to Alternative D, 2.5 miles of existing track pass through elk crucial WIN range (the same right-of-way proposed for Alternative C), 4.7 miles of track pass through WYL range, and 16.5 mile of existing right-of-way would pass through YRL ranges. Alternative D would not disturb new areas that are within elk crucial WIN, WYL and YRL ranges whereas 31.9 miles of Alternative B would affect new areas in elk habitat and 26.1 miles of Alternative C would do the same (2.5 miles of Alternative C through crucial WIN ranges would be on existing right-of-way). Alternative D would not pass within 0.75 mile of any known elk parturition ranges. Although the route would be within existing right-of-way currently used by trains, the potential for additional train traffic and concomitant noise could affect elk during during winter. But unlike the discussion of short-term impacts for Alternative B, passage of Alternative D through crucial elk WIN range, pronghorn and mule deer WYL range is not expected to impose significant new impacts to those habitats, at least in terms of lost habitat and decreased habitat function. Poaching, though could still be a short-term impact to big game under Alternative D.

Collisions of big game with construction vehicles are possible short-term and long-term impacts with Alternative D even though construction would occur adjacent to existing rail lines. In Wyoming, most big game mortalities are expected to occur within the portion of Alternative D that passes through 7.2 miles of elk crucial WIN and WYL ranges, 36.8 miles of mule deer and 27.7 miles of white-tailed deer WYL ranges, and 82 miles through pronghorn WYL, WIN and SWR ranges.

Alternative D would not affect any designated pronghorn winter ranges in South Dakota (see Table 3-96) but 25.0 miles would pass through pronghorn yearlong range in Custer County, all within the existing railroad right-of-way. Alternative D would not coincide with any deer winter range but would cross 61.5 miles of yearlong ranges used by mule deer and white-tailed deer in Fall River and Pennington counties. Some of that yearlong range used by white-tailed deer would be within existing right-of-way, mostly in Pennington County where the existing tracks parallel Box Elder Creek. Alternative D would disturb new areas of deer habitat in Fall River County where it would coincide with the proposed route for Alternative C. Although much of Alternative D would be within existing right-of-way in South Dakota where no new big game habitat would be destroyed, the level of impact to big game caused by increased train traffic traveling at higher speeds and more frequent noise under Alternative D will probably be above existing levels.

Waterfowl, Upland Game Birds, Furbearers, Small Game. Approximately 45 miles of Alternative D would be within 1.0 mile of a perennial stream or river, 30 miles would be within 0.5 mile, and 13 miles would be within 500 feet of these. Each of these zones of potential effects to waterfowl is less than estimates made for Alternative B and Alternative C.

There are 2 known sage grouse lek within 0.25 mile and 20 within 2.0 miles of Alternative D in Wyoming (see Table 4-51). But there are no known sage grouse or sharp-tailed grouse leks within 0.25 mile and only 11 leks within 2.0 miles of this Alternative in South Dakota (see Table 4-51).

There are approximately 29 miles of Alternative D within 1 mile of the Cheyenne River and tributaries, while 19 miles are within 0.5 mile and 12 miles are within 500 feet of these drainages, all of which would be within Pennington County, mostly along Box Elder Creek, and Fall River County where Alternative D follows the same route as Alternative C. Intersection of Alternative D with each of these zones of potential effects to wild turkeys is less than estimates made for Alternative B and Alternative C.

Raptors. Available data indicates there are 66 raptor nests within 0.5 mile of Alternative D in Wyoming and 7 nests within that distance of Alternative D in South Dakota (see Table 3-108). Only 30 miles of Alternative D would pass within 0.5 mile of potential nesting habitats in riparian zones in both states (see Table 4-33) compared to 85 miles similarly affected by Alternative B (see Table 4-11) and 58 miles affected by Alternative C (see Table 4-17). In South Dakota, there are only 3 red-tailed hawk nests within 0.25 mile of Alternative D. But in Wyoming, there are 6 red-tailed hawk nests, 3 golden eagle nests, 2 great horned owl nests, 1 Swainson's hawk nest and 25 ferruginous hawk nests within that distance (see Table 4-52).

Other Nongame Wildlife. In Wyoming, over 67 miles of Alternative D would pass through grasslands - less than Alternatives B (121 miles) and C (109 miles) - and 81 miles would coincide with shrub/brush rangelands and mixed rangelands - more than the other two alternatives - but all within existing railroad right-of-way. Alternative D would pass through 119 miles of grasslands in South Dakota - nearly the same as the other two alternatives - but would not coincide with any shrublands there. Although the differences are not great, Alternative D is expected to have slightly less impact to breeding birds than Alternative B and C simply because there would be less disturbance in grasslands and less noise effects to those grassland species.

Table 4-51
Number of Known Sage Grouse and Sharp-tailed Grouse Leks Within Various Distances of Alternative D in Wyoming and South Dakota

State and Managed Area	Grouse Species	Number of Leks within Distance			
		0.25 mile	2.0 miles	4.4 miles	6.1 miles
Wyoming - Upland and Small Game Management Areas					
USGMA 36 Niobrara	Sage Grouse	0	3	6	8
	Sharp-tailed Grouse	0	0	0	0
	Not Identified	0	0	0	0
	Total	0	3	6	8
USGMA 39 Belle Fourche	Sage Grouse	2	17	31	35
	Sharp-tailed Grouse	0	0	0	0
	Not Identified	0	0	0	0
	Total	2	17	31	35
South Dakota - Counties:					
Fall River	Sage Grouse	0	11	12	13
	Sharp-tailed Grouse	0	0	0	0
	Not Identified	0	0	0	1
	Total	0	11	12	14
Custer	Sage Grouse	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0
	Not Identified	0	0	0	1
	Total	0	0	0	1
Pennington	Sage Grouse	0	0	0	0
	Sharp-tailed Grouse	0	0	0	0
	Not Identified	0	0	0	0
	Total	0	0	0	0
Alternative D Total		2	31	49	58

Table 4-52
Number of Known Raptor Nests Within Varying Distances from Alternative D in Wyoming and South Dakota

State	Distance From (miles)	Number of Nests for Each Species within Distance (1)								
		GE	FH	RT	SW	PF	KE	GHO	BO	Other
Wyoming	0.25	3	25	6	1	0	0	2	0	0
	0.50	7	39	8	3	0	0	6	2	1
	1.0	12	57	16	3	1	0	12	2	1
South Dakota	0.25	0	0	3	0	0	0	0	0	0
	0.50	0	0	5	0	0	0	0	0	2
	1.0	0	0	8	0	0	0	0	0	2

1 = Species coeds are: GE, golden eagle; FH, ferruginous hawk; RT, red-tailed hawk; SW, Swainson's hawk; PF, prairie falcon; KE, American kestrel; GHO, great horned owl; BO, burrowing owl; Other includes northern harrier, long-eared owl, short-eared owl, and unknown species.

Aquatic Resources There are 76 total sites (101 fewer than Alternative B and 130 fewer than Alternative C) where Alternative D is within 500 feet of the Cheyenne River and perennial tributary streams in Wyoming and South Dakota (see Table 4-35). Alternative D would pass within 500 feet of these drainages for a total of 13.5 miles, less than the other alternatives. These sites are believed to be those most likely where sediments and/or accidentally released toxic compounds could be discharged into the Cheyenne River system, both in the short-term and long-term.

4.18.8.2 Long-Term Impacts. Long-term impacts due to the presence, operation and maintenance of Alternative D to game and nongame wildlife are expected to be similar to short-term impacts described for Alternative B. Alternative D would cross 82 miles of pronghorn WYL, WIN and SWR ranges (39.6 miles more than Alternative B and 38.6 miles more than Alternative C), 36.8 miles of mule deer WYL ranges (25.8 miles more than Alternative B and 27.8 miles more than Alternative C), and 7.2 miles of elk crucial WIN and WYL ranges (2.9 miles less than Alternative B and the same as Alternative C) in Wyoming. In South Dakota, none of Alternative D would pass through pronghorn winter ranges (14.6 miles for Alternative B and 14.2 miles for Alternative C). Likewise, none of Alternative D would pass through deer winter ranges while over 33 miles of Alternative C and nearly 40 miles of Alternative B would affect mule deer and white-tailed deer wintering areas in South Dakota.

Long-term impacts by Alternative D to big game are expected to be primarily increased mortality on the new and existing rail lines since train traffic volume will increase as well as train speeds. Assuming that most if not all of the existing railroad rights-of-way are fenced, Alternative D is not expected to contribute additional habitat fragmentation nor to further loss of habitat functions over the long-term as Alternative B and Alternative C would.

In Wyoming, there are 37 sage grouse known to be within 4.4 miles of Alternative D and 43 leks with 6.1 (see Table 4-518) and which may be affected by noise for the life of the project. Fewer known leks have been identified within those distances in South Dakota: 12 would be within 4.4 miles and 15 would be within 6.1 miles.

If noise from operating trains causes lower densities of grassland bird species within some distance from the railroad, Alternative D could affect 119 miles of grasslands (herbaceous rangeland) in South Dakota and 69 miles of grassland in Wyoming as well as 81 miles of sagebrush steppe.

4.18.8.3 Forest Plan Consistency Review

Existing Nebraska Forest Plan. Alternative D would not pass through or otherwise affect BGNG.

Existing Medicine Bow Forest Plan. It is likely that Alternative D would not comply with the Forest Plans' standards and guidelines restrictions pertaining to raptors since 1 Swainson's hawk nest and 8 ferruginous hawk nests within TBNG would be within 0.25 mile of Alternative D. No known sage grouse leks on TBNG would be within 1 mile of Alternative D but sage grouse nesting habitats could be adversely affected by noise, train movements, and removal of shrub-dominated vegetation that is a key habitat component for nesting sage grouse.

Alternative D is not expected to decrease habitat capability for big game species on TBNG to below levels needed to support the State of Wyoming population goals for each species Alternative D would, however, affect seasonal ranges used by different big game species on TBNG (see Table 3-90). The following pronghorn seasonal ranges on TBNG would be affected: 11 miles of WYL, 13 miles of YRL and 2 miles of SWR. For mule deer, 6 miles of WYL and 16 miles of YRL would be affected on TBNG while 4 miles of white-tailed deer WYL range and 0.2 mile of YRL would be crossed. Elk ranges affected by Alternative D on TBNG include 2.3 mile of crucial WIN, 4 miles of WYL and 10 miles of YRL ranges.

Medicine Bow Forest Plan management area prescriptions that would be affected by Alternative D are provided in Table 1-2 and discussed in detail in Table 6 through Table 12 in Appendix A. Estimates of where and how much of Alternative D would impact known or potential habitats utilized by management indicator species are provided in Table 4-53.

Northern Great Plains Management Plans Revision. The recently released proposed TBNG plan specifies standards and guidelines that would be applicable to species at-risk as well as game and nongame wildlife species and fisheries. The applicability of those Standards and Guidelines to implementation of the new railroad alternatives is discussed in Table 13, Appendix A. Conflicts between Alternative D and wildlife management on TBNG and BGNG have been analyzed in that table.

4.18.9 Proposed Mine Loop Options. Mine loops to the Black Thunder North, Black Thunder South, North Antelope East and North Antelope West mines would be within the Highlight and Lance Creek pronghorn herd

Table 4-53
Miles of Alternative D That Affect Land Use Cover Types (Potential Wildlife Habitats) That May Be Inhabited by Forest Service Management Indicator Species (Featured Species and Some Ecological Indicator Species) on TBNG in Wyoming

Land Use Cover Types Potential Wildlife Habitats	Miles	Forest Service Management Indicator Species Possibly Occurring in Land Use Cover Types on TBNG	Potential for Impacts to Species by Alternative D (1)
Cropland, Pasture	None	Antelope, Mule Deer, Prairie Vole, Black-tailed Prairie Dog, Golden Eagle, Upland Sandpiper, Mountain Plover, Longbilled Curlew	No
Other Agricultural Land	None	Prairie Vole, Upland Sandpiper, Mountain Plover, Longbilled Curlew	No
Herbaceous Rangeland	20.0	Antelope, Mule Deer, Elk, Prairie Vole, , Black-tailed Prairie Dog, Golden Eagle, Ferruginous Hawk, Upland Sandpiper, Mountain Plover, Longbilled Curlew	Yes
Shrub and Brush Rangeland	5.5	Antelope, Mule Deer, Elk, Prairie Vole, Black-tailed Prairie Dog, Sage Grouse, Golden Eagle, Brewer's Sparrow, Ferruginous Hawk	Yes
Mixed Rangeland	None	Antelope, Mule Deer, Elk, Prairie Vole, Black-tailed Prairie Dog, Sage Grouse, Golden Eagle, Brewer's Sparrow, Ferruginous Hawk, Mountain Plover	No
Deciduous Forest Land	None	Mule Deer, Elk, Golden Eagle, House Wren, Red-headed Woodpecker	No
Evergreen Forest Land	1.1	Mule Deer, Elk, Golden Eagle, Red Crossbill, Red-headed Woodpecker	Yes
Forested Wetlands	None	Mule Deer, Elk. Golden Eagle, Willow Flycatcher, House Wren, Red-headed Woodpecker, Woodhouse's Toad	No
Nonforested Wetlands	None	Mule Deer, Elk, Yellow Breasted Chat, Willow Flycatcher, Woodhouse's Toad	No
Bare Exposed Rock	None	Golden Eagle, Ferruginous Hawk	No

1 = Potential for impacts by Alternative D were judged as:
No: the Land Use Cover Type is not affected by the alternative
Limited: the alternative passes through the Land Use Cover Type for less than one mile, impact potential to management indicator species is possible but unlikely.
Yes: the alternative will pass through the Land Use Cover Type for more than one mile and the management indicator species are known to occur on TBNG in that cover type.

units. The loops would pass through WYL ranges for 11.6 miles (5.1 miles through the Highlight Herd Unit and 6.5 miles through the Lance Creek Herd Unit) and through YRL range in the Lance Creek Herd Unit for 3.9 miles. The mine loop options would pass through WYL range in the Thunder Basin Mule Deer Herd Unit for 2.1 miles and through YRL range for 8.0 miles and through YRL range in the Thunder Basin White-tailed Deer Herd Unit for 1.5 miles. Elk ranges in the Rochelle Hills Elk Herd Unit that would be affected by mine loops include WYL range for 0.1 mile and YRL range for 3.6 miles.

There are no sage grouse leks within 2 miles of any of the 4 mine loops evaluated in this report. However, there are 5 leks within 4.4 miles and 12 leks within 6.1 miles. Sage grouse attending those leks could be affected by noise associated with train operations and/or whistles over the life of the project. Raptor surveys on coal mines indicate there are 6 ferruginous hawk nests, 2 red-tail hawk nests, 1 golden eagle nest and 1 great horned owl nest within 0.25 mile of the proposed mine loops. Although current activity of each nest is not known, those nest structures are likely to be impacted by construction and operation of the mine loops and may not be suitable for nesting during the long-term. Twelve additional ferruginous hawk nests, 1 red-tailed hawk nest, and 1 golden eagle nest are within 0.5 mile of the rail loops. Depending on local topography, obscuring vegetation, and existing levels of human activities construction and operation of the loops could affect nesting birds using those nests, as well.

Because only 0.6 mile of the North Antelope West Mine Loop would cross black-tailed prairie dog colonies, impacts to wildlife species that utilize or inhabit those colonies are not expected to be significant although some individuals of some species could be affected. Likewise, loops to the 4 mines would pass within 0.5 mile of Antelope Creek for 2.3 miles and Little Thunder Creek for 0.9 mile and some individuals of some species might vacate otherwise suitable habitat in those riparian zones.

4.18.10 Proposed Yard Sites. The proposed yard near Wall, South Dakota would be within croplands and intersect the I-90 corridor. The site intersects 3 wetlands. Construction and operation of the Wall Yard is not expected to adversely affect wildlife species other than displacing passerine birds that might nest in fallow fields and the affected wetlands. Such impact would occur for the life of the project.

The proposed Edgemont Interchange Yard, also in South Dakota, would be within grassland vegetation, on soils designated as prime farmlands. That yard would cross 1 intermittent stream, a tributary to the Cheyenne River, and be within 0.5 mile of the river. Because the site is adjacent to the existing BNSF railroad, construction and operation of the yard are unlikely to affect mule deer and white-tailed deer if they occur along the Cheyenne River east of Edgemont. The proposed yard site is farther than 2 miles from the nearest known raptor nest and would not affect any known sage grouse or sharp-tailed grouse leks. The Interchange Yard is likely to displace passerine birds that might nest in grasslands and remove grassland vegetation. Such impact would occur for the life of the project. However, since the yard crosses an intermittent stream and is proximate to the Cheyenne River, the potential exists for accidental discharge of toxic materials and sediments into the river that could affect fish and other aquatic species downstream.

The proposed Western Yard in Wyoming, would cross mostly grasslands but also 21 intermittent streams, tributaries to Little Thunder Creek. No jurisdictional wetlands would be affected. Short- and long-term surface disturbance of at least 250 acres of grasslands and noise levels that would probably be consistently higher than along the operating railroad would adversely affect nesting habitats for a variety of nongame birds.

For most of its length, the yard would be within 0.5 mile of Little Thunder Creek and within 500 feet of at least 4 sites. One golden eagle nest and one red-tailed hawk nest in cottonwood trees along the creek would be within 0.5 mile of the yard. Three additional red-tailed hawk nests are within 1 mile of the site. Noise and activities associated with construction and operation of the yard would likely make nesting habitats along the creek unsuitable for raptors. No sage grouse or sharp-tailed grouse leks are known to be within 2 miles of the yard site.

The site also coincides with yearlong ranges used by pronghorn in the Lance Creek Herd Unit, by mule deer in the Thunder Basin Herd Unit, and by elk in the Rochelle Hills Herd Unit. For the short- and long-term, the yard would be fenced and present a barrier to big game movements, particularly to animals south of the yard seeking water in Little Thunder Creek to the north. If big game, as well as other species, became trapped within the yard right-of-way, their risk of mortality from moving trains would be high.

Since the yard site would affect numerous black-tailed prairie dog colonies, surface disturbances to prairie dog colonies will affect some individuals of species that may inhabit colonies or prey on prairie dogs. Such impact would last during the short- and long-term. With the proximity of the yard to Little Thunder Creek and numerous intermittent streams crossed, the potential exists for accidental discharge of toxic materials and sediments into the Cheyenne River system that could affect fish and aquatic species downstream.

4.19 Angostura Irrigation District

The Angostura Irrigation District is located in Custer and Fall River Counties along the Cheyenne River. The Angostura Dam and Reservoir is located about 9 miles southeast of Hot Springs and the irrigation district extends approximately 24 miles downstream of the dam. The irrigation district consists of approximately 12,000 acres and is located on benchlands along both sides of the Cheyenne River below Angostura Dam with 78 percent of the irrigated lands located on the south side of the river and the remaining 22 percent on the north side.

Most farm units within the irrigation district include both irrigated and nonirrigated lands. This intergrated irrigation-dryland type farming operation includes dryland cattle grazing areas adjoining the irrigation district. Alfalfa and corn are the major irrigated crops grown in the district. Other irrigated crops include barley, oats, wheat, pasture, hay and sorghum.

Table 4-54 provides the farm units that Alternative B, Alternative C and the W G Flat Route Variation would impact in the irrigation district. Alternative C would disturb the fewest acres and number of farm units (i.e., 134.8 acres in 8 farm units). Alternative B would disturb approximately 229.3 acres in 13 farm units in the district. Although the W G Flat Route Variation would disturb the most acres and farm units in the district (i.e., 232.5 acres and 14 farm units), it would disturb only one additional farm unit and 3.2 more acres than Alternative B. However, it is anticipated that the majority of the impacts associated with Alternative B would be confined to DM&E's existing right-of-way through the irrigation district so actual impacts to farm units and acreages may be considerably less. Further design would be necessary to quantify the actual disturbance outside of DM&E's existing right-fo-way.

Table 4-54 provides the percent of each farm unit that would be affected by the alternatives. Alternative B would disturb greater than 10 percent of the entire farm unit in 6

farm units. The disturbance from Alternative C would impact 5 farm units by 10 percent or more which is the fewest of the alternatives. The W G Flat Route Variation would disturb 9 farm units by 10 percent or more. The W G Flat Route Variation would have the highest impact to the Angostura Irrigation District of all of the alternatives considered to date.

Table 4-54
Angostura Irrigation District Farm Unit Impacts by Alternative

		Alternative B			W G Flat Route Variation			Alternative C (Hay Canyon)		
Farm Unit	Farm Unit Size (acres)	Alternative Right-of-Way (acres)	Remaining Unit Size (acres)	Percent of Farm Unit	Alternative Right-of-Way (acres)	Remaining Unit Size (acres)	Percent of Farm Unit	Alternative Right-of-Way (acres)	Remaining Unit Size (acres)	Percent of Farm Unit
Farm Unit 100	39.4	0.2	39.2	0.5	0.2	39.2	0.5	0.2	39.2	0.5
Farm Unit 100	306.4	36.6	109.4	11.9	36.7	108.6	12.0	36.5	110.6	11.9
			160.4			161.1			159.3	
Farm Unit 101	26.0	3.8	22.2	14.6	3.8	22.2	14.6	3.8	22.2	14.6
Farm Unit 101	53.0	8.0	45.0	15.1	8.0	45.0	15.1	8.0	45.0	15.1
Farm Unit 69	253.4	13.7	124.5	5.4	14.0	122.0	5.5	12.2	133.5	4.8
			115.2			117.4			107.7	
Farm Unit 68b	64.7	18.7	18.2	28.9	17.4	16.6	26.9	9.5	55.0	14.7
			27.8			30.7			0.2	
Farm Unit 68a	158.4	41.1	64.1	25.9	30.7	81.4	19.4	N/A	N/A	N/A
			53.2			46.3				
Farm Unit 23	234.0	3.5	230.5	1.5	N/A	N/A	N/A	N/A	N/A	N/A
Farm Unit 25	243.7	16.6	227.1	6.8	N/A	N/A	N/A	N/A	N/A	N/A
Farm Unit 29	181.5	2.9	178.6	1.6	N/A	N/A	N/A	N/A	N/A	N/A
Farm Unit 84	79.0	14.2	9.1	18.0	N/A	N/A	N/A	N/A	N/A	N/A
			55.7							
Farm Unit 26	363.3	13.8	349.5	3.8	N/A	N/A	N/A	N/A	N/A	N/A
Farm Unit 27	666.6	56.2	288.7	8.4	N/A	N/A	N/A	N/A	N/A	N/A
			321.7							
Farm Unit 93	592.4	N/A	N/A	N/A	2.9	589.5	0.5	N/A	N/A	N/A
Farm Unit 93a	53.0	N/A	N/A	N/A	20.0	1.9	37.7	N/A	N/A	N/A
						31.1				
Farm Unit 56	199.7	N/A	N/A	N/A	19.9	175.0	10.0	N/A	N/A	N/A
						4.8				
Farm Unit 48	238.5	N/A	N/A	N/A	0.9	237.6	0.4	N/A	N/A	N/A
Farm Unit 52	295.8	N/A	N/A	N/A	48.8	102.0	16.5	N/A	N/A	N/A
						145.0				
Farm Unit 91	157.3	N/A	N/A	N/A	16.7	17.4	10.6	N/A	N/A	N/A
						123.2				
Farm Unit 53	264.1	N/A	N/A	N/A	12.5	245.4	4.7	N/A	N/A	N/A
						6.2				
Farm Unit 70	201.0	N/A	N/A	N/A	N/A	N/A	N/A	18.4	181.0	9.2
									1.6	
Farm Unit 99	331.5	NA	NA	NA	NA	NA	NA	46.2	11.8	13.9
									273.5	
Total		229.3			232.5			134.8		

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Appendix A, Table 1. Railroad Alternative Consistency With Management Requirements of the 1984 Nebraska National Forest Plan - Buffalo Gap National Grassland			
Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
Diversity on National Forests and National Grasslands	01 Manage the Forest to provide for the maintenance or improvement of habitat diversity as described in the diversity appraisal procedure.	a. The following interspersion indices will be maintained as a minimum: Bessey Area and Samuel R. McKelvie National Forest - Interspersion Index = 19; Pine Ridge Area and Oglala National Grassland - Interspersion Index = 324; Western Half of the Buffalo Gap National Grassland - Interspersion Index = 101; Eastern Half of the Buffalo Gap National Grassland and Fort Pierre National Grassland - Interspersion Index = 296. b. Leave a minimum of three snags per acre on forested land receiving silvicultural treatment. Two replacement snags may be retained in addition to the three above. Retain occupied den trees and raptor nest trees.	a. The alternatives would not change the interspersion indice on BGNG. See Appendix A of the Nebraska National Forest Land and Resource Management Plan (Forest Service, 1984). b. The snag density described is not applicable to the alternatives (it applies to silvicultural treatment). Raptor nest surveys have been completed and will continue annually throughout the construction period (see Chapters 3 and 4). No raptor nests have been identified within the construction right-of-way on BGNG. DM&E is consulting with the U.S. Fish and Wildlife Service (USFWS) and South Dakota Department of Game, Fish and Parks (SDGFP) to determine adequate mitigation to offset indirect impacts to raptor nests and den trees pursuant to the requirements of the Migratory Bird Treaty Act and Bald Eagle Protection Act.
	02 Management of coniferous stands will be directed toward: providing a healthy, vigorous forest environment; reducing potential for catastrophic losses due to fires, insects, and disease; providing quality wildlife habitat; and providing recreation opportunities. Ensure retention of tree cover where it currently exists.		Not applicable to the alternatives.
	03 Manage forest cover types to provide variety in stand sizes, shape, crown closure, edge contrast, age structure and interspersion.	a. See individual prescriptions for standards and guidelines.	Not applicable to the alternatives.
National Grassland Management	01 Manage National Grasslands for the use(s) that best demonstrate programs of sound land conservation and utilization (grassland agriculture). Demonstrations should include, but not be limited to: a. Improved range utilization techniques; b. Wildlife habitat protection and improvement; c. Surface resource protection, management, and rehabilitation during and after mineral operations; d. Soil conservation and watershed protection; and e. Development of recreational potential.		The alternatives would be consistent with the general direction described. a. The alternatives would not limit the ability of the Forest Service to initiate improved range utilization techniques. b. Wildlife habitat will be adversely affected on BGNG. Although in places the impacts may be severe on BGNG, the impacts are anticipated to be localized. A wildlife mitigation plan, prepared in consultation with SDGFP and the USFWS, will address replacement of important wildlife habitats affected by construction and operation. c. Not applicable to the alternatives. d. Best management practices (BMPs) are being developed that address conservation of soil, sedimentation and the protection of water quality and watersheds. These BMPs will be incorporated into Storm Water Pollution Prevention Plans (SWPPPs) being prepared in compliance with South Dakota Department of Environment and Natural Resources (SDENR) regulations. Site-specific criteria for application of BMPs will be included in the SWPPPs. e. Operation of the railroad may preclude opportunities to develop recreation on parts of BGNG. However, no developed recreation sites are currently planned in the vicinity of the alternatives on BGNG.
	02 Accommodate appropriate objectives of all U.S. Department of Agriculture (USDA), State, and other Federal agencies and institutions pertinent to grassland agriculture in National Grassland management objectives.		Not applicable to the alternatives.
	03 Manage sites with unique or exceptional recreational, esthetics, or wildlife habitat, and areas with Research Natural Area (RNA) or special interest site values for their inherent values as part of the National Grassland demonstration.		Alternative B would cross RARE II and roadless areas on BGNG and would not be consistent with the general direction described. The inherent value of these RARE II and roadless areas (i.e., wilderness quality) would be adversely affected in close proximity to the operating railroad. Alternative C (including both route variations) would be consistent with the general direction. Alternative D would not affect NFS lands on BGNG. [Note: After the 1884 Nebraska National Forest Plan was developed, a special interest area (paleontological resources) was identified near Indian Creek. The Phiney Flat Route Variation would cross through a portion of this area - see Table 15 in this appendix.
Cultural Resource Management	01 Protect, find an adaptive use for, or interpret all cultural resources on National Forest System (NFS) lands which are listed on the National Register of Historic Places, the National Register of Historic Landmarks, or have been determined to be eligible for the National Register.	a. Follow direction in FSM 2360.	This general direction is addressed in the Cultural Resources Programmatic Agreement (see Appendix F of this report). The alternatives would be consistent with this general direction.

Appendix A, Table 1. Railroad Alternative Consistency With Management Requirements of the 1984 Nebraska National Forest Plan - Buffalo Gap National Grassland			
Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
	02 Nominate or recommend cultural resource sites to the National Register of Historic Places by 1990 in the following priority: a. Sites representing multiple themes; b. Sites representing themes which are not currently on the National Register within the State; or c. Sites representing themes which are currently represented by single sites.	a. Nominate or recommend sites in accordance with Section 110 (a) (2) of the National Historic Preservation Act of 1966.	Not applicable to the alternatives.
	03 Protect and foster public use and enjoyment of cultural resources: a. Complete cultural resource surveys prior to any ground-disturbing project; b. Avoid disturbance of known cultural resources until evaluated and determined not significant; c. Collect and record information from sites where there is no other way to protect the properties; d. Issue antiquities permits to qualifying academic institutions or other organizations for the study and research of sites.		The alternatives would be consistent with this general direction. a. Surveys will be completed for all NFS lands which would be disturbed during construction of the selected alternative. b. Disturbance of sites on NFS lands will not be allowed until adequate mitigation plans have been developed, approved and implemented. c. Site data collection will be incorporated into mitigation planning, where appropriate. d. Appropriate permits have been issued to cultural contractors working for the STB. Refer to the Cultural Resource Programmatic Agreement in Appendix F of this report for additional information.
Visual Resource Management	01 Apply the Visual Management System to all National Forest System (NFS) lands. Travel routes, use areas and water bodies determined to be of primary importance are sensitivity level 1 and appropriate visual quality objectives are established according to the Visual Management System.		This general direction required Forest Service action following approval of the forest plan in 1984. The purpose of this consistency review is to evaluate the alternatives based on visual quality objectives established for individual management prescriptions.
	02 Rehabilitate all existing projects and areas which do not meet the adopted visual quality objective(s) (VQO) specified for each management area. Set priorities for rehabilitation, considering the following: a. Relative importance of the area and the amount of deviation from the adopted VQO. Foreground areas have highest priority; b. Length of time it will take natural processes to reduce the visual impacts so that they meet the adopted VQO; c. Length of time it will take rehabilitation measures to meet the adopted VQO; and d. Benefits to other resource management objectives to accomplish rehabilitation.	a. Follow direction provided in FSM 2380 and FSH 2309.16 through FSH 2309.25.	This general direction required Forest Service action following approval of the forest plan in 1984. The general direction is not applicable to the alternatives.
	03 Achieve enhancement of landscapes through addition, subtraction or alteration of elements of the landscape such as vegetation, rockform, water features or structures. Examples of these include: a. Addition of vegetation species to introduce unique form, color or texture to existing vegetation. b. Vegetation manipulation to open up vistas or screen out undesirable views.		Not applicable to the alternatives.
	04 Plan, design and locate vegetation manipulation in a scale which retains the color and texture of the characteristic landscape, borrowing directional emphasis of form and line from natural features.	a. Meet the Visual Quality Objectives of retention and partial retention one full growing season after completion of a project. Meet modification and maximum modification objectives three full growing seasons after completion of a project. b. Determine sensitivity levels in accordance with FSH 2309.16, Agriculture Handbook No. 462, Vol. 2, Chapter 1; Sensitivity Levels.	Not applicable to the alternatives.
	05 Choose facility and structure design, color of materials, location and orientation to meet the adopted visual quality objective(s) for the management area.		The visual quality objective (VQO) for the majority of the NFS lands on BGNG which would be crossed by the alternatives is designated by the Nebraska Forest Plan (Forest Service, 1984) as "modification". The modification classification recognizes that management activities may dominate the landscape. All the alternatives would comply with the level of contrast allowed by the modification VQO. However, all fixed facilities and structures on NFS lands would be painted to blend with the natural environment as required by the general direction. A small portion of Alternatives B and C(including both route variations) would cross areas designated as Management Prescription 9A in the Nebraska

Appendix A, Table 1. Railroad Alternative Consistency With Management Requirements of the 1984 Nebraska National Forest Plan - Buffalo Gap National Grassland			
Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
			Forest Plan. Management Prescription 9A applies to the aquatic ecosystem, the riparian ecosystem, and adjacent ecosystems that remain within approximately 100 feet from both edges of all perennial streams and from shores of lakes and other still water bodies. Management Prescription 9A has a VQO of "partial retention". Management activities may be evident but should be subordinate to the natural landscape. Activities may introduce forms, lines and colors not found in the natural landscape but they should not dominate the views. Other natural features should attract the viewer's attention. Where the alternatives would cross or run parallel to Management Prescription 9A, the operating railroad is expected to dominate the natural landscape and the views. Other natural features would likely be subordinate to the railroad, especially when coal trains are passing. Therefore, Alternatives B and C (including both route variations) are not consistent with this general direction on BGNG. Alternative D would not cross NFS lands on BGNG.
Recreation Site Construction and Rehabilitation	01 Provide appropriate development facilities where the private sector is not meeting the demand.		Not applicable to the alternatives.
	02 Maintain cost-effective developed recreation facilities which complement non-Forest Service developments.		Not applicable to the alternatives.
	03 Provide facilities which are accessible to handicapped persons.		Not applicable to the alternatives.
	04 Facilities proposed for construction or reconstruction which lie within identified 100-year floodplains will be evaluated as to the specific flood hazards and values involved with the site. Viable alternatives will be thoroughly evaluated.	a. Follow procedures and guidelines in FSM 2527.04c.	Not applicable to the alternatives.
Management of Developed Recreation Sites	01 Construct, reconstruct and maintain developed sites in accordance with the established Recreation Opportunity Spectrum (ROS) classification for the management area.	a. Standards and Guidelines ROS Class* — Site Development Scale** P — Not to exceed 1 SPNM — Not to exceed 2 SPM — Not to exceed 2 RN — Class 3 or 4 R — Class 3 or 4 U — Class 5 * P = Primitive SPNM = Semi-primitive non-motorized SPM = Semi-primitive motorized RN = Roaded Natural R = Rural U = Urban ** FSM 2331.47	Not applicable to the alternatives.
	02 Provide appropriate development facilities where the private sector is not meeting the demand		Not applicable to the alternatives.
	03 Prohibit summer home development.		Not applicable to the alternatives.
	04 Fully developed recreation facilities only permitted in Management Areas 1A and 10C.		Not applicable to the alternatives.

Appendix A, Table 1. Railroad Alternative Consistency With Management Requirements of the 1984 Nebraska National Forest Plan - Buffalo Gap National Grassland			
Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
	05 Manage development scale 3 and 4 sites for full service when at least one of the following are met: a. A campground is designated as a fee site; b. A group campground or picnic ground has a reservation system and/or user fee; or c. The site is a swimming site, a boating site with a constructed ramp, or a staffed visitor information center.		Not applicable to the alternatives.
Dispersed Recreation Management	01 Provide a broad spectrum of dispersed recreation opportunities in accordance with the established Recreation Opportunity Spectrum (ROS) classification for the management area.		Not applicable to the alternatives.
	02 Close or rehabilitate dispersed sites where unacceptable environmental damage is occurring.	a. Close sites that cannot be maintained in Frissell Condition Class 1, 2, or 3 (Campsite Condition, Frissell, S.S.; Journal of Forestry August 1978). b. Rehabilitate sites that are in Frissell condition class 4.	Not applicable to the alternatives.
	03 Allow gathering of dead or down material for fuelwood for camping or picnicking use.		Not applicable to the alternatives.
	04 Manage resource activities and facilities in accordance with the Regional Acceptable Work Standards.	a. FSM 1310 R2 ID No. 1 7/22/82.	Not applicable to the alternatives.
	05 Demonstrate resource management which will encourage broadening the land base available for dispersed recreation.		Not applicable to the alternatives.
Wildlife and Fish Resource Management	01 Maintain or enhance habitat for threatened and endangered wildlife and plant species.		At this time, the alternatives are consistent with this general direction. Surveys conducted to date suggest that the alternatives will not adversely affect currently-listed federally-threatened or -endangered species on BGNG. However, surveys have not been conducted for nesting mountain plovers. The USFWS proposed to list the mountain plover as threatened in February, 1999. Prairie dog colonies which will be crossed by the alternatives may provide nesting habitat for this species. A proposal to list the sturgeon chub is advancing - this species may be present in streams tributary to the Cheyenne River on BGNG. Finally, the USFWS is currently evaluating whether listing the black-tailed prairie dog as threatened is warranted. Listing action on all these species is expected in the foreseeable future (i.e., during the period when construction of the railroad would occur). Environmental groups are currently working on petitions to list other species that may occur on BGNG - most notably the sage grouse. The alternatives have the potential to adversely affect all of these species. Future consistency with this general direction will depend upon listing decisions made by the USFWS.
	02 Conduct on-going surveys for threatened, endangered and sensitive species.	a. Conduct black-footed ferret surveys on prairie dog colonies where planned management activities may affect ferrets. U.S. Fish and Wildlife Service will be consulted on current ferret survey procedures.	Appropriate surveys for threatened and endangered species have been completed or will occur in the future. Annual follow-up surveys will be required for some species through the construction period (see Chapter 4). Surveys for black-footed ferrets, if required, will be conducted in the year prior to construction.
	03 Implement Black-footed Ferret Contingency Plan upon any confirmed sighting on or near NFS lands or for future ferret recovery efforts as identified in the Black-foot Ferret Recovery Plan (U.S. Fish and Wildlife Service document.)		Not applicable to the alternatives.
	04 Continue to manage black-tailed prairie dog as described in a 1978 Final Environmental Statement (Management of Prairie Dogs on Lands Administered by the Supervisor of the Nebraska National Forest) and a 1981 Decision Notice and Environmental Assessment.	a. Use registered rodenticides and grazing methods to reduce prairie dog populations. b. Reduce prairie dog population in the Conata Basin area of the Buffalo Gap National Grassland. The population reduction will be limited to retaining a specified number of active prairie dog colonies and acreage in a scattered distribution. Conata Basin is divided into four units and, as a minimum, eight colonies will be retained in each unit. Six of these colonies must be at least 30 acres in size and two must be at least 100 acres in size.	Not applicable to the alternatives.

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Management Activities	General Direction	Standards & Guidelines	Railroad Alternative Consistency
		c. Manage the prairie dog population on administered lands outside of Conata Basin in a manner that is consistent with other uses. The wildlife values of prairie dog colonies will be recognized, but to prevent serious conflicts with forage and watershed resources, the acreage of active prairie dog colonies will not be allowed to exceed two percent of the area suitable for grazing in an allotment. As a minimum, approximately 1600 acres of active prairie dog colonies will be retained on the administered lands outside Conata Basin.	
	05 Maintain habitat for viable populations of all existing vertebrate wildlife species.		The alternatives would not degrade habitat on BGNG to such an extent that viable populations of wildlife would no longer be supported.
	06 Provide habitat for management indicator species at a level no lower than 40% of potential.		The alternatives would not reduce habitat for any management indicator species to below 40% of potential (see Chapter 4).
Wildlife Habitat Improvement and Maintenance	01 Manage water capable of supporting fish populations to provide for those populations.	a. Construct a minimum of 10 percent of new reservoirs to a minimum depth of 12 feet over at least 25 percent of the surface acreage of normal water level. b. Do not allow manipulation of riparian vegetation on trout streams that would reduce shade cover by more than 50 percent.	The alternatives would not result in construction of new reservoirs on BGNG. No trout streams would be affected on BGNG.
	02 Construct fences to allow for pronghorn passage, where pronghorns exist.	a. Assure that the bottom wire, new construction and reconstruction on all cattle and horse allotment fences is a minimum of 16 inches above the ground. For sheep allotments, make the bottom wire a minimum of 10 inches above the ground.	The alternatives would be consistent with these standards and guidelines. Fencing on NFS lands would comply with Forest Service requirements.
	03 Manage wildlife and fish resources as outlined in the appropriate State Comprehensive Wildlife Management Plan.		Not applicable to the alternatives.
	04 Install bird escape ladders on all water tanks.		Not applicable to the alternatives.
	05 Maintain edge contrast of at least medium or high between tree stands created by even-aged management.	a. Contrast by Age Class is: Contrast** Age Class* / OG / M / P / SSS / GF / Shr / Gra OG: - / L / M / H / H / M / H M: L / - / M / M / H / M / H P: M / M / - / M / H / M / H SSS: H / M / M / - / L / L / L GF: H / H / H / L / - / M / L Shr: M / M / M / L / M / - / M Gra: H / H / H / L / L / M / - * OG = Old Growth; SSS = Shrub-seedling-sapling; M = Mature; GF = Grass-forb; P = Poles; SHR = Shrubland; GRA = grass ** H = High contrast; Medium contrast; L = Low contrast	Not applicable to the alternatives.
	06 Implement Black-footed Ferret Contingency Plan upon any confirmed sighting on or near NFS lands or for future ferret recovery efforts as identified in the Black-footed Ferret Recovery Plan (U.S. Fish and Wildlife Service document).		Not applicable to the alternatives.

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Management Activities	General Direction	Standards & Guidelines	Railroad Alternative Consistency
Wildlife and Fish Cooperation With Other Agencies	01 Manage animal damage in cooperation with the State Wildlife Agencies, Fish and Wildlife Service, other appropriate agencies, and cooperators to prevent or reduce damage to other resources and direct control toward preventing damage or removing only the offending animal.		Not applicable to the alternatives.
Range Resource Management	01 Invest in cost-effective allotment management and associated range improvements.	a. Base economic analysis on Project Effectiveness Analysis Handbook (FSH 2209.11).	Not applicable to the alternatives.
	02 Provide forage to sustain local dependent livestock industry as well as wildlife populations agreed to in Statewide Comprehensive Wildlife Management Plans for National Forest System lands.		Not applicable to the alternatives.
	03 In cooperation with State wildlife agencies, develop residual cover guidelines for prairie grouse by close of FY 1988.		Not applicable to the alternatives.
	04 Require Allotment Management Plans to be based on rangeland analysis and capabilities; specify objectives, management systems, improvements, and utilization standards; develop Plan with permittees and include it as a condition of the grazing permit.		Not applicable to the alternatives.
	05 Implement only range practices and improvements identified in Allotment Management Plans.		Not applicable to the alternatives.
Range Improvement and Maintenance	01 Structural range improvement should be designed to benefit wildlife and livestock.		Not applicable to the alternatives.
	02 Give first priority for improvements to rangeland in less than fair condition (don't allow higher condition to degenerate to lower condition in meantime).	a. Base range condition on the standards in Range Analysis Handbook (FSH 2209.21) or SCS methods.	Not applicable to the alternatives.
Silvicultural Prescriptions	01 Provide for wildlife habitat improvement and enhancement of other renewable resources in Sale Area Improvement Plans.		Not applicable to the alternatives.
	02 Make Christmas trees available in areas where other resource objectives can be accomplished through commercial or personal use Christmas tree sales.		Not applicable to the alternatives.
	03 Use trees of the best genetic quality available which are adapted to the planting site when supplemental planting. (Reference FSM 2475)		Not applicable to the alternatives.
	04 Apply a variety of silvicultural systems and harvest methods which best meet resource management objectives.	a. The appropriate harvest methods by forest cover type are: Appropriate Harvest Methods* Forest Cover Type / Even-aged / Uneven aged Ponderosa Pine / SW, CC, & S / GS & ST Eastern Red Cedar / CC / - *The following abbreviations are used for harvest methods: SW = Shelterwood; CC = Clearcut; GS = Group selection; ST = Single tree selection; S = Seed tree b. Utilization standards for live and dead material are: Species / Min. DBH / Min. Top Dia. / Length (feet) / % Net of Gross	Not applicable to the alternatives.

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Management Activities	General Direction	Standards & Guidelines	Railroad Alternative Consistency
		Live Trees - All Periods Sawtimber P. Pine 8.0 6.0 8 33-1/3 J. Pine 8.0 4.0 7 33-1/3 E.R. Cedar 4.0 3.0 7 50 c. Silvicultural Standards by Harvest Method: (These standards do not apply on areas managed for old growth) 1. Clearcut: Forest Cover Type / Rotation Age / Growing Stock / Thinning Cycle Level P. Pine 100-160 80-120 20-30yr J. Pine 70-90 80-120 20-30yr E.R. Cedar 60-80 175-180 20-30yr 2. Two-step shelterwood: Forest Cover Type / Rotation Age / Growing Stock / Thinning Cycle Level P. Pine 100-160 80-120 20-30yr J. Pine 70-90 80-120 20-30yr E.R. Cedar 60-80 175-400 20-30yr First Cut (seed cut): Remove 40-70 percent of the basal area or cut to basal area 25-60 for P. Pine; BA 20-40 for J. Pine; 50-60 trees/ac. E. Red Cedar Second Cut (removal cut): Remove all overstory when regenerated stand meets minimum stocking standards. 3. Three step-shelterwood: Rotation age, growing stock level, and thinning cycle is the same as two-step shelterwood. First Cut (preparatory cut): Remove 10-40 percent of the basal area or cut to BA 60-80 for P. Pine; BA 60-80 for J. Pine; 90-120 Trees/ac E.R. Cedar Second Cut (seed cut): Remove 40-50 percent of the remaining basal area or cut to BA 25-50, 10 to 20 years after preparatory cut for P. Pine and J. Pine 40-60 Trees/ac., 10 to 20 years after preparatory cut for E. R. Cedar.	

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Management Activities	General Direction	Standards & Guidelines	Railroad Alternative Consistency
		4. Selection Forest Cover Type / Residual BA / Cutting Cycle P. Pine: 80-120, 20-30yr J. Pine: 80-120, 20-30yr	
	05 Assure that all even-aged stands scheduled to be harvested during the planning period will generally have reached the culmination of mean annual increment of growth.		Not applicable to the alternatives.
	06 The maximum size of openings created by the application of even-aged silviculture will be 40 acres regardless of forest cover type. Exceptions are: a. Proposals for larger openings are subject to a 60-day public review and are approved by the Regional Forester; b. Larger openings are the result of natural catastrophic conditions of fire, insect or disease attack, windstorm; or c. The area does not meet the definition of created openings.	a. Size of openings : Patch clearcuts: 1-10 acres Clearcuts : 10-40 acres	Not applicable to the alternatives.
	07 Acceptable management intensity activities to determine harvest levels are: Ponderosa Pine / Jack Pine / E.R.Cedar Tree Improvement Site: X / X / N Preparation: X / X / N Reforestation Planting: X / X / X Seeding: X / N / O Natural: X / X / N Regeneration Protection: X / X / X Stocking Control thinning): Pre-commercial: X / X / X Commercial: X / X / X Salvage of Dead Material: X / X / X Cutting Methods: Clearcut: X / X / X Shelterwood: X / N / N Selection: X / N / N *Various combinations of these activities provide the acceptable range of management intensity for timber production (36 CFR 291.2 (b)(2)). X = Appropriate practice; O = Not an appropriate practice; N = Appropriate, but not a standard practice. May be acceptable where justified.		Not applicable to the alternatives.
	08 Establish a satisfactory stand on cut over areas, emphasizing natural regeneration within 5 years after final harvest except when provided for otherwise in specific management prescriptions, and permanent openings that serve specific management objectives.	a. Minimum stocking standards by productivity and forest cover type: Forest Cover Type / Site Prod (Cu. Ft./A/yr) / Planting Densities (Trees/A) P. Pine: 85+, 360-680 50-84, 360-550 20-49, 300-360	Not applicable to the alternatives.

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Management Activities	General Direction	Standards & Guidelines			Railroad Alternative Consistency
		J. Pine	85+	360-680	
			50-84	360-540	
			20-49	300	
		E. R. Cedar	55+	400-680	
			35-54	300-400	
			25-34	100-300	
		Forest Cover Type	Seedling Stocking Per Acre 1/		
			Min. 2/	Desir. 3/	
		P. Pine	205	310	
			205	255	
			190	240	
		J. Pine	245	340	
			200	280	
			150	250	
		E. R. Cedar	140	175	
			80	120	
			40	100	
		Forest Cover Type	Percent of Plots or transects that are stocked		
			Minimum	Desired	
		P. Pine	70	100	
			70	100	
			70	100	
		J. Pine	75	100	
			75	100	
			75	100	
		E. R. Cedar	80	100	
			80	100	
			80	100	
		Forest Cover Type	Seedling Height (inches)		
			Minimum	Desired	
		P. Pine	3	18	
		J. Pine	3	18	
		E. R. Cedar	3	18	
		1/ Lower densities are recommended to meet minimum stocking standards. Higher densities are recommended to meet desired stocking standards, with ample stock for selecting genetically superior trees. 2/ Minimum stocking standards are to be used where no precommercial cutting will be done, and only one harvest will be made to regenerate the stand. 3/ Desired stocking standards are to be used where at least one precommercial cut will be done followed by two sawlog harvests before the final cut is done.			

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Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
Wild and Scenic River Management	01 Protect river segments that have been determined eligible for potential addition to the National Wild and Scenic Rivers system from activities which could diminish or change the free-flowing character, water quality, or the scenic, recreational, fish and wildlife, and other values which make the river eligible for designation. a. Request that Federal lands which constitute the bed or bank, or which are within one-quarter mile of either bank, be temporarily withdrawn from appropriation and entry under the mining laws. Withdrawal should continue until the river segment is: a) found to be ineligible; b) not recommended for inclusion in the National system; or c) added to the system by Act of Congress. b. Safeguard the values of the river area by appropriate conditions and stipulations in leases, permits, and licenses, including prospecting, issued under terms of the mineral leasing laws. c. Extraction of salable, common-variety minerals from the river or the study area shall not be authorized until the study is complete and recommended actions are enacted. d. Prohibit construction of roads within the river study area if it would have direct and adverse effects on the values which make the river eligible for potential inclusion into the system. e. Maintain current motorized access character and avoid any changes to the potential wild and scenic river classification. f. Maintain free-flowing characteristics and water quality during the study and Congressional review period. g. Manage tree stands within the study area to maintain or enhance potential wild and scenic river values. Protect scenic values by sizing and shaping timber harvest units to achieve a natural appearance and to harmonize with the surrounding landscape. h. Prohibit special uses or permitted land uses which degrade or have directly adverse effects on values which make the river segment eligible. i. None of this direction shall abrogate any existing privileges or contracts affecting National Forest System lands held by any private party without consent of said party. Activities affecting the applicability of U.S. mining and mineral leasing laws are subject to valid existing rights.		No streams or rivers that have determined to be eligible for potential addition to the National Wild and Scenic River System would be affected on NFS lands on BGNG. The Forest Service has completed an eligibility inventory of wild and scenic rivers on BGNG. Both the Cheyenne River and Rapid Creek were evaluated. The draft grassland plan did not recommend either for management as wild and scenic (Forest Service, 1999a).
Riparian Area Management	01 Manage hardwood draws and riparian areas to provide for regeneration to sustain their inherent biological, physical, and visual values.	a. Maintain all riparian ecosystems in at least an upper mid-seral successional stage based upon the R2 Riparian Ecosystem Rating System.	Alternatives B and C would be inconsistent with this general direction. Alternative B would have the largest impact on riparian areas on NFS lands on BGNG. Alternative B would impact riparian areas on NFS lands along Cottonwood Creek, Spring Creek and at several locations adjacent to the Cheyenne River. Riparian impacts on NFS lands along Cottonwood Creek and the Cheyenne River would be eliminated by Alternative C but the impacts to Spring Creek would remain. The Phiney Flat Route Variation of Alternative C would eliminate riparian impacts on NFS lands along Spring Creek. The biological, physical, and visual values of riparian areas which would be crossed by the operating railroad on NFS lands on BGNG would not be sustained by Alternatives B and C. However, the impacts would be substantially reduced by implementing the Phiney Flat Route Variation for Alternative C.
	02 Prescribe silvicultural and livestock grazing systems to achieve riparian area objectives.		Not applicable to the alternatives.
	03 Locate and construct arterial and collector roads to maintain the basic natural condition and character of riparian areas.		It is anticipated that access to the construction right-of-way on BGNG will rely primarily on existing roads. However, should it become necessary to construct an access road on NFS lands, this general direction would be applied to the road location and construction techniques.
Water Uses Management	01 Protest water right applications of others when such uses will lower streamflows below levels acceptable for National Forest uses and purposes.		Not applicable to the alternatives. DM&E's need for water would be limited to construction activities.

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Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
	02 Determine and obtain rights to instream flow volumes to protect and maintain stream channel stability and capacity and to accomplish any proposed increase in use or resource activity.		Not applicable to the alternatives.
	03 Identify at the project level, upland areas that are immediately adjacent to Riparian (Prescription 9A) Management Areas. Adjacent upland areas are those portions of a management area which, when subjected to management activities, have a potential for directly affecting the condition of the adjacent Riparian Management Area. The magnitude of effects is dependent upon slope steepness, and the kind, amount, and location of surface and vegetation disturbance within the adjacent upland unit.	a. The following is a guide to identify the approximate extent of adjacent upland areas: Slope Gradient of Upland Areas Adjacent to Riparian Management Area — Upslope Distance From Boundary of Riparian Management Area % Slope Range — Feet 0-20 — 100 20-30 — 180 30-40 — 280 40-50 — 400 50-60 — 520 60-70 — 640 70-80 — 760 80-90 — 880 90-100 — 1000 100-150 — 1000-1300 b. Reduce, through designed management practices and appropriate erosion mitigation and vegetation/restoration measures, the project caused on-site erosion rates (calculated with appropriate Universal Soil Loss Equation methodology) by 75% within the first year after disturbance. Reduce project caused on-site erosion by 95% within five years after initial disturbance (USDA Tech. Pub. SA-TP 11, 1980: USDA SCS Tech. Note No. 10, 1977). c. Design continuing mitigation/restoration practices and follow-up maintenance activities to insure that 80% original ground cover (vegetation) recovery occurs within five years after disturbance.	b. BMPs are being designed to address sedimentation from these sites. These BMPs will be implemented through site-specific SWPPPs prepared in compliance with SDENR regulations. On NFS lands the BMPs will be designed to achieve the stabilization goals referenced in this section. The Forest Service will be provided with copies of the SWPPPs and BMPs for review and comment. It is anticipated that the final BMPs will be incorporated as conditions of approval to Forest Service approvals to construct and operate the railroad on NFS lands. c. Monitoring and maintenance will be addressed in the SWPPPs. Reclamation success objectives in the SWPPPs will consistent with the forest plan's 5 year - 80 percent goal.
Water Resource Improvement and Maintenance	01 Maintain instream flows and protect public property and resources.		Temporary dewatering of streams may be required in the vicinity of construction activities during installation of instream structures. However, downstream flow would be maintained at all times, where necessary, to protect aquatic resources.
	02 Improve or maintain water quality to meet State water quality standards. However, where the natural background water pollutants cause degradation, it is not necessary to implement improvement actions. Short-term or temporary failure to meet some parameters of the State standard, such as increased sediment from road crossing construction or water resource development may be permitted in special cases.		The alternatives are designed to maintain water quality in compliance with federal and state regulations. Before construction can begin, the SDENR must certify to the COE that water quality standards will be maintained during construction of the alternatives. That certification will apply to all lands affected by construction activities. To a certain extent, SDENR will rely upon BMPs developed by DM&E to determine the project's ability to comply with state water quality standards. SDENR will review the BMPs prior to issuing a 401 water quality certification. If the BMPs are found deficient, additional measures to protect water quality may be imposed by SDENR. In addition to the 401 water quality certification, DM&E will be required to prepare and implement SWPPPs in compliance with SDENR regulations. The purpose of the SWPPP is to prevent storm water from becoming "polluted" prior to leaving the construction site. Of primary concern is sedimentation. The SWPPP must specify storm water controls, such as hay bales, sedimentation (silt) fences, settling ponds, etc., that will be installed to prevent transport of sediment from construction sites to adjacent water bodies and wetlands. The SWPPP must also contain an inspection and maintenance schedule for storm water controls.
	03 Rehabilitate disturbed areas that are contributing sediment directly to perennial streams as a result of management activities to maintain water quality and reestablish vegetation cover.	a. Reduce to natural rate of erosion due to management activity in the season of disturbance and sediment yields within one year of the activity through necessary mitigation measures such as waterbarring and revegetation.	This general direction will be addressed in the SWPPPs developed for storm water permits required by the SDENR.

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	04 Limit use of herbicides, insecticides, rodenticides, or other chemical agents as part of management activities to times and places where possible transport to or by surface water has a low probability of occurrence. Follow all label requirements concerning water quality protection.		DM&E would comply with federal and state regulations pertaining to the application of boicides. Only licensed applicators would be employed. Use of biocides on NFS lands would require prior approval from the Forest Service.
Minerals Management General	01 Administer areas with producing sites and known reserves with consideration of ongoing and potential mineral activities.		Not applicable to the alternatives.
	02 In areas of high to moderate potential for valuable mineral deposits, perform site-specific mineral evaluations prior to making substantial capital investments, such as recreational developments.		Not applicable to the alternatives.
Mining Law Compliance and Administration	01 Prevent or control adverse impacts on surface resources in accordance with 36 CFR 228. a. Unclassified lands: Provide for reclamation of disturbed lands to achieve the planned uses specified in the Forest Plan, when those lands are no longer needed for mining operations. b. Designated Wilderness, Congressionally designated Wilderness Study Areas, and areas recommended for wilderness designation by RARE II on which Congressional action has not been completed: Provide for reasonable access of the type necessary to the purpose of proposed operations and for restoration of disturbed lands as near as practical to their natural condition when they are longer needed for operations. c. Other classified lands not withdrawn from operations under the General Mining Laws: Such lands may include Research Natural Areas, National Recreation Areas, "RARE II" Further Planning Areas, Special Interest Areas such as scenic and geologic, National Historic Sites, or some other type of specific classification. The status of classified lands with respect to withdrawal must be checked before an operating plan can be approved. Provide for reasonable protection of the purposes for which the lands were classified and for reclamation of disturbed lands to a condition suitable for the purposes for which the lands were classified.		Not applicable to the alternatives.
	02 Withdrawals must be for the purpose of protecting specific existing or proposed uses. Initiate actions for withdrawal from entry under the General Mining Laws when 36 CFR 228 and other applicable laws and regulations will not provide the opportunity for protection of surface resources and uses.		Not applicable to the alternatives.
Minerals Management-Oil, Gas and Geothermal	01 Review cases of suspected abuse of the mining laws such as occupancy of the land for purposes other than prospecting, mining and related operations. Initiate appropriate actions to resolve. First action should be administrative. Failure of such action requires examination of claims for validity, followed by appropriate contest proceedings or legal action.		Not applicable to the alternatives.
	02 Withdrawals of lands from operations of the mineral leasing acts will be requested only in exceptional situations because Federal decisions on mineral disposals under these acts are discretionary on a case-by-case basis.		Not applicable to the alternatives.
	03 Recommendations for or consent to issuance of leases or permits: 1. Unclassified Lands: a. Forest Service authorization of geophysical prospecting will include terms and conditions controlling operating methods and times to prevent or control adverse impacts on surface resources and uses. b. Recommendations for and consent to BLM issuance of leases and permits will include all current standard stipulations and the Regionally-approved special stipulations that may be necessary for additional protection of specific surface resources and uses. Reclamation requirements will have the objective of returning disturbed lands to the planned uses. These standard and current Regionally-approved special stipulations are in Appendix H to the Forest Plan.		Not applicable to the alternatives.

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Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
	(1) Standard stipulations, in addition to those in the basic lease or permit document, are BLM Form 3109-3, "Stipulation for Lands Under Jurisdiction of the Department of Agriculture" and Forest Service (R-2) Supplement D to BLM Form 3109-3, "Surface Disturbance Stipulation."		
	(2) Special Region 2 Forest Service stipulations will be used as appropriate to the surface resource situation on the lands involved in a lease or permit. These stipulations are titled as supplements to Form 3109-3 and are listed below: (a) Forest Service (R-2) Supplement C to Form 3109-3, "Limited Surface Use Stipulation". This stipulation notifies a lessee or permittee that certain described conditions exist upon the lands involved that require special operating plan provisions for their protection. (b) Forest Service (R-2) Supplement F to Form 3109-3, "Surface Use Stipulation". This stipulation notifies a prospective lessee or permittee that surface use or occupancy that would cause significant surface disturbance is not authorized upon tracts within the proposed lease or permit area. This stipulation is also used to protect wilderness values in areas being considered or studied as potential additions to the wilderness preservation system. Recision and replacement of this stipulation is provided if Congress removes the area from further consideration as wilderness.		Not applicable to the alternatives.
	(c) Forest Service (R-2) Supplement H to Form 3109-3, "Conditional No Surface Disturbance Stipulation". This stipulation notifies a prospective lessee or permittee that certain described conditions exist upon tracts within the proposed lease or permit area that will prevent any surface disturbance affecting those tracts unless an operating plan can be devised that will convince the Forest Service that surface use, occupancy and reclamation can take place without causing irretrievable environmental damage. (d) Forest Service (R-2) Supplement G to Form 3109-3, "Activity Coordination Stipulation". This stipulation notifies the lessee that surface values exist that are sensitive to high levels of activity. In such circumstances, the Forest Service may require that activities on the lease lands, when multiple leaseholds are involved, be conducted by a single operator, similar to the conduct of operations under a unitization agreement approved by the Bureau of Land Management. An alternative approach would be joint Forest Service/Bureau of Land Management approval of a coordinated plan of operations involving multiple operators. (e) Forest Service (R-2) Supplement A to Form 3109-3, "Further Planning Area Stipulation". This stipulation applies to lands identified for further planning in RARE II decision documents. It specifies the nature and extent of operations allowed and the conditions to be met for their approval.		Not applicable to the alternatives.
	c. Recommend against or deny consent to BLM for issuance of leases where operational damages on surface resources, including the impacts of surface-based access, product transportation and ancillary facilities necessary to production and related operations, would be irreversible and irretrievable, with no potential for reclamation and attachment of the no surface occupancy stipulation (Forest Service R-2: Supplement F to Form 3109-3) would prevent the effective recovery of the Federal mineral resource, as determined by the BLM. Negative recommendations or consent denials will be based on site-specific consideration of the following criteria: (1) Slopes steeper than 60 percent. (2) High erosion hazard rating. (3) High geologic hazard rating. (4) Low visual absorption capacity that prevents reclamation to established visual quality objective (VQO).		Not applicable to the alternatives.

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Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
	(5) A conclusion by the Forest Service (FS) and/or the United States Fish and Wildlife Service (USFWS) that the action will jeopardize the survival or recovery of federally listed threatened and endangered (T&E) wildlife or plant species. (6) Intrusions upon the identified critical (USFWS) or essential (FS) habitat of a federally listed (T&E) wildlife or plant species or upon the plant or animal itself. (7) Intrusion upon the habitat of individual plant or animal species listed by a state as threatened or endangered. (8) Intrusion upon the habitat of individual plant or animal species identified by the Regional Forester as needing special management to prevent its need for listing as a threatened or endangered species.		
	2. Designated Wilderness, Congressionally-designated Wilderness Study Areas, and areas recommended for Wilderness in RARE II on which Congress has not taken final action: a. Geophysical prospecting, when authorized, will be subject to terms and conditions insuring that operations will be done by methods and at such times that there will be no significant adverse impacts on surface resources. b. Wilderness is withdrawn from all leasing, subject to valid existing rights. c. Recommendations for consent to lease in Wilderness Study Areas and RARE II areas on which Congress has not taken final action will include Stipulation F, which withholds authorization of surface occupancy. Stipulation F may become inoperative if Congressional action releases the area from further consideration for addition to the Wilderness Preservation System. d. Recommendations for consent to lease in Further Planning Areas will include Forest Service Supplement A to Form 3109-3. 3. Classified lands other than Wilderness and related Study and Roadless areas, as described in "2" foregoing, which are not by law or otherwise withdrawn from operations under the mineral leasing acts. Examples of such lands include Wild and Scenic River System, RARE II Further Planning Areas, National Recreation Areas, National Historic Sites, Natural Areas, Special Areas--such as geological, scenic and zoological, and some other specific classifications. a. Forest Service authorize geophysical and similar prospecting only when terms and conditions can be applied that will protect the purposes for which the lands were classified.		Not applicable to the alternatives.
	b. Recommendations for and consent to BLM for issuance of leases and permits will include all current standard stipulations and the current Regionally-approved special stipulations necessary to protect the purposes for which the lands were classified. Standard and special stipulations are in Appendix H to the Forest Plan. See 1.b(1) under this Management Activity heading, foregoing, for the standard stipulations. Special stipulations to be applied as appropriate are: (1) Forest Service (R-2) Supplement B to Form 3109-3, "Classified Area Stipulation". This stipulation applies to lands classified under 36 CFR 251.23 and 294.1 for specific management purposes. Because of the regulatory provisions, no use or occupancy inconsistent with the classification is permitted. This does not necessarily mean recommendation against or denial of consent to BLM for issuance of leases. The reason is that classified areas may be only small portions of large leaseholds. (2) Forest Service (R-2) Supplement C to Form 3109-3, "Limited Surface Use Stipulations". This stipulation notifies a lessee or permittee that certain described conditions exist upon the lands involved that require special operating plan provisions for their protection.		Not applicable to the alternatives.

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	(3) Forest Service (R-2) Supplement E to Form 3109-3, "Wild and Scenic Rivers Sys. Stipulations". This stipulation establishes operating conditions for lands under study by Congress for inclusion in the National Wild and Scenic Rivers systems. It also provides for establishing appropriate operational controls should the lands be included in that system or should the lands not be added to the system. (4) Forest Service (R-2) Supplement F to Form 3100-3, "Surface Use Stipulation". This stipulation notifies prospective lessees or permittees that surface use or occupancy that would cause significant surface disturbance is not authorized for described lands. This stipulation may be applied in a wide variety of conditions in lieu of recommending against or denying consent to BLM for issuance of a lease. (5) Forest Service (R-2) Supplement H to Form 3109-11, "Conditional No Surface Disturbance Stipulation". This stipulation notifies a prospective lessee that certain described conditions exist upon tracts within the proposed lease or permit area that will prevent any surface disturbance affecting those tracts unless an operating plan can be devised that will convince the Forest Service that surface use, occupancy and reclamation can take place without causing irretrievable environmental damage. (6) Forest Service (R-2) Supplement G to Form 3109-3, "Activity Coordination Stipulation". This stipulation notifies the lessee that surface values exist that are sensitive to high levels of activity. In such circumstance, the Forest Service may require that activities on the lease lands, when multiple leaseholds are involved, be conducted by a single operator, similar to the conduct of operations under a unitization agreement approved by the BLM. An alternative approach would be joint Forest Service/BLM approval of a plan of operations involving multiple operators. c. Recommend against or deny consent to BLM for issuance of leases where operation damages to surface resources, including the impacts of surface-based access, product transportation and ancillary facilities necessary to production and related operations, would be irreversible and irretrievable, with no potential for reclamation and attachment of the no surface occupancy stipulation (Forest Service R-2: Supplement F to Form 3109-3) would prevent the effective recovery of the Federal mineral resource, as determined by the BLM. Negative recommendations or consent denials will be based on site-specific consideration of the following criteria: (1) Operations destroy or irretrievably damage the characteristics or purposes for which the lands were classified. (2) Slopes steeper than 40 percent. (3) High erosion hazard rating. (4) High geologic hazard rating. (5) Low visual absorption capacity that prevents reclamation to established visual quality objective (VQO). (6) A conclusion by the Forest Service (FS) and/or the United States Fish and Wildlife Service (USFWS) that the action will jeopardize the survival or recovery of federally listed threatened or endangered (T&E) wildlife or plant species. (7) Intrusions upon the identified critical (USFWS) or essential (FS) habitat of a federally listed (T&E) wildlife or plant species or upon the plant or animal itself. (8) Intrusion upon the habitat of individual plant or animal species listed by a State as threatened or endangered. (9) Intrusion upon the habitat of individual plant or animal species identified by the Regional Forester as needing special management to prevent its need for listing as a threatened or endangered species.		Not applicable to the alternatives.
Minerals Management-Coal, Leasable	01 Withdrawals of lands from operations of the mineral leasing acts will be requested only in exceptional situations because Federal decisions on mineral disposals under these acts are discretionary on a case-by-case basis.		Not applicable to the alternatives.

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Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
Uranium and Non-Energy Common Minerals Materials			
	02 Withdrawals from disposal of common variety mineral materials are unnecessary. The Forest Service has total discretionary authority for such disposals.		Not applicable to the alternatives.
	03 General direction for unclassified lands, designated Wilderness, and classified lands other than Wilderness are: 1. Unclassified Lands. a. Forest Service authorize common variety exploration and disposal under terms and conditions to prevent or control adverse impacts on surface resources and uses. The objective of reclamation requirements will be to return disturbed lands to the planned uses. b. Recommendations for and consent to BLM for issuance of leases, permits, and coal exploration licenses will include all current standard stipulations and the Regionally-approved special stipulations that may be necessary for additional protection of specific surface resources. The objective of reclamation requirements will be to return disturbed lands to the planned uses. The standard and current Regionally-approved special stipulations are in Appendix H to the Forest Plan. (1) Standard Stipulations, in addition to those in the basic lease, permit or license document, are BLM Form 3109-3, "Stipulation for Lands Under Jurisdiction of the Department of Agriculture", and Forest Service (R-2) stipulation, Supplement D to BLM Form 3109-3, "Surface Disturbance Stipulation".		Not applicable to the alternatives.
	(2) Special Forest Service, Region 2, stipulations will be used as appropriate to the surface resource situation involved in a lease, permit or license. These stipulations are titled as supplements to BLM Form 3109-3 and are listed below: (a) Forest Service (R-2) Supplement C to Form 3109-3, "Limited Surface Use Stipulations". This stipulation notifies a lessee, permitted or licensee that certain described conditions exist upon the lands involved that require special operating plan provisions for their protection. (b) Forest Service (R-2) Supplement H to Form 3109-3, "Conditional No Surface Disturbance Stipulation". The usual application of this stipulation for minable minerals will be in exploration permits and licenses. The stipulation notifies a prospective lessee, permitted or licensee that certain described conditions exist upon tracts within the proposed lease or permit area that will prevent any surface disturbance affecting those tracts unless an operating plan can be devised that will convince the Forest Service that surface use, occupancy and reclamation can take place without causing irretrievable environmental damage.		Not applicable to the alternatives.
	c. Recommend against or deny consent to BLM for issuance of leases, permits or coal exploration license where operational damages on surface resources, including the impacts of surface-based access, product transportation and ancillary facilities necessary to production and related operations, would be irreversible and irretrievable, with no potential for reclamation. If warranted after an analysis of the proposed activity area has been made, negative recommendations or consent denials will be based on site-specific consideration of the following criteria: (1) Terrain as it affects waste dumps and tailings disposal--related to dump and tailing stability, adequate room for placement. (2) Whether or not negative impacts on water quality are preventable. (3) For surface-based access, product transportation and ancillary facilities necessary to operations. Slopes steeper than 60 percent; high erosion hazard; high geologic hazard.		Not applicable to the alternatives.

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	(4) Low visual absorption capacity that prevents reclamation to established visual quality objective (VQO). (5) A conclusion by the Forest Service (FS) and/or the United States Fish and Wildlife Service (USFWS) that the action will jeopardize the survival recovery of federally listed threatened or endangered (T&E) wildlife or plant species. (6) Intrusions upon the identified critical (USFWS) or essential (FS) habitat of a federally listed (T&E) wildlife or plant species or upon the plant or animal itself. (7) Intrusion upon the habitat of individual plant or animal species listed by a State as threatened or endangered. (8) Intrusion upon the habitat of individual plant or animal species identified by the Regional Forester as needing special management to prevent its need for listing as a threatened or endangered species.		
	2. Designated Wilderness, Congressionally-designated Wilderness study areas, Further Planning Areas and RARE II areas on which Congress has not taken final action. a. Prospecting for and disposal of common varieties of mineral materials will not be authorized. b. Coal mining in the National Wilderness Preservation System is prohibited by the Coal Leasing Amendments Act of 1975. Therefore, coal leasing and coal exploration licenses will not be authorized for any of the foregoing described lands. c. Designated Wildernesses were withdrawn from exploration and leasing on December 31, 1983, subject to prior valid existing rights. d. No exploration permits or leasing is recommended in Wilderness Study Areas or areas recommended for Wilderness designation by the Forest Service until such time as Congress acts on the disposition of those areas, designates them Wilderness, or releases them from Wilderness consideration. A non-wilderness determination will result in the mineral resources being managed the same as other nonclassified National Forest System lands. 3. Classified lands other than Wilderness and areas as described in "2" foregoing, which are not by law or otherwise withdrawn from operations under the mineral leasing acts. Examples of such lands include Wild and Scenic Rivers, Natural Areas, Special Areas--such as geological, scenic and zoological, and some other specific classifications. a. The Forest Service authorizes common variety exploration and disposals under terms and conditions to protect the purposes for which the lands were classified. The objective of reclamation requirements will be to return disturbed lands to a condition suitable for the purposes for which they were classified. For Special Areas classified under 36 CFR 294 and 251.23 for specific management purposes, the regulatory provisions permit no use or occupancy inconsistent with the classification. b. Coal mining is prohibited by the Coal Leasing Amendment Act of 1975, within the National System of Trails and the Wild and Scenic Rivers System, including Study rivers designated by that Act. This prohibition also applies to the National Park System and the National Wildlife Refuge System, which lands are not under Forest Service jurisdiction. c. Recommend or consent to BLM for issuance of leases, permits or licenses only when terms and conditions can be applied that will protect the purposes for which the lands were classified.		Not applicable to the alternatives.

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Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
	d. Recommendations and consent to BLM for issuance of leases, permits or licenses will include all current standard stipulations and the current Regionally-approved special stipulations necessary to protect the purposes for which the lands were classified. Standard and special stipulations are in Appendix H to the Forest Plan. See 1.b.(1) under this management heading for the standard stipulations. Special stipulations to be applied as appropriate are: (1) Forest Service (R-2) Supplement A to Form 3109-3, "Further Planning Area Stipulation". This stipulation applies to lands identified for further planning in the RARE II decision documents. It specifies the nature and extent of operations allowed and the conditions to be met for their approval. (2) Forest Service (R-2) Supplement B to Form 3109-3, "Classified Area Stipulation". This stipulation applies to lands classified under 36 CFR 294 and 251.23 for specific management purposes. Because of the regulatory provisions, no use or occupancy inconsistent with the classification is permitted. This does not necessarily mean recommendation against or denial of consent to issuance of leases, permits or licenses is necessary. The reason is that classified areas may be only small portions of the lands involved. (3) Forest Service (R-2) Supplement C to Form 3109-3, "Limited Surface Use Stipulation". This stipulation notifies a lessee, permitted or licensee that certain described conditions exist upon the lands involved that require special operating plan provisions for their protection. (4) Forest Service (R-2) Supplement F Form 3109-3 "Surface Use Stipulation". This stipulation notifies prospective lessees or permittees that surface use or occupancy that would cause significant surface disturbance is not authorized for described lands. This "no surface occupancy" stipulation may be applied in a wide variety of conditions in lieu of recommending against or denying consent to BLM for issuance of a lease. (5) Forest Service (R-2) Supplement H to Form 3109-3, "Conditional No Surface Disturbance Stipulation". This stipulation notifies the prospective lessee, permitted or licensee that certain described conditions exist upon tracts within the proposed lease or permit area that will prevent any surface disturbance affecting those tracts unless a operating plan can be devised that will convince the Forest Service that surface use, occupancy and reclamation can take place without causing irretrievable environmental damage.		
	e. Recommend against or deny consent to issuance of leases, permits or licenses or use Forest Service (R-2) Supplement F to Form 3109-3 where operational damage on surface resources, including the impacts of surface-based access, product transportation and ancillary facilities necessary to production and related operations, would be irreversible and irretrievable, with no potential for reclamation. Negative recommendations or consent denials will be based on the consideration of the following criteria: (1) Operations would destroy or irretrievably damage the characteristics or purposes for which the lands are classified. (2) Terrain as it affects waste dumps and tailings disposal--related to dump and tailing stability, adequate room for placement, and whether or not waste and tailings can be handled or treated in a manner that results in no detrimental effects on the purposes for which the lands were classified. (3) Whether or not negative impacts on water quality are preventable. (4) For surface-based access, product transportation and ancillary facilities necessary to operations: slopes steeper than 40 percent; high erosion hazard; high geologic hazard. (5) Low visual absorption capacity that prevents reclamation to established visual quality objective (VQO).		Not applicable to the alternatives.

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Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
	(6) A conclusion by the Forest Service (FS) and/or the United States Fish and Wildlife Service (USFWS) that the action will jeopardize the survival or recovery of federally listed threatened or endangered (T&E) wildlife or plant species. (7) Intrusions upon the identified critical (USFWS) or essential (FS) habitat of a federally listed (T&E) wildlife or plant species or upon the plant or animal itself. (8) Intrusion upon the habitat or individual plant or animal of a species listed by a state as threatened or endangered (9) Intrusion upon the habitat of individual plant or animal of a species identified by the Regional Forester as needing special management to prevent its need for listing as a threatened or endangered species.		
Special Use Management (Non-Recreation)	01 Act on special use applications according to the following priorities: a. Land and land use activity requests relating to public safety, health and welfare, e.g., highways, powerlines and public service improvements. b. Land and land use activities contributing to increased economic activity associated with National Forest resources, e.g., oil and gas, and energy minerals. c. Land and land use activities that benefit only private users, e.g., road permits, rights-of-way for powerlines, telephones, waterlines, etc.		This general direction establishes Forest Service permit processing priorities.
	02 Do not approve any special use applications that can be reasonably met on private or other Federal lands unless it is clearly in the public interest.		According to DM&E, it would not be possible to construct and operate an economically-viable heavy haul railroad between the SPRB mines and DM&E's existing main line without crossing NFS lands. In addition, the STB has made an initial determination that DM&E's proposed project satisfies the transportation-related requirements of 49 U.S.C. 10901 and is therefore at least not inconsistent with the public necessity and convenience. STB regulations state that *"the Board shall issue a certificate...unless the Board finds that such activities are inconsistent with the public convenience and necessity..."* While the statute does not define "*public convenience and necessity*", a 3-part test has been developed to aid in this determination. The test requires a determination of whether: 1) the applicant is financially fit to undertake the construction and provide service; 2) there is a public demand or need for the proposed service; and 3) the construction project is in the public interest and will not unduly harm existing services. In its December 9, 1998 decision STB determined that DM&E's proposal meets the 3-part test. However, STB's initial determination does not grant approval to construct the project. No final decision by STB permitting construction to begin would be issued until such time as all statutory requirements - under both environmental and transportation law - have been satisfied. In fact, it is possible that in their final analysis STB could determine that, due to possible adverse environmental impacts, the public interest dictates that the application be denied even though the criteria of 49 U.S.C. 10901 have otherwise been met.
	03 Bury electrical utility lines of 33 KV or less and telephone lines except when: a. Visual quality objectives of the area can be met using an overhead line. b. Burial is not feasible due to geologic hazard or unfavorable geologic conditions. c. It is not economical as determined by a cost analysis. d. Greater long-term site disturbance would result. e. It is not technically feasible.		Any powerlines installed on NFS lands on BGNG would comply with this general direction.
	04 Do not approve special use applications for areas adjacent to developed sites unless the proposed use is compatible with the purpose and use of the developed site.		There are no developed sites adjacent to the alternatives on BGNG.
	05 Permit disposal of toxic waste, including nuclear waste, only after all suitable lands in a given area, both public and private, have been evaluated through the NEPA process and the best alternative determined.		Not applicable to the alternatives.

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Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
Rights-of-way and Land Adjustments	01 Improve National Forest System landownership patterns to further resource management objectives in coordination with needs of adjoining landowners.		Not applicable to the alternatives.
	02 Acquire rights-of-way on existing Forest System roads and trails that cross private land.		Not applicable to the alternatives.
	03 Insure floodplain and wetland values are approximately equal on both offered and selected tracts in proposed land exchanges or that values are in favor of the United States.		Not applicable to the alternatives.
	04 Classify lands or interest in lands for acquisition where lands are valuable for NFS purposes according to the following priorities: a. In designated wilderness areas and other Congressionally classified areas. b. Where lands or rights-of-way are needed to meet resource management goals and objectives. c. Lands which provide habitat for threatened and endangered species of animals and plants. d. Lands which include floodplain or wetlands. e. On lands of the National Grasslands that provide opportunities for demonstration of multiple uses in grassland agriculture. f. On lands having historical or cultural resources, outstanding scenic values or critical ecosystems, when these resources are threatened by change of use or when management may be enhanced by public ownership.	a. Consider the following factors when making National Forest land adjustments: Efficiencies of property boundary maintenance, consolidation of ownership, relationship to adjoining ownership, suitability for other public use, size of tract, presence of special values such as wetlands, historic sites, endangered species habitat, and consolidation of Federal agency management and uses. b. Consider the following factors when making National Grasslands land adjustments: Adjustments should be aimed at merging federal ownership into groupings of 3,000 to 30,000 acres. Individual private holdings large enough to provide adequate ranch headquarters are desirable.	Not applicable to the alternatives.
	05 Classify lands for disposal according to the following priorities: a. To States, counties, cities, or other Federal agencies when disposal will serve a greater public interest. b. In small parcels intermingled with mineral or homesteads patents. c. When suitable for development by the private sector, if development (residential, agricultural, industrial, recreational, etc.) is in the public interest. d. When critical or unique resource (wetlands, floodplains, essential big game winter range, threatened or endangered species habitat, historical or cultural resources, critical ecosystems, etc.) effects are mitigated by reserving interests to protect the resource, or by exchange where other critical resources to be acquired are considered to be of equal or greater value. e. In National Grasslands, when they offer no opportunity to meet National Grassland demonstration objectives.		Not applicable to the alternatives.
	06 Effect jurisdictional transfers which achieve the following objectives: a. Reduce duplication of efforts by users and agencies in terms of time, cost, and coordination. b. Improve or maintain user access to the administering agency. c. Decrease travel and enhance management. d. Improve public understanding of applicable laws, regulations, policies, and procedures. e. Develop more effective and efficient work units. f. Reduce administrative cost.		Not applicable to the alternatives.
	07 Identify areas where designation as transportation and utility corridors in the future are compatible with management area goals. Follow the process and definitions established in FSM 1922.51.	a. Avoid the following management areas unless studies indicate that impacts of the corridor can be mitigated: 1. Developed recreation areas 2. Roadless and undeveloped areas (RARE II) 3. Research Natural Areas 4. Riparian areas 5. Proposed wild and scenic river segments 6. Bessey Nursery	Alternative B would not be consistent with these standards and guidelines because the alternative would cross RARE II and inventoried roadless areas (see Chapter 3). The impacts associated with an operating railroad in an area recognized for its wilderness values could not be adequately mitigated. The wilderness characteristic of the RARE II and roadless areas would be lost. Alternatives C (including both route variations) and D would not cross RARE II or inventoried roadless areas on BGNG.

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			Alternatives B and C would also be inconsistent with the standard and guideline to avoid riparian areas. Alternative B would have the largest impact on riparian areas on NFS lands on BGNG. Alternative B would impact riparian areas along Cottonwood Creek, Spring Creek and at several locations adjacent to the Cheyenne River. Riparian impacts on NFS lands along Cottonwood Creek and the Cheyenne River would be eliminated by Alternative C but the impact to Spring Creek would remain. The Phiney Flat Route Variation of Alternative C would eliminate riparian impacts on NFS lands along Spring Creek.
Property Boundary Location	01 Locate, mark, and post landlines according to the following priorities: a. Lines needed to meet planned activities; b. Lines needed to protect NFS lands from encroachment, and c. All other lines.		Not applicable to the alternatives.
Soil Resource Management	01 Maintain soil productivity, minimize man-caused soil erosion, and maintain the integrity of associated ecosystems. a. Use site preparation methods which are designed to keep fertile, friable topsoil essentially intact. b. Give roads and trails special design considerations to prevent resource damage on capability areas containing soils with high shrink-swell capacity. c. Provide adequate road and trail cross drainage to reduce sediment transport energy. d. Revegetate all areas, capable of supporting vegetation, disturbed during road construction and/or reconstruction to stabilize the area and reduce soil erosion. Use less palatable plant species on cuts, fills, and other areas subject to trampling damage by domestic livestock and big game to discourage grazing by herbivores. e. Prevent livestock and wildlife grazing which reduces the percent of plant cover to less than the amount needed for watershed protection and plant health. f. Place tractor-built firelines on the contour, where possible, and avoid use of tractors on highly erodible sites. g. Provide permanent drainage and establish protective vegetative cover on all new temporary roads or equipment ways, and all existing roads which are being removed from the transportation system. h. Minimize soil compaction by reducing vehicle passes, skidding on snow, frozen or dry soil conditions, or by off-ground logging systems. i. Restore soil disturbance caused by human use to soil loss tolerance levels commensurate with the natural ecological processes for the treatment areas.	a. Use the following Standards and Guidelines unless more site specific requirements are developed during project design. 1. Limit intensive ground disturbing activities on unstable slopes and highly erodible sites. 2. Apply Packer's guides in the design for cross drain spacing and buffers. 3. Chisel or rip, on the contour, compacted soils. Soils are considered compacted if there is a 15 percent increase in bulk density or a 50 percent decrease in macro pore space. b. Follow procedures specified in Agricultural Handbook 537 for Utilizing the Universal Soil Loss Equation. (Cautions contained in WO 2550 letter dated 5/28/82 should be noted.) The guidance for K and T factors are in the National Soils Handbook 407.1 (a) (3) (xvii). c. Restore blowouts caused by management activities that are larger than one acre by seeding, planting, or through livestock management practices.	The standards and guidelines will be incorporated into the site-specific SWPPPs which are designed to implement BMPs to control sedimentation from construction sites. Reclamation techniques will be incorporated into the SWPPPs.
	02 Identify at the project level, upland areas that are immediately adjacent to Riparian (Prescription 9A) Management Areas. Adjacent upland areas are those portions of a management area which, when subjected to management activities, have a potential for directly affecting the condition of the adjacent Riparian Management Area. The magnitude of effects is dependent upon slope steepness, and the kind, amount, and location of surface and vegetation disturbance within the adjacent upland unit.	a. The following is a guide to identify the approximate extent of adjacent upland areas: Slope Gradient of Upland Areas Adjacent to Riparian Management Area — Upslope Distance From Boundary of Riparian Management Area % Slope Range — Feet 0-20 — 100 20-30 — 180 30-40 — 280 40-50 — 400 50-60 — 520 60-70 — 640 70-80 — 760 80-90 — 880 90-100 — 1000 100-150 — 1000-1300	b. BMPs are being designed to control sedimentation to these sites. These BMPs will be implemented through site-specific SWPPPs prepared in compliance with SDENR regulations. The objectives of reclamation on NFS lands will be to reduce erosion rates to the levels specified in the standard. c. Monitoring and maintenance will be addressed in the SWPPPs.

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		b. Reduce, through designed management practices and appropriate erosion mitigation and vegetation/restoration measures, the project caused on-site erosion rates (calculated with appropriate Universal Soil Loss Equation methodology) by 75% within the first year after disturbance. Reduce project caused on-site erosion by 95% within five years after initial disturbance (USDA Tech. Pub. SA-TP 11, 1980: USDA SCS Tech. Note No. 10, 1977) c. Design continuing mitigation/restoration practices and follow-up maintenance activities to insure that 80% original ground cover (vegetation) recovery occurs within five years after disturbance.	
Transportation System Management	01 Provide access for resource development or management activities.		Because the railroad would transport mineral resources developed, in part, on NFS lands, Forest Service approval of a special use permit would be consistent with this general direction.
	02 Provide easements where existing state and county highways are located on National Forest System lands.		Not applicable to the alternatives.
	03 Classify areas as to whether off-road vehicle use is permitted.	a. Specify off-road vehicle restrictions based on ORV use management (FSM 2355, R2 Supp. 88).	Not applicable to the alternatives.
	04 Close all newly constructed roads to public motorized use unless documented analysis shows: a. Use does not adversely impact other resources; b. Use is compatible with the ROS class established for the area; c. They are located in areas open to motorized use; d. They provide user safety; e. They serve an identified public need; f. The area accessed can be adequately managed; or g. Financing is available for maintenance or coop-maintenance can be arranged.		Not applicable to the alternatives.
	05 Manage road use by seasonal closure if: a. Use causes unacceptable damage to soil and water resources due to weather or seasonal conditions b. Use conflicts with the ROS class established for the area; c. Use causes unacceptable wildlife conflict or habitat degradation; d. Use results in unsafe conditions due to weather conditions; e. They serve a seasonal public or administration need, or f. Area accessed has seasonal need for protection or nonuse.		The alternatives would be required to comply with road closures on BGNG, if adopted. Currently, no roads would be crossed on BGNG which have established seasonal closures.
	06 Keep existing roads open to public motorized use unless: a. Financing is not available to maintain the facility or manage the associated use of adjacent lands; b. Use causes unacceptable damage to soil and water resources; c. Use conflicts with the ROS class established for the area; d. They are located in areas closed to motorized use and are not "designated routes" in the Forest travel management direction. e. Use results in unsafe conditions unrelated to weather conditions; f. There is little or no public need for them; or g. Use conflicts with wildlife management objectives.		Not applicable to the alternatives.
	07 Closed or restricted roads may be used for and to accomplish administrative purposes when: a. Prescribed in management area direction statements; b. Authorized by the Forest Supervisor; and c. In case of emergency.		Not applicable to the alternatives.
Arterial and Collector Road Construction and Reconstruction	01 Construct and reconstruct arterial and collector roads to meet multiple resource needs.		Not applicable to the alternatives.

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	02 Construct and reconstruct local roads to provide access for specific resource activities such as campgrounds, trailheads, timber sales, range allotments, mineral leases, etc., with the minimum amount of earthwork.		It is anticipated that access to construction sites on BGNG would primarily use existing roads. However, if it becomes necessary to construct an access road on NFS lands, this general direction would be applied.
Road Maintenance	01 Maintain all roads to the following minimum requirements: a. All arterial and open collectors - Level 3; b. All open local roads - Level 2; and c. All closed roads - Level 1.	a. Level 1 maintenance includes upkeep of drainage structures and vegetation cover necessary to prevent erosion.	A detailed Transportation Plan will be developed for activities on NFS lands. That plan will specifically address maintenance of roads on NFS lands during construction.
	02 Maintain structures, bridges, cattleguards, etc., to be structurally sound and safe for use.		A detailed Transportation Plan will be developed for activities on NFS lands. That plan will specifically address maintenance of roads on NFS lands during construction.
Trail System Management	01 Maintain all trails for foot and horse travel unless specifically closed to either or both class of user.		The alternatives will not affect trails on NFS lands on BGNG.
	02 Maintain all trails to the following minimum requirements: a. Structures (bridges, corduroy, etc.) are structurally sound and safe for specified class of user, b. Maintain drainage structures to prevent unacceptable resource damage, and c. Remove hazards from trails to allow safe passage for specified class of users. A safety hazard is a physical condition of a trail which may cause injury, is unusual or unexpected, and not readily identifiable by the trail user. It is not a condition which is easily identifiable and normally encountered for the type or location of the trail involved. The following examples illustrate this distinction: A hazard is a rotten bridge decking or handrail. A stream crossing where no bridge is provided and the user would expect this on the type and location of the trail is not a hazard. A hazard is a stable-appearing loose rock in a constructed treadway where all other rocks are stable. A trail treadway made up of rocks in a near-natural position, many of which are loose, is not a hazard. A hazard is a perennial bog-hole on a horse trail. An intermittent bog-hole which will dry up by early summer or within a few days following a rain storm is not a hazard. A hazard is a section of trail treadway supported by rotten cribbing. A section of trail where the treadway is obviously slippery is not a hazard. A hazard is a marked ford with holes deeper than the normal channel. A deep ford with a consistent stream bed is not a hazard.		Not applicable to the alternatives.
	03 Provide a full range of trail opportunities in coordination with other Federal, State, and municipal jurisdictions and private industries both on and off NFS lands.		Not applicable to the alternatives.
	04 Construct or reconstruct trails when needed as part of the transportation system.	a. Maintain trails in accordance with standards in the Trail Handbook (FSH 7709.12). b. Schedule trail maintenance in accordance with Regional Acceptable Work Standards. (FSM 1310 R2 ID No. 1 7/22/82.) c. Cross drains and conveyance structures are planned according to Forest Design Standards.	Not applicable to the alternatives.

Appendix A, Table 1. Railroad Alternative Consistency With Management Requirements of the 1984 Nebraska National Forest Plan - Buffalo Gap National Grassland			
Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
Fire Planning and Suppression	01 Provide a level of protection from wildfire that is cost efficient and that will meet management objectives for the area considering the following: a. The values of the resources that are threatened by fire, b. The probability of fire occurrence, c. The fuelbed that fires will probably occur in, d. The weather conditions that will probably influence fires that occur, e. The costs of fire protection programs (FFP and FFF), f. The social, economic, political, cultural, environmental, life and property concerns; and g. Management objectives for the area. Use the Fire Management Analysis process (FSH 5109.19) for this analysis.		Not applicable to the alternatives.
Escaped Fire Suppression	01 Take suppression action on all escaped fires considering the following: a. The values of the resources threatened by the fire (both positive and negative), b. Management objectives for the threatened area(s), c. The fuelbeds the fire may burn in, d. The current and projected weather conditions that will influence fire behavior, e. Natural barriers and fuel breaks, f. Social, economic, political, cultural, and environmental concerns, g. Public safety, h. Firefighter safety; and i. Costs of alternative suppression strategies. Use the escaped fire situation analysis to make this determination (FSM 5130.31).		Not applicable to the alternatives.
Fuel Treatment	01 Maintain fuel conditions which permit fire suppression forces to meet fire protection objectives for the area.	a. Reduce or otherwise treat all fuels so the potential fireline intensity of an area will not exceed 400 BTU's/sec/ft (B. I. -68) on 90% of the days during the regular fire season, or Break up continuous fuel concentrations exceeding the above standard into manageable units with fuel breaks or fire lanes, or Provide additional protection for areas exceeding the above standard when such protection will not be required for more than five years.	Not applicable to the alternatives.
Vegetation Treated by Burning	01 Use prescribed fire to accomplish resource management objectives, such as reducing fuel load buildup, wildlife habitat improvement, etc.		Not applicable to the alternatives.
	02 Limit use of prescribed fires on areas adjacent to riparian areas to protect riparian and aquatic values.		Not applicable to the alternatives.

Appendix A, Table 2. Railroad Alternative Consistency With Management Prescription 4G, Emphasis on Habitat Indicator Species, 1984 Nebraska National Forest Plan - Buffalo Gap National Grassland

Management Activity	General Direction	Standards and Guidelines	Railroad Alternative Consistency
Visual Resource Management	01 Design and implement management activities to blend with the natural landscape.	a. Do not exceed an adopted Visual Quality Objective (VQO) of modification	All alternatives would comply with the VQO of modification. Under the modification VQO, management activities may dominate the landscape.
Dispersed Recreation Management	01 Manage human recreational activities so they do not conflict with habitat needs of selected indicator species.		Not applicable to the alternatives.
	02 Semi-primitive nonmotorized, semi-primitive motorized, roaded natural and rural recreation opportunities can be provided.	a. Specify off-road vehicle restrictions based on ORV use management (FSM 2355, R2 Supp. 88). b. See FSM 2331, FSM 7732, FSH 7709.12 (Trails Handbook), FSH 7109. 11a and 11 b (Sign Handbook). c. Maximum Use and Capacity Levels are: Recreation use and capacity range during the snow-free period (PAOT/acre): Trail use and capacity range (PAOT/mile of trail):	Not applicable to the alternatives.

	Capacity Range			
Use Level	Very Low	Low	Moderate	High
ROS Class - Semi-Primitive Nonmotorized				
On Trails PAOT/mile	2.0	3.0	9.0	11.0
Area-wide PAOT/acre	.004	.008	.05	.08
ROS Class - Semi-Primitive Motorized				
On Trails PAOT/mile	2.0	3.0	9.0	11.0
Area-wide PAOT/acre	.004	.008	.05	.08
ROS Class - Roaded Natural				
On Trails PAOT/mile	-	-	-	-
Area-wide PAOT/acre	.04	.08	1.2	2.5
ROS Class - Rural				

Appendix A, Table 2. Railroad Alternative Consistency With Management Prescription 4G, Emphasis on Habitat Indicator Species, 1984 Nebraska National Forest Plan - Buffalo Gap National Grassland

Management Activity	General Direction	Standards and Guidelines	Railroad Alternative Consistency
		On Trails PAOT/mile - - - - Area-wide PAOT/acre .5 .8 5.0 7.5 Reduce the above use level coefficients as necessary to reflect usable acres, patterns of use, and general attractiveness of the specific management area type as described in the ROS Users Guide, Chapter 25. Reduce the above use levels where unacceptable changes to the biophysical resources will occur. d. Close areas to off-road vehicle use when ground cover, reflected by the C factor used in USLE, would be reduced to the point that the natural erosion rate is increased 10 percent per acre per year.	
	03 Facilities provided include development level 1 and 2 campgrounds, trails suitable for motorized trail bike use, local roads with primitive surface and parking lots at trail heads. Provide signing compatible with intended use.		Not applicable to the alternatives.
	04 Permit undesignated sites in Frissell condition class 1 through 3 where unrestricted camping is permitted.	a. Campsite condition class based upon Frissel, S.S., Journal of Forestry, May, 1978.	Not applicable to the alternatives.
	05 Manage site use and occupancy to maintain sites within Frissell condition class 3 except for designated sites which may be class 4. Close and restore class 5 sites.		Not applicable to the alternatives.
Wildlife and Fish Resource Management	01 Manage to maintain or improve habitat capability for deer, pronghorn antelope, and sharp-tailed grouse.		In consultation with the SDGFP and USFWS, DM&E is exploring mitigation opportunities to minimize impacts to deer, antelope and sage grouse habitat. With adequate mitigation, the alternatives would be consistent with this general direction.
	02 In cooperation with State wildlife agencies, develop residual cover guidelines for prairie grouse by close of FY 1988.		Not applicable to the alternatives.
	03 Manage wildlife and fish resources as outlined in the appropriate State Comprehensive Wildlife Management Plan.		Not applicable to the alternatives.
	04 Manage hayable sites within riparian and woody draw areas to enhance value.		Not applicable to the alternatives.
Range Resource Management	01 Practice intensive range management where it is consistent with maintaining or enhancing wildlife habitat.		Not applicable to the alternatives.
	02 Ensure that grazing agreements established with Grazing Associations provide for integrated management of associated private and other public rangeland and consider interrelationships of other resources.		Not applicable to the alternatives.
	03 Alter grazing systems, season of use, and stocking rates to enhance wildlife habitat.		Not applicable to the alternatives.
	04 Maintain at least 60 percent of rangeland in good or better condition, the other 40 percent should be in at least fair condition.	a. Base range condition on the standards in Range Analysis Handbook (FSH 2209.21) or SCS methods.	Not applicable to the alternatives.
Range Improvement and Maintenance	01 Provide range improvements and conservation practices that are multipurpose in nature.	a. Manage 40-50 percent of all grazing allotments under a noncontinuous system, except for the Fort Pierre National Grassland where at least 80 percent will be under a noncontinuous system. b. Livestock water developments will not exceed an average of one per 640 acres, except on the Ft. Pierre National Grassland where the average density will not exceed three per 640 acres. c. Fill in behind nonuse or grant temporary extensions only when suitable habitat conditions can be assured beforehand.	Not applicable to the alternatives.

Appendix A, Table 2. Railroad Alternative Consistency With Management Prescription 4G, Emphasis on Habitat Indicator Species, 1984 Nebraska National Forest Plan - Buffalo Gap National Grassland			
Management Activity	**General Direction**	**Standards and Guidelines**	**Railroad Alternative Consistency**
Transportation System Management	01 Manage road use to provide for habitat needs of management indicator species, including road closures and area closures, and to maintain habitat effectiveness.		Not applicable to the alternatives.
Fuel Treatment	01 Maintain fuel conditions which permit fire suppression and prescribed fire to maintain habitat needed for selected species or species population levels.		Not applicable to the alternatives.
	02 Provide firewood material using both commercial and noncommercial methods when surplus to wildlife needs.		Not applicable to the alternatives.

Appendix A, Table 3. Railroad Alternative Consistency With Management Prescription 6G, Emphasis on Livestock Grazing, 1984 Nebraska National Forest Plan - Buffalo Gap National Grassland

Management Activity	General Direction	Standards and Guidelines	Railroad Alternative Consistency
Visual Resource Management	01 Design and implement management activities to blend with the natural landscape.	a. Do not exceed an adopted Visual Quality Objective (VQO) of modification.	All alternatives would comply with the VQO of modification. Under the modification VQO, management activities may dominate the landscape.
	02 Permit undesignated sites in Frissell condition class 1 through 3 where unrestricted camping is permitted.	a. Campsite condition class based upon Frissel, S.S.; Journal of Forestry, May, 1978.	Not applicable to the alternatives.
	03 Manage site use and occupancy to maintain sites within Frissell condition class 3 except for designated sites which may be class 4. Close and restore class 5 sites.		Not applicable to the alternatives.
Dispersed Recreation Management	01 Semi-primitive nonmotorized, semi-primitive motorized, roaded natural and rural recreation opportunities can be provided.	a. Specify off-road vehicle restrictions based on ORV use management (FSM 2355, R2 Supp. 88). b. Close areas to off-road vehicle use when ground cover, reflected by the C factor used in USLE, would be reduced to the point that the natural erosion rate is increased 10 percent per acre per year.	Not applicable to the alternatives.
	02 In semi-primitive nonmotorized recreation settings, manage use to provide a low to moderate incidence of contact with other groups and individuals. Facilities provided include development level 1 and 2 campgrounds, trails, and parking lots at trail heads. Provide signing compatible with intended use.	a. Maximum Use and Capacity Levels are: -Trail and camp encounters during peak use days are less than 30 other parties per day. -Trail and area-wide use capacity: ROS Class - Semi-Primitive Motorized Use Level: Very Low / Low / Moderate / High On Trails PAOT/mile: 2.0 / 3.0 / 9.0 / 11.0 Area-wide PAOT/acre: .004 / .008 / .05 / .08 Reduce the above use level coefficients as necessary to reflect usable acres, patterns of use, and general attractiveness of the specific management area type as described in the ROS Users Guide, Chapter 25. Reduce the above use levels where unacceptable changes to the biophysical resources will occur.	Not applicable to the alternatives.
	03 Facilities provided include development level 1 and 2 campgrounds, trails, local roads with predominantly primitive surfaces, and parking lots at trail heads. Provide signing compatible with intended use.		Not applicable to the alternatives.
Wildlife Habitat Improvement and Maintenance	01 Manage wildlife and fish resources as outlined in the appropriate State Comprehensive Wildlife Management Plan.		Not applicable to the alternatives.
	02 Provide adequate forage to sustain big-game population levels agreed to in the Statewide Comprehensive Wildlife Management Plan on NFS lands.		Not applicable to the alternatives.
Range Resource Management	01 Manage to achieve and maintain a high standard of range condition for increased sustained livestock use. Practice intensive range management and use all available range and livestock management technology.	a. Base range condition on the standards in Range Analysis Handbook (FSH 2209.21) or SCS methods.	Not applicable to the alternatives.
Range Improvement and Maintenance	01 Alter grazing schemes, season of use, and livestock stocking rates to optimize use of forage for red meat production.	a. Fill in up to 100 percent of the nonuse requested for personal convenience.	Not applicable to the alternatives.

Appendix A, Table 3. Railroad Alternative Consistency With Management Prescription 6G, Emphasis on Livestock Grazing, 1984 Nebraska National Forest Plan - Buffalo Gap National Grassland			
Management Activity	**General Direction**	**Standards and Guidelines**	**Railroad Alternative Consistency**
	02 Provide range improvements and conservation practices that are multipurpose in nature.	a. Manage at least 51 percent of all grazing allotments under a noncontinuous system with even livestock distribution.	Not applicable to the alternatives.
	03 Allow cropping, seeding, fertilizing, and mechanical treatment.		Not applicable to the alternatives.
	04 Ensure that grazing agreements established with Grazing Associations provide for integrated management of associated private and other public rangeland and consider interrelationships of other resources.		Not applicable to the alternatives.

Appendix A, Table 4. Railroad Alternative Consistency With Management Prescription 9A, Emphasis on Riparian Area Management, 1984 Nebraska National Forest Plan - Buffalo Gap National Grassland

Management Activity	General Direction	Standards and Guidelines	Railroad Alternative Consistency
Visual Resource Management	01 Design and implement management activities which sustain inherent visual values of riparian areas and blend with the surrounding natural landscapes.	a. Do not exceed an adopted Visual Quality Objective (VQO) of partial retention.	While the partial retention VQO allows management activities to be evident they must remain subordinate to the natural landscape. They should not dominate the view. Alternatives B and C (including both route variations) would not be consistent with the partial retention VQO. Where it would cross through Management Prescription 9A, the operating railroad is expected to dominate the view and attract the viewer's attention.
Dispersed Recreation Management	01 Permit undesignated sites in Frissell condition class 1 through 3 where unrestricted camping is permitted.	a. Campsite condition class based upon Frissell, S.S.; Journal of Forestry, May, 1978.	Not applicable to the alternatives.
	02 Manage site use and occupancy to maintain sites within Frissell condition class 3 except for designated sites which may be class 4. Close and restore class 5 sites.		Not applicable to the alternatives.
Dispersed Recreation Management	03 Semi-primitive nonmotorized, semi-primitive motorized, roaded natural and rural recreation opportunities can be provided.		Not applicable to the alternatives.
	04 Provide roaded natural recreation opportunities within ½ mile of Forest arterial, collector and local roads with better than primitive surfaces which are open to public travel. Provide semi-primitive motorized recreation opportunities with a low to moderate incidence of contact with other groups and individuals within ½ mile of designated local roads with primitive surfaces and trails open to motorized recreation use. Where local roads are closed to public motorized recreation travel, provide for dispersed non-motorized recreation opportunities. Manage recreation use to provide for the incidence of contact with other groups and individuals appropriate for the established ROS class. Provide semi-primitive non-motorized recreation opportunities in all areas more than ½ mile away from roads and trails open to motorized recreation use.	a. Maximum Use and Capacity Levels are: Recreation use and capacity range during the snow-free period (PAOT/acre): Trail use and capacity range (PAOT/mile of trail): Capacity Range Use Level — Very Low — Low — Moderate — High ROS Class - Semi-Primitive Nonmotorized On Trails PAOT/mile — 2.0 — 3.0 — 9.0 — 11.0 Area-wide PAOT/acre — .004 — .008 — .05 — .08 ROS Class - Semi-Primitive Motorized On Trails PAOT/mile — 2.0 — 3.0 — 9.0 — 11.0 Area-wide PAOT/acre — .004 — .008 — .05 — .08 ROS Class - Roaded Natural On Trails PAOT/mile — - — - — - — -	Not applicable to the alternatives.

Appendix A, Table 4. Railroad Alternative Consistency With Management Prescription 9A, Emphasis on Riparian Area Management, 1984 Nebraska National Forest Plan - Buffalo Gap National Grassland			
Management Activity	**General Direction**	**Standards and Guidelines**	**Railroad Alternative Consistency**
		Area-wide PAOT/acre .04 .08 1.2 2.5 ROS Class - Rural On Trails PAOT/mile - - - - Area-wide PAOT/acre .5 .8 5.0 7.5 Reduce the above use level coefficients as necessary to reflect usable acres, patterns of use, and general attractiveness of the specific management area type as described in the ROS Users Guide, Chapter 25. Reduce the above use levels where unacceptable changes to the biophysical resources will occur. b. Specify off-road vehicle restrictions based on ORV use management (FSM 2355, R2 Supp. 88). c. See FSM 2331, FSM 7732, FSH 7709.12 (Trails Handbook), FSH 7109.11a and 11b (Sign Handbook).	
Wildlife Habitat Improvement and Maintenance	01 Provide habitat diversity through vegetation treatments, in conjunction with other resource activities, designed to maintain or improve wildlife or fisheries habitat.		Not applicable to the alternatives.
	02 Provide habitat for viable populations of all native vertebrate species of fish and wildlife.		The alternatives would result in localized losses of wildlife habitat associated with riparian areas. Although the losses may be locally significant, such losses would not eliminate viable populations of native vertebrate fish or wildlife on BGNG.
	03 Plan lake and stream habitat improvement projects with the assistance of state wildlife agencies, where aquatic habitats are below productive potential. Plan those improvements that harmonize with the visual setting.		Not applicable to the alternatives.
	04 Maintain a current fish habitat inventory in cooperation with state wildlife agencies.		Not applicable to the alternatives.
	05 Maintain instream flows in cooperation with state wildlife agencies to support a sustained yield of natural fisheries resources.		Temporary dewatering of streams at construction sites may be required during installation of instream structures. However, to protect aquatic resources, downstream flow would be maintained at all times where necessary.
Range Resource Management	01 Prohibit trailing of livestock along the length of riparian areas except where existing stock driveways occur. Rehabilitate existing stock driveways where damage is occurring in riparian areas. Relocate them outside riparian areas if possible, and if necessary to achieve riparian area goals.		Not applicable to the alternatives.
	02 Maintain proper stocking and livestock distribution to protect riparian ecosystems.		Not applicable to the alternatives.
Silvicultural Examination and Prescription	01 Manage forest cover types to perpetuate tree cover and provide healthy stands, high water quality and wildlife and fish habitat.		Not applicable to the alternatives.
	02 Provide firewood material using both commercial and noncommercial methods when surplus to wildlife needs.		Not applicable to the alternatives.
	03 Prohibit log landing and decking areas within the riparian area.		Not applicable to the alternatives.

Appendix A, Table 4. Railroad Alternative Consistency With Management Prescription 9A, Emphasis on Riparian Area Management, 1984 Nebraska National Forest Plan - Buffalo Gap National Grassland			
Management Activity	**General Direction**	**Standards and Guidelines**	**Railroad Alternative Consistency**
	04 Reduce debris jam potential by cutting stumps to near ground level in the 100-year floodplain of streams and lakes.		This general direction would be incorporated into construction plans for the alternatives.
Water Resource Improvement and Maintenance	01 Prevent or remove debris accumulations that reduce stream channel stability and capacity.		Design of the alternative's instream structures address the prevention of debris accumulations. All culverts would be a minimum of 36 inches in diameter. This size was chosen specifically to reduce debris accumulation and reduce the need for maintenance.
	02 Prevent soil surface compaction and disturbance in riparian ecosystems. Allow use of heavy construction equipment for construction, residue removal, etc., during periods when the soil is least susceptible to compaction or rutting.		The alternatives would not be consistent with this general direction. All alternatives would result in disturbance to riparian ecosystems on NFS lands on BGNG. In addition, it will be necessary for construction of bridges to occur year round including during the period when soils are wet and subject to compaction and rutting. BMPs (such as using mats) are being developed to address concerns regarding compaction and rutting. However, some compaction and rutting would occur during construction in riparian areas regardless of the BMPs employed.
	03 Proposed new land-use facilities (roads, campgrounds, buildings) will not normally be located within floodplain boundaries for the 100-year flood. Protect present and all necessary future facilities that cannot be located out of the 100-year floodplain by structural mitigation (deflection structures, riprap, etc.)	a. Implement mitigation measures when present or unavoidable future facilities are located in the active floodplain to ensure that State water quality standards, sediment threshold limits, bank stability criteria, flood hazard reduction and instream flow standards are met during and immediately after construction.	Because they are linear in nature, the alternatives can not avoid crossing floodplains. BMPs are being developed that address the concerns listed in the standards and guidelines. These BMPs will be incorporated into SWPPPs being prepared in compliance with SDENR regulations. Hydrology and hydraulic studies are being conducted to evaluate flood hazards. The Forest Service will be provided an opportunity to review and comment on the results of those studies for streams on NFS lands.
	04 Maintain sediment yield within threshold limits. The effects on water and sediment yields from vegetation manipulation and road construction projects will be determined through the use of appropriate modeling and/or quantification procedures to determine sediment yield threshold limits and water yield increase potentials.	a. Limit Changes in Channel rating or classification stores to an increase of 10 percent or less. Use channel stability criteria established by Cooper, 1978 and Pfankuch, 1975. Use channel classification criteria established by Rosgen, 1980. b. Prescription-induced water yield increases should not exceed prescribed thresholds of allowable increase nor should the total yield of water and sediment exceed maximum allowable amounts as stated in the above references. c. Maintain at least 80 percent of potential ground cover within 100 ft. from the edges of all perennial streams, lakes and other waterbodies, or to the outer margin of the riparian ecosystem, where wider than 100 feet.	a. & b. DM&E is currently completing hydrology and hydraulic studies of stream crossings. These studies will address channel stability, water yield, etc. Results of the studies will be provided to the Forest Service for review and comment for streams on NFS lands. c. The alternatives would not be consistent with this standard and guideline. At stream crossings, all ground cover would be removed within the construction right-of-way to the water's edge. Ground cover would be completely removed in the construction right-of-way through riparian areas. To varying degrees, all alternatives would cross riparian areas on BGNG.
	05 Avoid channelization of natural streams. Where channelization is necessary for flood control or other purposes, use stream geometry relationships to reestablish meanders, width/depth ratios, etc. consistent with each major stream type.		The need for channelization on NFS lands will be addressed in hydrology and hydraulic studies being conducted by DM&E. The Forest Service will be provided an opportunity to review and comment on these studies for streams on NFS lands.
	06 Treat disturbed areas resulting from management activities to reduce sediment yields to the natural erosion rates in the shortest possible time.		This general direction will be incorporated into the SWPPPs being prepared in compliance with SDENR regulations. These SWPPPs will specifically address reclamation requirements as well as timing.
	07 Stabilize streambanks which are damaged beyond natural recovery in a reasonable time period with appropriate methods or procedures that emphasize control by vegetation.	.	Bank stabilization will be addressed in the BMPs and SWPPPs being prepared in compliance with SDENR regulations. The COE 404 permit applications will address where bank armoring would be required.
	08 Require concurrent monitoring to ensure that mitigative measures are effective and in compliance with state water quality standards.	.	Monitoring and maintenance requirements will be incorporated into the SWPPPs.
Soil Resource Management	01 Rehabilitate disturbed soils areas where adverse impacts would occur according to the following priorities: - Aquatic ecosystems; - Riparian ecosystems; and - Riparian areas outside of aquatic and riparian ecosystems.		These priorities are consistent with the general restoration emphasis included in storm water regulations. These priorities will be incorporated into the SWPPPs.

Appendix A, Table 4. Railroad Alternative Consistency With Management Prescription 9A, Emphasis on Riparian Area Management, 1984 Nebraska National Forest Plan - Buffalo Gap National Grassland			
Management Activity	**General Direction**	**Standards and Guidelines**	**Railroad Alternative Consistency**
	02 Maintain or enhance the long-term productivity of soils within the riparian ecosystem.		The alternatives would not adversely affect the long-term productivity of soils within the riparian ecosystem. Adverse impacts from compaction and rutting would be alleviated with proper reclamation techniques. SWPPPs and restoration plans for the project will address topsoil salvage in riparian areas.
Mining Law Compliance and Administration	01 Minimize detrimental disturbance to the riparian area by mineral activities. Initiate timely and effective rehabilitation of disturbed areas and restore riparian areas to a state of productivity comparable to that before disturbance.	a. Prohibit the depositing of soil material from drilling, processing, or site preparation in natural drainageways. b. Locate the lower edge of disturbed or deposited soil banks outside the active floodplain. c. Prohibit stockpiling of topsoil or any other disturbed soil in the active floodplain. d. Prohibit mineral processing (milling) activities within the active floodplain. e. Discontinue heavy equipment use when soil compaction, rutting, and puddling is present.	Not applicable to the alternatives.
	02 Locate mineral removal activities away from the water's edge or outside the riparian area.		Not applicable to the alternatives.
	03 Confine heavy equipment use to areas necessary for mineral extraction.		Not applicable to the alternatives.
	04 Require concurrent monitoring to ensure that mitigative measures are effective and in compliance with State water quality standards.		Not applicable to the alternatives.
	05 Locate mining camps outside the active floodplain.	a. Locate drilling mud pits outside the active floodplain unless alternate locations are more environmentally damaging. If location is unavoidable, seal and dike all pits to prevent leakage. b. Drain and restore roads, pads, and drill sites immediately after use is discontinued. Revegetate to 80 percent of ground cover in the first year. Provide surface protection during storm-flow and snowmelt runoff events.	Not applicable to the alternatives.
Transportation System Management	01 Locate roads and trails outside riparian areas unless alternative routes have been reviewed and rejected as being more environmentally damaging.	a. Do not parallel streams when road location must occur in riparian areas except where absolutely necessary. Cross streams at right angles. Locate crossings at points of low bank slope and firm surfaces.	Although this standard and guideline specifically relates to roads, it has also been reviewed for consistency with the railroad alternatives. The 404(b)(1) showing in the COE application states that the location of the alternatives avoid water bodies and wetlands (including riparian areas) to the extent practicable. The COE had not ruled on the adequacy of the 404(b)(1) showing at the time this report was prepared. Crossings of streams are dictated by grade and curve limitations associated with the railroad design. Consequently, the locations of stream crossings can not be adjusted to comply with these standards and guidelines. Alternative B would have the largest impact on riparian areas on NFS lands on BGNG. Alternative B would impact riparian areas on NFS lands along Cottonwood Creek, Spring Creek and at several locations adjacent to the Cheyenne River. Riparian impacts on NFS lands along Cottonwood Creek and the Cheyenne River would be eliminated by Alternative C but the impact to Spring Creek would remain. The Phiney Flat Route Variation of Alternative C would eliminate riparian impacts on NFS lands along Spring Creek.
	02 Create artificial sediment traps with barriers where the natural vegetation is inadequate to protect the waterway or lake from significant accelerated sedimentation.		BMPs that address sediment traps and their use during construction are being developed for the SWPPPs. Sediment traps, such as hay bales, silt fence, settling basins, etc., will be incorporated in the BMPs and used on-site as appropriate. The SWPPPs will contain specific criteria describing where and when BMPs will be used in the field.
	03 Minimize detrimental disturbance to the riparian area by construction activities. Initiate timely and effective rehabilitation of disturbed areas and restore riparian areas so that a vegetation ground cover or suitable substitute protects the soil from erosion and prevents increased sediment yield.		Reclamation requirements will be addressed in the SWPPPs being prepared in compliance with SDENR regulations. Timing requirements for interim and final stabilization, including seeding, will be specifically addressed. The potential for sprigging as a means of accelerating restoration of riparian woody species will be assessed in the SWPPPs.

Appendix A, Table 5. Railroad Alternative Consistency With Additional Standards and Design Criteria from the Forest Service Watershed Conservation Practices Handbook (FSH 2509.25) that are Applicable to Management Prescription 9A, Emphasis on Riparian Area Management, Nebraska National Forest - Buffalo Gap National Grassland.

Standard/Design Criteria	Railroad Alternative Consistency
In the water influence zone next to perennial and intermittent streams, lakes, and wetlands, allow only those actions that maintain or improve long-term stream health and riparian ecosystem condition. **(standard)**	The alternatives would not be consistent with this standard. Where crossed by the alternatives, riparian ecosystem condition would be degraded from direct and indirect impacts. All activities associated with the alternatives that would occur within wetland or stream portions of the water influence zone on BGNG are regulated by the COE and SDENR. Regulatory programs implemented by those agencies will assure that no adverse impacts occur to the long-term health of streams. Mitigation pursuant to the COE's 404 permitting program will replace any direct wetland impacts associated with the project. Direct impacts will include the loss of a relatively narrow strip (approximately 200 feet in width) of riparian ecosystem to the railroad track bed. This loss would be most severe where the alternatives have been routed within drainages because of grade. Alternative B would have the largest impact on riparian areas on NFS lands on BGNG. Alternative B would impact riparian areas on NFS lands along Cottonwood Creek, Spring Creek and at several locations adjacent to the Cheyenne River. Riparian impacts on NFS lands along Cottonwood Creek and the Cheyenne River would be eliminated by Alternative C but the impact to Spring Creek would remain. The Phiney Flat Route Variation of Alternative C would eliminate riparian impacts on NFS lands along Spring Creek. The direct loss would be permanent (for the life of the project). Indirect impacts from noise would also occur. Noise impacts would further degrade the condition/habitat suitability of adjacent riparian areas. There are no regulatory programs that require compensatory mitigation from indirect adverse impacts to riparian ecosystems. DM&E, in consultation with the SDGFP and USFWS, is voluntarily exploring mitigation opportunities to offset these types of impacts.
Allow no action that will cause the long-term change to a lower stream health class in any stream reach. In degraded systems, progress toward robust stream health within the next plan period. **(design criteria)**	All streams which would be crossed by the alternatives on BGNG have been provided a water quality designation by the SDENR (see Chapter 3). Through the 401 certification process, the SDENR must certify to the COE that implementation of the alternatives would not violate state water quality standards. Stipulations can be added to the certification to further protect water quality and aquatic resources. The certification process will assure that the alternatives are consistent with this design criteria.
Allow no action that will cause long-term change away from desired condition in any riparian or wetland vegetation community. In degraded systems, progress toward desired condition within the next plan period. **(design criteria)**	Within the railroad right-of-way the alternatives would not be consistent with this design criteria. The nature of the railroad requires fill material be placed under the tracks. Where that fill material is added to wetland or riparian communities, the function and value of the vegetative community under the track will cease to exist. This is a relatively narrow impact area (generally less than 200 feet wide) and would be most severe where the alternatives have been routed along drainages to accommodate grade restrictions. In addition, the COE 404 permitting process will require DM&E to replace lost wetland function and value. Although the site-specific impact would result in a change in desired condition of wetland and riparian vegetation communities within the railroad right-of-way, the overall function and value of wetlands and riparian communities within each basin would be retained in the long-term.
Keep heavy equipment out of streams, swales, and lakes, except to cross at designated points, build crossings, or do restoration work, or if protected by at least 1 foot of packed snow or 2 inches of frozen soil. Keep heavy equipment out of streams during fish spawning, incubation, and emergence period. **(design criteria)**	Construction of the alternatives would comply with this design criteria. Equipment would work in streams only to support construction of railroad stream crossings. No timing restrictions to protect fish spawning, incubation and emergence have been developed for the streams on BGNG which would be crossed by the alternatives. If such timing restrictions are developed by the agencies, DM&E would be required to comply with the restriction.
Ensure at least one-end log suspension in the water influence zone. Fell trees in a way that protects vegetation in the water influence zone from damage. Keep log landings and skid trails out of water influence zones, including swales. **(design criteria)**	The alternatives would comply with this design criteria. The design criteria would be incorporated into construction plans for the alternatives.
Locate new concentrated-use sites outside the water influence zone if feasible and outside riparian areas and wetlands always. Harden or reclaim existing sites in the water influence zone to prevent detrimental soil and bank erosion. **(design criteria)**	The alternatives would comply with this design criteria. Alternative facilities have been located outside of water influence zones to the extent practicable. No facilities (other than tracks) are proposed for wetlands and riparian areas.
Exclude livestock from riparian areas and wetlands that are rated as Not Functioning by the PFC protocol, and where livestock grazing would impede improvement. **(design criteria)**	Not applicable to the alternatives.
Keep stock tanks, salt supplements, and similar features out of the water influence zone if feasible and out of riparian areas and wetlands always. Keep stock driveways out of the water influence zone except to cross at designated points. Harden water gaps and designated stock crossings where needed and feasible. **(design criteria)**	Not applicable to the alternatives.
Remove livestock from riparian areas and wetlands when the average stubble height of Carex species reaches 3-4 inches in spring-use pastures and 4-6 inches in summer/autumn use pastures. **(design criteria)**	Not applicable to the alternatives.
Avoid season-long grazing in riparian areas and wetlands. Apply short-duration grazing as feasible (generally less than 20 days) to provide greater opportunity for regrowth and to avoid utilization of woody species. Avoid livestock grazing, as feasible, during the hot season (mid-to-late summer) when livestock are more likely to concentrate in riparian areas and wetlands and to utilize woody species. **(design criteria)**	Not applicable to the alternatives.
Design grazing systems to limit utilization of woody species. Move livestock from riparian areas and wetlands when they begin to have a preference for woody species, especially plants in the young maturity classes. **(design criteria)**	Not applicable to the alternatives.
Maintain the extent of stable banks in each stream reach at 80 percent or more of reference conditions. Consider degree of livestock trampling on stream banks, by stream type, when timing livestock moves between units. As a general rule, stream banks can receive a maximum of 20-25% alteration and still maintain their integrity. **(design criteria)**	The alternatives would not adversely affect bank stability. BMPs that specifically address bank stability are being developed for the project. In some cases the alternatives would be designed to improve bank stability. The remainder of this design criteria is not applicable to the alternatives.
Adjust management in riparian areas and wetlands to remedy detrimental soil compaction whenever it occurs. **(design criteria)**	Remedying soil compaction would be addressed in the SWPPPs. The alternatives would comply with this design criteria.

Appendix A, Table 5. Railroad Alternative Consistency With Additional Standards and Design Criteria from the Forest Service Watershed Conservation Practices Handbook (FSH 2509.25) that are Applicable to Management Prescription 9A, Emphasis on Riparian Area Management, Nebraska National Forest - Buffalo Gap National Grassland.

Standard/Design Criteria	Railroad Alternative Consistency
Do not excavate earth material from, or store excavated earth material in, any stream, swale, lake, or water influence zone. **(design criteria)**	The alternatives would not be consistent with this design criteria. It would be impossible to construct any of the alternatives without excavating or filling these areas. Mitigation for the loss of these areas would be provided through the COE's 404 permitting process.
Design and construct all stream crossings and other instream structures to provide for passage of flow and sediment, withstand expected flood flows, and allow free movement on resident aquatic life. **(standard)**	In response to COE permitting requirements, hydrology and hydraulic studies are being conducted for all stream crossings on BGNG. These studies will provide information necessary to correctly size instream structures (i.e., culverts, bridges, etc.) to withstand expected flood flows and allow sediment passage. No structures which would impede movement of aquatic species would be installed. Consequently, the alternatives would comply with this design criteria.
Install stream crossings to meet Corps of Engineers and State permits, pass normal flow, and be hardened to withstand floods as follows: Design Life (years): 1 2 5 10 20 50 Design Flood (years): 10 10 25 50 100 200 **(design criteria)**	The alternatives would comply with this design criteria. Before construction can begin, permits must be secured from the State of South Dakota and the COE which address the ability of the railroad's proposed instream structures to pass normal flow and floods. General design criteria for all railroad structures is to allow passage of 100 year floods.
Size culverts and bridges to pass debris. Engineers work with hydrologists and aquatic biologists on site design. **(design criteria)**	Culverts will generally be a minimum of 36 inches in diameter. This size was chosen specifically to reduce debris accumulation. Bridges will be designed to address concerns with flood flows. The alternatives would be consistent with this design criteria.
Install stream crossings on straight an resilient stream reaches, as perpendicular to flow as possible, and to provide passage of fish and other aquatic life. **(design criteria)**	The alternatives would not be consistent with this design criteria. Because of design constraints on curves and grade, the alternatives have, in many cases, been routed parallel and adjacent to drainages. Consequently, some crossings of streams would not occur perpendicular to flow nor at straight or resilient reaches.
Install stream crossings to sustain bankfull dimensions of width, depth, and slope and keep stream beds and banks resilient. Favor hardened fords and bridges on streams with floodplains, and bottomless arches instead of pipe culverts. **(design criteria)**	The alternatives would not be consistent with this design criteria. The design of instream structures proposed by the railroad favors culverts instead of bottomless arches. However, crossings would sustain bankfull dimensions of width, depth and slope.
Conduct actions so that stream pattern, geometry, and habitats are maintained or improved toward robust stream health. **(standard)**	BMPs designed to address these concerns are being developed to support the 404 permit and 401 water quality certification applications. Generally, these permits would not allow any degradation of overall stream health. The alternatives would be consistent with this design criteria.
Add and remove rocks, wood, or other material in streams or lakes only if such action maintains or improves streams and lake health. Leave rocks and portions of wood that are embedded in beds or banks to prevent channel scour. **(design criteria)**	This design criteria would be incorporated into construction plans for the project. The alternatives would be consistent with this design criteria.
Install fish migration barriers only if needed to protect endangered, threatened, sensitive, or unique native aquatic populations, and only where natural barriers do not exist. **(design criteria)**	No fish migration barriers would be installed.
Do not relocate natural stream channels if avoidable. Return flow to natural channels where feasible. Construct channels and floodways with natural stream pattern and geometry and stable beds and banks. **(design criteria)**	The need for stream channelization is being evaluated in hydrology and hydraulic studies being conducted by DM&E to support the COE 404 application. The Forest Service will be provided an opportunity to review and comment on these studies.
Maintain long-term ground cover, soil structure, water budgets, and flow patterns of wetlands to sustain their ecological function, per 404 regulation. **(standard)**	A 404 permit must be issued by the COE before construction of any of the alternatives can begin. The 404 approval would address these design criteria. The alternatives would be consistent with this design criteria.
Keep ground vehicles out of wetlands unless protected by at least 1 foot of packed snow or 2 inches of frozen soil. Do not disrupt water supply or drainage patterns into wetlands. **(design criteria)**	Equipment would be limited to the construction right-of-way and approved access roads. Disruption of water supply or drainage patterns into wetlands is being addressed in the 404 permit applications. The alternatives would be consistent with this design criteria.
When feasible, keep roads and trails out of wetlands. If roads or trails must enter wetlands, use bridges or raised prisms to diffuse drainage to sustain flow patterns. Set crossing bottoms at natural levels of channel beds and wet meadow surfaces. Avoid actions that may dewater or reduce water budgets in wetlands. **(design criteria)**	Any roads necessary to support construction of the alternatives would avoid wetlands to the extent feasible. If wetlands are disturbed by road construction activities, adequate mitigation would be required before construction approval is granted. The impacts to wetlands would be addressed in the COE 404 permit. The alternatives would be consistent with this design criteria.
Avoid long-term reduction in organic ground cover and organic soil layers in any wetland. **(design criteria)**	This design criteria would be addressed in the COE 404 permitting process. The alternatives would be required to be consistent with this design criteria.
When feasible, keep buried utility and pipelines out of wetlands. If such a line must enter a wetland, use measures that sustain long-term wetland function. **(design criteria)**	Not applicable to the alternatives.
Avoid any loss of rare wetlands such as fens and springs. **(design criteria)**	No fens or springs would be affected on NFS lands on BGNG.
Do not build firelines in or around wetlands unless needed to protect life, property or wetlands. Use hand lines with minimum feasible soil disturbance. Use wetland features as firelines if feasible. **(design criteria)**	Not applicable to the alternatives.
Maintain enough water in perennial streams to sustain existing stream health. Return some water to dewatered perennial streams when needed and feasible. **(standard)**	It may be necessary to dewater portions of perennial stream beds temporarily during construction of instream structures. However, flow downstream of construction sites would be maintained at all times, where necessary, to protect aquatic resources. The alternatives would be consistent with this standard.

Appendix A, Table 5. Railroad Alternative Consistency With Additional Standards and Design Criteria from the Forest Service Watershed Conservation Practices Handbook (FSH 2509.25) that are Applicable to Management Prescription 9A, Emphasis on Riparian Area Management, Nebraska National Forest - Buffalo Gap National Grassland.

Standard/Design Criteria	Railroad Alternative Consistency
For existing dams and diversions on naturally perennial streams, obtain bypass flows at the point of diversion or storage that support a healthy, self-sustaining community of aquatic life having all regionally-expected species and population dynamics at permit reissuance. Bypass flows must exceed the native median flow of the lowest winter month for the fall-winter seasons, and the native median flow of the lowest summer month for the spring-summer seasons. **(design criteria)**	Not applicable to the alternatives.
For new dams and diversions, obtain bypass flows at the point of diversion or storage that protect stream processes, aquatic and riparian habitats and communities, and recreation and aesthetic values. Include base flows, and a range of high flows that bracket bankfull discharge, as needed to support these uses. **(design criteria)**	Not applicable to the alternatives.
Obtain instream flow water rights under federal and state law to protect stream processes, aquatic and riparian habitats and communities, and recreation and aesthetic values. Top priority is to protect imperiled native species. **(design criteria)**	Not applicable to the alternatives.
Manage water-use facilities to prevent gully erosion of slopes and to prevent sediment and bank damage of streams. **(standard)**	Not applicable to the alternatives.
Design all ditches, canals, and pipes with at least an 80% chance of passing high flow and remaining stable during their life. **(design criteria)**	Not applicable to the alternatives.
Do not flush or deposit sediment from behind diversion structures into the stream below. Deposit sediment in a designated upland site. **(design criteria)**	Not applicable to the alternatives.
Mitigate water imports so that the extent of stable banks in each receiving stream reach is at least 80 percent of reference conditions. **(design criteria)**	Not applicable to the alternatives.
Limit roads and other disturbed sites to the minimum feasible number, and total length consistent with the purpose of the specific operations, local topography, and climate. **(standard)**	The 404(b)(1) showing demonstrates how disturbance has been minimized to the extent practicable. At the time this report was prepared, the COE had not ruled on the adequacy of the railroad's 404(b)(1) showing.
Construct roads on ridge tops, stable upper slopes, or wide valley terraces if feasible. Stabilize soils onsite. End-haul soil if full-bench construction is used. Avoid slopes steeper than 70 percent. **(design criteria)**	If it is necessary to construct new roads on BGNG to access construction sites, the alternatives would comply with this design criteria.
Avoid soil-disturbing actions during periods of heavy rain or wet soils. Apply travel restriction to protect soil and water. **(design criteria)**	BMPs are being developed to address protection of wet soils from compaction and rutting. These issues will be addressed in the SWPPPs.
Install cross drains to disperse runoff into filter strips and minimize connected disturbed areas. Make cuts, fills, and road surfaces strongly resistant to erosion between each stream crossing and at least the nearest cross drain. Revegetate using certified local native plants as feasible; avoid persistent or invasive exotic plants. **(design criteria)**	The alternatives would comply with this design criteria. Specific BMPs, being designed for inclusion in the SWPPPs, would address these and other types of erosion control techniques including reclamation.
Where feasible, construct roads with rolling grades instead of ditches or culverts. **(design criteria)**	If it is necessary to construct new roads on BGNG to access construction sites, the alternatives would comply with this design criteria.
Retain stabilizing vegetation on unstable soils. Avoid new roads or heavy equipment use on unstable or highly-erodible soils. **(design criteria)**	If it is necessary to construct new roads on BGNG to access construction sites, the alternatives would comply with this design criteria.
Use existing roads unless other options will produce less long-term sediment. Reconstruct for long-term soil and drainage stability. **(design criteria)**	New road construction would be minimized on NFS lands on BGNG. Access to construction sites would primarily use existing roads. If new roads are required they would be constructed in compliance with the design criteria contained in this handbook.
Avoid ground skidding with blades lowered or on highly erodible slopes steeper than 40%. Conduct logging to disperse runoff as feasible. **(design criteria)**	Not applicable to the alternatives.
Designate, construct, and maintain recreational travelways for proper drainage and harden their stream crossings as needed to control sediment. **(design criteria)**	Not applicable to the alternatives.
Construct roads and other disturbed sites to minimize sediment discharge into streams, lakes, and wetlands. **(standard)**	The alternatives would be consistent with this standard. Sediment control would be addressed in site-specific SWPPPs.
Design all roads, trails, and other soil disturbances to the minimum standard for their use and to "roll" with the terrain as feasible. **(design criteria)**	Design criteria for the railroad generally limits grade to 1 percent or less. The alternatives would not, therefore, roll with the terrain. The alternatives would consist of a series of cuts and fills that level the bed regardless of the rolling nature of the terrain.
Use filter strips, and sediment traps if needed, to keep all sand-sized sediment on land and disconnect disturbed soil from streams, lakes and wetlands. Disperse runoff into filter strips. **(design criteria)**	The alternatives would be consistent with this standard. Sediment control would be addressed in site-specific SWPPPs.
Key sediment traps into the ground. Clean them out when 80% full. Remove sediment to a stable, gentle upland site and revegetate. **(design criteria)**	The alternatives would be consistent with this standard. Sediment control would be addressed in site-specific SWPPPs. Maintenance and inspection of sediment control structures will be a key issue addressed in the SWPPPs.
Keep heavy equipment out of filter strips except to do restoration work or build hardened stream or lake approaches. Yard logs up out of each filter strip with minimum disturbance of ground cover. **(design criteria)**	The alternatives would be consistent with this standard. Sediment control would be addressed in site-specific SWPPPs.
Build firelines outside filter strips unless tied into a stream, lake, or wetland as a firebreak with minimal disturbed soil. Retain organic ground cover in filter strips during prescribed fires. **(design criteria)**	Not applicable to the alternatives

Appendix A, Table 5. Railroad Alternative Consistency With Additional Standards and Design Criteria from the Forest Service Watershed Conservation Practices Handbook (FSH 2509.25) that are Applicable to Management Prescription 9A, Emphasis on Riparian Area Management, Nebraska National Forest - Buffalo Gap National Grassland.	
Standard/Design Criteria	**Railroad Alternative Consistency**
Stabilize and maintain roads and other disturbed sites during and after construction to control erosion. **(standard)**	The alternatives would be consistent with this standard. Sediment control would be addressed in site-specific. The SWPPPs will specifically address interim stabilization control techniques and their application during construction of the alternatives.
Do not encroach fills or introduce soil into stream, swales, lakes or wetlands. **(design criteria)**	The alternatives would not be consistent with this design criteria. It would be necessary to fill certain wetlands and cut others to maintain the design grade requirements and construct the track. Fill may be introduced in and adjacent to streams during construction of crossings.
Properly compact fills and keep woody debris out of them. Revegetate cuts and fills upon final shaping to restore ground cover, using certified local native plants as feasible; avoid persistent or invasive exotic plants. Provide sediment control until erosion control is permanent. **(design criteria)**	The alternatives would be consistent with this standard. Restoration requirements would be addressed in site-specific SWPPPs.
Do not disturb ditches during maintenance unless needed to restore drainage capacity or repair damage. Do not undercut the cut slope. **(design criteria)**	The alternatives would be consistent with this standard.
Space cross drains, from no more than 120 feet in highly erodible soils on steep grades, to no more than 1,000 feet in resistant soils on flat grades. Do not divert water from one stream to another. **(design criteria)**	The alternatives would be consistent with this standard. Water would not be diverted between streams and spacing of cross drains would be addressed in the SWPPPs.
Empty cross drains onto stable slopes that disperse runoff into filter strips. On soils that may gully, armor outlets to disperse runoff. Tighten cross-drain spacing so gullies are not created. **(design criteria)**	The alternatives would be consistent with this standard. Armoring of outlets and methods to repair rills and gullies will be addressed in the SWPPPs. Specific recommendations for waterbar spacing based on slope will be provided in the SWPPPs.
Harden rolling dips as needed to prevent rutting damage to the function of the rolling dips. Ensure that road maintenance provides stable surfaces and drainage. **(design criteria)**	Not applicable to the alternatives.
Where berms must be used, construct and maintain them to protect the road surface, drainage features, and slope integrity while also providing safety. **(design criteria)**	Not applicable to the alternatives.
Build firelines with rolling grades and minimum downhill convergence. Outslope or backblade, permanently drain, and revegetate firelines immediately after the burn. Use certified local native plants as feasible; avoid persistent or invasive exotic species. **(design criteria)**	Not applicable to the alternatives.
Reclaim roads and other disturbed sites when use ends, as needed, to prevent resource damage. **(standard)**	The alternatives would be consistent with this standard. Reclamation would be addressed in site-specific SWPPPs.
Site-prepare, drain, revegetate, and close temporary and intermittent use roads and other disturbed sites within one year after use ends. Provide stable drainage that disperses runoff into filter strips and maintains stable fills. Do this work concurrently. Use certified local native plants as feasible; avoid persistent or invasive exotic plants. **(design criteria)**	The alternatives would be consistent with this standard. Reclamation would be addressed in site-specific SWPPPs.
Remove all temporary stream crossings (including all fill material in the active channel), restore the channel geometry, and revegetate the channel banks using certified local native plants as feasible; avoid persistent or invasive exotic plants. **(design criteria)**	The alternatives would be consistent with this standard. Reclamation would be addressed in site-specific SWPPPs.
Manage land treatments to limit the sum of severely burned and detrimentally compacted, eroded, and displaced land to no more than 18% of any land unit. **(standard)**	Not applicable to the alternatives.
Restrict roads, landings, skid trails, concentrated-use sites, and similar soil disturbances to designated sites. **(design criteria)**	The alternatives would be consistent with this design criteria.
Operate heavy equipment for land treatments only when soil moisture is below the plastic limit, or protected by at least 1 foot of packed snow or 2 inches of frozen soil. **(design criteria)**	Not applicable to the alternatives.
Conduct prescribed fires when soil, humus, and large fuels are moist. **(design criteria)**	Not applicable to the alternatives.
Maintain and improve long-term levels of organic matter and nutrients on all lands. **(standard)**	The alternatives would not result in a reduction of organic matter or nutrients in soils.
On soils with topsoil thinner than 1 inch, topsoil organic matter less than 2%, or effective rooting depth less than 15 inches, retain 90% or more of the fine (less than 3 inches in diameter) logging slash in the stand after each clearcut and seed-tree harvest, and retain 50% or more of such slash in the stand after each shelterwood and group-selection harvest, considering existing and projected levels of fine slash. **(design criteria)**	Not applicable to the alternatives.
If machine piling of slash is done, conduct piling to leave topsoil in place and to avoid displacing soil into piles or windrows. **(design criteria)**	Not applicable to the alternatives.
Place new sources of chemical and pathogenic pollutants where such pollutants will not reach surfaces or ground water. **(standard)**	The alternatives would be consistent with this design criteria. A Spill Prevention, Control and Countermeasure (SPCC) Plan would be developed for the alternatives. Specific limits on fueling activities within close proximity to water bodies and wetlands would be incorporated into the SPCC Plan.
Put pack and riding stock sites, sanitary sites, and well drill-pads outside the water influence zone. **(design criteria)**	Not applicable to the alternatives.

Appendix A, Table 5. Railroad Alternative Consistency With Additional Standards and Design Criteria from the Forest Service Watershed Conservation Practices Handbook (FSH 2509.25) that are Applicable to Management Prescription 9A, Emphasis on Riparian Area Management, Nebraska National Forest - Buffalo Gap National Grassland.

Standard/Design Criteria	Railroad Alternative Consistency
Put vehicle service and fuel areas, chemical storage and use areas, and waste dumps and areas on gentle upland sites. Do mixing, loading, and cleaning on gentle upland sites. Dispose of chemicals and containers in State-certified disposal areas. **(design criteria)**	The alternatives would be consistent with this design criteria. A SPCC Plan would be developed for the alternatives. Fuel and construction material storage will be addressed in that plan.
Apply runoff controls to disconnect new pollutant sources from surface and ground water. **(standard)**	Drainage from fuel and material storage sites would be addressed in the SPCC Plan. Runoff controls, such as berms, liners, drips, etc. would be used to isolate spilled material from surface or ground water.
Install contour berms and trenches around vehicle service and refueling areas, chemical storage and use areas, and waste dumps to fully contain spills. Use liners as needed to prevent seepage to ground water. **(design criteria)**	The alternatives would be consistent with this design criteria. Specific design of spill containment would be addressed in the SPCC Plan.
Reclaim each mine waste dump when its use ends, using certified local native plants as feasible; avoid persistent or invasive exotic plants. Stabilize waste dumps and tailing in non-use periods to prevent wind and water erosion. If non-use will exceed one year, perform concurrent reclamation. **(design criteria)**	Not applicable to the alternatives.
Use lined ponds below waste dumps and tailing to contain all inflow. Build tailings dams with a 95% chance of containing floods over their design life. Permanently stabilize dams at final shaping. **(design criteria)**	Not applicable to the alternatives.
Clean waste water from concrete batching and aggregate operations before returning the water to streams, lakes or wetlands. **(design criteria)**	The alternatives would be consistent with this design criteria.
Inspect chemical equipment daily for leaks. If leaks or spills occur, report them and install emergency traps to contain them and clean them up. **(design criteria)**	The alternatives would be consistent with this design criteria. Inspection and reporting requirements would be incorporated into the SPCC plan.
Apply chemicals using methods which minimize risk of entry to surface and ground water. **(standard)**	The only chemical which would be applied is herbicides. Only licensed applicators would be used to apply herbicides. Application would be in strict conformance with federal and state regulations, including considerations necessary to protect ground and surface water. Use of herbicides on NFS lands would be coordinated with the Forest Service.
Favor pesticides with half-lives of 3 months or less. Apply at lowest effective rates as large droplets or pellets. Follow the label. Favor selective treatment. Use only aquatic-labeled chemicals in water influence zones. **(design criteria)**	Forest Service approval of herbicide application on NFS lands would be secured before application in compliance with appropriate regulations.
Use non-toxic, non-hazardous drilling fluids when feasible. **(design criteria)**	Not applicable to the alternatives.

Appendix A, Table 6. Railroad Alternative Consistency With Management Requirements of the 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland			
Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
Diversity on National Forests and National Grasslands	1. Maintain structural diversity of vegetation on units of land 5,000 to 20,000 acres in size, or fourth-order watersheds, that are dominated by forested ecosystems.	a. Maintain or establish a minimum of 20 percent of the forested area within a unit to provide vertical diversity except where the forest vegetation is comprised of more than 81 percent lodgepole pine in a unit, the vertical diversity may be less than 20 percent. b. Maintain or establish a minimum of 30 percent of the forested area within a unit to provide horizontal diversity. c. In forested areas of a unit, maintain at least 5 percent in grass/forb stages and at least 10 percent of the conifer potential natural vegetation type in old growth. This 10 percent must meet true old growth characteristics (if available) and occur in 30 acre or larger patches. Spruce/fir is the preferred type for old growth. d. In forested units, create or modify created openings so they have natural appearing shapes. Openings larger than 26 acres should be designed so they have a Patton edge shape index of at least 1.4. Openings smaller than 26 acres are not constrained by the diversity index.	Not applicable to the alternatives.
	2. Retain existing medium- or high-contrast edges within forested diversity units.		Not applicable to the alternatives.
	3. If medium-contrast edges are created in units dominated by grassland or shrubland, create openings with Patton edge-shape index of at least 1.4. Manage unmanipulated plant communities to reach late seral stages.	a. Maximum size of individual treated areas is 500 acres.	Not applicable to the alternatives.
	4. In forested diversity units, maintain at a minimum on each treated area, an average of 20-30 snags (in all stages of development) per 10 acres, well distributed over the diversity unit.	a. Provide at a minimum, an average of 4-6 snags per 10 acres of the following minimum diameters (where biologically feasible): - Ponderosa pine, Douglas-fir and spruce/fir: 12 inches DBH - Aspen and Lodgepole pine: 8 inches DBH. b. Retain an average length per acre of down-dead logs (where biologically feasible) of the following minimum diameters: - Ponderosa Pine, Douglas-fir and spruce-fir - 12 inch diameter 50 linear feet/acre. - Aspen and Lodgepole pine - 10 inch diameter 33 linear feet/acre.	Not applicable to the alternatives.
	5. Manage aspen for retention wherever it occurs, unless justified by one of the following: a. Conversion of determinate aspen to conifers, or shrub-or grass/forb seral stages for wildlife, esthetic, recreation, transportation, or watershed purposes. b. Conversion of determinate aspen to conifers on sites with high site index for conifers, in conjunction with a high demand for softwood; or c. Areas of aspen which are larger than are needed for wildlife or esthetic purposes.	a. For each 10 acres of aspen treatment, reserve one group (at least five trees, not of the same clone treated) of the largest aspen for wildlife habitat. b. Maintain at least 10 percent of aspen in over mature/old growth condition (90+ years).	Aspen would not be affected by the alternatives on TBNG.
	6. Conversion of any aspen stand for the above reasons will require regeneration of aspen stands elsewhere on the Forest to maintain about 77,700 acres of aspen on the Forest.		Aspen would not be affected by the alternatives on TBNG.
	7. If determinate aspen stands are managed for regeneration, treat contiguous areas no larger than 40 acres, unless larger areas are needed to protect aspen regeneration or prevent decadence. Treat entire clones. Indeterminate (climax) aspen stands can be converted to other cover types if needed to meet other objectives.		Aspen would not be affected by the alternatives on TBNG.
National Grassland Management	1. Manage National Grasslands for the use(s) that best demonstrate programs of sound land conservation and utilization (grassland agriculture). Demonstrations should include, but not be limited to: a. Improved range utilization techniques; b. Wildlife habitat protection and improvement; c. Surface resource protection, management, and rehabilitation during and after mineral operations. d. Soil conservation and watershed protection;	a. Confine demonstrations of cropping practices to soils recommended by the Soil Conservation Service (SCS).	The alternatives would be consistent with the general direction described. a. The alternatives would not limit the ability of the Forest Service to initiate improved range utilization techniques. b. Wildlife habitat will be adversely affected on TBNG. In places, the impacts are expected to be locally severe (i.e., where construction would be directly adjacent to sage grouse lek). However, the impacts would affect a relatively small portion of TBNG. Mitigation opportunities are being explored that will offset impacts to important wildlife resources.

Appendix A, Table 6. Railroad Alternative Consistency With Management Requirements of the 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland			
Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
	e. Development of recreational potential; f. Cropping practices, and g. Sites which should be retained in perennial vegetation.		c. Not applicable to the alternatives. d. BMPs are being developed that address conservation of soil, sedimentation and the protection of water quality and watersheds. These BMPs are being prepared for incorporation into site-specific SWPPPs. e. Operation of the railroad may preclude opportunities to develop certain types of recreation on parts of TBNG. However, the impact would be restricted to the vicinity of the railroad and, for the most part, would be consistent with current Recreation Opportunity Spectrum (ROS) designations on TBNG. f. & g. Not applicable to the alternatives.
	2. Manage sites with unique or exceptional recreational, esthetics, or wildlife habitat, and areas with Research Natural Area (RNA) or special interest site values for their inherent values as part of the National Grassland demonstration.		Alternative B would cross through the Rosecrans area which has been designated as a reintroduction site for the black-footed ferret. From a ferret reintroduction standpoint, the prairie dog towns in the Rosecrans area provide exceptional wildlife habitat. Consequently, Alternative B would not be consistent with this general direction. In addition to potential inconsistencies with the Rosecrans area, all the alternatives would also cross areas in the vicinity of the Rochelle Hills identified by the Wyoming Game and Fish Department (WGFD) as crucial elk winter range. Several elk calving areas are also located in close proximity to the alternatives. It is the policy of the Wyoming Game and Fish Commission that no net loss of these unique wildlife habitats occur. The railroad alternatives would result in a net loss (direct and indirect) of these habitats and would be inconsistent with the general direction contained in the forest plan. Mitigation is being explored that will offset these impacts.
	3. Accommodate appropriate objectives of all U.S. Department of Agriculture (USDA), State, and other Federal agencies and institutions pertinent to grassland agriculture in National Grassland management objectives.		Not applicable to the alternatives.
Cultural Resource Management	1. Protect, find an adaptive use for, mitigate according to an approved mitigation plan, or interpret all cultural resources on National Forest System (NFS) lands which are listed on the National Register of Historic Places, the National Register of Historic Landmarks, or have been determined to be eligible for the National Registers.	a. Follow direction in FSM 2360.	The alternatives would be consistent with this general direction. Refer to the Cultural Resources Programmatic Agreement in Appendix F of this report for additional information.
	2. Nominate or recommend cultural resource sites to the National Register of Historic Places by 1990 in the following priority: a. Sites representing multiple themes; b. Sites representing themes which are not currently on the National Register within the State; or c. Sites representing themes which are currently represented by single sites.		Not applicable to the alternatives.
	3. Protect and foster public use and enjoyment of cultural resources: a. Complete cultural resource surveys prior to any ground-disturbing project; b. Avoid disturbance of known cultural resources until evaluated and determined not significant; c. Collect and record information from sites where there is no other way to protect the properties; d. Issue antiquities permits to qualifying academic institutions or other organizations for the study and research of sites.		The alternatives would be consistent with this general direction. a. Surveys will be completed for all NFS lands which would be disturbed during construction of the alternatives. b. Disturbance of sites will not be allowed until adequate mitigation plans have been developed, approved and implemented. c. Site data collection will be incorporated into mitigation planning, where appropriate. d. Appropriate permits have been issued to cultural contractors working for the STB. Refer to the Cultural Resources Programmatic Agreement in Appendix F of this report for additional information.
	4. Interpret one representative sample of the following key historic themes: Forest Service management, logging/tie hack, lodges/resorts, mining, and livestock grazing.		Not applicable to the alternatives.
Visual Resource Management	1. Apply the Visual Management System to all National Forest System (NFS) lands. Travel routes, use areas and water bodies determined to be of primary importance are sensitivity level 1 and appropriate visual quality objectives are established according to the Visual Management System.	a. Follow direction provided in FSM 2380 and FSH 2309.16 through FSH 2309.25.	This general direction required Forest Service action following approval of the forest plan in 1985. The general direction is not applicable to the alternatives.

Appendix A, Table 6. Railroad Alternative Consistency With Management Requirements of the 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland			
Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
	2. Rehabilitate all existing projects and areas which do not meet the adopted visual quality objective(s) (VQO) specified for each management area. Set priorities for rehabilitation, considering the following: a. Relative importance of the area and the amount of deviation from the adopted VQO. Foreground areas have highest priority; b. Length of time it will take natural processes to reduce the visual impacts so that they meet the adopted VQO; c. Length of time it will take rehabilitation measures to meet the adopted VQO; and d. Benefits to other resource management objectives to accomplish rehabilitation.		This general direction required Forest Service action following approval of the forest plan in 1985. The general direction is not applicable to the alternatives.
	3. Achieve enhancement of landscapes through addition, subtraction or alteration of elements of the landscape such as vegetation, rockform, water features or structures. Examples of these include: a. Addition of vegetation species to introduce unique form, color or texture to existing vegetation. b. Vegetation manipulation to open up vistas or screen out undesirable views.		Not applicable to the alternatives.
	4. Plan, design and locate vegetation manipulation in a scale which retains the color and texture of the characteristic landscape, borrowing directional emphasis of form and line from natural features.	a. Meet the Visual Quality Objectives of retention and partial retention one full growing season after completion of a project. Meet modification and maximum modification objectives three full growing seasons after completion of a project. b. Determine sensitivity levels in accordance with FSH 2309.16, Agriculture Handbook No. 462, Vol. 2, Chapter 1; Sensitivity Levels.	Not applicable to the alternatives.
	5. Blend soil disturbance into natural topography to achieve a natural appearance, reduce erosion and rehabilitate ground cover.		The alternatives would not be consistent with this general direction. Soil disturbance would not blend with the natural topography because of the general need to cut and fill to meet the grade design requirement not to exceed 1 percent.
	6. Revegetate disturbed soils. In large projects, this may have to be done in stages.	a. Initiate revegetation of disturbed soils by the growing season following disturbance.	The alternatives would be consistent with this general direction and standard and guideline. SWPPPs will be developed in compliance with requirements of the Wyoming Department of Environmental Quality (WDEQ). Revegetation, including timing of restoration efforts, will be addressed in these SWPPPs.
	7. Choose facility and structure design, color of materials, location and orientation to meet the adopted visual quality objective(s) for the management area.		The VQO for the majority of the NFS lands on TBNG which would be crossed by the alternatives is designated by the forest plan as "modification". The modification VQO recognizes that management activities may dominate the landscape. All the alternatives would comply with the level of contrast allowed by modification. All fixed facilities and structures on NFS lands would be painted to blend with the natural environment as required by the general direction. Approximately 4 miles of Alternatives B, C and D would cross areas designated as Management Prescription 9A in the Medicine Bow Forest Plan. Management Prescription 9A applies to the aquatic ecosystem, the riparian ecosystem, and adjacent ecosystems that remain within approximately 100 feet from both edges of all perennial streams and from shores of lakes and other still water bodies. Management Prescription 9A has a VQO of "partial retention". Management activities may be evident but should be subordinate to the natural landscape. Activities may introduce forms, lines and colors not found in the natural landscape but they should not dominate the views. Other natural features should attract the viewer's attention. Where the alternatives would cross or run parallel to Management Prescription 9A, the railroad is expected to dominate the natural landscape and the views, particularly when a train is present. Other natural features would likely be subordinate to the railroad. Therefore, Alternatives B, C and D are not consistent with this general direction on TBNG.

Appendix A, Table 6. Railroad Alternative Consistency With Management Requirements of the 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland			
Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
Recreation Site Construction and Rehabilitation	1. Provide appropriate development facilities where the private sector is not meeting the demand.		Not applicable to the alternatives.
	2. Maintain cost-effective developed recreation facilities which complement non-Forest Service developments.		Not applicable to the alternatives.
	3. Provide facilities which are accessible to handicapped persons.		Not applicable to the alternatives.
	4. Facilities proposed for construction or reconstruction which lie within identified 100-year floodplains will be evaluated as to the specific flood hazards and values involved with the site. Viable alternatives will be thoroughly evaluated.	a. Follow procedures and guidelines in FSM 2527.04c.	Not applicable to the alternatives.
	5. Past and probable flood heights in inventoried 100-year floodplains will be posted to provide visible warnings to the using public about possible periodic flooding.	a. Follow procedures and guidelines in FSM 2527.6.	Not applicable to the alternatives.
Management of Developed Recreation Sites	1. Design, construct and operate developed sites which are adjacent to or provide an access point into a wilderness to complement wilderness management objectives.		Not applicable to the alternatives.
	2. Construct, reconstruct and maintain developed sites in accordance with the established Recreation Opportunity Spectrum (ROS) classification for the management area.	a. Standards and Guidelines ROS Class* — Site Development Scale** P — Not to exceed 1 SPNM — Not to exceed 2 SPM — Not to exceed 2 RN — Class 3 or 4 R — Class 3 or 4 U — Class 5 * P = Primitive SPNM = Semi-primitive non-motorized SPM = Semi-primitive motorized RN = Roaded Natural R = Rural U = Urban ** FSM 2331.47	Not applicable to the alternatives.
	3. Manage development scale 3 and 4 sites for full service when at least one of the following are met: a. A campground is designated as a fee site b. A group campground or picnic ground has a reservation system and/or user fee c. The site is a staffed visitor information center.	a. FSM 2331.47	Not applicable to the alternatives.
Dispersed Recreation Management	1. Provide a broad spectrum of dispersed recreation opportunities in accordance with the established Recreation Opportunity Spectrum (ROS) classification for the management area.		Not applicable to the alternatives.
	2. Close or rehabilitate dispersed sites where unacceptable environmental damage is occurring.	a. Close sites that cannot be maintained in Frissell Condition Class 1, 2, or 3 (Campsite Condition, Frissell, S.S.; Journal of Forestry August 1978). b. Rehabilitate sites that are in Frissell condition class 4.	Not applicable to the alternatives.

Appendix A, Table 6. Railroad Alternative Consistency With Management Requirements of the 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland

Management Activities	General Direction	Standards & Guidelines	Railroad Alternative Consistency
	3. Manage dispersed recreation activities to not exceed the established ROS PAOT/acre capacity. Manage use of trails in dispersed areas to not exceed the established PAOT/mile of trail guidelines.	a. Standards and Guidelines:	Not applicable to the alternatives.

Recreation use and capacity range during the snow-free period (PAOT/acre):

Trail use and capacity range (PAOT/mile of trail):

Use Level	Capacity Range Very Low	Low	Moderate	High
ROS class - Primitive				
On Trails PAOT/Mile	0.5	1.0	2.0	3.0
Area-wide PAOT/acre	.001	.002	.007	.025
ROS Class - Semi-Primitive Nonmotorized				
On Trails PAOT/mile	2.0	3.0	9.0	11.0
Area-wide PAOT/acre	.004	.008	.05	.08
ROS Class - Semi-Primitive Motorized				
On Trails PAOT/mile	2.0	3.0	9.0	11.0
Area-wide PAOT/acre	.004	.008	.05	.08
ROS Class - Roaded Natural				
On Trails PAOT/mile	-	-	-	-
Area-wide PAOT/acre	.04	.08	1.2	2.5
ROS Class - Rural				
On Trails PAOT/mile	-	-	-	-
Area-wide PAOT/acre	.5	.8	5.0	7.5

Appendix A, Table 6. Railroad Alternative Consistency With Management Requirements of the 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland			
Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
		Reduce the above use level coefficients as necessary to reflect usable acres, patterns of use, and general attractiveness of the specific management area type as described in the ROS Users Guide, Chapter 25. Reduce the above use levels where unacceptable changes to the biophysical resources will occur. VERY LOW applies to alpine; LOW applies to rock, mtn. grass, and clearcuts 1-20 years old; MODERATE applies to LP size class 9, mtn. grass, PP size class 9, 8 and 7, DF size class 9, 8 and 7, Aspen size class 9, SF size class 7, shelterwood cuts 90-120 years old, selection cuts 1-20 years old and clearcuts 80-120 years old; HIGH applies to SF size class 9 and 8, LP size class 8 and 7, Aspen size class 8 and 7 and clearcuts 20-80 years old.	
	4. Prohibit camping within a minimum of 100 feet from lakes and streams unless exceptions are justified by terrain or specific design which protects the riparian and aquatic ecosystems.		Not applicable to the alternatives.
	5. Manage resource activities and facilities in accordance with the Regional Acceptable Work Standards.	a. FSM 1310 R2 ID No. 1 7/22/82	Not applicable to the alternatives.
	6. Prohibit motorized vehicle use (except over snow vehicles operating on snow) off of Forest System roads and trails in alpine and Krummholtz ecosystems.		Not applicable to the alternatives.
	7. Manage outfitted recreation use to ensure at least 50% of the established ROS PAOT/Ac capacity for the management area is available for non-outfitted recreation use. Also manage outfitted use to ensure at least 50% of the available dispersed campsites in the management area are available for non-outfitted users. Outfitted use may be further limited based upon local agreement with the Wyoming Game and Fish Department in furtherance of their objectives.		Not applicable to the alternatives.
Recreation Management (Private and Other Public Sector)	1. Ensure that permitted private and public sector sites on Forest Service lands which are adjacent to, or provide an access point into, a wilderness complement wilderness management objectives.		Not applicable to the alternatives.
Wilderness Area Management	1. Cultural resources sites will be managed in accordance with the Wyoming Wilderness Act of 1984.		Not applicable to the alternatives.
	2. Provide opportunities for human isolation, solitude, self-reliance and challenge while traveling cross-country and on system trails.		Not applicable to the alternatives.
	3. Utilize a permit system to manage use levels and patterns during the summer use period based upon the following criteria: a. When acceptable use levels, as specified in the individual prescriptions, are exceeded during 20 percent of the summer use season, or b. When acceptable capacities, as specified in the individual prescriptions, in primitive or pristine management areas are exceeded on 10 percent or more of the days during the summer use season. c. Apply a permit system to an entire wilderness, not just impacted portions of a wilderness.		Not applicable to the alternatives.
	4. Do not impose party-size limits during traditionally light-use seasons or during fall hunting seasons unless necessary to prevent unacceptable levels of change to the biological and physical resources.		Not applicable to the alternatives.

Appendix A, Table 6. Railroad Alternative Consistency With Management Requirements of the 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland			
Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
	5. Maximum party-size limit for the summer use period is 25 people and/or recreational stock. Party size limits less than 25 people and/or recreational stock will be established where biological and physical resource capability cannot support that level of use. Party sizes established for protection of biophysical resources will set limits for both people and recreational stock. Parties larger than established limits may be allowed under permit on a case-by-case basis when compatible with other wilderness management objectives.		Not applicable to the alternatives.
	6. Prohibit competitive contest events, group demonstrations, ceremonies, and other similar events.		Not applicable to the alternatives.
	7. Prohibit dogs, or require them to be physically controlled on a leash. Exceptions will be made for permittee's working dogs, and for hunting dogs while hunting during legal seasons.		Not applicable to the alternatives.
	8. Prohibit recreational stock along lake shores and streambanks except for watering and through-travel.		Not applicable to the alternatives.
	9. Require users camping overnight with recreational stock to carry cubed, pelleted, or rolled feed and/or certified weed-free hay where grazing is prohibited.		Not applicable to the alternatives.
	10. Control overnight grazing of recreational stock in alpine and Krummholtz ecosystems according to use standards in Management Activity DO2, Forest Direction.	a. Base range condition on the standards in Range Analysis Handbook (FSH 2209.21). b. Allowable soil disturbance criteria: 20% maximum disturbance on ranges with good-excellent soil stability condition on 0-15% slopes. 15% maximum disturbance on ranges with fair soil stability conditions on slopes less than 15% and good or better soil stability conditions on slopes of 16-25% 10% maximum disturbance on ranges with fair soil stability conditions on slopes of 16-25%, and good soil stability conditions on slopes of 26-45%.	Not applicable to the alternatives.
	11. Prohibit new range improvement structures other than corrals, fences or water developments essential to sustain current permitted numbers.		Not applicable to the alternatives.
	12. Implement revegetation only for rehabilitation of areas in less than "fair" range condition based upon their natural potential. Use only native species for revegetation. Implement only where natural vegetation possibilities are poor, and only where degradation was due to human activities.	a. Base range condition on the standards in Range Analysis Handbook (FSH 2209.21).	Not applicable to the alternatives.
	13. Permit fish and wildlife research and management utilizing guidelines adopted by the International Association of Fish and Wildlife Agencies (FSM 2323.3).		Not applicable to the alternatives.
	14. See Mining Law Compliance and Administration and Minerals Management Activities in Forest Direction for minerals direction.		Not applicable to the alternatives.
	15. Suppress man-caused wildfires.		Not applicable to the alternatives.
	16. Maintain fire-dependent ecosystems using prescribed fires ignited naturally. Reclaim areas disturbed as part of fire control activities to meet the visual quality objective of retention.		Not applicable to the alternatives.
	17. Protect air quality related values from adverse affects from air pollution.	a. See criteria and standards in FSM 2120.	See the project-specific EIS for estimates of impacts to air quality related values.
	18. Control natural insect or disease outbreaks in wilderness only when justified by predicted loss of resource values outside of wilderness. Conduct analysis in accordance with FSM 3430.		Not applicable to the alternatives.
	19. Control problem animals on a case-by-case basis in cooperation with other agencies (FSM 2610) using methods directed at the offending animal but which presents the least risk to other wildlife and/or visitors.		Not applicable to the alternatives.

Appendix A, Table 6. Railroad Alternative Consistency With Management Requirements of the 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland			
Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
Wildlife and Fish Resource Management	1. Where present on National Forest lands, the following species are management indicator species. a. FEATURED SPECIES 1) Elk; 2) Mule Deer; 3) Bighorn Sheep; 4) Turkey; b. RECOVERY SPECIES 1) Bald Eagle; 2) Peregrine Falcon; 3) Black-footed Ferret c. ECOLOGICAL INDICATORS 1) Pine Marten; 2) Beaver; 3) Redbacked Vole; 4) Longtailed Vole; 5) Dwarf Shrew; 6) Western Jumping Mouse; 7) Osprey; 8) Goshawk; 9) Whitetailed Ptarmigan; 10) Sage Grouse; 11) Blue Grouse; 12) Hairy Woodpecker; 13) Yellowbellied Sapsucker; 14) Lewis Woodpecker; 15) White Crowned Sparrow; 16) Ruby Crowned Kinglet; 17) Yellow Warbler; 18) Cedar Waxwing; 19) Sandhill Crane; 20) Boreal Toad; 21) Smooth Green Snake; 22) Wood Frog d. FISH 1) Colorado River cutthroat trout; 2) Common trout species		Not applicable to the alternatives.
	2. Where present on Thunder Basin National Grassland, the following species are management indicator species. a. FEATURED SPECIES 1) Antelope; 2) Mule Deer; 3) Elk b. RECOVERY SPECIES 1) Bald Eagle; 2) Black-footed Ferret; 3) Peregrine Falcon c. ECOLOGICAL INDICATORS 1) Prairie Vole; 2) Blacktailed Prairie Dog; 3) Sage Grouse; 4) Yellow Breasted Chat ; 5) Golden Eagle; 6) Brewers Sparrow; 7) Willow Flycatcher; 8) House Wren; 9) Ferruginous Hawk; 10) Red Crossbill; 11) Mountain Plover; 12) Upland Sandpiper; 13) Longbilled Curlew; 14) Red-headed Woodpecker; 15) Woodhouse's Toad		Potential impacts to each of these species is addressed in Chapter 4 of this report.
	3. Manage and provide habitat for recovery of endangered and threatened species.		On TBNG, Alternatives C and D would not adversely affect habitat for currently listed federally-endangered or -threatened species. A bald eagle winter roost occurs in the vicinity of the alternatives on NFS lands. However, its status is unknown and the bald eagle has been proposed for down listing. Alternative B would cross NFS lands designated for reintroduction of the black-footed ferret. Alternative B would not be consistent with this general direction. Unless adequate mitigation could be developed, it is anticipated that habitat fragmentation and noise from the operating railroad through the Rosecrans area would adversely affect the site and its suitability for ferret reintroduction/recovery. Several species occur on TBNG which could be listed as federally-threatened or -endangered in the future. The mountain plover has been proposed for listing as threatened by the USFWS. It likely occurs in prairie dog towns across TBNG and is a management indicator species for the grassland. The USFWS is currently evaluating the status of the black-tailed prairie dog. Based on existing information the USFWS has determined that listing as threatened may be warranted. Black-tailed prairie dog towns would be crossed by all the alternative but are particularly abundant along Alternative B in the Rosecrans area. It is expected that the USFWS will receive a petition to list the sage grouse as threatened in the future. Listing decisions for these species are anticipated during the construction period for the railroad.
	4. Maintain habitat for viable populations of all existing vertebrate wildlife species.	a. Habitat for each species on the forest will be maintained at least at 40 percent or more of potential.	The alternatives would be consistent with this general direction. The alternatives would not reduce habitat for any species on TBNG to below 40 percent of potential.
	5. Maintain existing population level of the wood frog.		The alternatives would be consistent with this general direction. Impacts to wood frog are addressed in Chapter 4 of this report.
	6. Manage habitat occupied by existing populations of Colorado River Cutthroat Trout to maintain the population and protect species purity.		The alternatives would not cross or run adjacent to streams which contain Colorado cutthroat trout.

Appendix A, Table 6. Railroad Alternative Consistency With Management Requirements of the 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland			
Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
	7. Provide habitat for management indicator species at a level no lower than 40 percent of potential. Maintain effective wildlife habitat by providing habitat continuity and juxtaposition of cover and open areas around critical wildlife habitat.	a. No activities shall be allowed within one mile of an active bald eagle nest or peregrine falcon nest from February 1 to July 31 if they would cause nesting failure or abandonment. No activities shall be allowed within one half mile of an active bald eagle or peregrine falcon nest at any time if they would cause disturbance of the adult birds on the nest. b. No activities shall be allowed within one mile of an active bald eagle winter roost site from November 1 to April 1 if they would cause reduction of use of the roost. c. No activities shall be allowed within one quarter mile of an active golden eagle nest from February 1 to July 31 if they would cause nesting failure or abandonment. d. No activities shall be allowed within one quarter mile of an active ferruginous hawk, Swainson's hawk, goshawk, osprey, or prairie falcon nest from March 1 to July 31 if they would cause nesting failure or abandonment. e. No activities shall be allowed within 300 feet of any raptor (identified in item d) nest at any time if they would cause nest abandonment, unless specific practices are successfully implemented to maintain or increase nesting opportunities at other sites. This does not apply to existing surface occupancies. f. New roads or other developments shall be placed out of sight of the existing raptor nest if possible, unless specific practices are successfully implemented to maintain or increase nesting opportunities at other sites. g. No activities shall be allowed within one quarter mile of any rookery from March 1 to July 31 if they would cause abandonment of the rookery, unless specific practices are successfully implemented to maintain or increase the opportunities at other rookery sites.	An operating railroad on NFS lands would not be capable of complying with these restrictions. These standards and guidelines could be reasonably imposed on construction activities but not on operation of the railroad. As is discussed in Chapter 2, at peak 34 coal trains would pass along the track daily. Traffic would occur round the clock. It would be impossible to operate the railroad economically and comply with these requirements. For the project to proceed on NFS lands, the Forest Service would be required to amend the forest plan and waive these standards and guidelines for areas directly and indirectly affected by operation of the railroad. Mitigation opportunities are being explored which may prove successful in offsetting some of these impacts.
		h. No activities shall be allowed within one quarter mile of a sage grouse or sharp-tailed grouse lek at any time if they would cause abandonment of the lek, unless specific practices are successfully implemented to maintain or increase the existing habitat capability for grouse. i. Maintain shrubland for a minimum distance of 300 feet, where shrubs exist, from edges delineating natural openings, perennial streams, lakes, other water bodies, riparian zones, aspen or conifer stands, cliffs, rimrocks, caves and talus. Shrublands should extend from the edges of natural openings for a distance of at least 300 feet into the opening. j. Treated blocks of sagebrush and mountain shrub shall be no larger than 80 acres in areas that are used by sage grouse or sharp-tailed grouse, or are classified as winter range. k. Vegetation treatment, excluding timber harvest, shall not be undertaken within two miles of leks unless initiated specifically to enhance brood rearing habitat. Treatment of shrubs will not exceed 20 percent of the total management area within a ten year period. l. Restrict activities within one mile of known bighorn sheep lambing grounds from May 1 through June 20 if they would cause unacceptable stress to lambing ewes.	An operating railroad on NFS lands would not be capable of complying with the restrictions contained in h. The alternatives would pass within 0.25 miles of several sage grouse lek on TBNG. In addition, noise from the railroad would carry further than 0.25 miles and may adversely affect strutting sage grouse beyond the usual 0.25 mile buffer. Although the railroad could attempt to provide new strutting grounds for displaced birds on NFS lands, success is expected to be limited.
	8. Manage fish habitats to maintain viable populations of all existing vertebrate species in the planning unit and to maintain and improve habitat of management indicator species.		Impacts to fisheries are addressed in Chapter 4 of this report. Implementation of the alternatives is not anticipated to have an adverse effect on fisheries on TBNG.
	9. Manage fish habitat which is providing a fishery at or near its potential to maintain fish populations at existing levels. Manage fish habitat which is determined to be limiting a fish population to a level below its potential to improve habitat conditions which may be limiting.		Impacts to fisheries are addressed in Chapter 4 of this report. Implementation of the alternatives is not anticipated to have an adverse effect on fisheries on TBNG.

Appendix A, Table 6. Railroad Alternative Consistency With Management Requirements of the 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland

Management Activities	General Direction	Standards & Guidelines	Railroad Alternative Consistency
	10. Plan water development, mineral exploration and development, timber harvest, livestock grazing, and other project uses and management practices to ensure activities are compatible with fishery management objectives, to ensure adequate protection is given to the fishery resource to prevent fish habitat degradation, and to ensure unavoidable adverse impacts are mitigated.	a. Require minimum (conservation) pools of at least 1/3 of the water surface area for all new impoundments capable of sustaining fishery resources.	Impacts to fisheries are addressed in Chapter 4 of this report. Implementation of the alternatives is not anticipated to have an adverse effect on fisheries on TBNG.
Wildlife Habitat Improvement and Maintenance	1. Use both commercial and noncommercial silvicultural practices to accomplish wildlife habitat objectives.	a. In forested areas, maintain deer or elk hiding cover on 60 percent or more of the perimeter of all natural openings, all created openings and along at least 75 percent of the edge of arterial and collector roads and 40 percent along streams and rivers. Not more than one half of the hiding cover can be contiguous to another portion of the hiding cover. Along streams and rivers in addition to hiding cover, 20 percent or more of the edge must be in thermal cover. b. In diversity units dominated by forested ecosystems, maintain a minimum of 40 percent of the diversity unit in deer or elk hiding cover. This hiding cover should be well distributed over the unit. Maintain 20 percent of the diversity unit in thermal cover (winter or spring-summer). Hiding cover can be used to meet thermal cover requirements also, if they indeed coincide biologically. c. In diversity units dominated by non-forested ecosystems, maintain deer and elk hiding cover as follows: %of Unit Forested — % of Forested Area in Cover 35-50 — at least 50% 20-34 — at least 60% less than 20 — at least 75% These levels may be exceeded temporarily during periods when stands are being regenerated to meet the cover standard, or to correct tree disease problems, in aspen stands, or where windthrow or wildfire occurred. Maintain hiding cover along at least 75 percent of the edge of arterial and collector roads, and at least 60 percent along streams and rivers, where trees occur. d. Alter age classes of browse stands in a diversity unit, no more than 25 percent within a ten-year period.	Not applicable to the alternatives.
	2. Maintain edge contrast of at least medium or high along at least 30 percent of the edge next to all created and natural openings, roads, and riparian areas.	a. Contrast by Age Class is:	Not applicable to the alternatives.

Contrast**

Age Class*	OG	M	P	SSS	GF	Shr	Gra
OG	-	L	M	H	H	M	H
M	L	-	M	M	H	M	H
P	M	M	-	M	H	M	H
SSS	H	M	M	-	L	L	L
GF	H	H	H	L	-	M	L
Shr	M	M	M	L	M	-	M
Gra	H	H	H	L	L	M	-

* OG = Old Growth; M = Mature; P = Poles; SSS = Shrub-seedling-sapling; GF = Grass-forb; Shr = Shrubland; Gra = Grassland
** H = High contrast; ; M = Medium contrast; L = Low contrast

Appendix A, Table 6. Railroad Alternative Consistency With Management Requirements of the 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland			
Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
	3. Improve habitat capability through direct treatments of vegetation, soil, and waters.		Not applicable to the alternatives.
	4. Conduct habitat improvement projects jointly or cooperatively funded with the States.		Not applicable to the alternatives.
Wildlife and Fish Cooperation With Other Agencies	1. Manage animal damage in cooperation with the State Wildlife Agencies, Fish and Wildlife Service, other appropriate agencies, and cooperators to prevent or reduce damage to other resources and direct control toward preventing damage or removing only the offending animal.		Not applicable to the alternatives.
	2. Allow denning or aerial gunning only for the purpose of animal damage control and under the following conditions: a. Methods are specified in the Forest Animal Control Plan; b. Denning and aerial gunning is done by an authorized individual; and c. The permit is issued by the State for aerial gunning.		Not applicable to the alternatives.
Range Resource Management	1. Provide forage to sustain local dependent livestock industry as well as wildlife populations agreed to in Statewide Comprehensive Wildlife Management Plans for National Forest System lands.		Not applicable to the alternatives.
	2. Remove livestock for the remainder of the grazing season from allotments managed under a continuous grazing system when further utilization on key areas will exceed allowable use criteria for the season.		Not applicable to the alternatives.
	3. Manage livestock and wild herbivores forage use by implementing allowable use guides.	a. Livestock and wild herbivores allowable forage use by grazing system and range type are: 1. Rest Rotation System: a. Use by range type: - Mainly seed reproduction: (Bunchgrass, plains grassland, foothills shrub and alpine range types): 50-60 percent on heavy use pastures. Up to 45 percent on light use pastures. - Mainly vegetation reproduction (meadow, sandhill prairie, bluegrass bottoms, and aspen range types): Bluegrass: maximum up to 80 percent; others, 55-65 percent on heavy use pastures, 40-50 percent on light use pastures. - Wild herbivores use during spring in rest-pastures will not exceed 25%. b. Allowable soil disturbance or recovery criteria: Soil and vegetation condition must be restored to at least the pre-treatment condition by the return to the same point in the grazing cycle. 2. Deferred Rotation System: a. Use by range type: - Mainly seed reproduction: 40-50 percent on all pastures. - Mainly vegetation reproduction: 45-55 percent on all pastures. b. Allowable soil disturbance or recovery criteria: Soil and vegetation conditions must be restored to at least the pre-treatment condition by the return to the same point in the grazing cycle. 3. Rotation System a. Use by range type: - Mainly seed reproduction: Max. of 50 percent on last used pastures; Max. of 40 percent on first used pasture. - Mainly vegetation reproduction: Max. Of 55 percent on last used pasture. Max. Of 45 percent on first used pasture. b. Allowable soil disturbance or recovery criteria: Same as deferred rotation system above.	Not applicable to the alternatives.

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Management Activities	General Direction	Standards & Guidelines	Railroad Alternative Consistency
		4. Continuous System (grazing same time and place every year): -Mainly seed reproduction --- Season / Excellent / Fair / Poor / Very Poor --- Full Grazing Season or Spring / 31-40% / 21-30% / 11-20% / 0-10% --- Summer / 36-45% / 26-35% / 11-25% / 0-10% --- Fall and/ro winter / 46-55% / 31-45% / 16-30% / 0-15% --- - Mainly vegetation reproduction: Same as primary seed reproduction except increase utilization by 10% on bluegrass. Allowable soil disturbance: 20% maximum disturbance on ranges with good-excellent soil stability condition on 0-15% slopes. 15% maximum disturbance on ranges with fair soil stability condition on less than 15% slopes, and on good or better soil stability condition on 16-25% slopes. 10% maximum disturbance on ranges with fair soil stability condition on 16-25% slopes, and good or better soil stability condition on 26-45% slopes.	Not applicable to the alternatives.
		5. Alternate Years System: a. Use by range type on key areas: -Mainly seed reproduction: --- Condition Class on Key Area / Use --- Good-Excellent / 51-60% Fair / 36-50% Poor / 21-35% Very Poor / 0-20% --- -Mainly vegetation reproduction: --- Condition Class on Key Area / Use --- Good-Excellent / 56-65% Fair / 41-55% Poor / 31-40% Very Poor / 0-30% ---	Not applicable to the alternatives

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Management Activities	General Direction	Standards & Guidelines	Railroad Alternative Consistency
		Bluegrass 80% on good or better condition and same proper use percent for fair and lower as above. Soil Disturbance criteria is same as for continuous grazing.	
	4. Achieve or maintain satisfactory range conditions on all rangelands.		The alternatives would not adversely affect range conditions.
	5. Where "Herbage Left Ungrazed Standards" have been developed, such as for the Sandhills Prairie and Shortgrass Plains, they may be used in lieu of the standards in Item 3 above.		Not applicable to the alternatives.
	6. Treat noxious farm weeds in the following priority: a. Leafy spurge and Russian and spotted knapweed; b. Invasion of new plant species classified as noxious farm weeds; c. Infestation in new areas; d. Expansion of existing infestations of Canada and musk thistle, and other noxious farm weeds; and e. Reduce acreage of current infestation.		Not applicable to the alternatives.
Range Improvement and Maintenance	1. Structural range improvement should be designed to benefit wildlife and livestock.	a. Structural improvements and maintenance will be in accordance with FSH 2209.22-R2.	Not applicable to the alternatives.
Silvicultural Prescriptions	1. Provide for wildlife habitat improvement and enhancement of other renewable resources in Sale Area Improvement Plans.		Not applicable to the alternatives.
	2. Apply a variety of silvicultural systems and harvest methods which best meet resource management objectives.	a. The appropriate harvest method by forest cover type are:	Not applicable to the alternatives.

Forest Cover Type	Appropriate Harvest Methods* Even-aged	Uneven- aged
Interior Ponderosa Pine	SW, CC &S	GS & ST
Mixed Conifer **	SW & CC	GS
Aspen	CC	--
Lodgepole Pine	SW & CC	GS
Engelmann spruce-Subalpine-fir	SW & CC	GS & ST

* The following abbreviations are used for harvest methods: SW = Shelterwood; CC = Clearcut; GS = Group Selection; ST = Single tree selection; S = See Tree

** Mixed Conifer includes Interior Douglas fir and white fir.

b. Utilization standards by National Forest for live and dead material are:

Species	Min. DBH	Min. Top Dia.	Length (feet)	%Net of Gross
Live Trees - All Periods				
Sawtimber				
Black Hills:				
Conifers	8.0	6.0	8	33-1/3
Aspen	7.0	6.0	8	50

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Management Activities	General Direction	Standards & Guidelines	Railroad Alternative Consistency
		All others: Conifers 7.0 6.0 8 33-1/3 Aspen 7.0 6.0 8 50 Products Other than Sawtimber Black Hills: 5.0 4.0 8-1/3 -- All Others: 5.0 4.0 6-1/2 --	
		Dead Trees - All Periods Sawtimber Colorado & Medicine Bow Forests: Lodgepole Pine 8.0 7.0 16 50* Other Conifers** 12.0 10.0 16 50* Bighorn & Shoshone Forests: Lodgepole Pine 8.0 7.0 16 50* Other Conifers** 12.0 10.0 16 50* Black Hills: Same Standards as Live Trees Products Other than Sawtimber 5.0 4.0 Variable * Considering all defects except weather checking. Prominent checks or splits are considered defects. ** Dead subalpine fir will not require removal on sawtimber sales on any National Forests in Colorado and the Medicine Bow National Forest in Wyoming.	Not applicable to the alternatives.
		c. Silvicultural standards by harvest method: 1. Clearcut (patch or stand): Forest Cover Type / Rotation Age / Growing Stock Level / Cutting Cycle Ldgpl Pine: 90 to 140 yrs / 80 to 120 / 20 to 30 yrs Aspen: 80 to 120 yrs / N/A / N/A Other: 100 or more yrs. / 60 to 120 / 20 to 30 yrs 2. Two-step shelterwood: Forest Cover Type / Rotation Age / Growing Stock Level / Cutting Cycle PP, MC, and SF: 100 to 180yrs. / 80 to 160 / 20 to 30 yrs LP: 90 to 140 yrs. / 80 to 140 / 20 to 30 yrs. Other: 100 or more yrs. / 60 or 120 / 20 to 30 yrs. First cut (seed cut) : Remove up to 70 percent of the stand basal area for all species.	Not applicable to the alternatives.

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Management Activities	General Direction	Standards & Guidelines	Railroad Alternative Consistency
		Second cut (removal cut): Remove all overstory when regenerate stand meets minimum stocking standards.	
		3. Three-step shelterwood: Rotation age, and cutting cycle is the same as two-step shelterwood. First cut (preparatory cut): Remove up to 30 percent of the stand basal area for all species. Second cut (seed cut) Remove up to 43 percent of the remaining stand basal areas for all species. Third cut (removal cut): Remove all overstory when regenerated stand meets minimum stocking standards. 4. Selection Forest Cover Type / Residual BA / Cutting Cycle SF and MC: 80 to 160 / 20 to 30 yrs Other: 80 to 140 / 20 to 30 yrs d. To facilitate the control of soil erosion within acceptable tolerance: 1. Permit conventional logging equipment on slopes of less than 20 percent where soil surveys or site-specific soil data are unavailable. 2. Allow conventional logging equipment on slopes up to 40 percent where soil or site-specific soil data are available to design erosion mitigation needs. 3. Utilize high flotation equipment on slopes up to 60 percent or cable and aerial systems on any slope.	Not applicable to the alternatives.
	3. Clearcuts may be applied to dwarf mistletoe infected stands of any forest cover type.		Not applicable to the alternatives.
	4. Assure that all even-aged stands scheduled to be harvested during the planning period will generally have reached the culmination of mean annual increment of growth.		Not applicable to the alternatives.
	5. The maximum size of openings created by the application of even-aged silviculture will be 40 acres regardless of forest cover type. Exceptions are: a. Proposals for larger openings are subject to a 60-day public review and are approved by the Regional Forester; b. Larger openings are the result of natural catastrophic conditions of fire, insect or disease attack, windstorm; or c. The area does not meet the definition of created openings.	a. Size of openings: Patch clearcuts : 1-10 acres Clearcuts :10-40 acres	Not applicable to the alternatives.

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Management Activities	General Direction	Standards & Guidelines	Railroad Alternative Consistency
	6. Acceptable management intensity activities to determine harvest levels are:		Not applicable to the alternatives.

Management Activity	Engelmann Spruce Subalpine Fir	Interior Ponderosa Pine	Lodgepole Pine	Interior Douglas Fir and White Fir	Aspen	Other Pines	Hardwoods
Tree Improvement	X	X	X	N	N	N	X
Site Preparation	X	X	X	X	N	N	X
Reforestation							
Planting	X	X	X	X	O	N	X
Seeding	O	X	N	O	O	O	X
Natural Regeneration	X	X	X	X	X	X	X
Protection	X	X	X	X	N	N	X
Stocking Control (thinning):							
Pre-Commercial	X	X	X	X	O	X	X
Commercial	X	X	X	X	O	X	X
Salvage of Dead Material	X	X	X	X	X	N	X
Cutting Methods:							
Clearcut	X	X	X	X	X	N	X
Shelterwood	X	X	N	X	O	N	X
Selection	X	X	N	X	O	X	X

*Various combinations of these activities provide the acceptable range of management intensity for timber production (36 CFR 291.2 (b) (2)).
X = Appropriate practice; O = Not an appropriate practice; N = Appropriate, but not a standard practice. May be acceptable where justified.

	7. Make Christmas trees available in areas where other resource objectives can be accomplished through commercial or personal use Christmas tree sales.		Not applicable to the alternatives.
	8. Utilize firewood material when compatible with other resources.		Not applicable to the alternatives.
Reforestation	1. Establish a satisfactory stand on cutover areas, emphasizing natural regeneration within five years after final harvest except: a. For permanent openings that serve specific management objectives; b. When other resource objectives dictate a different period such as spruce-fir clearcuts where planting must occur within three years after harvest; c. In those lodgepole pine stands where the period for natural regeneration should be extended up to seven years after clearcutting; and d. When provided for otherwise in specific management prescriptions.	a. Establish a seven-year regeneration period for lodgepole pine stands meeting the following criteria: (1) Natural regeneration is expected to provide satisfactory stocking within 7 years after cutting, (2) Establishment of trees is not impaired by competing vegetation, and (3) Maintenance of favorable site condition does not require additional site preparation.	Not applicable to the alternatives.
		b. MINIMUM STOCKING STANDARDS BY PRODUCTIVITY AND FOREST COVER TYPE:	Not applicable to the alternatives.

Forest Cover Type	Site Prod. (Cu. Ft./A/YR)	Planting Densities 1/ (Trees/A)
Spruce-fir	85+	360-680
	50-84	360-540
	20-49	300
Aspen	all	---
Mixed	85+	435-680

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Management Activities	General Direction	Standards & Guidelines	Railroad Alternative Consistency
		Conifer 50-84 435-550 20-49 300-360 Lodgepole Pine 85+ 360-680 50-84 360-540 20-49 300 Ponderosa Pine 85+ 435-680 50-84 435-550 20-49 300-360 Seedling Stocking Per Acre Forest Cover Type Min. 2/ Desir.3/ Spruce-fir 200 340 200 280 150 155 Aspen 300 600 Mixed Conifer 205 310 205 255 190 240 Lodgepole Pine 245 340 200 280 150 250 Ponderosa Pine 205 310 205 255 190 240	
		Percent of Plots or Transects That are Stocked Forest Cover Type Minimum Desired Spruce-fir 75 100 75 100 75 100 Aspen 75 100 Mixed Conifer 75 100 75 100 75 100 Lodgepole Pine 75 100 75 100 75 100 Ponderosa Pine 70 100 70 100 70 100 Seedling Height (Inches) Forest Cover Type Minimum Desired Spruce-fir 3" 18" Aspen 12" 45" Mixed Conifer 3" 18"	Not applicable to the alternatives.

Appendix A, Table 6. Railroad Alternative Consistency With Management Requirements of the 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland			
Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
		Lodgepole Pine 3" 18" Ponderosa Pine 3" 18" _____ 1/ Lower densities are recommended to meet minimum stocking standards. Higher densities are recommended to meet desired stocking standards, with ample stock for selecting genetically superior trees. 2/ Minimum stocking standards are to be used where no precommercial cutting will be done, and only one harvest will be made to regenerate the stand. 3/ Desired stocking standards are to be used where at least one precommercial cut will be done followed by two sawlog harvests before the final cut is done. (Aspen will have only one final cut.)	
	2. Do not apply final shelterwood removal cut until the desired number (as specified in Minimum Stocking Standards) of well-established seedling/acre are expected to remain following overwood removal.		Not applicable to the alternatives.
	3. Use trees of the best genetic quality available which are adapted to the planting site when supplemental planting. (Reference FSM 2475)		Not applicable to the alternatives.
Timber Stand Improvement	1. Utilize Christmas tree sales for stocking controls where the opportunity exists.		Not applicable to the alternatives.
Riparian Area Management	1. Also see Management Prescription 9A for riparian area management.		See Appendix A, Table 10
	2. Design and implement activities in management areas to protect and manage the riparian ecosystem.	a. Maintain all riparian ecosystems in at least an upper mid-seral successional stage based upon the R2 Riparian Ecosystem Rating System.	All of the alternatives would result in direct and indirect impacts to riparian areas on TBNG. These impacts would be mitigated somewhat through the COE's 404 permitting process. However, it is likely that the COE would limit replacement to only those acres of wetland habitat that would be directly lost through construction activities. DM&E is exploring mitigation opportunities to offset indirect habitat impacts. Without such mitigation that alternatives would be inconsistent with this general direction.
	3. Deposit no waste material (silt, sand, gravel, soil, slash, debris, chemicals or other material) below high water lines, in riparian areas, in areas immediately adjacent to riparian areas, or in natural drainageways (draws, land surface depressions or other areas where overland flow concentrates and flows directly into streams or lakes).		The alternatives would be consistent with this general direction. Disposal of waste material will not be allowed in areas specified in the general direction.
	4. Manage riparian areas to reach the latest seral stage possible within the stated objectives.		Not applicable to the alternatives.
	5. Prescribe silvicultural and livestock grazing systems to achieve riparian area objectives.		Not applicable to the alternatives.
	6. Locate and construct arterial and collector roads to maintain the basic natural condition and character of riparian areas.		Not applicable to the alternatives.
Water Uses Management	1. Protest water right applications of others when such uses will lower streamflows below levels acceptable for National Forest uses and purposes.		Not applicable to the alternatives.
	2. Special Use Permits, easements, rights-of-way, and similar authorizations for use of NFS lands shall contain conditions and stipulations to maintain instream or bypass flows necessary to fulfill all National Forest uses and purposes.		The alternatives would be consistent with this general direction.

Appendix A, Table 6. Railroad Alternative Consistency With Management Requirements of the 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland

Management Activities	General Direction	Standards & Guidelines	Railroad Alternative Consistency
Water Resource Improvement and Maintenance	1. Maintain instream flows and protect public property and resources.	a. Provide for instream flows to protect from change the scenic esthetic values and fish and wildlife habitats and otherwise protect the environment. In all streams that support a fishery or receive seasonal spawning use, prescribed flows shall include habitat maintenance flows of at least 30 percent of the average daily flow (ADF) for the year or the full natural low flow, whichever is less, and a flushing flow of not less than the estimated bankfull discharge for a continuous 72 hour period that coincides with the spring runoff season. Determine instream flow needs using an accepted method, prior to the implementation of any project that will directly or indirectly alter the streamflow in any fishery support stream.	Only temporary impacts to streamflow are anticipated during construction of crossings. The area affected would generally be limited to that portion of the stream directly adjacent to the construction site. Downstream streamflow would be maintained at all times, where necessary, to protect aquatic resources.
	2. Improve or maintain water quality to meet State water quality standards. However, where the natural background water pollutants cause degradation, it is not necessary to implement improvement actions.		Prior to construction the WDEQ must certify to the COE that implementation of the project will comply with state water quality standards. Construction cannot commence until the 401 water quality certification has been issued. In reviewing the certification request, WDEQ will evaluate the suitability of BMPs contained in the site-specific SWPPPs. If the BMPs are found to be deficient, WDEQ can impose additional conditions to protect state water quality. In addition to the 401 certification application, DM&E must also prepare site-specific BMPs which specify where and how erosion/sediment controls will be implemented and a maintenance and inspection protocol for those controls. These SWPPPs are designed to prevent/minimize the introduction of sediment and other pollutants into ground and surface water.
	3. Develop a schedule of water yield treatments within fourth-order watersheds which attains desired water yield increases while maintaining stream channel stability.	a. Provide mitigation measures necessary to prevent increased sediment yields from exceeding "threshold limits" (as determined by "State of the Art" modeling [HYSED] or actual measurements) identified for each (fourth-order) watershed.	A series of BMPs are being developed for inclusion in SWPPPs required by WDEQ. These BMPs will specifically address methods to control sedimentation impacts.
	4. Rehabilitate disturbed areas that are contributing sediment directly to perennial streams as a result of management activities to maintain water quality and reestablish vegetation cover.	a. Reduce to natural rate any erosion due to management activity in the season of disturbance and sediment yields within one year of the activity through necessary mitigation measures such as waterbarring and revegetation.	A series of BMPs are being developed for inclusion in SWPPPs. These BMPs will specifically address methods to control sedimentation impacts. Reclamation requirements will be addressed in the SWPPPs.
	5. Limit use of herbicides, insecticides, rodenticides, or other chemical agents as part of management activities to times and places where possible transport to or by surface water has a low probability of occurrence. Follow all label requirements concerning water quality protection.		The alternatives would be consistent with this general direction. Any application of biocides on NFS lands would require Forest Service approval and only licensed applicators would be employed.
Minerals Management General	1. Administer areas with producing sites and known reserves with consideration of ongoing and potential mineral activities.		Not applicable to the alternatives.
	2. Avoid or minimize capital investments, such as developed recreation, in or adjacent to areas with known reserves and alienated mineral rights.		Not applicable to the alternatives.
	3. In areas of actively producing sites or areas containing known reserves, consider only surface resource programs compatible with minerals activities.		Not applicable to the alternatives.
	4. In areas of high to moderate potential for valuable mineral deposits, perform site-specific mineral evaluations prior to making substantial capital investments, such as recreational developments.		Not applicable to the alternatives.
Mining Law Compliance and Administration	1. Prevent or control adverse impacts on surface resources in accordance with 36 CFR 228. a. Unclassified lands: Provide for reclamation of disturbed lands to achieve the planned uses specified in the Forest Plan, when those lands are no longer needed for mining operations. b. Designated Wilderness, Congressionally designated Wilderness Study Areas, and areas recommended for wilderness designation by RARE II on which Congressional action has not been completed: Provide for reasonable access of the type necessary to the purpose of proposed operations and for restoration of disturbed lands as near as practical to their natural condition when they are no longer needed for operations.		Not applicable to the alternatives.

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Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
	c. Other classified lands not withdrawn from operations under the General Mining Laws: Such lands may include Research Natural Areas, National Recreation Areas, "RARE II" Further Planning Areas, Special Interest Areas such as scenic and geologic, National Historic Sites, or some other type of specific classification. The status of classified lands with respect to withdrawal must be checked before an operating plan can be approved. Provide for reasonable protection of the purposes for which the lands were classified and for reclamation of disturbed lands to a condition suitable for the purposes for which the lands were classified.		
	2. Withdrawals must be for the purpose of protecting specific existing or proposed uses. Initiate actions for withdrawal from entry under the General Mining Laws when 36 CFR 228 and other applicable laws and regulations will not provide the opportunity for protection of surface resources and uses.		Not applicable to the alternatives.
	3. Review cases of suspected abuse of the mining laws such as occupancy of the land for purposes other than prospecting, mining and related operations. Initiate appropriate actions to resolve. First action should be administrative. Failure of such action requires examination of claims for validity, followed by appropriate contest proceedings or legal action.		Not applicable to the alternatives.
Minerals Management-Oil, Gas and Geothermal	1. Withdrawals of lands from operations of the mineral leasing acts will be requested only in exceptional situations because Federal decisions on mineral disposals under these acts are discretionary on a case-by-case basis.		Not applicable to the alternatives.
	2. Recommendations for or consent to issuance of leases or permits: 1. Unclassified Lands: a. Forest Service authorization of geophysical prospecting will include terms and conditions controlling operating methods and times to prevent or control adverse impacts on surface resources and uses. b. Recommendations for and consent to BLM issuance of leases and permits will include all current standard stipulations and the Regionally approved special stipulations that may be necessary for additional protection of specific surface resources and uses. Reclamation requirements will have the objective of returning disturbed lands to the planned uses. These standard and current Regionally-approved special stipulations are in Appendix D to the forest plan. (1) Standard stipulations, in addition to those in the basic lease or permit document, are BLM Form 3109-3, "Stipulation for Lands Under Jurisdiction of the Department of Agriculture" and Forest Service (R-2) Supplement D to BLM Form 3109-3, "Surface Disturbance Stipulation." (2) Special Region 2 Forest Service stipulations will be used as appropriate to the surface resource situation on the lands involved in a lease or permit. These stipulations are titled as supplements to Form 3109-3 and are listed below: (a) Forest Service (R-2) Supplement C to Form 3109-3, "Limited Surface Use Stipulation." This stipulation notifies a lessee or permittee that certain described conditions exist upon the lands involved that require special operating plan provisions for their protection. (b) Forest Service (R-2) supplement F to Form 3109-3, "Surface Use Stipulation." This stipulation notifies a prospective lessee or permittee that surface use or occupancy that would cause significant surface disturbance is not authorized upon tracts within the proposed lease or permit area. This stipulation is also used to protect wilderness values in areas being considered or studied as potential additions to the wilderness preservation system. Recision and replacement of this stipulation is provided if Congress removes the area from further consideration as wilderness.		Not applicable to the alternatives.

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Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
	(c) Forest Service (R-2) Supplement H to Form 3109-3, "Conditional No Surface Disturbance Stipulation." This stipulation notifies a prospective lessee or permittee that certain described conditions exist upon tracts within the proposed lease or permit area that will prevent any surface disturbance affecting those tracts unless an operating plan can be devised that will convince the Forest Service that surface use, occupancy and reclamation can take place without causing irretrievable environmental damage. (d) Forest Service (R-2) Supplement G to Form 3109-3, "Activity Coordination Stipulation." This stipulation notifies the lessee that surface values exist that are sensitive to high levels of activity. In such circumstances, the Forest Service may require that activities on the lease lands, when multiple leaseholds are involved, be conducted by a single operator, similar to the conduct of operations under a unitization agreement approved by the BLM. An alternative approach would be joint Forest Service/BLM approval of a coordinated plan of operations involving multiple operators. (e) Forest Service (R-2) Supplement A to Form 3109-3, "Further Planning Area Stipulation". This stipulation applies to lands identified for further planning in RARE II decision documents. It specifies the nature and extent of operations allowed and the conditions to be met for their approval.		
	c. Recommend against or deny consent to BLM for issuance of leases where operational damages on surface resources, including the impacts of surface-based access, product transportation and ancillary facilities necessary to production and related operations, would be irreversible and irretrievable, with no potential for reclamation and attachment of the no surface occupancy stipulation (Forest Service (R-2) Supplement F to Form 3109-3) would prevent the effective recovery of the Federal mineral resource, as determined by the BLM. Negative recommendations or consent denials will be based on site-specific consideration of the following criteria: (1) Slopes steeper than 60 percent. (2) High erosion hazard rating. (3) High geologic hazard rating. (4) Low visual absorption capacity that prevents reclamation to established visual quality objective (VQO). (5) A conclusion by the Forest Service (FS) and/or the United States Fish and Wildlife Service (USFWS) that the action will jeopardize the survival or recovery of federally listed threatened and endangered (T&E) wildlife or plant species. (6) Intrusions upon the identified critical (USFWS) or essential (FS) habitat of a federally listed (T&E) wildlife or plant species or upon the plant or animal itself. (7) Intrusion upon the habitat of individual plant or animal species listed by a State as threatened or endangered. (8) Intrusion upon the habitat of individual plant or animal species identified by the Regional Forester as needing special management to prevent its need for listing as a threatened or endangered species.		Not applicable to the alternatives.
	2. Designated Wilderness, Congressionally-designated Wilderness Study Areas, and areas recommended for Wilderness on which Congress has not taken final action: a. Geophysical prospecting, when authorized, will be subject to terms and conditions insuring that operations will be done by methods and at such times that there will be no significant adverse impacts on surface resources. b. Wilderness is withdrawn from all leasing, subject to valid existing rights. c. No exploration permits or leasing is recommended in Wilderness Study Areas or areas recommended for Wilderness designation by the Forest Service until such time as Congress acts on the disposition of those areas, designates them Wilderness or releases them from Wilderness consideration.		Not applicable to the alternatives.

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Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
	3. Classified lands other than Wilderness and areas described in "2" foregoing, which are not by law or otherwise withdrawn from operations under the mineral leasing acts. Examples of such lands include Wild and Scenic Rivers, National Recreation Areas, National Historic Sites, Natural Areas, Special Areas--such as geological, scenic and zoological, and some other specific classifications. a. Forest Service authorizes geophysical and similar prospecting only when terms and conditions can be applied that will protect the purposes for which the lands were classified. b. Recommendations for and consent to BLM for issuance of leases and permits will include all current standard stipulations and the current Regionally-approved special stipulations necessary to protect the purposes for which the lands were classified. Standard and special stipulations are in Appendix D to the forest plan. See 1.b(1) under this Management Activity heading, foregoing, for the standard stipulations. Special stipulations to be applied as appropriate are: (1) Forest Service (R-2) Supplement B to Form 3109-3, "Classified Area Stipulation." This stipulation applies to lands classified under 36 CFR 251.23 and 294.1 for specific management purposes. Because of the regulatory provisions, no use or occupancy inconsistent with the classification is permitted. This does not necessarily mean recommendation against or denial of consent to BLM for issuance of leases. The reason is that classified areas may be only small portions of large leaseholds. (2) Forest Service (R-2) Supplement C to Form 3109-3, "Limited Surface Use Stipulations." This stipulation notifies a lessee or permittee that certain described conditions exist upon the lands involved that require special operating plan provisions for their protection. (3) Forest Service (R-2) Supplement E to Form 3109-3, "Wild and Scenic Rivers System Stipulations." This stipulation establishes operating conditions for lands under study by Congress for inclusion in the National Wild and Scenic Rivers System. It also provides for establishing appropriate operational controls should the lands be included in that system or should the lands not be added to the system. (4) Forest Service (R-2) Supplement F to Form 3109-3, "Surface Use Stipulation." This stipulation notifies prospective lessees or permittees that surface use or occupancy causing significant surface disturbance is not authorized for described lands. This stipulation may be applied in a wide variety of conditions in lieu of recommending against or denying consent to BLM for issuance of a lease. (5) Forest Service (R-2) Supplement H to Form 3109-3, "Conditional No Surface Disturbance Stipulation." This stipulation notifies a prospective lessee that certain described conditions exist upon tracts within the proposed lease or permit area that will prevent any surface disturbance affecting those tracts unless an operating plan can be devised that will convince the Forest Service that surface use, occupancy and reclamation can take place without causing irretrievable environmental damage. (6) Forest Service (R-2) Supplement G to Form 3109-3, "Activity Coordination Stipulation." This stipulation notifies the lessee that surface values exist that are sensitive to high levels of activity. In such circumstance, the Forest Service may require that activities on the leased lands, when multiple leaseholds are involved, be conducted by a single operator, similar to the conduct of operations under a unitization agreement approved by the BLM. An alternative approach would be joint Forest Service/BLM approval of a plan of operations involving multiple operators.		Not applicable to the alternatives.

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Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
	c. Recommend against or deny consent to BLM for issuance of leases where operation damages to surface resources, including the impacts of surface-based access, product transportation and ancillary facilities necessary to production and related operations would be irreversible and irretrievable, with no potential for reclamation and attachment of the no surface occupancy stipulation (Forest Service (R-2) Supplement F to Form 3109-3) would prevent the effective recovery of the Federal mineral resource, as determined by the BLM. Negative recommendations or consent denials will be based on site-specific consideration of the following criteria: (1) Operations destroy or irretrievably damage the characteristics or purposes for which the lands were classified. (2) Slopes steeper than 40 percent. (3) High erosion hazard rating. (4) High geologic hazard rating. (5) Low visual absorption capacity that prevents reclamation to established visual quality objective (VQO). (6) A conclusion by the Forest Service (FS) and/or the United States Fish and Wildlife Service (USFWS) that the action will jeopardize the survival or recovery of federally listed threatened or endangered (T&E) wildlife or plant species. (7) Intrusions upon the identified critical (USFWS) or essential (FS) habitat of a federally listed (T&E) wildlife or plant species or upon the plant or animal itself. (8) Intrusion upon the habitat of individual plant or animal species listed by a State as threatened or endangered. (9) Intrusion upon the habitat of individual plant or animal species identified by the Regional Forester as needing special management to prevent its need for listing as a threatened or endangered species.		
Minerals Management-Coal, Leasable Uranium and Non-Energy Common Minerals Materials	1. Withdrawals of lands from operations of the mineral leasing acts will be requested only in exceptional situations because Federal decisions on mineral disposals under these acts are discretionary on a case-by-case basis.		Not applicable to the alternatives.
	2. Withdrawals from disposal of common variety mineral materials are unnecessary. The Forest Service has total discretionary authority for such disposals.		Not applicable to the alternatives.
	3. General direction for unclassified lands, designated wilderness, and classified lands other than Wilderness are: 1. Unclassified Lands. a. Forest Service authorize common variety exploration and disposals under terms and conditions to prevent or control adverse impacts on surface resources and uses. The objective of reclamation requirements will be to return disturbed lands to the planned uses. b. Recommendations for and consent to BLM for issuance of leases, permits, and coal exploration licenses will include all current standard stipulations and the Regionally-approved special stipulations that may be necessary for additional protection of specific surface resources. The objective of reclamation requirements will be to return disturbed lands to the planned uses. The standard and current Regionally-approved special stipulations are in Appendix D to the forest plan.		Not applicable to the alternatives.

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Management Activities	General Direction	Standards & Guidelines	Railroad Alternative Consistency
	(1) Standard Stipulations, in addition to those in the basic lease, permit or license document, are BLM Form 3109-3, "Stipulation for Lands Under Jurisdiction of the Department of Agriculture," and Forest Service (R-2) stipulation, Supplement D to BLM Form 3109-3, "Surface Disturbance Stipulation." (2) Special Forest Service, Region 2, Stipulations will be used as appropriate to the surface resource situation involved in a lease, permit or license. These stipulations are titled as supplements to BLM Form 3109-3 and are listed below: (a) Forest Service (R-2) Supplement C to Form 3109-3, "Limited Surface Use Stipulations." This stipulation notifies a lessee, permittee or licensee that certain described conditions exist upon the lands involved that require special operating plan provisions for their protection. (b) Forest Service (R-2) Supplement H to Form 3109-3, "Conditional No Surface Disturbance Stipulation." The usual application of this stipulation for minable minerals will be in exploration permits and licenses. The stipulation notifies a prospective lessee, permittee or licensee that certain described conditions exist upon tracts within the proposed lease or permit area that will prevent any surface disturbance affecting those tracts unless an operating plan can be devised that will convince the Forest Service that surface use, occupancy and reclamation can take place without causing irretrievable environmental damage.		
	c. Recommend against or deny consent to BLM for issuance of leases, permits or coal exploration licenses where operational damages on surface resources, including the impacts of surface-based access, product transportation and ancillary facilities necessary to production and related operations, would be irreversible and irretrievable, with no potential for reclamation. Negative recommendations or consent denials will be based on site-specific consideration of the following criteria: (1) Terrain as it affects waste dumps and tailings disposal--related to dump and tailing stability, adequate room for placement. (2) Whether or not negative impacts on water quality are preventable. (3) For surface-based access, product transportation and ancillary facilities necessary to operations; Slopes steeper than 60 percent; high erosion hazard; high geologic hazard. (4) Low visual absorption capacity that prevents reclamation to established visual quality objective (VQO). (5) A conclusion by the Forest Service (FS) and/or the United States Fish and Wildlife Service (USFWS) that the action will jeopardize the survival or recovery of federally listed threatened or endangered (T&E) wildlife or plant species. (6) Intrusions upon the identified critical (USFWS) or essential (FS) habitat of a federally listed (T&E) wildlife or plant species or upon the plant or animal itself. (7) Intrusion upon the habitat or individual plant or animal species listed by a State as threatened or endangered. (8) Intrusion upon the habitat of individual plant or animal species identified by the Regional Forester as needing special management to prevent its need for listing as a threatened or endangered species.		Not applicable to the alternatives.
	2. Designated Wilderness, Congressionally-designated Wilderness Study Areas, and areas recommended for Wilderness on which Congress has not taken final action. a. Prospecting for and disposals of common varieties of mineral materials will not be authorized. b. Coal mining in the National Wilderness Preservation System is prohibited by the Coal Leasing Amendments Act of 1975. Therefore, coal leasing and coal exploration licenses will not be authorized for any of the foregoing described lands.		Not applicable to the alternatives.

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Management Activities	General Direction	Standards & Guidelines	Railroad Alternative Consistency
	c. Designated Wildernesses were withdrawn from exploration and leasing on December 31, 1983, subject to prior valid existing rights. d. No exploration permits or leasing is recommended in Wilderness Study Areas or areas recommended for Wilderness designation by the Forest Service until such time as Congress acts on the disposition of those areas, designates them Wilderness, or releases them from Wilderness consideration. A non-wilderness determination will result in the mineral resources being managed the same as other nonclassified National Forest System lands.		
	3. Classified lands other than Wilderness and areas as described in "2" foregoing, which are not by law or otherwise withdrawn from operations under the mineral leasing acts. Examples of such lands include Wild and Scenic Rivers, Natural Areas, Special Areas--such as geological, scenic and zoological, and some other specific classifications. a. The Forest Service authorizes common variety exploration and disposals under terms and conditions to protect the purposes for which the lands were classified. The objective of reclamation requirements will be to return disturbed lands to a condition suitable for the purposes for which they were classified. For Special Areas classified under 36 CFR 294 and 251.23 for specific management purposes, the regulatory provisions permit no use or occupancy inconsistent with the classification. b. Coal mining is prohibited by the Coal Leasing Amendment Act of 1975, within the National System of Trails and the Wild and Scenic Rivers System, including Study rivers designated by that Act. This prohibition also applies to the National Park System and the National Wildlife Refuge System, which lands are not under Forest Service jurisdiction.		Not applicable to the alternatives.
	c. Recommend or consent to BLM for issuance of leases, permits or licenses only when terms and conditions can be applied that will protect the purposes for which the lands were classified. d. Recommendations and consent to BLM for issuance of leases, permits or licenses will include all current standard stipulations and the current Regionally approved special stipulations necessary to protect the purposes for which the lands were classified. Standard and special stipulations are in Appendix D to the forest plan. See 1.b.(1) under this management heading for the standard stipulations. Special stipulations to be applied as appropriate are: (1) Forest Service (R-2) Supplement A to Form 3109-3, "Further Planning Area Stipulation." This stipulation applies to lands identified for further planning in the RARE II decision documents. It specifies the nature and extent of operations allowed and the conditions to be met for their approval. (2) Forest Service (R-2) Supplement B to Form 3109-3, "Classified Area Stipulation." This stipulation applies to lands classified under 36 CFR 294 and 251.23 for specific management purposes. Because of the regulatory provisions, no use or occupancy inconsistent with the classification is permitted. This does not necessarily mean recommendation against or denial of consent to issuance of leases, permits or licenses is necessary. The reason is that classified areas may be only small portions of the lands involved.		Not applicable to the alternatives.
	(3) Forest Service (R-2) Supplement C to Form 3109-3, "Limited Surface Use Stipulation." This stipulation notifies a lessee, permittee or licensee that certain described conditions exist upon the lands involved that require special operating plan provisions for their protection. (4) Forest Service (R-2) Supplement F Form 3109-3 "Surface Use Stipulation." This stipulation notifies prospective lessees or permittees that surface use or occupancy that would cause significant surface disturbance is not authorized for described lands. This "no surface occupancy" stipulation may be applied in a wide variety of conditions in lieu of recommending against or denying consent to BLM for issuance of a lease.		Not applicable to the alternatives.

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Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
	(5) Forest Service (R-2) Supplement H to Form 3109-3, "Conditional No Surface Disturbance Stipulation." This stipulation notifies the prospective lessee, permittee or licensee that certain described conditions exist upon tracts within the proposed lease or permit area that will prevent any surface disturbance affecting those tracts unless a operating plan can be devised that will convince the Forest Service that surface use, occupancy and reclamation can take place without causing irretrievable environmental damage.		
	e. Recommend against or deny consent to issuance of leases, permits or licenses where operational damages on surface resources including the impacts of surface-based access, product transportation and ancillary facilities necessary to production and related operations, would be irreversible and irretrievable, with no potential for reclamation and attachment of the no surface occupancy stipulation (Forest Service (R-2) Supplement F to Form 3109-3) would prevent the effective recovery of the Federal mineral resource, as determined by the BLM. Negative recommendations or consent denials will be based on the consideration of the following criteria: (1) Operations destroy or irretrievably damage the characteristics or purposes for which the lands are classified. (2) Terrain as it affects waste dumps and tailings disposal--related to dump and tailing stability, adequate room for placement, and whether or not waste and tailings can be handled or treated in a manner that results in no detrimental effects on the purposes for which the lands were classified. (3) Whether or not negative impacts on water quality are preventable. (4) For surface-based access, product transportation and ancillary facilities necessary to operations: Slopes steeper than 40 percent; high erosion hazard; high geologic hazard. (5) Low visual absorption capacity that prevents reclamation to established visual quality objective (VQO). (6) A conclusion by the Forest Service (FS) and/or the United States Fish and Wildlife Service (USFWS) that the action will jeopardize the survival or recovery of federally listed threatened or endangered (T&E) wildlife or plant species. (7) Intrusions upon the identified critical (USFWS) or essential (FS) habitat of a federally listed (T&E) wildlife or plant species or upon the plant or animal itself. (8) Intrusion upon the habitat or individual plant or animal of a species listed by a State as threatened or endangered. (9) Intrusion upon the habitat or individual plant or animal of a species identified by the Regional Forester as needing special management to prevent its need for listing as a threatened or endangered species.		Not applicable to the alternatives.
Special Use Management (Non-Recreation)	1. Act on special use applications according to the following priorities: a. Land and land use activity requests relating to public safety, health and welfare, e.g., highways, powerlines and public service improvements. b. Land and land use activities contributing to increased economic activity associated with National Forest resources, e.g., oil and gas, and energy minerals. c. Land and land use activities that benefit only private users, e.g., road permits, rights-of-way for powerlines, telephones, waterlines, etc.		This general direction establishes Forest Service processing priorities.
	2. Do not approve any special use applications that can be reasonably met on private or other Federal lands unless it is clearly in the public interest.		According to DM&E, it would not be possible to construct and operate an economically-viable heavy haul railroad between the SPRB mines and DM&E's existing main line without crossing NFS lands. In addition, the STB has made an initial determination that DM&E's proposed project satisfies the transportation-related requirements of 49 U.S.C. 10901 and is therefore at least not inconsistent with the public necessity and convenience. STB regulations state that *"the Board shall issue a certificate...unless the Board finds that such activities are inconsistent with the public convenience and necessity..."* While the statute does not define "*public convenience and necessity*", a 3-part test has

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Management Activities	General Direction	Standards & Guidelines	Railroad Alternative Consistency
			been developed to aid in this determination. The test requires a determination of whether: 1) the applicant is financially fit to undertake the construction and provide service; 2) there is a public demand or need for the proposed service; and 3) the construction project is in the public interest and will not unduly harm existing services. In its December 9, 1998 decision STB determined that DM&E's proposal meets the 3-part test. However, STB's initial determination does not grant approval to construct the project. No final decision by STB permitting construction to begin would be issued until such time as all statutory requirements - under both environmental and transportation law - have been satisfied. In fact, it is possible that in their final analysis STB could determine that, due to possible adverse environmental impacts, the public interest dictates that the application be denied even though the criteria of 49 U.S.C. 10901 have otherwise been met.
	3. Bury electrical utility lines of 33 KV or less and telephone lines except when: a. Visual quality objectives of the area can be met using an overhead line. b. Burial is not feasible due to geologic hazard or unfavorable geologic conditions. c. It is not economical as determined by a cost analysis. d. Greater long-term site disturbance would result. e. It is not technically feasible.		Any powerlines installed on NFS lands on TBNG would comply with this general direction.
	4. Design and construct all power and distribution lines to protect all birds of prey from electrocution.		Any powerlines installed on NFS lands on TBNG would comply with this general direction.
	5. Do not approve special use applications for areas adjacent to developed sites unless the proposed use is compatible with the purpose and use of the developed site.		The alternatives would not be located adjacent to developed sites on TBNG. The alternatives would be consistent with this general direction.
Rights-of-way and Land Adjustments	1. Acquire rights-of-way on existing Forest System roads and trails that cross private land.		Not applicable to the alternatives.
	2. Insure floodplain and wetland values are approximately equal on both offered and selected tracts in proposed land exchanges or that values are in favor of the United States.		Not applicable to the alternatives.
	3. Classify lands or interest in lands for acquisition where lands are valuable for NFS purposes according to the following priorities: a. In designated wilderness areas and other Congressionally classified areas. b. Where lands or rights-of-way are needed to meet resource management goals and objectives. c. Lands which provide habitat for threatened and endangered species of animals and plants. d. Lands which include floodplain or wetlands. e. On lands of the National Grassland that provide opportunities for demonstration of multiple uses in grassland agriculture. f. On lands having historical or cultural resources, outstanding scenic values or critical ecosystems, when these resources are threatened by change of use or when management may be enhanced by public ownership.		Not applicable to the alternatives.
	4. Classify lands for disposal according to the following priorities: a. To States, counties, cities, or other Federal agencies when disposal will serve a greater public interest. b. In small parcels intermingled with mineral or homesteads patents. c. When suitable for development by the private sector, if development (residential, agricultural, industrial, recreational, etc.) is in the public interest.		As is discussed in Chapter 2 of this report, a portion of the proposed western yard site consists of a small, isolated parcel of NFS lands. It has been proposed that this parcel be exchanged for lands in the Rosecrans area that would make management of the black-footed ferret reintroduction site more efficient. Such an exchange would be consistent with this general direction.

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Management Activities	General Direction	Standards & Guidelines	Railroad Alternative Consistency
	d. When critical or unique resource (wetlands, floodplains, essential big game winter range, threatened or endangered species habitat, historical or cultural resources, critical ecosystems, etc.) effects are mitigated by reserving interests to protect the resource, or by exchange where other critical resources to be acquired are considered to be of equal or greater value. e. In National Grasslands, when they offer no opportunity to meet National Grassland demonstration objectives.		
	5. Effect jurisdictional transfers which achieve the following objectives: a. Reduce duplication of efforts by users and agencies in terms of time, cost, and coordination. b. Improve or maintain user access to the administering agency. c. Decrease travel and enhance management. d. Improve public understanding of applicable laws, regulations, policies, and procedures. e. Develop more effective and efficient work units. f. Reduce administrative cost.		Not applicable to the alternatives.
Property Boundary Location	1. Locate, mark, and post landlines according to the following priorities: a. Lines needed to meet planned activities; b. Lines needed to protect NFS lands from encroachment, and c. All other lines.		Not applicable to the alternatives.
Soil Resource Management	1. Maintain soil productivity, minimize man-caused soil erosion, and maintain the integrity of associated ecosystems. a. Use site preparation methods which are designed to keep fertile, friable topsoil essentially intact. b. Give roads and trails special design considerations to prevent resource damage on capability areas containing soils with high shrink-swell capacity. c. Provide adequate road and trail cross drainage to reduce sediment transport energy. d. Revegetate all areas, capable of supporting vegetation, disturbed during road construction and/or reconstruction to stabilize the area and reduce soil erosion. Use less palatable plant species on cuts, fills, and other areas subject to trampling damage by domestic livestock and big game to discourage grazing by herbivores. e. Prevent livestock and wildlife grazing which reduces the percent of plant cover to less than the amount needed for watershed protection and plant health. f. Place tractor-built firelines on the contour, where possible, and avoid use of tractors on highly erodible sites. g. Provide permanent drainage and establish protective vegetative cover on all new temporary roads or equipment ways, and all existing roads which are being removed from the transportation system. h. Minimize soil compaction by reducing vehicle passes, skidding on snow, frozen or dry soil conditions, or by off-ground logging systems. i. Restore soil disturbance caused by human use to soil loss tolerance levels commensurate with the natural ecological processes for the treatment areas.	a. Use the following Standards and Guidelines unless more site specific requirements are developed during project design. 1. Limit intensive ground disturbing activities on unstable slopes and highly erodible sites. 2. Apply Packer's guides in the design for cross drain spacing and buffers. 3. Chisel or rip, on the contour, compacted soils. Soils are considered compacted if there is a 15 percent increase in bulk density or a 50 percent decrease in macro pore space.	Soil productivity and erosion control would be addressed using BMPs being prepared for the SWPPPs required by WDEQ. This general direction and standards and guidelines would be incorporated into the SWPPPs as appropriate. Compaction relief will be addressed specifically as it is critical to overall reclamation process.
	2. Identify at the project level, upland areas that are immediately adjacent to Riparian (Prescription 9A) Management Areas. Adjacent upland areas are those portions of a management area which, when subjected to management activities, have a potential for directly affecting the condition of the adjacent Riparian Management Area. The magnitude of effects is dependent upon slope steepness, and the kind, amount, and location of surface and vegetation disturbance within the adjacent upland unit.	a. The following is a guide to identify the approximate extent of adjacent upland areas: Slope Gradient of Upland Areas Adjacent to Riparian Management Area — Upslope Distance from Boundary of Riparian Management Area % Slope Range — Feet 0-20 — 100 20-30 — 180 30-40 — 280	b. BMPs have been designed to control sedimentation to these sites. These BMPs will be implemented through site-specific SWPPPs. c. Monitoring and maintenance will be addressed in the SWPPPs. Reclamation success monitoring will incorporate the Forest Service's 5 year - 80 percent goal.

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Management Activities	General Direction	Standards & Guidelines	Railroad Alternative Consistency
		40-50 400 50-60 520 60-70 640 70-80 760 80-90 880 90-100 1000 100-150 1000-1300 b. Reduce, through designed management practices and appropriate erosion mitigation and vegetation/restoration measures, the project caused on-site erosion rates (calculated with appropriate Universal Soil Loss Equation methodology) by 75% within the first year after disturbance. Reduce project caused on-site erosion by 95% within five years after initial disturbance (USDA Tech. Pub. SA-TP 11, 1980: USDA SCS Tech. Note No. 10, 1977). c. Design continuing mitigation/restoration practices and follow-up maintenance activities to insure that 80% original ground cover (vegetation) recovery occurs within five years after disturbance.	
Transportation System Management	1. Classify areas as to whether off-road vehicle use is permitted based on the overall land management objectives.		Not applicable to the alternatives.
	2. Manage public motorized use on roads and trails to maintain or enhance effective habitat for elk.	a. Work toward an open road and trail density of not more than 2.0 miles per 640 acres, except on Pole Mountain and Thunder Basin National Grasslands, within fourth order watersheds. In calculating miles of open road and motorized trail density, one mile of open road or motorized trail with an average of five or more vehicles per day (ADT) counts as 1.00 mile of road; one mile with an ADT of one to five counts as 0.70 miles of road; and one mile with less than one ADT counts as 0.05 miles of road. b. Specify off-road vehicle restrictions based on ORV use management (FSM 2355, R2 Supp.88).	The alternatives would not result in increased open road and trail density on TBNG. Any roads constructed for temporary construction access would be reclaimed upon completion of construction.
	3. Close all newly constructed roads to public motorized use unless documented analysis shows: a. Use does not adversely impact other resources; b. Use is compatible with the ROS class established for the area; c. They are located in areas open to motorized use; d. They provide user safety; e. They serve an identified public need; f. The area accessed can be adequately managed; or g. Financing is available for maintenance or coop-maintenance can be arranged.		If new temporary roads are necessary on TBNG they would be closed to protect the public.
	4. Manage road use by seasonal closure if: a. Use causes unacceptable damage to soil and water resources due to weather or seasonal conditions b. Use conflicts with the ROS class established for the area; c. Use causes unacceptable wildlife conflict or habitat degradation; d. Use results in unsafe conditions due to weather conditions; e. They serve a seasonal public or administration need; or f. Area accessed has seasonal need for protection or nonuse.		The alternatives would be required to comply with seasonal road closures on TBNG roads, if adopted. Currently, no roads would be crossed on TBNG which have established seasonal closures.
	5. Keep existing roads open to public motorized use unless: a. Financing is not available to maintain the facility or manage the associated use of adjacent lands; b. Use causes unacceptable damage to soil and water resources; c. Use conflicts with the ROS class established for the area; d. They are located in areas closed to motorized use and are not "designated routes" in the Forest travel management direction.		Not applicable to the alternatives.

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Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
	e. Use results in unsafe conditions unrelated to weather conditions; f. There is little or no public need for them; or g. Use conflicts with wildlife management objectives.		
	6. Restrict vehicle traffic to minimize wildlife harassment in essential wildlife habitat, and to prevent resource damage in forage and cover areas.		Currently, such restrictions do not exist on TBNG in areas which would be crossed by the alternatives. However, if such restrictions are imposed in the future, the alternatives would be required to comply with the restrictions.
	7. Closed or restricted roads may be used for and to accomplish administrative purposes when: a. Prescribed in management area direction statements; b. Authorized by the Forest Supervisor; and c. In case of emergency.		Not applicable to the alternatives.
Arterial and Collector Road Construction and Reconstruction	1. Construct and reconstruct arterial and collector roads to meet multiple resource needs.	a. Construction and reconstruction standards for arterial and collector roads are: Standard: Arterial / Collector Travel Speed: Average 30-55 mph / Average 10-30 mph Lanes: Generally 2 lanes / Generally 1 lane Surface: All weather, generally asphalt or gravel / Generally gravel or native surface, sometimes asphalt Width: Typically 20 to 24 feet, but some single land with intervisible 10-foot turnouts / Typically 12 to 16 feet, with intervisible 10-foot turnouts Drainage: Permanent, not to impede traffic / Permanent, but may impede traffic	Not applicable to the alternatives.
	2. Construction and reconstruction of roads will be implemented on a project by project basis. Construction and reconstruction standards will be consistent with the expected use on the road. Existing roads will be used if practical. Roads not needed after the project is complete will be closed.		Not applicable to the alternatives.
Local Road Construction and Reconstruction	1. Construct and reconstruct local roads to provide access for specific resource activities such as campgrounds, trailheads, timber sales, range allotments, mineral leases, etc., with the minimum amount of earthwork.	a. Construction and reconstruction standards for local roads are: Trave Speed: Average less than 20 mph Lanes: Usually single lane except for developed recreation sites. Surface: Varies from asphalt to native surface; majority native surface.	It is anticipated that access to construction sites on TBNG would primarily use existing roads. However, if it becomes necessary to construct an access road on NFS lands, the general direction and standards would be applied.

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Management Activities	General Direction	Standards & Guidelines	Railroad Alternative Consistency
		Width :Typically 10 thru 14 feet. Turnouts optional depending upon traffic management. Usually not intervisible. Drainage: Dips and culverts.	
	2. Construction and reconstruction of roads will be implemented on a project by project basis. Construction and reconstruction standards will be consistent with the expected use on the road. Existing roads will be used if practical. Roads not needed after the project is complete will be closed.		The alternatives would be consistent with this general direction.
Road Maintenance	1. Maintain all roads to the following minimum requirements: a. arterials-Level 3 b. collectors-Level 2 c. all open local roads-Level 2 d. all closed local roads-Level 1.	a. See levels of maintenance in FSM 7730. b. Level 1 maintenance includes upkeep of drainage structures and vegetation cover necessary to prevent erosion.	A Transportation Plan will be developed for NFS lands. That plan will specifically address maintenance of roads on NFS lands on TBNG during construction. This general direction will be incorporated into the Transportation Plan.
	2. Require shared maintenance responsibility by National Forest System resource users when appropriate.		The Forest Service will work with DM&E to determine whether shared maintenance responsibilities are appropriate for roads used to access the operating railroad. DM&E would be solely responsible for maintaining roads used on NFS lands to access construction sites.
	3. Maintain structures, bridges, cattleguards, etc., to be structurally sound and safe for use.		The Transportation Plan will address maintenance of roads on NFS lands on TBNG during construction.
Trail Construction and Reconstruction	1. Construct or reconstruct trails when needed as part of the transportation system.	a. Cross drains and conveyance structures are planned according to Forest Design Standards.	The alternatives will not affect trails on NFS lands on TBNG.
	2. Obliterate unauthorized short cuts and undesired trails. Reroute trails where resource damage is occurring.		The alternatives will not affect trails on NFS lands on TBNG.
Trail System Management	1. Maintain all trails for foot and horse travel unless specifically closed to either or both class of user.		Not applicable to the alternatives.
	2. Maintain all trails to the following minimum requirements: a. Structures (bridges, corduroy, etc.) are structurally sound and safe for specified class of user, b. Maintain drainage structures to prevent unacceptable resource damage, and c. Remove hazards from trails to allow safe passage for specified class of users. A safety hazard is a physical condition of a trail which may cause injury, is unusual or unexpected, and not readily identifiable by the trail user. It is not a condition which is easily identifiable and normally encountered for the type or location of the trail involved. The following examples illustrate this distinction: A hazard is a rotten bridge decking or handrail. A stream crossing where no bridge is provided and the user would expect this on the type and location of the trail is not a hazard. A hazard is a stable-appearing loose rock in a constructed treadway where all other rocks are stable. A trail treadway made up of rocks in a near-natural position, many of which are loose, is not a hazard. A hazard is a perennial bog-hole on a horse trail. An intermittent bog-hole which will dry up by early summer or within a few days following a rain storm is not a hazard.		Not applicable to the alternatives.

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Management Activities	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
	A hazard is a section of trail treadway supported by rotten cribbing. A section of trail where the treadway is obviously slippery is not a hazard. A hazard is a marked ford with holes deeper than the normal channel. A deep ford with a consistent stream bed is not a hazard.		
	3. Provide a full range of trail opportunities in coordination with other Federal, State, and municipal jurisdictions and private industries on and off NFS lands.		Not applicable to the alternatives.
	4. CONTINENTAL DIVIDE NATIONAL SCENIC TRAIL (CDNST): Apply Interim Management for the CDNST corridor to identified alternative routes utilizing both existing trails and roads and nonexisting routes which may be used as connecting travel segments. Interim management will establish visual quality objectives for the Foreground and Middleground areas within the corridor.	a. The CDNST corridor is that area which encompasses the foreground and middleground of the seen-area as viewed from the alternative travel routes identified in the CDNST Comprehensive Plan. Interim management which protects the current scenic quality and recreation opportunities will be applied until such time that a specific trail route is formally designated as a part of the CDNST System. b. All travel route alternatives within the CDNST corridor have a Visual Management System (VMS) sensitivity Level I classification until a specific trail route is formally designated. Foreground and middleground areas within the corridor will meet the highest visual quality objective available within the existing visual condition class constraints and the visual quality objective of the management area.	The alternatives will not affect the Continental Divide National Scenic Trail.
	5. Do not mark existing travel routes as being a part of the CDNST system until they have been formally designated.		Not applicable to the alternatives.
	6. Upon formal designation of a travel route segment as a part of the CDNST system, manage the segment to emphasize foot travel, provide for horse use where safe to do so, and the continuation of motorized use where presently permitted and considered appropriate in the management direction for the overall management area. Give consideration to the needs of the long-distance traveler. Where motorized use is permitted, limit to snowmobiles operating on snow and vehicles with less than 40 inch width. Where the route coexists with a primitive local road, it may be open to use by larger vehicles.	a. The formally designated CDNST travelway will have a sensitivity Level I classification. Foreground and middleground areas, as seen from the trail, will meet the highest visual quality objective available within the existing visual condition class constraints, and the visual quality objective of the specific management area. b. Mark trail routes using the CDNST logo according to appropriate standards in the Comprehensive Plan. c. All other prescribed direction, standards and guidelines for the specific management area through which the (CDNST) passes apply. d. Maintain trails in accordance with standards in the Trail Handbook (FSH 7709.12). e. Schedule trail maintenance in accordance with Regional Acceptable Work Standards. (FSM 1310 R2 ID No. 1 7/22/82.)	Not applicable to the alternatives.
Fire Protection	1. Protect life, property, and resource values from wildfire in a cost efficient manner that maximizes the benefits of shared resources and developing technologies (FSM 5100).	a. Planned budgets and programs are based on an analysis of efficiency and public concern. b. Fiscal year fire program activities are based on a cost-efficient analysis of the budget. c. Wildfire suppression is based on least-cost plus damages with consideration for public concerns.	Not applicable to the alternatives.
Prescribed Fire	1. Prescribed fire will be used as a vegetative and fuels management technique where it is the most cost-efficient and acceptable alternative to achieve management objectives (FSM 5140).	a. A historical record will be maintained with each prescribed fire plan which documents the biological/physical effects and the fire behavior which produced the effects. b. Use current technologies to achieve an optimum balance between positive and negative effects, and prevent escaped fires	Not applicable to the alternatives.
Air Resource Management	1. Comply with State and Federal air quality standards. (See FSM 2120)		The alternatives would be consistent with this general direction. See the EIS for detailed information regarding impacts to air quality.
Insect and Disease Management/Suppression	1. Prevent or suppress epidemic insect and disease populations that threaten forest tree stands with an integrated pest management (IPM) approach consistent with resource management objectives.		Not applicable to the alternatives.

Appendix A, Table 7. Railroad Consistency With Management Prescription 4B, Emphasis on Habitat Indicator Species, 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland

Management Activity	General Direction	Standards and Guidelines	Railroad Alternative Consistency
Visual Resource Management	1. Design and implement management activities to blend with the natural landscape.	a. Do not exceed an adopted Visual Quality Objective (VQO) of modification.	All alternatives would comply with the VQO of modification. Under the modification VQO, management activities may dominate the landscape.
Dispersed Recreation Management	1. Manage human recreational activities so they do not conflict with habitat needs of selected indicator species.		Not applicable to the alternatives.
	2. Semi-primitive nonmotorized, semi-primitive motorized, roaded natural and rural recreation opportunities can be provided.	a. Maximum Use and Capacity Levels are: Recreation use and capacity range during the snow-free period (PAOT/acre): Trail use and capacity range (PAOT/mile of trail):	Not applicable to the alternatives.

Use Level	Capacity Range: Very Low	Low	Moderate	High
ROS Class - Semi-Primitive Nonmotorized				
On Trails PAOT/mile	2.0	3.0	9.0	11.0
Area-wide PAOT/acre	.004	.008	.05	.08
ROS Class - Semi-Primitive Motorized				
On Trails PAOT/mile	2.0	3.0	9.0	11.0
Area-wide PAOT/acre	.004	.008	.05	.08
ROS Class - Roaded Natural				
On Trails PAOT/mile	-	-	-	-
Area-wide PAOT/acre	.04	.08	1.2	2.5
ROS Class - Rural				
On Trails PAOT/mile	-	-	-	-
Area-wide PAOT/acre	.5	.8	5.0	7.5

Appendix A, Table 7. Railroad Consistency With Management Prescription 4B, Emphasis on Habitat Indicator Species, 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland			
Management Activity	**General Direction**	**Standards and Guidelines**	**Railroad Alternative Consistency**
		Reduce the above use level coefficients as necessary to reflect usable acres, patterns of use, and general attractiveness of the specific management area type as described in the ROS Users Guide, Chapter 25. Reduce the above use levels where unacceptable changes to the biophysical resources will occur.	
		b. Specify off-road vehicle restrictions based on ORV use management (FSM 2355, R2 Supp. 88). c. See FSM 2331, FSM 7732, FSH 7709.12 (Trails Handbook), FSH 7109. 11a and 11b (Sign Handbook).	Not applicable to the alternatives.
	3. Permit undesignated sites in Frissell condition class 1 through 3 where unrestricted camping is permitted.		Not applicable to the alternatives.
Wildlife and Fish Resource Management	1. Manage for habitat needs of management indicator species.	a. Maintain habitat capability at a level at least 80 percent of potential capability.	Alternatives B and C may not be consistent with this general direction. Both alternatives parallel the Little Thunder Creek drainage on TBNG and could reduce habitat capability to below 80 percent of potential for some management indicator species, particularly nesting golden eagles and Swainson's hawks. The alternativies pass through elk crucial winter range on TBNG and may reduce habitat capability to below 80 percent of potential for wintering elk.
		b. Limit human activities associated with the issuance of contracts and permits to maintain habitat capability at a level at least 80 percent of potential capability.	Human activities associated with construction and operation of any alternatives could decrease habitat capability on TBNG to below 80 percent of potential capability on crucial elk winter range and where Alternatives B and C parallel Little Thunder Creek, nesting habitt for some management indicator species.
		c. Maintain at least 90 percent of the habitat needed to support the State population goals for each species.	Only a small portion of the habitat on NFS lands on TBNG would be affected by the alternatives. The alternatives would be consistent with this standard and guideline.
	2. Provide effective habitat for elk and deer where these species are present.	a. Maintain, along 75 percent of all arterial and collector road edges, cover that hides 90 percent of an adult elk or deer from human view at a distance of 150 feet from the road.	Not applicable to the alternatives.
		b. In diversity units dominated by forested ecosystems, maintain a minimum of 50 percent of the diversity unit in deer or elk hiding cover. This hiding cover should be well distributed over the unit. Maintain 30 percent of the diversity unit in thermal cover (winter or spring-summer). Hiding cover can be used to meet thermal cover requirements if they indeed coincide biologically.	Not applicable to the alternatives.
Wildlife Habitat Improvement and Maintenance	1. Improve habitat capability through direct treatments of vegetation, soil, and waters.		Not applicable to the alternatives.
	2. Maintain habitat for old growth dependent species.	a. Management areas will be managed to attain at least 20 percent in old growth and occur in 30 acre or larger patches.	Old growth would not be affected by implementation of the alternatives.
	3. Maintain existing natural shrub and grassland openings unless treatment is designed to benefit wildlife.		Not applicable to the alternatives.
	4. Manage habitat for birds and small mammals.		The alternatives would have insignificant impacts on habitat for birds and small mammals.
	5. Retain prairie dog towns needed to provide essential habitat for the black-footed ferret.	.	Alternatives C and D would be consistent with this general direction. Alternative B would not. Alternative B would cross through portions of the Rosecrans area which has been designated a reintroduction site for the black-footed ferret.
	6. Manage grasslands and grassland shrub types to improve wildlife habitat. Improve habitat conditions by increasing forage available to wildlife and enhancing vegetation diversity.		The alternatives will temporarily and permanently remove grassland and grassland-shrub vegetation within TBNG and would be inconsistent with this general direction.

Appendix A, Table 7. Railroad Consistency With Management Prescription 4B, Emphasis on Habitat Indicator Species, 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland

Management Activity	General Direction	Standards and Guidelines	Railroad Alternative Consistency
	7. Manage the Ponderosa Pine Association on the Thunder Basin National Grassland for wildlife and esthetics.		All the alternatives would cross small areas of ponderosa pine in the vicinity of the Rochelle Hills. Impacts to this association are expected to be negligible.
Range Resource Management	1. Implement rotation grazing systems.		Not applicable to the alternatives.
	2. Apply wildlife and livestock forage allowable use guides specified in Forest Direction. Modify so needs of management indicator species are met.		Not applicable to the alternatives.
	3. Structural range improvement should be designed to benefit wildlife and livestock.	a. Structural improvements will not adversely affect big game movement (FSH 2209.22).	Not applicable to the alternatives.
Silvicultural Prescriptions	1. Manage forest cover types to provide variety in stand sizes, shape, crown closure, edge contrast, age structure and interspersion.		Not applicable to the alternatives.
	2. Vegetation treatment of forested areas will be used to work towards a forest environment that is a mosaic of tree stands that provide cover and forage for indicator species of wildlife.		Not applicable to the alternatives.
	3. Manage forest cover types using the following harvest methods. - Clearcut in aspen and lodgepole - Shelterwood or clearcut in interior ponderosa pine, mixed conifer and Engelmann spruce-subalpine fir.	a. Apply harvest methods to forest cover types as specified in General Direction on at least 80% of the forest cover type. Up to 20 percent of the type may be treated using other appropriate harvest methods specified in Forest Direction. Follow silvicultural standards as specified in Forest Direction Requirements.	Not applicable to the alternatives.
	4. Apply intermediate treatments to maintain growing stock level standards.		Not applicable to the alternatives.
	5. For management purposes, a cut-over area is considered an opening until minimum stocking standards by forest cover type and site productivity are met.	a. When the Visual Quality Objective of an area is modification or maximum modification, the regenerated stand shall meet or exceed all of the following characteristics before a cut-over area is no longer considered an opening: Forest Cover Type / Minimum Stocking Level (Trees/acre) / Tree Stand Height (ft) 1/ Inland Ponderosa Pine: 190 / 6 Mixed Conifers: 190 / 6 Lodgepole Pine: 150 / 6 Engelmann Spruce-Subalpine Fir: 150 / 6 Aspen: 300 / 6 Forest Cover Type / Crown Closure (Percent) / Distribution /2 Inland Ponderosa Pine: 30 / 70% Mixed Conifers: 30 / 75% Lodgepole Pine: 30 / 75% Engelmann Spruce-Subalpine fir: 30 / 75% Aspen: 30 / 75% 1/ Applies to trees specified as minimum stocking level. 2/ Percent of plots or transects that are stocked.	Not applicable to the alternatives.
	5. Use trees of the best genetic quality available which are adapted to the planting site when supplemental planting. (Reference FSM 2475)		Not applicable to the alternatives.

Appendix A, Table 7. Railroad Consistency With Management Prescription 4B, Emphasis on Habitat Indicator Species, 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland			
Management Activity	**General Direction**	**Standards and Guidelines**	**Railroad Alternative Consistency**
Transportation System Management	1. Manage road use to provide for habitat needs of management indicator species, including road closures and area closures, and to maintain habitat effectiveness.	a. Achieve an open road and trail density except on Pole Mountain and Thunder Basin National Grassland, of not more than 1.2 miles per 640 acres. In calculating miles of open road and motorized trail density, one mile of open road or motorized trail with an average of five or more vehicles per day (ADT) counts as 1.00 mile of road; one mile with an ADT of one to five counts as 0.70 miles of road; and one mile with less than one ADT counts as 0.05 miles of road.	The alternatives could not be subject to closure to maintain habitat effectiveness for managment indicator species and would not be consistent with this general direction.
Arterial and Collector Road Construction and Reconstruction	1. Meet the following practices unless practical design alternatives are available. Screen meadows, clearcuts, and other openings from roads by means of vegetation or topography. Locate and construct cuts and fills so they do not block big game travel routes. Lay out roads to facilitate closure for management needs. Avoid single tangents of roads of more than .25 mile in forested sites to increase the cover values and discourage road hunting.		The general direction provided applies to roads. However, at least one of the practices also has direct applicability to impacts from the railroad alternatives. The alternatives would not be consistent with the general direction to construct cut and fills so that they do not block game travel routes. Without adequate mitigation the railroad could prove to be a barrier to big game migration in several areas on TBNG. DM&E is exploring mitigation opportunities to allow movement of wildlife across the existing track, including evaluating the feasibility of installing large box culverts and fencing to direct wildlife to safe crossing locations.
Fuel Treatment	1. Maintain fuel conditions which permit fire suppression and prescribed fire to maintain habitat needed for selected species or species population levels.		Not applicable to the alternatives.

Appendix A, Table 8. Railroad Alternative Consistency With Management Prescription 4C, Emphasis on Wildlife Habitat in Woody Draws and Other Woody Vegetation Areas on Rangelands, 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland.

Management Activity	General Direction	Standards & Guidelines	Railroad Alternative Consistency
Visual Resource Management	1. Design and implement management activities to blend with the natural landscape.	a. Do not exceed an adopted Visual Quality Objective (VQO) of modification.	The alternatives would comply with the VQO of modification. Under the modification VQO, management direction may dominate the landscape.
Dispersed Recreation Management	1. Manage human recreational activities so they do not conflict with habitat needs of selected indicator species.		Not applicable to the alternatives.
	2. Semi-primitive nonmotorized, semi-primitive motorized, roaded natural and rural recreation opportunities can be provided.	a. Maximum Use and Capacity Levels are: Recreation use and capacity range during the snow-free period (PAOT/acre): Trail use and capacity range (PAOT/mile of trail):	Not applicable to the alternatives.

	Capacity Range			
Use Level	Very Low	Low	Moderate	High
ROS Class - Semi-Primitive Nonmotorized				
On Trails PAOT/mile	2.0	3.0	9.0	11.0
Area-wide PAOT/acre	.004	.008	.05	.08
ROS Class - Semi-Primitive Motorized				
On Trails PAOT/mile	2.0	3.0	9.0	11.0
Area-wide PAOT/acre	.004	.008	.05	.08
ROS Class - Roaded Natural				
On Trails PAOT/mile	-	-	-	-
Area-wide PAOT/acre	.04	.08	1.2	2.5

Appendix A, Table 8. Railroad Alternative Consistency With Management Prescription 4C, Emphasis on Wildlife Habitat in Woody Draws and Other Woody Vegetation Areas on Rangelands, 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland.

Management Activity	General Direction	Standards & Guidelines	Railroad Alternative Consistency
		ROS Class - Rural On Trails PAOT/mile - - - - Area-wide PAOT/acre .5 .8 5.0 7.5 Reduce the above use level coefficients as necessary to reflect usable acres, patterns of use, and general attractiveness of the specific management area type as described in the ROS Users Guide, Chapter 25. Reduce the above use levels where unacceptable changes to the biophysical resources will occur. b. Specify off-road vehicle restrictions based on ORV use management (FSM 2355, R2 Supp. 88). c. See FSM 2331, FSM 7732, FSH 7709.12 (Trails Handbook), and 11b (Sign Handbook).	
	3. Permit undesignated sites in Frissell Condition Class 1 through 3 where unrestricted camping is permitted.		Not applicable to the alternatives.
Wildlife Habitat Improvement and Maintenance	1. Manage for habitat needs of indicator species.	a. Maintain habitat capability at a level at least 70 percent of potential capability for species other than early succession-oriented species.	It is not anticipated that the alternatives would reduce habitat capability to below 70 percent of potential capability.
	2. Maintain existing natural shrub and grassland openings unless treatment is designed to benefit wildlife.	a. In areas where shrub types are actively managed, maintain at least 25% of the browse in young growth and 50% in mature growth. If cover is needed for optimum habitat, tree planting may be done.	Not applicable to the alternatives.
	3. Manage habitat for birds and small mammals.	a. All turkey roost tree groups are retained. The group includes the trees actually used for roosting and other trees used for cover. A minimum size group of .10 acre is retained.	A survey for turkey roosts has not been completed. If present, they could be impacted directly or made unsuitable for use from noise. If so, the alternatives would not be consistent with this standard unless mitigation is developed to offset the impact.
	4. Manage grasslands and grassland shrub types to improve wildlife habitat. Improve habitat conditions by increasing forage available to wildlife and enhancing vegetation diversity.		Not applicable to the alternatives.
	5. Manage the area to maintain wildlife habitat in good condition. Design range improvements to increase the carrying capacity for wildlife species. Invest in special wildlife habitat structure improvements to meet the special needs of indicator species.		Where crossed by the operating railroad, habitat quality would degrade to less than good condition from direct as well as indirect impacts, particularly in woody draws. The alternatives would not be consistent with this direction.
Range Resource Management	1. Prevent habitat degradation adjacent to water sources.	a. Unregulated livestock access to water impoundments behind dams must be less than 50 percent of the impoundment perimeter. b. Maintain late seral stage vegetation on at least 20 percent of the area within a 100 foot radius around all created water sources except impoundments behind dams.	Not applicable to the alternatives.
	2. Perpetuate woody vegetation.	a. Maintain woody vegetation in all stages of development on at least 60 percent of the area.	Not applicable to the alternatives.
	3. Apply wildlife and livestock forage allowable use guides specified in Forest Direction. Modify so needs of management indicator species are met.	a. Maintain vegetation in fair or better range condition.	Not applicable to the alternatives.
	4. Implement rotation grazing systems.		Not applicable to the alternatives.
	5. Manage for sustained yield of livestock with the intent to upgrade range conditions for wildlife and livestock while using the available forage.		Not applicable to the alternatives.

Appendix A, Table 8. Railroad Alternative Consistency With Management Prescription 4C, Emphasis on Wildlife Habitat in Woody Draws and Other Woody Vegetation Areas on Rangelands, 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland.

Management Activity	General Direction	Standards & Guidelines	Railroad Alternative Consistency
Range Improvement and Maintenance	1. Structural range improvement should be designed to benefit wildlife and livestock.	a. Structural improvements will not adversely affect big game movement (FSH 2209.22).	Not applicable to the alternatives.
Silvicultural Prescriptions	1. For management purposes, a cut-over area is considered an opening until minimum stocking standards by forest cover type and site productivity are met.	a. When the Visual Quality Objective of an area is modification or maximum modification, the regenerated stand shall meet or exceed all of the following characteristics before a cutover area is no longer considered an opening. Forest Cover Type / Minimum Stocking Level (Trees/acre) / Tree Stand Height (ft) 1/ Inland Ponderosa Pine: 190, 6 Mixed Conifers: 190, 6 Lodgepole Pine: 150, 6 Engelmann Spruce-Subalpine Fir: 150, 6 Aspen: 300, 6 Forest Cover Type / Crown Closure (Percent) / Distribution 2/ Inland Ponderosa Pine: 30, 70% Mixed Conifers: 30, 75% Lodgepole Pine: 30, 75% Engelmann Spruce-Subalpine Fir: 30, 75% Aspen: 30, 75% 1/ Applies to trees specified as minimum stocking level. 2/ Percent of plots or transects that are stocked.	Not applicable to the alternatives.
Water Uses Management	1. Avoid locating new wells in the area.		Not applicable to the alternatives.
Transportation System Management	1. Restrict off-road vehicle travel as needed to protect management indicator species and other species.	a. Determine off-road vehicle restrictions based on the needs of wildlife. Follow ORV Management Guidelines Handbook (R2 FSH 2309.26).	Not applicable to the alternatives.
	2. Locate and construct roads to maintain the basic natural condition, character, and habitat effectiveness of woody draws.		If new roads are necessary to access construction sites, they would be consistent with this general direction.

Appendix A, Table 9. Railroad Alternative Consistency With Management Prescription 6B, Emphasis on Livestock Grazing, 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland.

Management Activity	General Direction	Standards & Guidelines	Railroad Alternative Consistency
Visual Resource Management	1. Design and implement management activities to blend with the natural landscape.	a. Do not exceed an adopted Visual Quality Objective (VQO) of modification.	All alternatives would comply with the VQO of modification. The modification VQO allows management activities to dominate the landscape.
		b. When projects require clearing of vegetation and (or) soil disturbance, use irregular clearing edges and shapes to blend with the natural landscapes.	This standard and guideline is not intended to apply to linear projects such as the alternatives. To do as required would result in more disturbance than confining construction activities to a well defined construction right-of-way.
Dispersed Recreation Management	1. Semi-primitive nonmotorized, semi-primitive motorized, roaded natural and rural recreation opportunities can be provided.		Not applicable to the alternatives.
	2. Provide roaded natural recreation opportunities within ½ mile of Forest arterial, collector and local roads with better than primitive surfaces which are open to public travel. Provide semi-primitive motorized recreation opportunities with a low to moderate incidence of contact with other groups and individuals within ½ mile of designated local roads with primitive surfaces and trails open to motorized recreation use. Where local roads are closed to public motorized recreation travel, provide for dispersed non-motorized recreation opportunities. Manage recreation use to provide for the incidence of contact with other groups and individuals appropriate for the established ROS class. Provide semi-primitive non-motorized recreation opportunities in all areas more than ½ mile away from roads and trails open to motorized recreation use.	a. Maximum Use and Capacity Levels are: Recreation use and capacity range during the snow-free period (PAOT/acre): Trail use and capacity range (PAOT/mile of trail):	Not applicable to the alternatives.

	Capacity Range			
Use Level	Very Low	Low	Moderate	High
ROS Class - Semi-Primitive Nonmotorized				
On Trails PAOT/mile	2.0	3.0	9.0	11.0
Area-wide PAOT/acre	.004	.008	.05	.08
ROS Class - Semi-Primitive Motorized				
On Trails PAOT/mile	2.0	3.0	9.0	11.0
Area-wide PAOT/acre	.004	.008	.05	.08
ROS Class - Roaded Natural				
On Trails PAOT/mile	-	-	-	-
Area-wide PAOT/acre	.04	.08	1.2	2.5

Appendix A, Table 9. Railroad Alternative Consistency With Management Prescription 6B, Emphasis on Livestock Grazing, 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland.			
Management Activity	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
		ROS Class - Rural --- On Trails PAOT/mile - - - - --- Area-wide PAOT/acre .5 .8 5.0 7.5 --- Reduce the above use level coefficients as necessary to reflect usable acres, patterns of use, and general attractiveness of the specific management area type as described in the ROS Users Guide, Chapter 25. Reduce the above use levels where unacceptable changes to the biophysical resources will occur. b. Specify off-road vehicle restrictions based on ORV use management (FSM 2355, R2 Supp. 88). c. See FSM 2331, FSM 7732, FSH 7709.12 (Trails Handbook), FSH 7109.11a and 11b (Sign Handbook).	
	3. Permit undesignated sites in Frissell condition class 1 through 3 where unrestricted camping is permitted.		Not applicable to the alternatives.
Wildlife and Fish Resource Management	1. Maintain habitat capability for management indicator species.	a. Maintain capability at 60 percent of potential capability.	It is not anticipated that implementation of any of the alternatives would reduce habitat capability below 60 percent of potential capability on TBNG.
Wildlife Habitat Improvement and Maintenance	1. Maintain sufficient prairie dog towns to sustain prairie dog populations. Provide adequate habitat for species dependent on prairie dog towns such as burrowing owls and black-footed ferrets.	a. Prairie dog towns that are contiguous with private lands or those within one-quarter mile of private land where prairie dogs will cause damage to private lands will be controlled using zinc phosphide or other approved chemical. b. Prairie dog towns more than one-quarter mile from private land and on federal land tracts of more than 640 acres will be retained and usually reduced in size to 80-100 acres if larger than 100 acres.	Not applicable to the alternatives.
Range Resource Management	1. Use only intensive grazing systems or remove livestock when recovery of range condition cannot be accomplished by an intensive grazing system.		Not applicable to the alternatives.
	2. Improve range condition to fair or better or forage value rating to moderately high or better.	a. Base range condition on the standards in Range Analysis Handbook (FSH 2209.21).	Not applicable to the alternatives.
	3. Invest in cost-effective allotment management and associated range improvements.	a. Base economic analysis on Project Effectiveness Analysis Handbook (FSH 2209.11).	Not applicable to the alternatives.
	4. Invest in cost-effective grazing management and rangeland productivity improvements. Where improvements include water developments, a water right in the name of the United States must be obtained.	a. Structural improvements will not adversely affect big-game movement.	Not applicable to the alternatives.
Silvicultural Prescriptions	1. Maintain and manage forested inclusions to provide a high level of forage production, wildlife habitat, and diversity.		Not applicable to the alternatives.
	2. Manage forest cover types using the following harvest methods. - Clearcut in aspen and lodgepole. - Shelterwood or clearcut in interior ponderosa pine, mixed conifer and Engelmann spruce-subalpine fir.	a. Apply harvest treatments to forest cover types as specified below on at least 80% of the forest cover type. Up to 20 percent of the type may be treated using other harvest methods specified in Forest Direction.	Not applicable to the alternatives.
			Not applicable to the alternatives.

Appendix A, Table 9. Railroad Alternative Consistency With Management Prescription 6B, Emphasis on Livestock Grazing, 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland.

Management Activity	General Direction	Standards & Guidelines	Railroad Alternative Consistency
	3. For management purposes, a cut-over area is considered an opening until minimum stocking standards by forest cover type and site productivity are met.	a. When the Visual Quality Objective of an area is modification or maximum modification, the regenerated stand shall meet or exceed all of the following characteristics before a cut-over area is no longer considered an opening:	

Forest Cover Type	Minimum Stocking Level (Trees/acre)	Tree Stand Height (ft.) 1/
Inland Ponderosa Pine	190	6
Mixed Conifers	190	6
Lodgepole Pine	150	6
Engelmann Spruce-Subalpine Fir	150	6
Aspen	300	6

Forest Cover Type	Crown Closure (Percent)	Distribution 2/
Inland Ponderosa Pine	30	70%
Mixed Conifers	30	75%
Lodgepole Pine	30	75%
Engelmann Spruce-Subalpine fir	30	75%
Aspen	30	75%

1/ Applies to trees specified as minimum stocking level.
2/ Percent of plots or transects that are stocked.

Appendix A, Table 10. Railroad Alternative Consistency With Management Prescription 9A, Emphasis on Riparian Area Management, 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland.

Management Activity	General Direction	Standards & Guidelines	Railroad Alternative Consistency
Visual Resource Management	1. Design and implement management activities which sustain inherent visual values of riparian areas and blend with the surrounding natural landscapes.	a. Do not exceed an adopted Visual Quality Objective (VQO) of partial retention.	All the alternatives would cross approximately 4 miles of this management prescription. While the partial retention VQO allows management activities to be evident they must remain subordinate to the natural landscape. They should not dominate the view. The alternatives would not be consistent with the partial retention VQO. Where it would cross through Management Prescription 9A, the operating railroad is expected to dominate the view and attract the attention of visitors.
Management of Developed Recreation Sites	1. Continue to operate existing developments if they provide support for concentrated public use at natural recreation attractions such as lakes and reservoirs.		Not applicable to the alternatives.
	2. Do not develop additional recreation facilities within 100 feet of water bodies or within the 100 year floodplain except for facilities necessary to allow water related recreation use.		Not applicable to the alternatives.
Dispersed Recreation Management	1. Semi-primitive non-motorized, semi-primitive motorized, roaded-natural and rural recreation opportunities can be provided.		Not applicable to the alternatives.
	2. Provide roaded-natural recreation opportunities within ½ mile of Forest arterial, collector and local roads with better than primitive surfaces which are open to public travel. Provide semi-primitive motorized recreation opportunities with a low to moderate incidence of contact with other groups and individuals within ½ mile of designated local roads with primitive surfaces and trails open to motorized recreation use. Where local roads are closed to public motorized recreation travel, provide for dispersed non-motorized recreation opportunities. Manage recreation use to provide for the incidence of contact with other groups and individuals appropriate for the established ROS class. Provide semi-primitive non-motorized recreation opportunities in all areas more than ½ mile away from roads and trails open to motorized recreation use.	a. Maximum Use and Capacity Levels are: Recreation use and capacity range during the snow-free period (PAOT/acre): Trail use and capacity range (PAOT/mile of trail): Capacity Range Use Level / Very Low / Low / Moderate / High ROS Class - Semi-Primitive Nonmotorized On Trails PAOT/mile: 2.0 / 3.0 / 9.0 / 11.0 Area-wide PAOT/acre: .004 / .008 / .05 / .08 ROS Class - Semi-Primitive Motorized On Trails PAOT/mile: 2.0 / 3.0 / 9.0 / 11.0 Area-wide PAOT/acre: .004 / .008 / .05 / .08 ROS Class - Roaded Natural On Trails PAOT/mile: - / - / - / -	Not applicable to the alternatives.

Appendix A, Table 10. Railroad Alternative Consistency With Management Prescription 9A, Emphasis on Riparian Area Management, 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland.			
Management Activity	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
		Area-wide PAOT/acre .04 .08 1.2 2.5 ROS Class - Rural On Trails PAOT/mile - - - - Area-wide PAOT/acre .5 .8 5.07.5 Reduce the above use level coefficients as necessary to reflect usable acres, patterns of use, and general attractiveness of the specific management area type as described in the ROS Users Guide, Chapter 25. Reduce the above use levels where unacceptable changes to the biophysical resources will occur. b. Specify off-road vehicle restrictions based on ORV use management (FSM 2355, R2 Supp. 88). c. See FSM 2331, FSM 7732, FSH 7709.12 (Trails Handbook), FSH 7109.11a and 11b (Sign Handbook).	
	3. Permit undesignated sites in Frissell condition class 1 through 3 where unrestricted camping is permitted.		Not applicable to the alternatives.
Wildlife Habitat Improvement and Maintenance	1. Provide habitat diversity through vegetation treatments, in conjunction with other resource activities, designed to maintain or improve wildlife or fisheries habitat.		Not applicable to the alternatives.
	2. Provide habitat for viable populations of all native vertebrate species of fish and wildlife.		The alternatives would result in localized losses of wildlife habitat. Although the losses may be locally severe, such losses would not eliminate viable populations of native vertebrate fish or wildlife on TBNG.
	3. Manage riparian areas to reach the latest seral stage possible within stated objectives.	a. Maintain all riparian ecosystems in at least an upper mid-seral successional stage based upon the R2 Riparian Ecosystem Rating System.	Not applicable to the alternatives.
	4. Plan lake and stream habitat improvement projects with the assistance of state wildlife agencies, where aquatic habitats are below productive potential. Plan those improvements that harmonize with the visual setting.		Not applicable to the alternatives.
	5. Maintain a current fish habitat inventory in cooperation with state wildlife agencies.		Not applicable to the alternatives.
	6. Maintain instream flows in cooperation with state wildlife agencies to support a sustained-yield of natural fisheries resources.		Temporary dewatering of streams at construction sites may be required during installation of instream structures. However, to protect aquatic resources, downstream flow would be maintained at all times, where necessary.
	7. Maintain habitat for old growth dependent species.	a. Management areas will be managed to attain a least 20 percent in old growth and occur in 30 acre or larger patches.	Not applicable to the alternatives.
	8. Manage vegetation within riparian areas around water bodies to attain and maintain the optimum number of species consistent with site characteristics of each riparian area and maximum structural diversity within each vegetative type.	a. Manage spruce/fir and ponderosa pine timber types under all aged systems and harvest deciduous trees only as a tool for maintaining or enhancing habitat. b. Do not harvest cottonwood unless regeneration can be assured. c. Retain all snags except hazard trees in recreation areas. d. Maintain nest trees and potential nest trees for raptors as large as possible in diameter, adjacent to water bodies.	a. Not applicable to the alternatives. b. Loss of cottonwoods during construction will require compensatory mitigation. The 404 permit application will contain specific proposals regarding replacement of lost cottonwoods. Cottonwood regeneration will be evaluated as a technique to replace cottonwoods cleared from the right-of-way on TBNG. c. It is not known if snags occur within the construction right-of-way. If they occur, snags would be cleared. The alternatives would not be consistent with this standard and guideline.

Appendix A, Table 10. Railroad Alternative Consistency With Management Prescription 9A, Emphasis on Riparian Area Management, 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland.			
Management Activity	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
			d. Although no known nest trees occur in the construction right-of-way, potential nest trees would be removed. However, the loss of these potential nest trees is expected to be insignificant.
	9. Manage habitat for birds and small mammals.	a. All turkey roost tree groups are retained. The group includes the trees actually used for roosting and other trees used for cover. A minimum size group of .10 acre is retained.	A survey for turkey roost tees has not been completed. If they exist in the right-of-way they would be removed. Roost trees adjacent to the right-of-way could be lost due to noise.
	10. Increase or encourage fruit and seed production by planting food patches or seeding skid trails, landings and roads to large seeded grasses for turkey.		Not applicable to the alternatives.
	11. Manage the area to maintain wildlife habitat in good condition. Design range improvements to increase the carrying capacity for wildlife species. Invest in special wildlife habitat structure improvements to meet the special needs of indicator species.		Where this management prescription area is crossed by the alternatives, the quality of wildlife habitat is expected to decrease within the construction right-of-way as well as in areas adversely affected by noise from the operating railroad. The alternatives would not be consistent with the general direction to maintain wildlife habitat in good condition.
	12. Design project construction plans, permits and activities to minimize siltation or pollution of streams and lakes.		BMPs are being developed that address impacts from sedimentation. These BMPs will be incorporated into SWPPPs required by WDEQ.
	13. Require sediment control for any construction activity within the aquatic zone to prevent downstream sedimentation.		BMPs are being developed that address impacts from sedimentation. These BMPs will be incorporated into SWPPPs required by WDEQ.
Range Resource Management	1. Maintain proper stocking and livestock distribution to protect riparian ecosystems.		Not applicable to the alternatives.
	2. Prohibit trailing of livestock along the length of riparian areas except where existing stock driveways occur. Rehabilitate existing stock driveways where damage is occurring in riparian areas. Relocate existing stock driveways outside riparian areas if necessary to achieve riparian-area goals.		Not applicable to the alternatives.
	3. Permit livestock use in riparian ecosystems only when compatible with maintenance of the ecosystem and achievement of riparian area objectives.	a. Graze livestock only under a specific grazing plan designed to protect understory vegetation. Residual herbaceous forage should average five inches in height to meet other resource needs on the forest. b. Do not allow livestock salting in riparian zones or in upland areas immediately adjacent to riparian areas.	Not applicable to the alternatives.
Silvicultural Prescriptions	1. Manage forest cover types to perpetuate tree cover and provide healthy stands, high water quality and wildlife and fish habitat.		Not applicable to the alternatives.
	2. Vegetation treatment of forested areas will be used to work towards retention of a deciduous forest, when present, or an environment of tall, uneven-aged coniferous forest that is stable and perpetuated in mid to late seral condition. Individual trees may occasionally be removed or treated to promote replacement trees or to create streambank cover and provide down and dead material as habitat for indigenous wildlife species.		Not applicable to the alternatives.
	3. Manage Forest Cover types using the following harvest methods: - Clearcut in aspen, and - Selection (Group or Single tree) in all other cover types.	a. Apply harvest methods to forest cover types as specified in General Direction on at least 80% of the forest cover type. Up to 20 percent of the type may be treated using other appropriate harvest methods specified in Forest Direction. Follow silvicultural standards as specified in Forest Direction Requirements.	Not applicable to the alternatives.
	4. Conduct silvicultural treatments in riparian ecosystems only when compatible with maintenance of the ecosystem and achievement of riparian area objectives or when the timber stand is in danger of being lost from epidemic disease or insect attacks.	a. Vehicular or skidding equipment shall not be used in riparian areas or upland areas immediately adjacent to riparian areas except where roads and landings are approved. Trees felled into riparian areas and upland areas immediately adjacent to riparian areas shall be removed by endlining, and resulting slash shall be removed where necessary to protect cover, soil, and water.	Not applicable to the alternatives.
	5. Prohibit log landing and decking areas within the riparian area.		Not applicable to the alternatives.
	6. Reduce debris jam potential by cutting stumps to near ground level in the 100-year floodplain.		This general direction would be incorporated into construction plans for the alternatives.

Appendix A, Table 10. Railroad Alternative Consistency With Management Prescription 9A, Emphasis on Riparian Area Management, 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland.

Management Activity	General Direction	Standards & Guidelines	Railroad Alternative Consistency
	7. For management purposes, a cut-over area is considered an opening until minimum stocking standards by forest cover type and site productivity are met.	a. When the Visual Quality Objective of an area is partial retention, the regenerated stand shall meet or exceed all of the following characteristics before a cut-over area is no longer considered an opening: Forest Cover Type / Minimum Stocking Level (Trees/acre) / Tree Height /1 (% of the adjacent mature stand height) Inland Ponderosa Pine: 190 / 25 Mixed Conifers: 190 / 25 Lodgepole Pine: 150 / 25 Engelmann Spruce Subalpine fir: 150 / 25 Aspen: 300 / 25 Forest Cover Type / Crown Closure (Percent) / Distribution /2 Inland Ponderosa Pine: 30 / 70% Mixed Conifers: 30 / 75% Lodgepole Pine: 30 / 75% Engelmann Spruce Subalpine fir: 30 / 75% Aspen: 30 / 75% 1/ Applies to trees specified as minimum stocking level. 2/ Percent of plots or transects that are stocked.	Not applicable to the alternatives.
Water Uses Management	1. Prevent or remove debris accumulations that reduce stream channel stability and capacity.		Design of the alternatives instream structures address the prevention of debris accumulations. All culverts would be a minimum of 36 inches in diameter. This size was chosen specifically to reduce debris accumulation and reduce maintenance.
	2. Proposed new land-use facilities (roads, campgrounds, buildings) will not normally be located within floodplain boundaries for the 100-year flood. Protect present and all necessary future facilities that cannot be located out of the 100-year floodplain by structural mitigation (deflection structures, riprap, etc.).	a. Implement mitigation measures when present or unavoidable future facilities are located in the active floodplain to ensure that State water quality standards, sediment threshold limits, bank stability criteria, flood hazard reduction and instream flow standards are met during and immediately after construction.	Because they are linear in nature, the alternatives can not avoid crossing floodplains. BMPs are being developed that address the concerns listed in the standards and guidelines. These BMPs will be incorporated into SWPPPs being prepared in compliance with WDEQ regulations.
	3. Prevent stream channel instability, loss of channel cross-sectional areas, and loss of water quality resulting from activities that alter vegetative cover.		These issues are addressed in the COE 404 permit applications for the project. BMPs are being developed that address these issues.
	4 Maintain sediment yield within threshold limits. The effects on water and sediment yields from vegetation manipulation and road construction projects will be determined through the use of appropriate modeling and/or quantification procedures to determine sediment yield threshold limits and water yield increase potentials.	a. Limit changes in channel rating or classification scores to an increase of 10 percent or less. Use channel stability criteria established by Cooper, 1978 and Pfankuch, 1975. Use channel classification criteria established by Rosgen, 1980. b. Prescription-induced water yield increases should not exceed prescribed thresholds of allowable increase nor should the total yield of water and sediment exceed maximum allowable amounts as stated in the above references. c. Maintain at least 80 percent of potential ground cover within 100 ft. from the edges of all perennial streams, lakes and other waterbodies, or to the outer margin of the riparian ecosystem, where wider than 100 feet.	a. & b. DM&E is currently completing hydrology and hydraulic studies of stream crossings. These studies will address channel stability, water yield, etc. Results of the studies for stream crossings on TBNG will be provided to the Forest Service for review and comment. c. The alternatives would not be consistent with this standard and guideline. At stream crossings all ground cover would be removed within the construction right-of-way to the water's edge. Ground cover would be completely removed in the construction right-of-way through riparian areas. All the alternatives would cross roughly the same amount of riparian area on TBNG.

Appendix A, Table 10. Railroad Alternative Consistency With Management Prescription 9A, Emphasis on Riparian Area Management, 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland.			
Management Activity	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
	5. Avoid channelization of natural streams. Where channelization is necessary for flood control or other purposes, use stream geometry relationships to reestablish meanders, width/depth ratios, etc. consistent with each major stream type.		The need for stream channelization on NFS lands will be addressed in hydrology and hydraulic studies being conducted by DM&E. The Forest Service will be provided the opportunity to review and comment on these studies for streams on NFS lands on TBNG.
	6. Treat disturbed areas resulting from management activities, to reduce sediment yields to the natural erosion rates in the shortest possible time.		This general direction will be incorporated into the SWPPPs being prepared in compliance with WDEQ regulations. These SWPPPs will specifically address reclamation requirements as well as timing.
	7. Stabilize streambanks which are damaged beyond natural recovery in a reasonable time period with appropriate methods or procedures that emphasize control by vegetation.		This general direction will be addressed in the SWPPPs. The COE 404 permit applications will address where bank armoring would be required.
	8. Design and locate settling ponds to reduce downstream sediment yield and to prevent washout during high water. Locate settling ponds outside of the active channel. Restore any channel changes to hydraulic geometry standards for each stream type.		Settling ponds are included as one of the many BMPs available to reduce sedimentation impacts associated with construction. If settling ponds are used, they will comply with this general direction.
	9. Include wildlife and fish habitat, aesthetic, or safety goals when planning projects that result in vegetation type conversion.		All of these factors are considered in the evaluation of riparian impacts resulting from the alternatives. The COE 404 permitting process specifically addresses losses of wildlife and fish habitat.
	10. Require concurrent monitoring to ensure that mitigative measures are effective and in compliance with state water quality standards.		Monitoring and maintenance requirements will be incorporated into the SWPPPs.
Water Resource Improvement and Maintenance	1. Use directional tree felling and whole tree skidding in upland areas immediately adjacent to riparian areas.		Not applicable to the alternatives.
Soil Resource Management	1. Rehabilitate disturbed soil areas where adverse impacts would occur according to the following priorities: - Aquatic ecosystems; - Riparian ecosystems; and - Riparian areas outside of aquatic and riparian ecosystems.		These priorities are consistent with the general restoration emphasis included in storm water regulations. These priorities will be incorporated into the SWPPPs being prepared in compliance with WDEQ regulations.
	2. Prevent soil surface compaction and disturbance in riparian ecosystems. Allow use of heavy construction equipment for construction, residue removal, etc., during periods when the soil is least susceptible to compaction or rutting.		The alternatives would not be consistent with this general direction. All alternatives would result in disturbance to riparian ecosystems on NFS lands on TBNG. In addition, it will be necessary for construction of bridges to occur year round including during periods when soils are wet and subject to rutting and compaction. BMPs (such as using mats) are being developed to address concerns regarding compaction and rutting. However, some compaction and rutting would occur during construction in riparian areas regardless of the BMPs employed.
	3. Maintain or enhance the long-term productivity of soils within the riparian ecosystem.		The alternatives would not adversely affect the long-term productivity of soils within the riparian ecosystem.
Mining Law Compliance and Administration	1. Minimize detrimental disturbance to the riparian area by mineral activities. Initiate timely and effective rehabilitation of disturbed areas and restore riparian areas to a state of productivity comparable to that before disturbance.	a. Prohibit the depositing of soil material from drilling, processing, or site preparation in natural drainageways.	Not applicable to the alternatives.
		b. Locate the lower edge of disturbed or deposited soil banks outside the active floodplain.	Not applicable to the alternatives.
		c. Prohibit stockpiling of topsoil or any other disturbed soil in the active floodplain.	Not applicable to the alternatives.
		d. Prohibit mineral processing (milling) activities within the active floodplain.	Not applicable to the alternatives.
		e. Discontinue heavy equipment use when soil compaction, rutting, and puddling is present.	Not applicable to the alternatives.

Appendix A, Table 10. Railroad Alternative Consistency With Management Prescription 9A, Emphasis on Riparian Area Management, 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland.			
Management Activity	**General Direction**	**Standards & Guidelines**	**Railroad Alternative Consistency**
	2. Locate mineral removal activities away from the water's edge or outside the riparian area.	a. Locate drilling mud pits outside the active floodplain unless alternate locations are more environmentally damaging. If location is unavoidable, seal and dike all pits to prevent leakage. b. Drain and restore roads, pads, and drill sites immediately after use is discontinued. Revegetate to 80 percent of ground cover in the first year. Provide surface protection during stormflow and snowmelt runoff events.	Not applicable to the alternatives.
	3. Design and locate placer mine settling ponds to prevent washout during high water. Locate settling ponds outside of the active channel. Restore any channel changes to hydraulic geometry standards for each stream type.	a. Permit diversion activities within the riparian zone where technology is available to maintain water quality standards, sediment threshold limits, and instream flow standards.	Not applicable to the alternatives.
	4. Confine heavy equipment use to areas necessary for mineral extraction.		Not applicable to the alternatives.
	5. Locate mining camps outside the active floodplain.		Not applicable to the alternatives.
	6. Require concurrent monitoring to ensure that mitigative measures are effective and in compliance with State water quality standards.		Not applicable to the alternatives.
Transportation System Management	1. Locate roads and trails outside riparian areas unless alternative routes have been reviewed and rejected as being more environmentally damaging.	a. Do not parallel streams when road location must occur in riparian areas except where absolutely necessary. Cross streams at right angles. Locate crossings at points of low bank slope and firm surfaces.	Although this standard and guideline specifically relates to roads, it has also been reviewed for consistency with the railroad alternatives. The 404(b)(1) showing in the COE application states that the location of the alternatives avoid water bodies and wetlands (including riparian areas) to the extent practicable. The COE had not ruled on the adequacy of the 404(b)(1) showing as the time this report was prepared. Crossings of streams are dictated by grade and curve limitations associated with the railroad design. Consequently, the locations of stream crossings cannot be adjusted to comply with these standards and guidelines. The alternatives would not be consistent with these standards and guidelines.
	2. Create artificial sediment traps with barriers where the natural vegetation is inadequate to protect the waterway or lake from significant accelerated sedimentation.		BMPs that address sediment traps and their use during construction are being developed for the SWPPPs.
	3. Minimize detrimental disturbance to the riparian area by construction activities. Initiate timely and effective rehabilitation of disturbed areas and restore riparian areas so that a vegetation ground cover or suitable substitute protects the soil from erosion and prevents increased sediment yield.		Reclamation requirements will be addressed in the SWPPPs.
Local Road Construction and Reconstruction	1. Design road construction and gravel extraction to protect riparian, aesthetic, and aquatic values, and maintain the integrity of the ecosystem including quantity and quality of water.	a. Build roads in riparian areas and upland areas immediately adjacent to riparian areas only if there is no reasonable alternative. Roads should cross riparian areas and streams as directly as possible. b. Gravel pits shall be rehabilitated to simulate a natural riparian/aquatic situation if permitted in riparian zones. c. Do not build adjacent to streams, within upland areas immediately adjacent to riparian areas, or lake shores unless there are no alternatives and then only if the road will be located a sufficient distance from the water's edge so that sediment entering the water is minimized.	It is anticipated that existing roads would be used to access construction sites on NFS lands on TBNG. However, if it becomes necessary to construct new access roads, DM&E would comply with these standards and guidelines.

Appendix A, Table 11. Railroad Alternative Consistency With Additional Standards and Design Criteria from the Forest Service Watershed Conservation Practices Handbook (FSH 2509.25) that are Applicable to Management Prescription 9A, Emphasis on Riparian Areas Management, Medicine Bow National Forest - Thunder Basin National Grassland

Standard/Design Criteria	Railroad Alternative Consistency
In the water influence zone next to perennial and intermittent streams, lakes, and wetlands, allow only those actions that maintain or improve long-term stream health and riparian ecosystem condition. **(standard)**	Each alternative would cross approximately 4 miles of this management area on TBNG. The alternatives would not be consistent with this standard. Where crossed by the alternatives, riparian ecosystem condition would be degraded from direct and indirect impacts. All activities associated with the alternatives that would occur within wetland or stream portions of the water influence zone on BGNG are regulated by the COE and WDEQ. Regulatory programs implemented by those agencies will assure that no adverse impacts occur to the long-term health of streams. Mitigation pursuant to the COE's 404 permitting program will replace any direct wetland impacts associated with the project. Direct impacts will include the loss of a relatively narrow strip (approximately 200 feet in width) of riparian ecosystem to the railroad track bed. This loss would be most severe where the alternatives have been routed within drainages because of grade. Noise impacts would further degrade the condition/habitat suitability of adjacent riparian areas. There are no regulatory programs that require compensatory mitigation from indirect adverse impacts to riparian ecosystems. DM&E is voluntarily exploring mitigation opportunities to offset these types of impacts.
Allow no action that will cause the long-term change to a lower stream health class in any stream reach. In degraded systems, progress toward robust stream health within the next plan period. **(design criteria)**	All streams which would be crossed by the alternatives on TBNG have been provided a water quality designation by the WDEQ. Through the 401 certification process, the WDEQ must certify to the COE that implementation of the alternatives would not violate state water quality standards. Stipulations can be added to the certification to further protect water quality and aquatic resources. The certification process will assure that the alternatives are consistent with this design criteria.
Allow no action that will cause long-term change away from desired condition in any riparian or wetland vegetation community. In degraded systems, progress toward desired condition within the next plan period. **(design criteria)**	The alternatives would not be consistent with this design criteria. The nature of the railroad requires fill material be placed under the tracks. Where that fill material is added to wetland or riparian communities, the function and value of the vegetative community under the track will cease to exist. This is a relatively narrow impact area (generally less than 200 feet wide). In addition, the COE 404 permitting process will require DM&E to replace lost wetland function and value. Although the local site-specific impact would result in a change in desired condition of wetland and riparian vegetation communities within the construction right-of-way, the overall function and value of wetlands and riparian communities within each basin would be retained in the long-term.
Keep heavy equipment out of streams, swales, and lakes, except to cross at designated points, build crossings, or do restoration work, or if protected by at least 1 foot of packed snow or 2 inches of frozen soil. Keep heavy equipment out of streams during fish spawning, incubation, and emergence period. **(design criteria)**	Construction of the alternatives would comply with this design criteria. Equipment would work in streams only to support construction of railroad stream crossings. No timing restrictions to protect fish spawning, incubation and emergence have been developed for the streams on TBNG which would be crossed by the alternatives. If such timing restrictions are developed by the agencies, DM&E would comply with the restrictions.
Ensure at least one-end log suspension in the water influence zone. Fell trees in a way that protects vegetation in the water influence zone from damage. Keep log landings and skid trails out of water influence zones, including swales. **(design criteria)**	The alternatives would comply with this design criteria. The design criteria would be incorporated into construction plans for the alternatives.
Locate new concentrated-use sites outside the water influence zone if feasible and outside riparian areas and wetlands always. Harden or reclaim existing sites in the water influence zone to prevent detrimental soil and bank erosion. **(design criteria)**	The alternatives would comply with this design criteria. Alternative facilities have been located outside of water influence zones to the extent allowed by railroad design criteria. No facilities (other than tracks) are proposed for wetlands and riparian areas.
Exclude livestock from riparian areas and wetlands that are rated as Not Functioning by the PFC protocol, and where livestock grazing would impede improvement. **(design criteria)**	Not applicable to the alternatives.
Keep stock tanks, salt supplements, and similar features out of the water influence zone if feasible and out of riparian areas and wetlands always. Keep stock driveways out of the water influence zone except to cross at designated points. Harden water gaps and designated stock crossings where needed and feasible. **(design criteria)**	Not applicable to the alternatives.
Remove livestock from riparian areas and wetlands when the average stubble height of Carex species reaches 3-4 inches in spring-use pastures and 4-6 inches in summer/autumn use pastures. **(design criteria)**	Not applicable to the alternatives.
Avoid season-long grazing in riparian areas and wetlands. Apply short-duration grazing as feasible (generally less than 20 days) to provide greater opportunity for regrowth and to avoid utilization of woody species. Avoid livestock grazing, as feasible, during the hot season (mid-to-late summer) when livestock are more likely to concentrate in riparian areas and wetlands and to utilize woody species. **(design criteria)**	Not applicable to the alternatives.
Design grazing systems to limit utilization of woody species. Move livestock from riparian areas and wetlands when they begin to have a preference for woody species, especially plants in the young maturity classes. **(design criteria)**	Not applicable to the alternatives.
Maintain the extent of stable banks in each stream reach at 80 percent or more of reference conditions. Consider degree of livestock trampling on stream banks, by stream type, when timing livestock moves between units. As a general rule, stream banks can receive a maximum of 20-25% alteration and still maintain their integrity. **(design criteria)**	The alternatives would not adversely affect bank stability. BMPs that address bank stability are being developed. In some cases the alternatives would be designed to improve bank stability. The remainder of this design criteria is not applicable to the alternatives.
Adjust management in riparian areas and wetlands to remedy detrimental soil compaction whenever it occurs. **(design criteria)**	Remedying soil compaction would be addressed in the SWPPPs. The alternatives would comply with this design criteria.
Do not excavate earth material from, or store excavated earth material in, any stream, swale, lake, or water influence zone. **(design criteria)**	The alternatives would not be consistent with this design criteria. It would be impossible to construct any of the alternatives without excavating or filling these areas. Mitigation for the loss of these areas would be provided through the COE's 404 permitting process.

Appendix A, Table 11. Railroad Alternative Consistency With Additional Standards and Design Criteria from the Forest Service Watershed Conservation Practices Handbook (FSH 2509.25) that are Applicable to Management Prescription 9A, Emphasis on Riparian Areas Management, Medicine Bow National Forest - Thunder Basin National Grassland

Standard/Design Criteria	Railroad Alternative Consistency
Design and construct all stream crossings and other instream structures to provide for passage of flow and sediment, withstand expected flood flows, and allow free movement on resident aquatic life. **(standard)**	In response to COE permitting requirements, hydrology and hydraulic studies are being conducted for all stream crossings on TBNG. These studies will provide information necessary to correctly size instream structures (i.e., culverts, bridges, etc.) to withstand expected flood flows and allow sediment passage. No structures which would impede movement of aquatic species would be installed. Consequently, the alternatives would comply with this design criteria.
Install stream crossings to meet Corps of Engineers and State permits, pass normal flow, and be hardened to withstand floods as follows: Design Life (years): 1 2 5 10 20 50 Design Flood (years): 10 10 25 50 100 200 **(design criteria)**	The alternatives would comply with this design criteria. Before construction can begin, permits must be secured from the COE which will address the ability of the railroad's proposed instream structures to pass normal flow and floods. General design criteria for all railroad structures is to allow passage of 100 year floods.
Size culverts and bridges to pass debris. Engineers work with hydrologists and aquatic biologists on site design. **(design criteria)**	Culverts will generally be a minimum of 36 inches in diameter. This size was chosen specifically to reduce debris accumulation. Bridges will be designed to address concerns with flood flows. The alternatives would be consistent with this design criteria.
Install stream crossings on straight an resilient stream reaches, as perpendicular to flow as possible, and to provide passage of fish and other aquatic life. **(design criteria)**	The alternatives would not be consistent with this design criteria. Because of design constraints on curves and grade, the alternatives have, in many cases, been routed parallel to drainages. Consequently, some crossings of streams do not occur perpendicular to flow nor at straight or resilient reaches.
Install stream crossings to sustain bankfull dimensions of width, depth, and slope and keep stream beds and banks resilient. Favor hardened fords and bridges on streams with floodplains, and bottomless arches instead of pipe culverts. **(design criteria)**	The alternatives would not be consistent with this design criteria. The design of instream structures proposed by the railroad favors culverts instead of bottomless arches. However, crossings would sustain bankfull dimensions of width, depth and slope.
Conduct actions so that stream pattern, geometry, and habitats are maintained or improved toward robust stream health. **(standard)**	BMPs designed to address these concerns are being developed to support the 404 and 401 permit applications. Generally, these permits would not allow any degradation of overall stream health. The alternatives would be consistent with this design criteria.
Add and remove rocks, wood, or other material in streams or lakes only if such action maintains or improves streams and lake health. Leave rocks and portions of wood that are embedded in beds or banks to prevent channel scour. **(design criteria)**	This design criteria would be incorporated into construction plans for the project. The alternatives would be consistent with this design criteria.
Install fish migration barriers only if needed to protect endangered, threatened, sensitive, or unique native aquatic populations, and only where natural barriers do not exist. **(design criteria)**	No fish migration barriers would be installed.
Do not relocate natural stream channels if avoidable. Return flow to natural channels where feasible. Construct channels and floodways with natural stream pattern and geometry and stable beds and banks. **(design criteria)**	The need for stream channelization is being evaluated in hydrology and hydraulic studies currently being conducted by DM&E. The Forest Service will be provided an opportunity to review and comment on these studies.
Maintain long-term ground cover, soil structure, water budgets, and flow patterns of wetlands to sustain their ecological function, per 404 regulation. **(standard)**	A 404 permit must be issued by the COE before construction of any of the alternatives can begin. The 404 approval would address these design criteria. The alternatives would be consistent with this design criteria.
Keep ground vehicles out of wetlands unless protected by at least 1 foot of packed snow or 2 inches of frozen soil. Do not disrupt water supply or drainage patterns into wetlands. **(design criteria)**	Equipment would be limited to the construction right-of-way and approved access roads. The potential for adversely affecting water supply or drainage patterns into wetlands is being addressed in the COE permit applications. The alternatives would be consistent with this design criteria.
When feasible, keep roads and trails out of wetlands. If roads or trails must enter wetlands, use bridges or raised prisms to diffuse drainage to sustain flow patterns. Set crossing bottoms at natural levels of channel beds and wet meadow surfaces. Avoid actions that may dewater or reduce water budgets in wetlands. **(design criteria)**	Any roads necessary to support construction of the alternatives would avoid wetlands to the extent feasible. If wetlands are disturbed by road construction activities, adequate mitigation would be required before construction approval is granted. The impacts to wetlands would be addressed in the COE 404 permit. The alternatives would be consistent with this design criteria.
Avoid long-term reduction in organic ground cover and organic soil layers in any wetland. **(design criteria)**	This design criteria would be addressed in the COE 404 permitting process. The alternatives would be required to be consistent with this design criteria.
When feasible, keep buried utility and pipelines out of wetlands. If such a line must enter a wetland, use measures that sustain long-term wetland function. **(design criteria)**	Not applicable to the alternatives.
Avoid any loss of rare wetlands such as fens and springs. **(design criteria)**	No fens or springs would be affected on NFS lands on TBNG.
Do not build firelines in or around wetlands unless needed to protect life, property or wetlands. Use hand lines with minimum feasible soil disturbance. Use wetland features as firelines if feasible. **(design criteria)**	Not applicable to the alternatives.
Maintain enough water in perennial streams to sustain existing stream health. Return some water to dewatered perennial streams when needed and feasible. **(standard)**	It may be necessary to dewater construction sites in perennial streams temporarily during construction of instream structures. However, flow downstream of construction sites would be maintained at all times where necessary to protect aquatic resources. The alternatives would be consistent with this standard.

Appendix A, Table 11. Railroad Alternative Consistency With Additional Standards and Design Criteria from the Forest Service Watershed Conservation Practices Handbook (FSH 2509.25) that are Applicable to Management Prescription 9A, Emphasis on Riparian Areas Management, Medicine Bow National Forest - Thunder Basin National Grassland	
Standard/Design Criteria	**Railroad Alternative Consistency**
For existing dams and diversions on naturally perennial streams, obtain bypass flows at the point of diversion or storage that support a healthy, self-sustaining community of aquatic life having all regionally-expected species and population dynamics at permit reissuance. Bypass flows must exceed the native median flow of the lowest winter month for the fall-winter seasons, and the native median flow of the lowest summer month for the spring-summer seasons. **(design criteria)**	Not applicable to the alternatives.
For new dams and diversions, obtain bypass flows at the point of diversion or storage that protect stream processes, aquatic and riparian habitats and communities, and recreation and aesthetic values. Include base flows, and a range of high flows that bracket bankfull discharge, as needed to support these uses. **(design criteria)**	Not applicable to the alternatives.
Obtain instream flow water rights under federal and state law to protect stream processes, aquatic and riparian habitats and communities, and recreation and aesthetic values. Top priority is to protect imperiled native species. **(design criteria)**	Not applicable to the alternatives.
Manage water-use facilities to prevent gully erosion of slopes and to prevent sediment and bank damage of streams. **(standard)**	Not applicable to the alternatives.
Design all ditches, canals, and pipes with at least an 80% chance of passing high flow and remaining stable during their life. **(design criteria)**	Not applicable to the alternatives.
Do not flush or deposit sediment from behind diversion structures into the stream below. Deposit sediment in a designated upland site. **(design criteria)**	Not applicable to the alternatives.
Mitigate water imports so that the extent of stable banks in each receiving stream reach is at least 80 percent of reference conditions. **(design criteria)**	Not applicable to the alternatives.
Limit roads and other disturbed sites to the minimum feasible number, and total length consistent with the purpose of the specific operations, local topography, and climate. **(standard)**	The 404(b)(1) showing demonstrates how disturbance has been minimized to the extent practicable. At the time this report was prepared, the COE had not ruled on the adequacy of the railroad's 404(b)(1) showing.
Construct roads on ridge tops, stable upper slopes, or wide valley terraces if feasible. Stabilize soils onsite. End-haul soil if full-bench construction is used. Avoid slopes steeper than 70 percent. **(design criteria)**	If it is necessary to construct new roads on TBNG to access construction sites, the alternatives would comply with this design criteria.
Avoid soil-disturbing actions during periods of heavy rain or wet soils. Apply travel restriction to protect soil and water. **(design criteria)**	BMPs are being developed to address protection of soils from compaction and rutting. These issues will be addressed in the SWPPPs.
Install cross drains to disperse runoff into filter strips and minimize connected disturbed areas. Make cuts, fills, and road surfaces strongly resistant to erosion between each stream crossing and at least the nearest cross drain. Revegetate using certified local native plants as feasible; avoid persistent of invasive exotic plants. **(design criteria)**	The alternatives would comply with this design criteria. Specific BMPs, being designed for inclusion in the SWPPPs, would address these and other types of erosion control techniques including reclamation.
Where feasible, construct roads with rolling grades instead of ditches or culverts. **(design criteria)**	If it is necessary to construct new roads on TBNG to access construction sites, the alternatives would comply with this design criteria.
Retain stabilizing vegetation on unstable soils. Avoid new roads or heavy equipment use on unstable or highly-erodible soils. **(design criteria)**	If it is necessary to construct new roads on TBNG to access construction sites, the alternatives would comply with this design criteria.
Use existing roads unless other options will produce less long-term sediment. Reconstruct for long-term soil and drainage stability. **(design criteria)**	New road construction would be minimized on NFS lands on TBNG. Access to construction sites would primarily use existing roads. If new roads are required they would be constructed in compliance with the design criteria contained in this handbook.
Avoid ground skidding with blades lowered or on highly erodible slopes steeper than 40%. Conduct logging to disperse runoff as feasible. **(design criteria)**	Not applicable to the alternatives.
Designate, construct, and maintain recreational travelways for proper drainage and harden their stream crossings as needed to control sediment. **(design criteria)**	Not applicable to the alternatives.
Construct roads and other disturbed sites to minimize sediment discharge into streams, lakes, and wetlands. **(standard)**	The alternatives would be consistent with this standard. Sediment control would be addressed in site-specific SWPPPs.
Design all roads, trails, and other soil disturbances to the minimum standard for their use and to "roll" with the terrain as feasible. **(design criteria)**	Design criteria for the railroad limit grade generally to 1 percent or less. The alternatives would not, therefore, roll with the terrain. The alternatives would consist of a series of cuts and fills that level the bed regardless of the rolling nature of the terrain.
Use filter strips, and sediment traps if needed, to keep all sand-sized sediment on land and disconnect disturbed soil from streams, lakes and wetlands. Disperse runoff into filter strips. **(design criteria)**	The alternatives would be consistent with this standard. Sediment control would be addressed in site-specific SWPPPs.
Key sediment traps into the ground. Clean them out when 80% full. Remove sediment to a stable, gentle upland site and revegetate. **(design criteria)**	The alternatives would be consistent with this standard. Sediment control would be addressed in site-specific. Maintenance and inspection of sediment control structures will be a key issue addressed in the SWPPPs.
Keep heavy equipment out of filter strips except to do restoration work or build hardened stream or lake approaches. Yard logs up out of each filter strip with minimum disturbance of ground cover. **(design criteria)**	The alternatives would be consistent with this standard. Sediment control would be addressed in site-specific SWPPPs. The SWPPPs will specifically address interim stabilization during construction.

Appendix A, Table 11. Railroad Alternative Consistency With Additional Standards and Design Criteria from the Forest Service Watershed Conservation Practices Handbook (FSH 2509.25) that are Applicable to Management Prescription 9A, Emphasis on Riparian Areas Management, Medicine Bow National Forest - Thunder Basin National Grassland	
Standard/Design Criteria	**Railroad Alternative Consistency**
Build firelines outside filter strips unless tied into a stream, lake, or wetland as a firebreak with minimal disturbed soil. Retain organic ground cover in filter strips during prescribed fires. **(design criteria)**	Not applicable to the alternatives
Stabilize and maintain roads and other disturbed sites during and after construction to control erosion. **(standard)**	The alternatives would be consistent with this standard. Sediment control would be addressed in site-specific SWPPPs.
Do not encroach fills or introduce soil into stream, swales, lakes or wetlands. **(design criteria)**	The alternatives would not be consistent with this design criteria. It would be necessary to fill certain wetlands and cut others to maintain the design grade requirements and construct the track. Fill may be introduced in and adjacent to streams during construction of crossings.
Properly compact fills and keep woody debris out of them. Revegetate cuts and fills upon final shaping to restore ground cover, using certified local native plants as feasible; avoid persistent or invasive exotic plants. Provide sediment control until erosion control is permanent. **(design criteria)**	The alternatives would be consistent with this standard. Sediment control would be addressed in site-specific SWPPPs
Do not disturb ditches during maintenance unless needed to restore drainage capacity or repair damage. Do not undercut the cut slope. **(design criteria)**	The alternatives would be consistent with this standard.
Space cross drains, from no more than 120 feet in highly erodible soils on steep grades, to no more than 1,000 feet in resistant soils on flat grades. Do not divert water from one stream to another. **(design criteria)**	The alternatives would be consistent with this standard. Water would not be diverted between streams and spacing of cross drains would be addressed in the SWPPPs.
Empty cross drains onto stable slopes that disperse runoff into filter strips. On soils that may gully, armor outlets to disperse runoff. Tighten cross-drain spacing so gullies are not created. **(design criteria)**	The alternatives would be consistent with this standard. Armoring of outlets and methods to repair rills and gullies will be addressed in the SWPPPs. Waterbar spacing will be specified in the SWPPPs.
Harden rolling dips as needed to prevent rutting damage to the function of the rolling dips. Ensure that road maintenance provides stable surfaces and drainage. **(design criteria)**	Not applicable to the alternatives.
Where berms must be used, construct and maintain them to protect the road surface, drainage features, and slope integrity while also providing safety. **(design criteria)**	Not applicable to the alternatives.
Build firelines with rolling grades and minimum downhill convergence. Outslope or backblade, permanently drain, and revegetate firelines immediately after the burn. Use certified local native plants as feasible; avoid persistent or invasive exotic species. **(design criteria)**	Not applicable to the alternatives.
Reclaim roads and other disturbed sites when use ends, as needed, to prevent resource damage. **(standard)**	The alternatives would be consistent with this standard. Reclamation would be addressed in site-specific SWPPPs.
Site-prepare, drain, revegetate, and close temporary any intermittent use roads and other disturbed sites within one year after use ends. Provide stable drainage that disperses runoff into filter strips and maintains stable fills. Do this work concurrently. Use certified local native plants as feasible; avoid persistent or invasive exotic plants. **(design criteria)**	The alternatives would be consistent with this standard. Reclamation would be addressed in site-specific SWPPPs.
Remove all temporary stream crossings (including all fill material in the active channel), restore the channel geometry, and revegetate the channel banks using certified local native plants as feasible; avoid persistent or invasive exotic plants. **(design criteria)**	The alternatives would be consistent with this standard. Reclamation would be addressed in site-specific SWPPPs.
Manage land treatments to limit the sum of severely burned and detrimentally compacted, eroded, and displaced land to no more than 18% of any land unit. **(standard)**	Not applicable to the alternatives.
Restrict roads, landings, skid trails, concentrated-use sites, and similar soil disturbances to designated sites. **(design criteria)**	The alternatives would be consistent with this design criteria.
Operate heavy equipment for land treatments only when soil moisture is below the plastic limit, or protected by at least 1 foot of packed snow or 2 inches of frozen soil. **(design criteria)**	Not applicable to the alternatives.
Conduct prescribed fires when soil, humus, and large fuels are moist. **(design criteria)**	Not applicable to the alternatives.
Maintain and improve long-term levels of organic matter and nutrients on all lands. **(standard)**	The alternatives would not result in a reduction of organic matter or nutrients in soils.
On soils with topsoil thinner than 1 inch, topsoil organic matter less than 2%, or effective rooting depth less than 15 inches, retain 90% or more of the fine (less than 3 inches in diameter) logging slash in the stand after each clearcut and seed-tree harvest, and retain 50% or more of such slash in the stand after each shelterwood and group-selection harvest, considering existing and projected levels of fine slash. **(design criteria)**	Not applicable to the alternatives.
If machine piling of slash is done, conduct piling to leave topsoil in place and to avoid displacing soil into piles or windrows. **(design criteria)**	Not applicable to the alternatives.
Place new sources of chemical and pathogenic pollutants where such pollutants will not reach surfaces or ground water. **(standard)**	The alternatives would be consistent with this design criteria. A SPCC Plan would be developed for the selected alternative. Specific limits on fueling activities within close proximity to water bodies and wetlands would be incorporated into the SPCC Plan.
Put pack and riding stock sites, sanitary sites, and well drill-pads outside the water influence zone. **(design criteria)**	Not applicable to the alternatives.

Appendix A, Table 11. Railroad Alternative Consistency With Additional Standards and Design Criteria from the Forest Service Watershed Conservation Practices Handbook (FSH 2509.25) that are Applicable to Management Prescription 9A, Emphasis on Riparian Areas Management, Medicine Bow National Forest - Thunder Basin National Grassland	
Standard/Design Criteria	**Railroad Alternative Consistency**
Put vehicle service and fuel areas, chemical storage and use areas, and waste dumps and areas on gentle upland sites. Do mixing, loading, and cleaning on gentle upland sites. Dispose of chemicals and containers in State-certified disposal areas. **(design criteria)**	The alternatives would be consistent with this design criteria. An SPCC would be developed for the alternatives. Fuel and construction material storage will be addressed in that plan.
Apply runoff controls to disconnect new pollutant sources from surface and ground water. **(standard)**	Drainage from fuel and material storage sites would be addressed in the SPCC plan. Runoff controls, such as berms, liners, drips, etc., would be used to isolate spilled material from surface and groundwater.
Install contour berms and trenches around vehicle service and refueling areas, chemical storage and use areas, and waste dumps to fully contain spills. Use liners as needed to prevent seepage to ground water. **(design criteria)**	The alternatives would be consistent with this design criteria. Spill containment would be addressed in the SPCC plan.
Reclaim each mine waste dump when its use ends, using certified local native plants as feasible; avoid persistent or invasive exotic plants. Stabilize waste dumps and tailing in non-use periods to prevent wind and water erosion. If non-use will exceed one year, perform concurrent reclamation. **(design criteria)**	Not applicable to the alternatives.
Use lined ponds below waste dumps and tailing to contain all inflow. Build tailings dams with a 95% chance of containing floods over their design life. Permanently stabilize dams at final shaping. **(design criteria)**	Not applicable to the alternatives.
Clean waste water from concrete batching and aggregate operations before returning the water to streams, lakes or wetlands. **(design criteria)**	The alternatives would be consistent with this design criteria.
Inspect chemical equipment daily for leaks. If leaks or spills occur, report them and install emergency traps to contain them and clean them up. **(design criteria)**	The alternatives would be consistent with this design criteria. Inspection requirements would be incorporated into the SPCC plan.
Apply chemicals using methods which minimize risk of entry to surface and ground water. **(standard)**	The only chemical which would be applied is herbicides. Only licensed applicators would be used to apply herbicides. Application would be in strict conformance with federal and state regulations, including considerations necessary to protect ground and surface water. Use of herbicides on NFS lands would be coordinated with the Forest Service.
Favor pesticides with half-lives of 3 months or less. Apply at lowest effective rates as large droplets or pellets. Follow the label. Favor selective treatment. Use only aquatic-labeled chemicals in water influence zones. **(design criteria)**	Forest Service approval of herbicide application on NFS lands would be secured before application in compliance with appropriate regulations.
Use non-toxic, non-hazardous drilling fluids when feasible. **(design criteria)**	Not applicable to the alternatives.

Appendix A, Table 12. Railroad Alternative Consistency With Management Prescription 12A, Surface Mining Development, 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland.			
Management Activity	**General Direction**	**Standards & Guidelines**	**Railroad Alternatives Consistency**
Visual Resource Management	1. Plan reclamation to meet the adopted visual quality objective under the post mining management prescription. Treat background areas to maintain form or pattern of form to reflect natural occurrences in the landscape. Study the size, scale, and shape of existing form and repeat them with the appropriate activity.	a. Do not exceed an adopted visual quality objective (VQO) of modification.	All alternatives would comply with the VQO of modification. Under the modification VQO, management activities may dominate the landscape.
	2. Provide for orderly rehabilitation of areas identified as unacceptable modification. Ensure that areas currently considered as unacceptable modification are upgraded to the Visual Quality Objective of maximum modification and managed under the short term goal of rehabilitation.	a. Rehabilitation should be to the adopted VQO, but not to exceed modification.	All alternatives would comply with the VQO of modification.
	3. Use the following short term goals to accomplish rehabilitation: Reduce the impact of form and/or line by reshaping or visually linking areas to create a more natural appearance. Revegetate, reshape land forms, provide forms in scale with natural forms and modify edges of areas to reduce the impact of form and/or line. Reduce the impact of color or texture changes by revegetation, feathered edges and the elimination of management debris.		This general direction applies to rehabilitation of coal mines and is not applicable to the alternatives.
Dispersed Recreation Management	1. Manage recreation to achieve the inventoried or desired recreation opportunity class. Resolve people/mineral development conflicts in favor of mineral development.	a. Recreation use capacity will be the same as the prescription to be applied after rehabilitation.	Not applicable to the alternatives.
Wildlife Habitat Improvement and Maintenance	1. Rehabilitate habitat disturbed through mining activities.		Not applicable to the alternatives.
	2. When available use spoil piles of rocks to provide habitat for wildlife.		Not applicable to the alternatives.
	3. Where feasible design ridges that provide special habitat for antelope and mule deer. Revegetate with shrub, ponderosa pine, juniper, or herbaceous species depending upon which species are best suited to the site.		Not applicable to the alternatives.
	4. Design drainage to favor vegetation needing more moisture such as sedges rushes and others.		Not applicable to the alternatives.
	5. Prior to mining prepare alternate suitable replacement sites for sage grouse strutting grounds and nesting areas and sharptail grouse dancing grounds and nesting areas.		Not applicable to the alternatives.
	6. Develop a mitigation plan for any golden eagle nests or roosts which may be disturbed by mining activities.		Not applicable to the alternatives.
	7. Establish cottonwoods, green ash, boxelder or other deciduous trees around ponds and wet sites.		Not applicable to the alternatives.
	8. Where feasible design mining reclamation ponds being developed to support a fishery.	a. Where feasible develop ponds with deep areas (14 feet) to prevent winter kill of fish and shallow areas (1-2 feet) where aquatic vegetation such as cattails, bulrush, sedges, rushes and other plants can grow. Stock selected ponds with fish compatible with water chemistry and temperatures.	Not applicable to the alternatives.
Range Improvement and Maintenance	1. Establish and maintain vegetation consisting of a mixture of native species or proven introduced species that will enhance the post-mining management prescription. Accomplish this by planting, maintaining, and manipulating vegetation through mechanical and nonmechanical methods such as herbicide application, prescribed fire, seeding, interseeding, furrowing, terracing, pitting, ripping, etc.		Not applicable to the alternatives.
	2. Construct and maintain fences necessary to control and distribute livestock and protect revegetated areas. Construct and maintain water developments and/or provide water to facilitate desired use of available forage.		Not applicable to the alternatives.
	3. Relocate existing developments to meet the needs of livestock and wildlife during and following mining.		Not applicable to the alternatives.

Appendix A, Table 12. Railroad Alternative Consistency With Management Prescription 12A, Surface Mining Development, 1985 Medicine Bow National Forest Plan - Thunder Basin National Grassland.			
Management Activity	**General Direction**	**Standards & Guidelines**	**Railroad Alternatives Consistency**
Soil Resource Management	1. All topsoil and overburden shall be stripped and stockpiled.		Not applicable to the alternatives.
	2. Assure that severely disturbed lands are returned to an equal or better than original condition. Complete the following practices on all strip mined areas: Stake topsoil stripping depth in the field. Strip, stockpile and reapply topsoil only when soil moisture is below field capacity (1 bar moisture). Stabilize stockpiles to be retained for more than six months. Soil loss will not exceed soil loss tolerance limits.		Not applicable to the alternatives.
Arterial and Collector Road Construction and Reconstruction	1. Construct new access roads to a standard that will accommodate the projected maximum traffic requirements during the 20 year design life.		Not applicable to the alternatives.
	2. Establish ground cover on disturbed areas (excluding the running surface).		Not applicable to the alternatives.

Appendix A, Table 13. Draft Grassland Wide Standards Contained in the Buffalo Gap National Grassland and Thunder Basin National Grassland Proposed Grassland Plans (Forest Service, 1999a and 1999b).	
Grassland Wide Standard and Guidelines	**Railroad Alternative Consistency**
A. Air	
1. Conduct all land management activities in such a manner as to comply with all applicable federal, state, and local air-quality standards and regulations including: Federal Clean Air Act, as amended, 1990 (42 USC 7401-7671); Wyoming Environmental Quality Act (35-11-201 and 35-11-202); and South Dakota Air Pollution Control Program (Title 74, #26). **Standard**	All the alternatives would be required to comply with air quality standards and regulations.
2. Meet requirements of the Prevention of Significant Deterioration (PSD), State Implementation Plans (SIP) and applicable Smoke Management Plans. **Standard**	All the alternatives would be required to comply with PSD regulations and SIPs.
3. Ensure emissions from grassland and forest management activities are within Class I and Class II increments. **Standard**	Impacts to Air Quality Related Values (AQRVs) were evaluated by modeling predicted emissions from the alternatives. Anticipated impacts to AQRVS are provided in the draft EIS for DM&E's project.
B. Water	
1. Manage land treatments to conserve site moisture and to protect long-term stream health from damage by increased runoff. **Standard**	Not applicable to the alternatives.
2. Manage land treatments to maintain enough organic ground cover in each land unit to prevent harmful increased runoff [exceptions may occur in special habitat situations (e.g. prairie dog habitat)]. **Standard**	Not applicable to the alternatives.
3. Allow only those land treatments that maintain or improve long-term stream health in the water-influence zone next to perennial and intermittent streams, lakes and wetlands. **Standard**	Not applicable to the alternatives.
4. Design and construct all stream crossings and other instream structures to pass normal flows, withstand expected flood flows, and allow free movement of resident aquatic life and maintain hydrologic function. **Standard**	Design criteria for the railroad would be consistent with this standard. Hydrology and hydraulic studies are being conducted by DM&E to support COE 404 applications. The results of these studies for streams located on NFS lands will be provided to the Forest Service for review and comment.
5. Conduct actions so that stream pattern, geometry, and habitats are maintained or improved toward robust stream health. **Standard**	The alternatives are not anticipated to result in adverse impacts to stream patterns or geometry on NFS lands. However, some habitat degradation can be expected, particularly on BGNG where Alternatives B and C parallel Spring Creek and where Alternative B parallels the Cheyenne River and Cottonwood Creek. The Phiney Flat Route Variation would eliminate impacts to riparian, wetland and aquatic habitats along Spring Creek from Alternative C.
6. Protect ground cover, soil structure, water budgets and flow patterns in wetlands. **Standard**	Wetlands are primarily protected through the COE's 404 permitting program. Where impacts will occur, mitigation is being designed to replace losses.
7. Maintain enough water in perennial streams to sustain existing stream health. Return some water to de-watered perennial streams when needed and feasible. **Standard**	No long-term impacts to stream flow are expected from implementation of the alternatives. It may be necessary to temporarily dewater in-stream construction sites. However, only temporary impacts are expected and seasonal restrictions would be applied, where appropriate, to protect aquatic resources.
8. Manage water-use facilities to prevent gully erosion of slopes to prevent sediment and bank damage to streams. **Standard**	These potential impacts will be addressed through BMPs designed to minimize sedimentation impacts from the alternatives.
9. Construct roads and other disturbed sites to minimize sediment discharge into streams, lakes and wetlands. **Standard**	These potential impacts will be addressed through BMPs designed to minimize sedimentation impacts from the alternatives.
10. Place new sources of chemicals and pathogenic pollutants where such pollutants will not reach surface or ground water. **Standard**	These issues will be addressed in site-specific SPCC Plans developed for the alternatives.
11. Apply runoff controls to disconnect new pollutant sources from surface and ground water. **Standard**	These issues will be addressed in site-specific SPCC developed for the alternatives.
12. Use methods to apply chemicals that minimize risk of unintended entry to surface and ground water. **Standard**	Herbicides would be applied during operation of the railroad. Herbicide application will conducted by licensed applicators and in compliance with federal, state and local regulations. These regulations specifically address application of herbicides near water resources.
13. Design activities to protect and manage the riparian ecosystem. Maintain the integrity of the ecosystem including quantity and quality of water. **Standard**	Implementation of the alternatives would have an adverse impact on riparian resources on NFS lands. Some riparian habitat would be lost from direct construction activities. In addition, the integrity of the riparian ecosystem would also be affected by noise from the operating railroad. Impacts would be greatest on BGNG. The alternatives would not be consistent with this standard.
14. Locate activities and facilities away from the water's edge or outside the riparian areas, woody draws, wetlands and floodplains unless alternatives have been assessed and determined to be more environmentally damaging. If necessary to locate activities or facilities in these areas, then: • Deposit no waste material (silt, sand, gravel, soil, slash, debris, chemical or other material) below high water lines, in riparian areas, in areas immediately adjacent to riparian areas or in natural drainageways (draws, land surface depressions or other areas where overland flow concentrates and flows directly into streams or lakes). • Prohibit the depositing of soil material in natural drainageways. • Locate the lower edge of disturbed or deposited soil banks outside the active floodplain. • Prohibit stockpiling of topsoil or any other disturbed soil in the active floodplain.	The alternatives would not comply with this standard. It is generally recognized that the location of the railroad is severely restricted by grade. Generally, the only locations in western South Dakota and eastern Wyoming which contain relatively flat grades are along streams. Where possible, the railroad has been routed outside of riparian/wetland areas. The W G Flat and Phiney Flat route variations for Alternative C were developed specifically to significantly reduce impacts to riparian ecosystems although most of the impact reduction would occur on private and state lands. In the near future DM&E will submit to the COE a 404(b)(1) showing as part of the 404 application process. The purpose of that showing is to demonstrate that all practicable alternatives have been applied to reduce impacts to wetlands and waters of the U.S. After review the COE will make a decision regarding the adequacy of DM&E's 404(b)(1) showing. If the COE determines that practicable alternatives exist which are less damaging to wetlands and waters of the U.S., the COE must deny DM&E's application.

Appendix A, Table 13. Draft Grassland Wide Standards Contained in the Buffalo Gap National Grassland and Thunder Basin National Grassland Proposed Grassland Plans (Forest Service, 1999a and 1999b).	
Grassland Wide Standard and Guidelines	**Railroad Alternative Consistency**
• Locate drilling mud pits outside riparian areas, wetlands and floodplains. If location is unavoidable in these areas, seal and dike all pits to prevent leakage. • Rehabilitate gravel pits to simulate a natural riparian/aquatic situation if permitted in riparian zones. • Do not allow new roads to parallel streams when road location must occur in riparian areas except where absolutely necessary. Cross streams at right angles. Locate crossings at points of low bank slope and firm surfaces. **Standard**	
C. Soils	
1. Limit roads and other disturbed sites to the minimum feasible number, width and total length consistent with the purpose of specific operations, local topography and climate. **Standard**	Construction of the railroad would be consistent with this requirement. Only areas necessary for construction of an efficient and safe heavy haul railroad would be disturbed.
2. Stabilize and maintain roads and other disturbed sites during and after construction to control erosion. **Standard**	BMPs are being designed that will address this standard. These BMPs will be incorporated into project-specific SWPPPs, the COE 404 permit applications and other appropriate approvals.
3. Reclaim roads and other disturbed sites when use ends, as needed, to prevent resource damage. **Standard**	Reclamation will be addressed in the BMPs and the SWPPPs.
4. Manage land treatments to limit the sum of severely burned and detrimentally compacted, eroded and displaced land to no more than 15 percent of any land unit. **Standard**	Not applicable to the alternatives.
5. Maintain or improve long-term levels of organic matter and nutrients on all lands. **Standard**	The alternatives would not affect organic matter or nutrients.
6. Prohibit soil-disturbing activities (e.g., road construction, well pad construction) on slopes greater than 40 percent and on soils susceptible to mass failure. **Guideline**	No known slopes in excess of 40 percent or known soils susceptible to mass failure would be disturbed on NFS lands.
D. Geology and Minerals **General**	
1. Require operators to obtain water for mineral operations from private sources, except where: a) private sources are not available; b) water is available from National Forest System land ponds or wells; and c) such use would not significantly conflict with established uses. **Standard**	Not applicable to the alternatives.
2. Prohibit rig stacking and storage of equipment not being used. **Standard**	Not applicable to the alternatives.
3. Allow rock hounding (hunting and collecting rocks and minerals, not including fossils) on National Forest System lands without a permit, (unless specified otherwise in geographic or management area direction) providing the activity does not interfere with existing rights and that specimens are used for personal, non-commercial uses. The maximum amount of collected rocks and minerals per person per day should not exceed 25 pounds, and the total maximum weight in a calendar year per person should not exceed 250 pounds. Permits may be issued, however, for larger amounts. **Guideline**	Not applicable to the alternatives.
Geophysical Operations	
4. Prohibit geophysical operations that cause surface disturbance in Research Natural Areas, Special Interest Areas, American Indian traditional use area, and known National Register eligible sites where there are not suitable mitigation measures. **Standard**	Not applicable to the alternatives.
5. Minimize surface and other resource disturbance from geophysical operations. Do not allow new road construction, unless alternatives have been assessed and determined to be more environmentally damaging. **Guideline**	Not applicable to the alternatives.
6. Allow geophysical operations within developed recreation sites; however, type, timing, seasonal, or location restrictions will be applied to avoid conflicts with recreationists, and to maintain the recreational setting of the developed site. **Guideline**	Not applicable to the alternatives.
Oil and Gas Operations	
7. Promote use of closed circulation systems. Discourage the use of open reserve pits for oil and gas drilling operations. In cases where the use of pits for drilling operations is justified, analyze and monitor construction and use for minimal potential for leakage and structural failure (including pit solidification). **Guideline**	Not applicable to the alternatives.
8. Prohibit the use of production pits. **Standard**	Not applicable to the alternatives.
9. Do not allow field offices unless operator can show that they are essential to production operations. When operator can demonstrate need for such facilities, they will be limited in size and design to serve only those purposes for which they are necessary. **Guideline**	Not applicable to the alternatives.
10. Provide information to the public to identify hydrogen sulfide hazards from oil production. **Guideline**	Not applicable to the alternatives.
Energy and Mineral-Related Special Uses	
11. Minimize disturbance by co-locating roads, pipelines, gathering lines, and power lines for energy resource development. **Guideline**	Not applicable to the alternatives.
12. Authorize commercial produced water disposal wells with a special use permit with appropriate fees for surface use. **Standard**	Not applicable to the alternatives.

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Grassland Wide Standard and Guidelines	**Railroad Alternative Consistency**
Locatable	
13. Authorize occupancy and other building construction for mining purposes on claims only if warranted and justified. Such construction and occupancy will be permitted under an approved plan of operations. **Standard**	Not applicable to the alternatives.
E. Paleontological Resources	
1. Allow collection of paleontological resources with authorization (permit or area designation). **Standard**	Not applicable to the alternatives.
2. Allow collection of on-top-the-surface petrified wood for personal, non-commercial use, without charge but with a free-use permit, or without a permit in designated areas, according to the following stipulations (See 36 CFR 228.62[e]): • No known heritage values, scientific values, or other prohibitive restrictions occur at the site. • The maximum amount of collected petrified wood per person per day does not exceed 25 pounds, and that the total maximum weight in one calendar year per person does not exceed 250 pounds. Permits may be issued, however, to museums, educational institutions and similar groups for larger amounts. **Standard**	Not applicable to the alternatives.
3. Prohibit the commercial collection of fossils. **Standard**	Not applicable to the alternatives.
4. Protect from disturbance or mitigate from disturbance key paleontological resources (Classes 3, 4 and 5 of the Fossil Potential Classification) to conserve scientific, educational, interpretive and legacy values. **Standard**	Alternatives B and C would cross through a paleontological special interest area on TBNG. The Phiney Flat Route Variation would cross through a paleontological special interest area on BGNG. In conformance with this standard, plans are being developed that will mitigate impacts to these sites and conserve scientific, educational, interpretive and legacy values. The mitigation plans would be implemented prior to any construction on NFS lands.
5. Survey and post land boundaries where paleontological sites have Fossil Potential Classification sensitivity ranking of 3, 4 or 5, as funding allows. **Guideline**	Not applicable to the alternatives.
6. Conduct paleontologic surveys prior to ground-disturbing activities. **Standard**	A paleontological survey of the alternatives has been completed for NFS lands. The results of the survey are provided in the draft EIS.
BIOLOGICAL RESOURCES **F. Fish, Wildlife and Rare Plants Animal Damage Control**	
1. Require mitigation measures to protect National Forest System resources when animal damage control activities are conducted by other governmental entities. Emphasize public safety; threatened, endangered, and sensitive species conservation; water quality protection; or other resource values. **Standard**	Not applicable to the alternatives.
2. Prohibit pesticide spraying where it would have adverse effects on species at risk, species of concern, or on the food base of insectivorous birds or other wildlife. **Guideline**	During operations, herbicides would be applied to the track. The application would be coordinated with the Forest Service to assure that concerns identified in this guideline are addressed.
3. Do not allow pesticide use for grasshopper control where outbreaks are due to livestock management problems. Allow baiting where chronic hotspots cannot be corrected through livestock grazing strategies and where consistent with other resource objectives. **Guideline**	Not applicable to the alternatives.
4. Maintain habitat improvements, such as tree and shrub plantings and wetland exclosures, that are effectively meeting fish and wildlife objectives. **Guideline**	Habitat improvement would not be affected by the alternatives.
Raptors	
5. Protect all raptor nests (including owl nests) unless known to be inactive for at least the last 5 years. Base the extent of the protection on proposed management activities, human activities existing before nest establishment, species, topography, vegetation cover, and other factors. **Standard**	The alternatives would not be consistent with this requirement. Raptor surveys have shown that there are a number of raptor nests in relatively close proximity to the alternatives. Some of these nests are located on NFS lands. Operation of the railroad is expected to make some of these nesting sites unusable in the future, particularly those used by sensitive species such as ferruginous hawks, and the occupants will be required to find other suitable nesting habitat away from the railroad.
Management direction for selected raptor species is as follows: ***Bald Eagle***	
6. If a winter roost area or nest site is discovered, ensure that the necessary habitat components are maintained, including maintenance and regeneration of woodlands. **Standard**	No direct impacts to woodlands supporting bald eagle winter roosts or nest sites would occur on NFS lands.
7. Prohibit human activities within 1 mile of bald eagle winter roosting areas from November 15 through February if disturbance could cause an adverse effect. These activities would typically include ground-disturbing construction (i.e., range developments, trail or road construction, etc.), seismic surveys, or other activities resulting in high human density and/or noise. **Standard**	A winter roost has been identified within 1 mile of the alternatives on TBNG. However, activity levels are the roost sites are not well known. The alternatives would not comply with this standard as it would not be economically feasible to restrict operation of the railroad from November 15 through February. A seasonal restriction on construction could be imposed which would reduce impacts during the construction phase.
8. Prohibit human activities within 1 mile of a bald eagle nest from February 1 through July 31 if disturbance could cause nest abandonment or failure. This includes the construction of support facilities for existing developments. **Standard**	No bald eagle nests have been identified within 1 mile of the alternatives on NFS lands.

Appendix A, Table 13. Draft Grassland Wide Standards Contained in the Buffalo Gap National Grassland and Thunder Basin National Grassland Proposed Grassland Plans (Forest Service, 1999a and 1999b).	
Grassland Wide Standard and Guidelines	**Railroad Alternative Consistency**
Peregrine Falcon	
9. If a nest site is discovered, ensure that necessary habitat components are maintained. **Standard**	No peregrine falcon nests have been identified within 1 mile of the alternatives on NFS lands.
10. Prohibit human activities within 1 mile of an peregrine falcon nest from February 1 through July 31 if the disturbance could cause nest abandonment or failure. These activities would typically include ground-disturbing construction (i.e., range developments, trail or road construction, etc.), seismic surveys, or other activities resulting in high human density and/or noise. This includes the construction of support facilities for existing developments. **Standard**	No peregrine falcon nests have been identified within 1 mile of the alternatives on NFS lands.
Ferruginous Hawk	
11. Prohibit human activities within 1 mile of an ferruginous hawk nest from March 1 through July 31 if disturbance would likely cause nest abandonment or failure. These activities would typically include ground-disturbing construction (i.e., range developments, trail or road construction, etc.), seismic surveys, or other activities resulting in high human density and/or noise. This includes the construction of support facilities for existing developments. **Standard**	Raptor surveys have identified ferruginous hawk nests within 1 mile of the alternatives on NFS lands. The alternatives would not comply with this standard as it would not be economically feasible to restrict operation of the railroad from March 1 through July 31. A seasonal restriction on construction could be imposed which would reduce impacts during the construction phase.
Merlin	
12. Prohibit human activities within ½ mile of a merlin nest from March 15 through July 15 if disturbances would likely cause nest abandonment or failure. These activities would typically include ground-disturbing construction, seismic surveys, or other activities resulting in high human density and/or noise. This includes the construction of support facilities for existing developments. **Standard**	Although raptor nest surveys did not identify any merlin nests, it should not be assumed that nests are not located within 0.5 miles of the alternatives. These nests are often difficult to locate. Like other raptor species discussed above, if merlins are nesting in close proximity to the operating railroad, the nest sites may become unsuitable requiring the occupants to select potentially less suitable nesting sites.
13. Do not construct or place structures or facilities within 1/4 mile of a nest if it would likely result in degradation of nesting habitat, nest abandonment or failure. **Standard**	See above.
Burrowing Owls	
14. Prohibit human activities within 1/4 mile of a burrowing owl nest from May 1 through July 31 if disturbance would likely cause habitat degradation, nest abandonment or failure. These activities would typically include ground-disturbing construction, seismographic surveys, or other activities resulting in high human density and/or noise. This includes the construction of support facilities for existing developments. **Standard**	Although burrowing owl surveys have not been completed, they are likely occupants of prairie dog towns and similar suitable habitat that would be crossed by the alternatives. Like other raptors discussed above, it would not be economically feasible to restrict operation of the railroad from May 1 through July 31 to avoid nesting season. Consequently, some nesting areas may become unsuitable and the alternatives would not be consistent with this standard.
15. Do not construct or place structures or facilities within 1/8 mile of a nest if it would likely result in degradation of nesting habitat, nest abandonment or failure. **Standard**	Same as above.
Bald Eagle, Peregrine Falcon, Goshawk, Ferruginous Hawk, Prairie Falcon, Swainson's Hawk, Golden Eagle	
16. Do not construct or place structures or facilities within ½ mile of a nest if it would likely result in degradation of nesting habitat, nest abandonment or nest failure. **Standard**	The alternatives would not be consistent with this standard. See discussion above.
Wetlands	
17. Manage natural and constructed wetland basins for a diversity of wetland plant communities and wetland-dependent wildlife species by providing a mosaic of shoreline and emergent vegetation conditions across the landscape consistent with geographic area vegetation direction. **Guideline**	Although wetlands would be impacted during construction of the alternatives, they will be replaced. Please refer to the COE 404 permit application filed by the applicant for more details regarding how loss of wetland function and value will be replaced.
Upland Game Birds and Waterfowl	
19. In areas where tall, dense nesting cover is desired for upland game birds, waterfowl and other ground-nesting birds, provide adequate residual cover by carrying over grass from previous growing season into spring. Criteria for helping determine where to provide quality residual nesting cover follows: • Presence of moderate to highly productive range sites, • Proximity to prairie grouse display grounds, • Proximity to cooperative waterfowl/wetland development projects and other major wetland complexes, • Proximity to private croplands and other winter foraging habitat. **Guideline**	Not applicable to the alternatives.
20. Permit haying and mowing only where desired vegetation conditions are being met. Haying and mowing on National Forest System lands should be delayed until July 15 or later to protect ground-nesting birds. **Guideline**	Not applicable to the alternatives.
21. Delay livestock turn-on dates until June 15 or later in areas grazed in the previous grazing season to provide quality nesting cover for upland game birds. **Guideline**	Not applicable to the alternatives.

Appendix A, Table 13. Draft Grassland Wide Standards Contained in the Buffalo Gap National Grassland and Thunder Basin National Grassland Proposed Grassland Plans (Forest Service, 1999a and 1999b).	
Grassland Wide Standard and Guidelines	**Railroad Alternative Consistency**
22. Prohibit human activities within 1 mile of a sharp-tailed grouse display ground from March 15 through May 15 if disturbance would likely cause abandonment of display grounds. These activities would typically include ground-disturbing construction (i.e., range developments, trail or road construction, etc.), seismic surveys, or other activities resulting in high human density and/or noise. This includes the construction of support facilities for existing developments. **Guideline**	Sharp-tailed grouse display grounds have been identified within 1 mile of the alternatives on NFS lands. As with raptor nests, it would not be possible to operate the railroad in such a manner that restricts noise impacts on these display grounds between March 15 and May 15. The alternatives would not be consistent with this guideline.
23. Do not construct or place structures or facilities within 1/4 mile of a sharp-tailed grouse display ground if it would likely cause abandonment of the display ground. **Guideline**	No display grounds are currently known to occur within 0.25 miles of the alternatives.
Big Game	
24. Provide adequate cover to maintain screening, through time, along roads where timber management activities are taking place so as to minimize disturbance of deer and elk. **Guideline**	Not applicable to the alternatives.
25. Promote thick and brushy understories and midstories in prairie woodlands where quality deer fawning habitat is desired. **Guideline**	Not applicable to the alternatives.
26. Design and build structures, such as roads and canals, so that they do not create unreasonable or unnecessary movement barriers or hazards for big game and other wildlife. **Guideline**	The railroad will constitute a barrier to big game movement. DM&E is currently working with the WGFD and SDGFP to develop a mitigation plan to address the impacts associated with restricted big game movement across the tracks.
Bighorn Sheep	
27. Prevent interaction between bighorn sheep and domestic sheep and goats on National Forest System lands. **Guideline**	Not applicable to the alternatives.
28. Restrict new developments, including new facilities, roads and trails, and concentrations of human activities within a 1-mile sight distance of bighorn sheep lambing area areas if they would adversely impact production. Restrictions on activities may be required during lambing season (April 1 through June 15). Dates for restrictions may vary because of climatic conditions. **Guideline**	Not applicable to the alternatives.
Fisheries	
29. Where feasible, design water impoundments to provide quality recreational fisheries and/or waterfowl habitats. **Guideline**	Not applicable to the alternatives.
30. no content	Not applicable to the alternatives.
Species at Risk and Species of Concern	
Swift Fox	
31. Prohibit the use of M-44s (sodium cyanide) on National Forest System lands for predator control in active swift fox habitat. **Standard**	Not applicable to the alternatives.
32. Work with Animal and Plant Health Inspection Service and state agencies to prohibit the use of leg-hold traps without pan-tension devices for predator control and fur harvest in active swift fox habitat on National Forest System lands. **Guideline**	Not applicable to the alternatives.
33. Prohibit human activities within 1/4 mile of swift fox dens from March 1 through July 30 if they would likely cause den abandonment or displacement of fox from the local area. These activities would typically include ground disturbing construction (i.e., range developments, trail or road construction, etc.), seismic surveys, or other activities resulting in high human density and/or noise. This includes the construction of support facilities for existing developments. **Guideline**	Future surveys will be necessary to identify swift fox dens in close proximity to the railroad. However, it will not be possible to restrict railroad operations within the specified dates. Some abandonment/displacement may occur if den sites are located in close proximity to the alternatives.
Sage Grouse and sagebrush/greasewood plant communities	
34. Prohibit human activities within 2 miles of sage grouse display grounds from March 1 through June 15 if they would likely cause disruption of breeding or abandonment of display grounds. These activities would typically include ground-disturbing construction (i.e., range developments, trail or road construction, etc.), seismic surveys, or other activities resulting in high human density and/or noise. This includes the construction of support facilities for existing developments. **Standard**	The alternatives would not be consistent with this standard. There are numerous sage grouse leks within 2 miles of the alternatives on NFS lands. It will not be possible to restrict operation of the railroad within 2 miles of the leks during the specified period. Some adverse impacts to leks, including possible abandonment, are expected.
35. Prohibit construction or placement of structures or facilities within 1/4 mile of a sage grouse display ground if they are likely to cause disruption of breeding or abandonment of the display ground. **Standard**	There are a number of leks on NFS lands within 0.25 miles of the alternatives. The alternatives would not be consistent with this requirement. Rerouting the alternatives to avoid these lek buffers would not be possible without adversely affecting the operating grade of the railroad.
36. Prohibit sagebrush spraying or prescribed burning in any areas known to support wintering or nesting populations of sage grouse. Areas of taller sagebrush (16-32 inches, 20-40percent cover) are usually preferred for nesting. **Guideline**	Not applicable to the alternatives.
37. Prohibit sagebrush spraying or prescribed burning in areas with less than 15 percent sage crown cover (800-1000 plants per acre of 8-24 inch height). **Guideline**	Not applicable to the alternatives.

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Grassland Wide Standard and Guidelines	**Railroad Alternative Consistency**
38. Apply any sagebrush spraying or prescribed burning in irregular patterns in order to fit the terrain and to leave buffer strips against meadows, stream courses and timber. It is often desirable to leave untreated sagebrush patches at swales and ridges, rock outcroppings and watering sites. **Guideline**	Not applicable to the alternatives.
39. In areas with a significant sage grouse population, prohibit sagebrush spraying or prescribed burning within 100 yards of meadow edges, along cover routes that lead to important meadow areas, or within 1/4 mile of the perimeter of areas used for strutting or nesting. **Guideline**	Not applicable to the alternatives.
40. Manage for sagebrush/greasewood stands of 250 acres or more. When spraying or burning within these stands, treat no more than 80 acre blocks of sagebrush in areas of significant sage grouse use, unless on-site investigations determine that treatment of larger areas will not be detrimental to sage grouse populations or habitat. **Guideline**	Not applicable to the alternatives.
40a. Maintain between 15% - 40% live shrub canopy cover in areas of significant sage grouse use or where sage grouse habitat is desired, except on burned or sprayed sagebrush/greasewood stands. **Guideline**	Not applicable to the alternatives.
41. Encourage re-establishment of sagebrush in areas where sagebrush habitat is desired. Include some combination of legume and composite species for sage grouse in seeding projects. **Guideline**	Not applicable to the alternatives.
41a. Within sagebrush and greasewood stands, maintain a minimum of 20% residual herbaceous canopy cover. This canopy cover should be composed of native perennial grasses and native forbs. **Guideline**	Not applicable to the alternatives.
42. Within the overall vegetation objectives, promote optimum vegetation composition and structure in sagebrush and wet meadow habitats within 2 miles of sage grouse display grounds and, where desired, in other potential sage grouse nesting and brooding habitat using the following standards and guidelines: a) Maintain small openings within sagebrush/greasewood stands at a maximum ratio of 1acre of opening (usually grass/forb) to 3 acres of shrub. **Guideline** b) Delay grazing from the beginning of the growing season until July 15th, unless the average height of desirable herbaceous vegetation exceeds 7 inches. Grazing should not reduce the average height below 7 inches until after July 15th. **Standard** c) Maintain 60% or more of the potential herbaceous cover within the sagebrush/greasewood stands into the next growing season or maintain high herbaceous structure. **Standard**	Not applicable to the alternatives.
43 - 46. no content	Not applicable to the alternatives.
Mountain Plover	
47. Prohibit human activities within a mountain plover use area, rookery, or 1/4 mile of mountain plover nests from March 1 through July 31 if disturbance would likely cause nest abandonment or failure. **Standard**	It is anticipated that the mountain plover will be listed as a federally-threatened species before construction of the railroad is complete. Potential impacts to this species and appropriate mitigation measures are incorporated into the biological assessment for the project. The USFWS will have to concur with mitigation plans for this species.
48. Do not poison prairie dogs within ½ mile of nests or nesting areas found during the last 5 years in prairie dog colonies. **Standard**	Not applicable to the alternatives.
Black-tailed Prairie Dog Colonies	
49. Limit rodenticide use from October 1 through December 31 to reduce risks to migratory birds and other wildlife species. **Standard**	Not applicable to the alternatives.
50. Prohibit use of burrow fumigants. **Standard**	Not applicable to the alternatives.
51. For areas other than Management Area 3.63, limit the use of rodenticides to one or more of the following situations: • Human health and safety risks occur in the immediate area. • Prairie dog colonies occur on isolated National Forest System tracts less than 3,000 acres unless adjacent landowners do not object to additional colonization or biophysical features constrain additional colonization. • Unwanted colonization on adjoining lands is occurring and the most likely source of prairie dogs appears to be colonies located along the property boundary on National Forest System lands. **Guideline**	Not applicable to the alternatives.
52. Regulate shooting in prairie dog colonies from March 1 through July 31 where significant risks have been identified for species at risk or species of concern or where shooting is preventing or slowing a desired prairie dog population expansion. Dates of restrictions may vary for different wildlife species needing protection. Coordinate and consult with the appropriate state wildlife agency prior to implementation of shooting restrictions. **Guideline**	Not applicable to the alternatives.
53. Emphasize the use of vegetation management and other non-chemical methods in managing for desired levels of colony growth and establishment. **Guideline**	Not applicable to the alternatives.
54. Re-evaluate prairie dog management if the total acreage of active prairie dog colonies expands to the following levels: Great Plains Dry Steppe Province Units (5% of potential prairie dog habitat) Thunder Basin National Grassland 24,000 acres. **Standard**	Not applicable to the alternatives.

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Grassland Wide Standard and Guidelines	**Railroad Alternative Consistency**
Cavity-Nesting Species	
55. To conserve habitat for at-risk cavity-nesting species, prohibit harvest of dead trees greater than 10 inch diameter in riparian areas and in other prairie woodlands. **Guideline**	The alternatives would not comply with this guideline. All trees in the construction right-of-way would be cleared.
Bats	
56. Minimize human disturbance to protect the microhabitats and the dependent species at caves, mines, riparian, wetland and other occupied habitats where bat populations or other cave-dependent species have been documented. When closing mines or caves in the course of establishing resource protection or in response to safety concerns, minimize disturbance to resident or seasonal bat or other cave-dependent species populations. Provide access to bats and other species endemic to the cave or mine and maintain microclimate conditions important to those species. Where bat concentrations are located outside of caves or mines, manage human disturbance to protect those populations. Retain large living or dead cottonwood trees (and/or other large tree species) in riparian areas as important roosting habitat for bats. **Guideline**	Important bat habitat has not been identified in the vicinity of the alternatives.
DISTURBANCE PROCESSES **G. Fire** **Fire Suppression**	
1. Develop an Appropriate Management Response (AMR) for each management area outlined in the Fire Management Plan for each forest and national grassland. Until the AMR is developed, protect life, property, and resource values from wildfire in a cost-efficient manner that maximizes the benefits of shared resources and developing technologies. **Guideline**	Not applicable to the alternatives.
2. Minimize impacts to paleontological and heritage resources, streams, stream banks, shorelines, lakes and associated vegetation, and key threatened and endangered species habitat from wildfire suppression efforts in the following ways: • Prohibit the use of earth-moving equipment on known paleontological or heritage sites. • Discourage the application of fire-retardant chemicals over riparian areas, wetlands and open water. • Prior to using earth-moving equipment, consult appropriate specialists for guidance. **Guideline**	Not applicable to the alternatives.
3. Encourage the use of minimum impact suppression tactics. **Guideline**	Not applicable to the alternatives.
Fuel Treatment	
4. Use the Fire Protection Assessment (FPA) (to be developed) for purposes of identifying and prioritizing fire management program activities. **Guideline**	Not applicable to the alternatives.
5. Reduce the threat of wildfire to public and private developments by following standards in the National Fire Protection Association Publication 299, Protection of Life and Property from Wildfire, and reduce the fuel loading to acceptable standards. **Guideline**	Not applicable to the alternatives.
H. Insects and Diseases	
1. Manage insects and diseases using integrated pest management techniques. Treatment activities will be based on risks to human health and the value of and risks to wildlife habitat, adjacent lands, public lands and other resources. Priority should be given to areas where values to be protected exceed the cost of protection. **Guideline**	Not applicable to the alternatives.
2. Set priorities for controlling insects and disease based on the following:· Prevent the introduction of new invaders;· Conduct early treatment of new infestations;· Contain and control established infestations. **Guideline**	Not applicable to the alternatives.
3. Set priorities for the treatment of insects and disease based on the following: • Rate of spread of the species; • Invasions within special management areas, such as Research Natural Areas and Wildernesses, activity corridors, and high use areas; • Probability of successful treatment(s) in meeting desired conditions. **Guideline**	Not applicable to the alternatives.
I. Livestock Grazing	
1. Allow permitted bison grazing. Require amendments to grazing agreements to allow a change of class of livestock to include bison. Evaluate bison grazing to include the following criteria: associated health issues; fence requirements; handling facilities; and human safety. **Standard**	Not applicable to the alternatives.
2. Cooperate with states in ensuring healthy livestock (including bison), such as testing for diseases (e.g., Brucellosis) and vaccinating for other diseases prior to placement on public lands. **Standard**	Not applicable to the alternatives.
3. Implement adaptive management guidelines for droughts to attain desired conditions and to meet management objectives (See Appendix D). **Guideline**	Not applicable to the alternatives.

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Grassland Wide Standard and Guidelines	**Railroad Alternative Consistency**
4. Adjust management to account for other natural disturbance processes, such as fire, flood and grasshoppers. **Guideline**	Not applicable to the alternatives.
5. Manage livestock grazing in riparian/woody draw areas that maintain or improve these habitats. The following practices should be implemented: **Guideline** • Avoid season-long grazing in riparian/woody draw areas. • Avoid activities, such as feeding, salting, herding, or watering, that concentrate livestock into riparian/woody draw areas. • Control the timing, duration, and intensity of grazing in riparian areas to promote establishment and development of woody species, based on local growing conditions. • Exclude livestock from riparian areas that are "Not Functioning" (as rated by the Proper Functioning Condition protocol) due to livestock impacts and where improvement is likely to occur without livestock grazing. • Prioritize the removal or relocation of fences or water developments that adversely affect riparian/woody draw areas.	Not applicable to the alternatives.
6. Meet rest requirements based on the following (but not limited to): • Where high structure is required for habitat for unique plant and animal communities and management indicator species (MIS); • Where increased fuel loads are desired for prescribed burning; or • Where ungrazed areas are desired for monitoring potential vegetation or for research needs; or • Where ungrazed areas are desired for biological diversity. **Guideline**	Not applicable to the alternatives.
7. As a minimum, when allotment management plans are revised, adjust animal unit equivalents to account for the variations in live weight of livestock. **Guideline**	Not applicable to the alternatives.
8. Discourage the use of guard dogs for livestock protection where conflicts with other public users are likely. **Guideline**	Not applicable to the alternatives.
9. Prohibit domestic sheep lambing on National Forest System lands when conflicts with other public uses may occur. **Guideline**	Not applicable to the alternatives.
10. Prohibit feed storage or regular and routine winter feeding of domestic livestock. **Guideline**	Not applicable to the alternatives.
11. Prohibit livestock grazing in developed recreation sites unless it can be accommodated before or after the recreation-use season and unless it enhances the management of the site. **Guideline**	Not applicable to the alternatives.
12. Prioritize for removal any fences or water developments where secondary range or high structure is desired. **Guideline**	Not applicable to the alternatives.
J. Noxious and Undesirable Plant Species	
1. Once appropriate consultation with state agencies has taken place, allow only noxious weed-free products for feed or revegetation projects. This includes certified, heat-treated, or other appropriately processed products. **Standard**	Not applicable to the alternatives.
2. Use genetically local (at the sub-section level) native plant species in revegetation efforts where technically and economically feasible. To prevent soil erosion, non-native annuals or sterile perennial species may be used while native perennials are becoming established. **Guideline**	This guideline will be addressed in the BMPs and SWPPPs for the project.
3. Manage noxious and undesirable plant species using integrated management techniques, including chemical, biological, and mechanical control. **Guideline**	DM&E would coordinate management of noxious and undesirable plant species on NFS lands with the Forest Service.
4. To prevent the spread of noxious weeds and undesirable plant species, include necessary provisions in contracts and permits for use of National Forest System lands and resources. **Standard**	Appropriate conditions of approval will be incorporated into Forest Service project approvals.
5. Set priorities for controlling noxious weeds based on the following: • Prevent the introduction of new invaders; • Conduct early treatment of new infestations; • Contain and control established infestations. **Guideline**	Not applicable to the alternatives.
6. Set priorities for the treatment of noxious weeds based on the following: • Rate of spread of the species; • Invasions within special management areas, such as Research Natural Areas and Wildernesses, activity corridors, and high use; • Probability of successful treatment(s). **Guideline**	Not applicable to the alternatives.
7. Allow haying only where noxious weeds are either not present or are pre-treated to prevent seeding, unless needed as a method to control noxious weeds. If used as a control method, ensure proper disposal of the hay. **Guideline**	Not applicable to the alternatives.

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Grassland Wide Standard and Guidelines	**Railroad Alternative Consistency**
MANAGED RECREATION **K. Recreation** **General**	
1. Protect instream flows at special recreation features. Use the following categories to rank streams and stream reaches based on the recreation features and values described: • High priority features: scenic areas and overlooks, visitor centers, canoeing areas, scenic byways, native threatened, endangered, and sensitive species, rivers designated under the Wild and Scenic Rivers Act, Wilderness water resources under threat of degradation, and similar features where flowing water is critical to a quality recreational experience. • Moderate priority features: recreation areas, including roads, trails, campgrounds and picnic grounds next to streams where flowing water contributes to a quality recreational experience and to aesthetic values. **Standard**	Not applicable to the alternatives.
2. Manage activities to be consistent with the adopted Recreation Opportunity Spectrum class. **Guideline**	Not applicable to the alternatives.
3. Manage recreational use to stay within the capacity for the Recreation Opportunity Spectrum (ROS) objective (Table 1-1). **Guideline** Recreation Opportunity Spectrum (ROS) Objective Table 1-1 **ROS Class/Capacity Range Low Moderate** **Primitive** On trails - PAOT/mile 1.0 2.0Areawide - PAOT/M acres 2.0 7.0 **Semi-Primitive Non-motorized** On Trails - PAOT/mile 3.0 9.0Areawide - PAOT/M acres 8.0 50.0 **Semi-Primitive Motorized** On Trails - PAOT/mile 3.0 9.0Areawide - PAOT/M acres 8.0 10.0 **Roaded Natural** On Trails - PAOT/mile 3.0 9.0Areawide - PAOT/M acres 80.0 1200.0 **Rural** On Trails - PAOT/mile 3.0 9.0Areawide - PAOT/M acres 800.0 5000.0 **NOTES:** LOW applies to flat and gentle topography MODERATE applies to rolling, dissected topography, grass and pole-size and mature ponderosa pine. PAOT = Persons at one time.	Not applicable to the alternatives.
4. Close, rehabilitate, or mitigate sites when dispersed campsite conditions are such that either widespread bare mineral soil is exposed or soil erosion is obvious (Frissel-Cole Class 4),as funding allows. **Guideline**	Not applicable to the alternatives.
Developed Recreation Sites	
5. When planting native trees, shrubs and ground cover, use species known to be compatible with the site and site uses. **Guideline**	Not applicable to the alternatives.
6. Reduce the threat of wildfire and the risk of damage to recreational facilities according to the standards found in the National Fire Protective Association's Publication 299, "Protection of Life and Property from Wildfire." **Guideline**	Not applicable to the alternatives.
7. Treat noxious weeds when there will be the least impact to the general public. **Guideline**	Not applicable to the alternatives.
8. Where needed to meet user needs or to protect resources, consider providing hardened sites. **Guideline**	Not applicable to the alternatives.
9. Close facilities if public safety or sanitation cannot be provided. **Standard**	Not applicable to the alternatives.
10. Consider closing facilities if operation of the site is not deemed to be comparatively cost effective. **Guideline**	Not applicable to the alternatives.
11. Design recreational facilities to blend with the elements found in the natural landscape. **Guideline**	Not applicable to the alternatives.
12. Use standard design of facilities when constructing or reconstructing recreation sites. **Guideline**	Not applicable to the alternatives.
13. Make facilities at trailheads or along trails consistent with the Recreation Opportunity Setting and provide for parking, trail information and appropriate sanitation facilities, as needed. **Guideline**	Not applicable to the alternatives.
14. Allow oil and gas leasing within developed recreation sites; however, no ground-disturbing oil and gas activities are permitted. **Standard**	Not applicable to the alternatives.
Outfitters and Guides	
15. Consider the following criteria before making a decision to issue an outfitting and guiding service permit: • Recreation analysis identifies additional recreational opportunities that can be utilized by the public if outfitter and guide services become available. • There will not be significant conflict with other permitted outfitters and guides as a result of the activities associated with the permit. • The issuance of the permit will not result in greater restrictions on the non-outfitted public to use and enjoy the national forests or national grasslands.	Not applicable to the alternatives.

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Grassland Wide Standard and Guidelines	**Railroad Alternative Consistency**
• Other resource considerations, including the biological needs of wildlife, are considered and found compatible with the proposed action. • Private land is unavailable to accommodate the type of recreational use proposed by the applicant. • The inability of the public to utilize the recreational opportunities on National Forest System lands is not a result of access problems brought about by the action of the applicant or his or her collaborator. • The permit furthers national grassland and forest goals. **Guideline**	
16. Require all outfitters and guides conducting activities with high risk or frequency of serious injury, such as snowmobiling or all-terrain vehicle use, to have a valid advanced first aid certification or equivalent, approved qualifications. **Standard**	Not applicable to the alternatives.
L. Scenery Management	
1. Manage activities to be consistent with the scenic integrity objective(s), as referenced by the Adopted Scenic Integrity Objective map. **Guideline**	The alternatives would cross a range of SIL classes. Alternatives B and C would both cross areas designated in the draft grassland plans as high SIL class. Management objectives are based on retention. This level refers to landscapes where the valued landscape character appears intact. Deviations may be present but must repeat the form, line, color, texture and pattern common to the landscape character so completely and at such scale that they are not evident. Alternatives B and C would be inconsistent with this SIL class. All the alternatives would cross areas with a moderate SIL class. This level refers to landscapes where the valued landscape character appears slightly altered. Management objectives are based on partial retention. Noticeable deviations must remain visually subordinate to the landscape character being viewed. As was discussed previously, the operating railroad is not expected to subordinate to the natural landscape, especially in the foreground and middleground. The majority of the NFS lands that would be crossed by the alternatives are designated as low SIL class. The management objective for this SIL class is modification. This level refers to landscapes where the valued landscape character appears moderately altered. Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, vegetative type changes or architectural styles outside the landscape being viewed. They should not only appear as valued character outside the landscape being viewed but compatible or complimentary to the character within. The alternatives would be consistent with this SIL class.
2. Meet the scenic integrity objectives of high and moderate within 1 year after completion of a project. Meet low scenic integrity objective within 3 years after completion of a project. **Guideline**	Not applicable to the alternatives.
3. Rehabilitate all existing projects and areas that do not meet the scenic integrity objective specified for the management area. Consider the following when setting priorities for rehabilitation: • Relative importance of the area and the amount of deviation from the scenic integrity objectives. • Length of time it will take natural processes to reduce the visual impacts so that they meet the scenic integrity objective. • Length of time it will take rehabilitation measures to meet scenic integrity objectives. • Benefits to other resource management objectives to accomplish rehabilitation. **Guideline**	Not applicable to the alternatives.
ADMINISTRATION **M. Land Ownership**	
1. Consider the following when opportunities to acquire lands occur: • Lands with important or unique resources, such as water frontage, wetlands, flood plains and associated riparian ecosystems, cave resources, essential big-game winter range, threatened or endangered species habitat, Forest Service sensitive species habitat, important paleontological or geologic sites, important historical, heritage resources or traditional cultural properties, outstanding scenic values, or critical ecosystems when these resources are threatened by change of use, or when management may be enhanced by public ownership; • Lands that include prairie dog colonies or that present opportunities to allow expansion of colonies that already exist on nearby National Forest System lands are a high priority. • Important botanical, wildlife and fishery management areas. This includes lands supporting rare plant communities.· Lands with important value for outdoor recreation purposes. • Lands needed to protect resource values by eliminating or reducing fire risks or soil erosion. • Non-federal lands in mineralized areas that have low potential for future mineralized patents, and where the minerals will be donated to the United States. • Reduction of Forest Service administrative costs and improvement of management efficiency. This includes: reducing miles of land line boundaries and number of corners, special uses, title claims, rights-of-way grants and easements, numbers of allotments and intermingled ownership livestock pastures, and other factors that decrease administrative costs and improve management efficiency.	If an exchange is desirable for the proposed western yard and additional land could be incorporated into the Rosecrans Black-footed Ferret Reintroduction Site, the exchange would be consistent with this guideline. The management prescription for the parcel in the western yard is 3.65 - Rangelands with Diverse Natural-Appearing Landscapes.

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Grassland Wide Standard and Guidelines	**Railroad Alternative Consistency**
• The acquisition would reduce conflicts between Forest Service, tribal lands and private landownership objectives, especially when conflicts are adversely impacting National Forest System management. This includes reducing conflicts involving the management of prairie dog colonies along National Forest System lands. • Give priority to acquiring lands in Congressionally designated Wilderness and other classified areas. • Concentrate acquisitions within or around existing blocks of public ownership of at least 2,000 to 3,000 acres. • Excepting unique situations, discourage exchanges between national grassland and proclaimed national forest lands. • Lands that would correct maladjustments of land use. **Guideline**	
2. Consider the following to identify lands for possible disposal: • Lands in developed areas that have lost or are losing their national grassland character. • Lands suitable for development by the private sector, if developments, such as residential, agricultural, industrial, or recreational, are in the public interest. • Isolated parcels of any size, such as parcels having no legal public or administrative access and the effort to acquire such access is not cost-efficient or otherwise reasonable. • Lands less than 3,000 acres and not contiguous to larger blocks of public lands. • Reserved or acquired road rights-of-way parcels that are substantially surrounded by lands not owned by the United States, and are no longer needed for rights-of-way purposes. • Lands encumbered by special-use permits and occupied by substantial structural improvements that no longer serve a greater public need. **Guideline**	An exchange of NFS lands located in the western yard would be consistent with this guideline.
3. Consider the following before making land adjustments: • Although lands with important or unique resources may be disposed of, consider reservation, mitigation and compensation values gained in acquired lands. Important or unique resources may include water frontage, wetlands, flood plains and associated riparian ecosystems, cave resources, essential big-game winter range, threatened or endangered species habitat, important paleontological or geologic sites, important historical, heritage resources or traditional cultural properties, outstanding scenic values, or critical ecosystems. • Avoid land adjustments that could result in a trend toward federal listing or loss of population viability for species of concern. Sensitive species habitat can be conveyed if conveyance would not result in a trend toward federal listing or adversely impact the population viability of the species, or if mitigation and compensation values gained in acquired lands are to be considered, or if effects could be mitigated. **Guideline**	None of the sensitive resources/characteristics are present on the small isolated track of NFS lands located at the western yard site.
4. Obtain reasonable public and administrative access to all National Forest System lands in the following ways: • Require reciprocal grants, where needed, when granting rights-of-way easements across National Forest System lands. • Reserve in land disposal actions, existing and designated inventoried rights-of-way that are needed for implementation of the management plan and to protect them for future construction and occupancy. **Standard**	Not applicable to the alternatives.
5. Prior to management prescription allocation, consider managing acquired lands in accordance with management prescriptions of adjacent lands. **Guideline**	Not applicable to the alternatives.
6. Recognize preexisting rights, such as mineral rights and private property access. **Standard**	Not applicable to the alternatives.
N. Heritage Resources	
1. Consult with American Indian traditional religious leaders during design of projects with potential to affect cultural rights and practices to help ensure protection, preservation, and use of areas that are culturally important to them. **Standard**	This issue is addressed in the Cultural Resources Programmatic Agreement (see Appendix F of this report).
2. Consider American Indian traditional cultural plant use when designing vegetative management activities. **Guideline**	Not applicable to the alternatives.
3. Leave human remains undisturbed unless there is an urgent reason for their disinterment. In case of accidental disturbance of historic graves or re-internment, take steps outlined in Appendix M of the grassland plans. Follow appropriate state or tribal policies regarding re-internment of human skeletal remains encountered during earth moving activities where appropriate. **Standard**	This issue is addressed in the Cultural Resources Programmatic Agreement (see Appendix F of this report).
4. Protect heritage resources from damage by activities or vandalism through project design, specified protection measures, monitoring, and coordination. **Guideline**	This issue is addressed in the Cultural Resources Programmatic Agreement (see Appendix F of this report).
5. During the conduct of activities designed to enhance and interpret significant heritage sites for the education and enjoyment of the public, avoid degrading the heritage property or causing conflicts with other resource considerations. **Guideline**	Not applicable to the alternatives.
6. Prohibit ground-disturbing activities on National Register listed or nominated sites or heritage districts where the heritage values are important for reasons other than archaeological research. **Standard**	This issue is addressed in the Cultural Resources Programmatic Agreement (see Appendix F of this report).

Appendix A, Table 13. Draft Grassland Wide Standards Contained in the Buffalo Gap National Grassland and Thunder Basin National Grassland Proposed Grassland Plans (Forest Service, 1999a and 1999b).	
Grassland Wide Standard and Guidelines	**Railroad Alternative Consistency**
O. Plant Collecting	
1. Ensure plant collecting does not jeopardize the continued vigor or existence of a plant population or associated plant communities. **Standard**	Not applicable to the alternatives.
2. Require permits to collect sensitive plants or parts of sensitive plants. **Standard**	Not applicable to the alternatives.
3. Protect the distribution and species viability of plants associated with medicinal and traditional cultural values. **Guideline**	Not applicable to the alternatives.
4. Protect American Indian traditional plant collecting areas. **Guideline**	This issue is addressed in the Cultural Resources Programmatic Agreement (see Appendix F of this report).
P. Special Uses	
1. Place all new pipelines underground. **Guideline**	Not applicable to the alternatives.
2. Route roads, pipelines, gathering lines, and technically required overhead power lines in a manner as to minimize visual impacts and conform to approved corridors. When these facilities leave corridors, they should be subordinate in the landscape. **Guideline**	Not applicable to the alternatives.
3. Design and construct such power lines to minimize the risk of raptor electrocution. **Standard**	Not applicable to the alternatives.
4. Do not allow continuous or dusk-to-dawn lighting at facilities. Exceptions may be made for the lighting of towers or lines to facilitate flight safety, and staffed, around-the-clock operations. **Guideline**	The alternatives would comply with this guideline.
5. Disapprove land-use authorizations on National Forest System lands identified for disposal if that occupancy may affect disposal action. **Standard**	Not applicable to the alternatives.
6. Act on special-use applications according to the following priorities: • Land and land-use activity requests relating to public safety, health and welfare, e.g.,highways, power lines and public service improvements. • Land and land-use activities contributing to increased economic activity associated with National Forest System resources, e.g., oil and gas and energy minerals. • Land and land-use activities that benefit only private users, e.g., road permits, rights-of-way for power lines, telephones, waterlines, etc. **Guideline**	Not applicable to the alternatives.
7. Disapprove any special-use applications that can be reasonably met on private or other federal lands unless it is clearly in the public interest. **Guideline**	According to DM&E, it would not be possible to construct and operate an economically-viable heavy haul railroad between the SPRB mines and DM&E's existing main line without crossing NFS lands. In addition, the STB has made an initial determination that DM&E's proposed project satisfies the transportation-related requirements of 49 U.S.C. 10901 and is therefore at least not inconsistent with the public necessity and convenience. STB regulations state that *"the Board shall issue a certificate...unless the Board finds that such activities are inconsistent with the public convenience and necessity..."* While the statute does not define "*public convenience and necessity*", a 3-part test has been developed to aid in this determination. The test requires a determination of whether: 1) the applicant is financially fit to undertake the construction and provide service; 2) there is a public demand or need for the proposed service; and 3) the construction project is in the public interest and will not unduly harm existing services. In its December 9, 1998 decision STB determined that DM&E's proposal meets the 3-part test. However, STB's initial determination does not grant approval to construct the project. No final decision by STB permitting construction to begin would be issued until such time as all statutory requirements - under both environmental and transportation law - have been satisfied. In fact, it is possible that in their final analysis STB could determine that, due to possible adverse environmental impacts, the public interest dictates that the application be denied even though the criteria of 49 U.S.C. 10901 have otherwise been met.
8. Bury electrical utility lines of 33 KV or less and telephone lines. **Standard**	Not applicable to the alternatives.
9. Use National Forest Landscape Management Volume 2, Chapter 2, Utilities 1 for principles and concepts. **Guideline**	This guideline will be reviewed and appropriate mitigation opportunities developed for inclusion as conditions of approval in the Forest Service special use permit for the project.
10. Consolidate occupancy of transportation or utility corridors and sites where ever possible and compatible. **Guideline**	Alternative D evaluates the suitability of using a existing transportation corridors to reach the SPRB coal mines. According to DM&E consolidation of the project with existing transportation corridors is not possible (see Appendix D of this report).
11. Allow haying and mowing only when grazing or prescribed fire are not viable methods to accomplish desired vegetation objectives. **Guideline**	Not applicable to the alternatives.
12. Issue special-use permits for haying on road easements only to the holder of the easement. Allow haying or mowing on road rights-of-way only for reasons of public safety or fuel reduction. The permittee may not sell or profit from the haying operation. **Guideline**	Not applicable to the alternatives.

Appendix A, Table 13. Draft Grassland Wide Standards Contained in the Buffalo Gap National Grassland and Thunder Basin National Grassland Proposed Grassland Plans (Forest Service, 1999a and 1999b).	
Grassland Wide Standard and Guidelines	**Railroad Alternative Consistency**
13. Do not locate utility corridors in Experimental Forests, Special Interest Areas, developed recreation sites, Research Natural Areas, certain wildlife habitat areas, paleontological, archeological and historical sites, American Indian traditional use areas, active coal mining units, Wild and Scenic Rivers, nationally classified trails, municipal water supply areas, and municipal watersheds, unless studies indicate that impacts from the corridor can be mitigated. **Guideline**	Mitigation to archeological and historical sites and American Indian traditional use areas is addressed in the Cultural Resources Programmatic Agreement. Alternatives B and C would cross a paleontological special interest area would be crossed on TBNG. The Phiney Flat Route Variation for Alternative C would cross a paleontological special interest area on BGNG. It is anticipated that impacts to these sites can be satisfactorily mitigated. With the exception of wildlife habitat areas, none of the other areas mentioned in the guideline would be affected. Wildlife habitat areas are addressed at several locations above.
14. Ensure utility corridors are consistent between adjoining National Forest System lands, regions, and other federal, tribal and state land management agencies.	Not applicable to the alternatives.
Q. Infrastructure	
1. Allow motorized use on new or existing, or as designated on the travel map, unless a documented decision shows 1 : (Note: Motorized use may occur on or within 300 feet of designated travelways. As a minimum, designated travelways will include most Forest Service administrative roads.) • Motorized use conflicts with Management Plan objectives; • Motorized use is incompatible with the recreation opportunity spectrum class; • Travelways are located in areas closed to motorized use and are not "designated routes;" • Motorized use creates user conflicts that result in unsafe conditions related to weather conditions; • Physical characteristics of travelway(s) preclude any form of motorized use; • Travelways do not serve an existing or identified future public need; or • Financing is not available for maintenance necessary to protect resources. **Standard**	Not applicable to the alternatives.
2. On all lands outside of designated travelways, motorized use is prohibited (except for authorized administrative use, such as grazing administration, noxious weed control, or fire control) unless the Forest Visitor Map or a Forest Order indicates that such use is specifically allowed. **Standard**	Not applicable to the alternatives.
3. Allow motorized wheelchair use in a non-motorized area so long as that wheel chair meets the legal definition of being "designed solely for use by a mobility impaired person for locomotion that is suitable for use in an indoor pedestrian area". (Title V, Section 507(c)(2) of the Americans with Disabilities Act). **Standard**	Not applicable to the alternatives.
4. Do not invest in new facilities on lands meeting the criteria for disposal. **Guideline**	Not applicable to the alternatives.
5. Keep drinking water safe for human consumption at Forest Service facilities or at facilities under special-use permit by the Forest Service. **Standard**	Not applicable to the alternatives.
6. Newly acquired facilities will not be retained unless sufficient maintenance funding is available or cooperative maintenance can be secured, and a substantial government benefit can be demonstrated. **Guideline**	Not applicable to the alternatives.
7. Require a special-use permit for motorized access to private land where access for the general public is not available. **Guideline**	Not applicable to the alternatives.
8. Install gates along all existing range allotment and pasture fences at intervals to provide reasonable access (not exceed 1 mile), as funding allows. Install gates along all new fences at intervals not to exceed 1 mile and at fence corners. **Guideline**	Not applicable to the alternatives.
9. Provide a minimum of 12-foot openings for gates to allow access for fire fighting equipment, as funding allows. **Guideline**	Not applicable to the alternatives.
10. Install user-friendly gate closures, as funding allows. **Guideline**	Not applicable to the alternatives.
11. Use cattle guards or hinged metal gates on popular and designated travel routes, as funding allows. Place a gate adjacent to each cattle guard. **Guideline**	Not applicable to the alternatives.
12. Build new and reconstructed fences to the specifications listed in Appendix B to provide for big game (adults and young) movement during all seasons, where desired. **Guideline**	The alternatives would be designed to comply with this guideline.
13. Do not construct any woven wire fences. **Guideline**	The alternatives would be designed to comply with this guideline.
14. Prioritize for reconstruction those fences that do not meet big game specifications. Prioritize removal of existing woven wire fences. Mitigate existing fences that do not meet big game specifications. **Guideline**	Not applicable to the alternatives.
15. Leave interior gates that are not along transportation corridors open when not needed to control livestock. **Guideline**	Not applicable to the alternatives.
16. See the following publications for fence construction for livestock, including bison: *Facilities for Handling, Sheltering and Trailing Livestock*, September 1987, Society For Range Management; *Fences*, July 1988, Society For Range Management; and *Facilities for Watering Livestock and Wildlife*, January 1989, MTDC 89-1. **Guideline**	Fence would be constructed to comply with Forest Service specifications.

Appendix A, Table 13. Draft Grassland Wide Standards Contained in the Buffalo Gap National Grassland and Thunder Basin National Grassland Proposed Grassland Plans (Forest Service, 1999a and 1999b).	
Grassland Wide Standard and Guidelines	**Railroad Alternative Consistency**
17. Restrict capital investments on lands with non-federal mineral estate ownership in areas of moderate to high mineral development potential if purpose of capital investment would conflict with mineral development. **Guideline**	Not applicable to the alternatives.
18. Perform site-specific mineral evaluations prior to making substantial capital investments, such as recreation developments, on Federal mineral estate in areas of moderate to high potential for valuable mineral deposits. Depending on conclusions from mineral evaluation and potential for mineral development, consider alternate location for capital investment, withdrawal of locatable minerals, or restrictions on surface occupancy for leasable minerals. **Guideline**	Not applicable to the alternatives.

Appendix A, Table 14. Railroad Alternative Consistency With Proposed Management Prescription 1.2, Recommended for Wilderness, 1999 Proposed Nebraska National Forest and Associated Units and Thunder Basin National Grassland Land and Resource Management Plans.

Theme	Goals	Standards and Guidelines	Railroad Alternative Consistency
These are areas that the Forest Service has or will recommend to Congress for inclusion in the Wilderness System. The areas are managed to protect Wilderness characteristics until Congressional action is taken. Non-conforming activities may be limited or restricted.	These areas are managed to protect their Wilderness characteristics. Existing uses not compatible with Wilderness management, such as mechanized equipment, may be present. The number of structures and facilities to support livestock grazing, such as fences and water tanks, is limited (no net gain). Large pasture size and less intrusive developments promote an open, natural-appearing landscape.		Only Alternative B would cross NFS lands with this proposed management prescription. The crossings would occur on BGNG. These lands are currently designated as RARE II or roadless areas. Construction and operation of the railroad through these areas would not be consistent with the theme or goals for these areas. The presence of the railroad would essentially eliminate many of the wilderness qualities of these areas. A net gain in fences would occur. Although Alternative C does not pass through these areas, it is located in close proximity to several roadless areas on BGNG.
	Uses, use levels, and management actions may vary from area to area. However, Forest Service activities that would eliminate an area from future Wilderness recommendation are not allowed.		Construction and operation of the railroad in these areas would eliminate the areas from future Wilderness recommendation. Alternative B would not be consistent with this goal.
	Existing two-track roads and old roads may be evident but will diminish over time or may become designated trails.		Not applicable to the alternatives.
	Vegetative composition and structure are controlled by natural processes, such as fire, insects, disease, and grazing. Vegetation is managed within the range of natural variability.		Not applicable to the alternatives.
	There is some evidence of past and present human use, such as fences, trails, water developments and primitive roads. Generally, opportunities for primitive recreation are provided, with a moderate degree of solitude available.		In the vicinity of the operating railroad, primitive recreation opportunities would be eliminated and no solitude would be available to recreation users when trains are traveling through the area. Alternative B would not be consistent with this requirement.
	Both directional and resource protection signs may be present. Bridges or other structures may be present, but are normally only located where they are needed to protect resources, or where no safe opportunity exists to cross a stream along a system trail during periods of normal water flow.		Not applicable to the alternatives.
		General 1. Allow uses and activities (e.g. recreation, grazing, mineral leasing) only if they do not degrade the characteristics for which the area was identified. **Standard**	The operating railroad would not be consistent with this standard. The railroad would degrade the wilderness characteristics of the area. Direct impacts on NFS lands would be limited to Alternative B. However, Alternative C would introduce noise and potentially visual impacts to RARE II and roadless areas where it is routed on private lands adjacent to NFS lands on BGNG.
		2. Reclaim disturbed lands to a condition suitable for the purposes for which the area was identified. **Standard**	Disturbed areas could be reclaimed to a sufficient degree to comply with this standard.
		3. Limit motorized use to administrative purposes (e.g., grazing administration, noxious weed control, and fire suppression). **Standard**	Alternative B would not comply with this standard. At peak up to 34 trains would cross these areas daily. In addition to the locomotives, motorized equipment would be necessary within these areas for track inspection, repair and maintenance.
		Mineral and Energy Resources 4. Prohibit mineral material removal. **Standard.**	Not applicable to the alternatives.
		5. Allow oil and gas leasing; however, prohibit ground-disturbing oil and gas activities. **Standard**	Not applicable to the alternatives.
		6. Prohibit road construction for geophysical seismic projects. If access is not feasible by off-road travel, use of portable techniques is required. **Standard**	Not applicable to the alternatives.

Appendix A, Table 14. Railroad Alternative Consistency With Proposed Management Prescription 1.2, Recommended for Wilderness, 1999 Proposed Nebraska National Forest and Associated Units and Thunder Basin National Grassland Land and Resource Management Plans.

Theme	Goals	Standards and Guidelines	Railroad Alternative Consistency
		Livestock Grazing 7. Allow livestock facilities that do not detract from the semi-primitive/primitive character of the area. **Standard**	Not applicable to the alternatives.
		Fire 8. Prohibit use of heavy ground-disturbing equipment for fire suppression unless authorized by the forest or grassland supervisor. **Standard**	Not applicable to the alternatives.
		9. Use perimeter control as the wildland fire management strategy. **Guideline**	Not applicable to the alternatives.
		Insects and Diseases 10. Control natural insect and disease outbreaks only when outbreaks threaten resource values outside of the area. **Guideline**	Not applicable to the alternatives.
		Infrastructure 11. Prohibit construction of facilities and structures that are not subordinate to the landscape or not in keeping with the semi-primitive/primitive character of the area. **Guideline**	The operating railroad would not be subordinate to the landscape. The semi-primitive/primitive character of the areas would change. Alternative B would not be consistent with this guideline.
		12. Allow no net gain of fences and water developments. **Standard**	A net gain in fences would occur. Both sides of the railroad would be fenced to keep livestock off the tracks. As such, fence density would increase.
		Special Uses 13. Prohibit new utility corridors. **Standard**	Alternative B would result in a new utility corridor through these areas and would not be consistent with this standard.
		14. Prohibit new special-use facilities. **Guideline**	Alternative B would result in new facilities through these areas and would not be consistent with this guideline.

Appendix A, Table 15. Railroad Alternative Consistency With Proposed Management Prescription 2.1, Special Interest Areas, 1999 Proposed Nebraska National Forest and Associated Units and Thunder Basin National Grassland Land and Resource Management Plans.

Theme	Desired Conditions	Standards and Guidelines	Railroad Alternative Consistency
Special Interest Areas are managed to protect or enhance and, where appropriate, develop and interpret for public education and recreation, areas with unusual characteristics.			Two SIAs would be crossed by the alternatives. Alternatives B and C would cross the Thunder Basin Paleontological SIA on TBNG. The Phiney Flat Route Variation of Alternative C would cross the Indian Creek SIA on BGNG.
	Evidence of human activities is consistent with the characteristics for which the area was established. Encounters between individuals or parties depend on the objectives for designation.		The proposed management emphasis for the Thunder Basin Paleontological SIA is on interpretation and education of geology and paleontology. Construction of the railroad through this SIA would be consistent with the management emphasis. Construction of the railroad would offer a unique opportunity to discover geologic and paleontological resources. Important discoveries could be made as a result of excavation activities associated with construction of the alternatives. DM&E and the Forest Service will prepare a plan that addresses how impacts to this site would be mitigated and how the public can benefit from both education and interpretation of resources unearthed during construction of the alternatives. The alternatives are consistent with the desired conditions for this SIA. The management emphasis for the Indian Creek SIA is on maintaining the scenic beauty and remote character of the area. The Phiney Flat Route Variation would not be consistent with the management emphasis. The operating railroad would introduce sights and sounds inconsistent with the wilderness qualities of the area.
	Vegetation, terrestrial and aquatic habitats will usually, but not always, appear natural.		This desired condition recognizes that it may not be possible to maintain natural appearing vegetation and aquatic habitats within these areas. The alternatives would be consistent with this desired condition.
	Vegetative manipulation may be used to maintain or restore natural conditions, to protect threatened, endangered and sensitive species, or other values for which the Special Interest Area was designated.		Not applicable to the alternatives.
		General 1. Allow uses and activities (e.g. recreation, grazing, mineral leasing, road construction) only if they do not degrade the characteristics for which the area was designated. **Standard**	The alternatives would be consistent with this standard. The management emphasis for these SIAs is interpretation of geologic and paleontological resources for the benefit of the public.
		2. Reclaim disturbed lands to a condition suitable for the purposes for which the lands were identified. **Standard**	The alternatives would be consistent with this standard.
		Mineral and Energy Resources 3. When withdrawal is necessary to protect the values for which the area was designated, request withdrawal from mineral entry in conformance with Section 204 of the Federal Land Policy and Management Act of 1976 (PL 94-576). **Standard**	Not applicable to the alternatives.
2.1c - Thunder Basin Paleontological SIA: This 5,140-acre site features a high concentration of fossil remains from the late Cretaceous Period ending about 65 million years ago. The site is within the Lance Formation, which is composed of 2,600 feet of dull-gray sandy shales alternating with lenticular, light-colored sandstones and thin lignite beds. The Lance Formation has a very good potential to produce a large variety of fossils of excellent research value. This is the most productive fossil-bearing site on the Thunder Basin National Grassland. Management emphasis is on interpretation and education of geology and paleontology.			

Appendix A, Table 15. Railroad Alternative Consistency With Proposed Management Prescription 2.1, Special Interest Areas, 1999 Proposed Nebraska National Forest and Associated Units and Thunder Basin National Grassland Land and Resource Management Plans.			
Theme	**Desired Conditions**	**Standards and Guidelines**	**Railroad Alternative Consistency**
		Prohibit ground-disturbing fire control methods. **Standard**	Not applicable to the alternatives.
		Only allow collection of the paleontological resource through a permit for the purposes of research, mitigation, protection of important specimens, and other official agency duties. **Standard**	Not applicable to the alternatives.
		Require monitoring by a professional paleontologist during all soil disturbance. **Standard**	The alternatives would be consistent with this standard.
		Allow maintenance of existing structural range facilities only after it has been determined by an on-site survey there will be no damage to paleontological resources. **Standard**	Not applicable to the alternatives.
		Limit livestock concentration activities, such as salting, supplement feeding, dust and oil stations, temporary corrals, to designated locations where a site survey has determined no risk of damage to paleontological resources. **Standard**	Not applicable to the alternatives.
		Prohibit mineral material removal. **Standard**	Not applicable to the alternatives.
		Prohibit locatable mineral operating plans that would harm scientific value of the paleontological resources. **Standard**	Not applicable to the alternatives.
2.1g - Indian Creek SIA: This 24,660-acre site offers the largest block of scenic, Cheyenne River badlands breaks and the largest roadless area on the Buffalo Gap National Grassland. The rugged, remote terrain gives up an abundance of scientifically significant fossil resources. Management emphasis is on maintaining the scenic beauty and remote character.			
		Only allow collection of the paleontological resource through a permit for the purposes of research, mitigation, protection of important specimens, and other official agency responsibilities. **Standard**	Not applicable to the alternatives.
		Require monitoring by a professional paleontologist during all soil disturbance. **Standard**	The alternatives would be consistent with this standard.
		Limit motorized use to administrative purposes (e.g., grazing administration, noxious weed control). **Standard**	The alternatives would not be consistent with this standard. The operating railroad would introduce motorized uses into this area.

Appendix A, Table 16. Railroad Alternative Consistency With Proposed Management Prescription 3.63, Black-footed Ferret Reintroduction Habitat, 1999 Proposed Nebraska National Forest and Associated Units and Thunder Basin National Grassland Land and Resource Management Plans.

Theme	Desired Conditions	Standards and Guidelines	Railroad Alternative Consistency
Black-tailed prairie dog colony complexes and intermingled public grasslands are actively and intensively managed for possible reintroductions of black-footed ferrets by U.S. Fish and Wildlife Service.			Alternative B would cross through this management area. The area would not be affected by Alternatives C or D.
	Prairie dog colony complexes and compatible land uses are established and/or maintained for black-footed ferret reintroductions. Prairie dog populations are maintained or increased through vegetation management and/or relocation of prairie dogs into suitable habitat.		Without proper mitigation, the railroad may preclude the reintroduction of black-footed ferrets into portions of this management area.
	Plant and animal species and communities associated with black-footed ferrets and black-tailed prairie dogs are actively restored.		Not applicable to the alternatives.
	The Forest Service works with other agencies and organizations to pursue conservation agreements or easements with adjoining land jurisdictions to achieve black-footed ferret recovery objectives.		Not applicable to the alternatives.
	In areas where landownership patterns are not conducive to effective prairie dog management, landownership adjustments to achieve more favorable landownership patterns are pursued. Unwanted impacts to adjoining lands are minimized.		Not applicable to the alternatives.
		General 1. Allow uses and activities (e.g. recreation, grazing, mineral leasing, road construction) only if they contribute to the protection or enhancement of the characteristics for which the area was designated. **Standard**	Alternative B would not contribute to the protection or enhancement of this site for black-footed ferret reintroductions. The railroad would fragment habitat (prairie dog towns) and could present a barrier to the ferret's ability to use large blocks of prairie dog towns. It is uncertain what impacts noise and ground vibrations may have on ferrets. These impacts could adversely affect the ability of ferrets to reproduce. Train traffic could result in direct mortality to ferrets.
		Mineral and Energy Resources 2. Allow oil and gas leasing; however, no ground-disturbing oil and gas activities are permitted if they may have adverse effects on black-footed ferret reintroduction objectives. **Standard**	Not applicable to the alternatives.
		Livestock Grazing 3. Use livestock grazing strategies and stocking rates to achieve desired rates of prairie dog colony establishment and growth. **Guideline**	Not applicable to the alternatives.
		Fish and Wildlife 4. Consider using rodenticides to reduce prairie dog populations only in response to public health and safety risks or unwanted colonization of adjoining lands. Mutual concurrence by the Forest Service and US Fish and Wildlife Service is required on a colony-by-colony basis before authorizing any poisoning. **Guideline**	Not applicable to the alternatives.
		Recreation 5. Prohibit shooting in prairie dog colonies unless needed to help reduce unwanted colonization of adjoining lands. Authorize shooting in selected areas only through mutual concurrence by the Forest Service and U.S. Fish and Wildlife Service. Coordinate and consult with the appropriate state wildlife agency prior to implementation of authorized shooting. **Guideline**	Not applicable to the alternatives
		6. Work with Animal and Plant Health Inspection Service and state agencies to prohibit the use of leg-hold traps without pan-tension devices for predator control and fur harvest on National Forest System lands in this management area. **Guideline**	Not applicable to the alternatives.

Appendix A, Table 17. Railroad Alternative Consistency With Proposed Management Prescription 3.64, Special Plant and Wildlife Habitat, 1999 Proposed Nebraska National Forest and Associated Units and Thunder Basin National Grassland Land and Resource Management Plans.

Theme	Desired Conditions	Standards and Guidelines	Railroad Alternative Consistency
These areas are managed to emphasize specific plant and wildlife species and communities			This management areas would be crossed only by Alternatives C, although Alternative B is routed directly adjacent to the area. The crossing would occur on BGNG south of Rapid Creek near Creston.
	Activities and uses are managed so specific species or communities can effectively use the same area. High levels of suitability and habitat effectiveness are maintained for specific plant and wildlife species or communities.		Alternative C would be consistent with the desired condition.
	Conflicts that cannot be mitigated are resolved in favor of specific plan and wildlife species and communities		Alternative C would be consistent with the desired condition.
		Addressed for appropriate geographic area.	The crossing would occur in the Fall River Northeast Geographic Area. The geographic area direction contains objectives that address only sharp-tailed grouse habitat. Those objectives include: - Provide diverse and quality grassland habitat at levels that, in combination with habitat on adjoining lands, helps support stable to increasing sharp-tailed grouse populations (long-term trends) across this geographic area. - Establish and maintain quality nesting and brooding habitat for sharp-tailed grouse and associated wildlife by meeting vegetation objectives for high structure within 10 years. - Establish and maintain quality winter foraging habitat for sharp-tailed grouse and associated wildlife by enhancing and/or maintaining regeneration of shrub patches and the shrub component of wooded draws and riparian habitats. Construction of Alternative C is not expected to adversely affect the habitats listed above. It is anticipated that Alternative C would be consistent with these objectives.

Appendix A, Table 18. Railroad Alternative Consistency With Proposed Management Prescription 3.65, Rangelands with Diverse Natural-Appearing Landscapes, 1999 Proposed Nebraska National Forest and Associated Units and Thunder Basin National Grassland Land and Resource Management Plans.

Theme	Desired Conditions	Standards and Guidelines	Railroad Alternative Consistency
Management emphasizes maintaining or restoring a diversity of native plants and animals, and ecological processes and functions, while providing for a mix of other rangeland values and uses with limits on facilities to support livestock grazing.			All the alternatives would cross this proposed management area. The theme for this management areas does not prohibit construction or operation of a railroad.
	These areas have relatively few livestock grazing developments, such as fences and water tanks, which results in uneven livestock grazing patterns and diverse vegetation composition and structure.		Not applicable to the alternatives.
	The number of structures and facilities to support livestock grazing is limited (no net gain) to maintain or increase secondary, inaccessible, and ungrazed capable rangelands.		Not applicable to the alternatives.
	Most areas are grazed by livestock annually, but some areas are secondary or inaccessible range and receive no or periodic grazing. Livestock grazing intensity varies from low to high because of uneven livestock grazing distribution and other livestock grazing management strategies.		Not applicable to the alternatives.
	Prescribed fire is used as a management tool; most wildfires are aggressively controlled if threatening facilities or private property. Natural outbreaks of native insects and diseases are allowed to proceed without intervention unless there is a substantial threat to high-value resources and intervention is documented in a project decision.		Not applicable to the alternatives.
	Natural-appearing landscapes predominate; however, oil and gas facilities may occur and are subordinate to the landscape.		The alternatives would be inconsistent with this desired condition. Where the railroad alternatives are located, they would dominate the landscape. The operating railroad would not be subordinate to the landscape.
		Livestock Grazing 1. When allotment management plans are revised, include quantitative objectives for secondary, inaccessible, or ungrazed capable rangeland. **Standard**	Not applicable to the alternatives.
		Infrastructure 2. Maintain or increase the average size of fenced grazing units. **Standard**	The alternatives would not be consistent with this standard. The railroad would cross through a number of fenced grazing units on both TBNG and BGNG. The railroad would be fenced on both sides to prevent livestock from gaining access to the railroad right-of-way. In some cases, tunnels will be installed to allow livestock to move under the tracks to access both sides of the grazing unit. However, where small remnants of the fenced grazing units remain, it is anticipated that tunnels would not be provided and the grazing unit size would be reduced. These isolated remnant grazing units may be combined with other grazing units on the same side of the track.
		3. Allow no net gain of fences, water developments or roads. **Guideline**	The railroad would not be consistent with this guideline. Both sides of the railroad would be fenced. There would be a net gain in fences in this management area.
		4. When reconstructing water impoundments, consider opportunities to enhance native wildlife species habitat and restore natural drainage patterns. **Guideline**	Not applicable to the alternatives.

Appendix A, Table 19. Railroad Alternative Compliance With Proposed Management Prescription 3.68, Big Game Range, 1999 Proposed Nebraska National Forest and Associated Units and Thunder Basin National Grassland Land and Resource Management Plans.

Theme	Desired Conditions	Standards and Guidelines	Railroad Alternative Consistency
These areas are managed to emphasize deer, elk and pronghorn habitat.			All the alternatives would cross this management area.
	Activities and uses are managed so that big game can effectively use the area. High levels of suitability and habitat effectiveness are maintained for big game. Conflicts that cannot be mitigated are resolved in favor of big game.		The railroad alternatives would not be consistent with this desired condition. Where this habitat is crossed by the alternatives, it is anticipated that habitat suitability and effectiveness will be degraded. Some displacement of animals from these habitats during crucial periods could occur.
	Big game habitat management goals are developed by the Forest Service in consultation with states and owners of intermingled, privately owned land to minimize resource conflicts on and off National Forest System lands and to provide recreation opportunities and a diversity of plant and animal communities.		Not applicable to the alternatives.
		General 1. Allow uses and activities (e.g. recreation, grazing, mineral leasing) only if they do not degrade the characteristics for which the area was identified. **Standard**	The alternatives would not be consistent with this standard. It is anticipated that the operating railroad would result in degradation of habitat suitability and effectiveness.
		2. Limit activities during big game wintering from December 15 through March 15 if they would reduce habitat effectiveness. **Guideline**	The railroad could not comply with this guideline. It would not be possible to economically operate the railroad and restrict operations during the period suggested in the guideline.
		3. Limit activities during elk parturition from May 1 through June 30 if they would reduce habitat effectiveness. **Guideline**	The railroad could not comply with this guideline. It would not be possible to economically operate the railroad and restrict operations during the period suggested in the guideline.
		Wildlife 4. Maintain big-game habitat-effectiveness at 85%. **Standard**	On a grassland-wide basis, it is not anticipated that the operating railroad would reduce habitat effectiveness to below 85 percent. However, in areas bisected by the railroad effectiveness of these unique habitats could be reduced to below 85 percent.
		Livestock Grazing 5. Limit livestock grazing forage allocation based on big game needs. **Standard**	Not applicable to the alternatives.
		6. Where needed, alter livestock grazing systems, season of use, and stocking rates to meet big game habitat objectives. **Guideline**	Not applicable to the alternatives.
		7. Limit livestock grazing strategies in riparian habitats, wooded draws and other wooded habitats to those that promote dense understory and mid-story vegetation for cover and forage. **Standard**	Not applicable to the alternatives.
		8. Limit livestock grazing strategies in shrublands, including big sage and silver sage plant communities, to those that promote healthy herbaceous understories and productive shrubs. Do not convert shrublands to other vegetation types. **Standard**	Not applicable to the alternatives.
		Silviculture 9. Do not allow cutting or removal of trees if thermal cover is less than 20 percent of the forested area. **Guideline**	Not applicable to the alternatives.
		Recreation 10. Permit recreation facilities needed to support summer recreational activities, but close them during periods when big game are present in concentrated numbers. **Guideline**	Not applicable to the alternatives.

Appendix A, Table 19. Railroad Alternative Compliance With Proposed Management Prescription 3.68, Big Game Range, 1999 Proposed Nebraska National Forest and Associated Units and Thunder Basin National Grassland Land and Resource Management Plans.			
Theme	**Desired Conditions**	**Standards and Guidelines**	**Railroad Alternative Consistency**
		Infrastructure 11. Close roads, as needed, to prevent disturbance during the winter and during fawning/calving periods. **Guideline**	This guideline could be applied to construction activities associated with the alternatives.
		12. Construct new roads as local roads. **Standard**	It is anticipated that access to construction sites on the national grasslands would use existing roads. However, should it be necessary to construct a new road on the grasslands, the alternatives would be consistent with this standard.
		13. Prohibit new roads from crossing important forage, cover and fawning/calving areas. **Guideline**	It is anticipated that access to construction sites on the national grasslands would use existing roads. However, should it be necessary to construct a new road on the grasslands, the alternatives would be consistent with this standard.

Appendix A, Table 20. Railroad Alternative Consistency With Proposed Management Prescription 4.32, Dispersed Recreation: High Use, 1999 Proposed Nebraska National Forest and Associated Units and Thunder Basin National Grassland Land and Resource Management Plans.

Theme	Desired Conditions	Standards and Guidelines	Railroad Alternative Consistency
These areas are managed for recreational opportunities and scenic qualities and are usually adjacent to developed recreation sites and bodies of water.			The only alternative which would affect this proposed management area is Alternative D. It would cross about 5 miles of this management area on TBNG between Osage and Upton, Wyoming in Weston County. The alternative would be directly adjacent to an existing BNSF railroad throughout this proposed management area. Because the impact of an operating, heavy-haul railroad is already present, it was concluded that Alternative D would be consistent with the management area prescription.
	Visitors recreate in a relatively natural environment, while pursuing a variety of unstructured recreational activities, such as camping, picnicking, fishing, and off-highway vehicle use.		Not applicable to the alternatives.
	Because of the amount and types of use, these areas offer a more social type of recreational experience.		Not applicable to the alternatives.
	All resource activities are compatible with, and reduce impacts to, recreational resources and opportunities. Motorized travel may be restricted during certain times of the year.		Because the impact of an operating, heavy-haul railroad is already present through this area, it was concluded that Alternative D would be consistent with the management area prescription.
	The areas offer few conveniences for users but may have toilets, trash cans, fire grills, and vehicle barriers if needed to protect resources. Existing improvements, such as roads, trails, bridges, fences, oil and gas wells, and water developments, blend into the landscape where feasible.		See above.
	The potential for contact with other users is moderate to high. Solitude or isolation is less important than the opportunity to participate in desired recreational activities.		Not applicable to the alternatives.
	Generally, these areas appear as a natural-appearing landscape over large areas, but modifications on a small scale are acceptable and blend with the area's natural features.		Alternative D would be parallel to an existing heavy-haul railroad through this management area. Visual intrusions from an operating railroad already exist.
	Biological communities complement the recreational values.		Not applicable to the alternatives.
		General 1. Allow uses and activities (e.g., grazing, mineral leasing) only if they do not degrade the characteristics for which the area was identified. **Guideline**	Because the impact of an operating, heavy-haul railroad is already present through this area, it was concluded that Alternative D would be consistent with the management area prescription.
		Livestock Grazing 2. Do not salt or supplement feed within 1/4 mile of designated roads. **Guideline**	Not applicable to the alternatives.

Appendix A, Table 21. Railroad Alternative Consistency With Proposed Management Prescription 5.12, General Forest and Rangelands: Range Vegetation Emphasis, 1999 Proposed Nebraska National Forest and Associated Units and Thunder Basin National Grassland Land and Resource Management Plans.

Theme	Goals	Standards and Guidelines	Railroad Alternative Consistency
These areas are managed for the sustainability of physical, biological and scenic values associated with woody vegetation and open grassland.			All the alternatives, except Alternative D would cross this management area.
	These areas are dominated by open meadows, grasslands, shrublands and areas of woody vegetation.		The alternatives would not change the vegetative composition of the management area.
	Diversity is achieved by maintaining or enhancing hardwood and coniferous trees, shrub inclusions and other beneficial plant communities and openings. Tree densities vary within stands to create landscape-scale diversity. Fire is used to promote open, park-like timber stands.		The alternatives would not change the vegetative composition of the management area.
	Late-successional vegetation may be found in the area.		Not applicable to the alternatives.
	Management emphasis is on a balance of resource uses and opportunities, such as livestock grazing, wildlife habitat, dispersed recreation, minerals management and timber harvest. Some areas produce substantial forage for livestock and wildlife. Though some areas are forested, they usually do not produce commercial wood fiber because of poor site potential.		The alternatives would be consistent with this goal.
	Recreation facilities may be present. Range and other management activities are coordinated with recreation so they do not conflict with the managed use season. Signs of motorized travel, hunting, hiking, timber harvest, mining and livestock grazing may be evident. Recreation use is moderate throughout the summer and increases during hunting seasons.		The alternatives would be consistent with this goal.

Appendix A, Table 22. Railroad Alternative Consistency With Proposed Management Prescription 6.1, Rangeland with Broad Resource Emphasis, 1999 Proposed Nebraska National Forest and Associated Units and Thunder Basin National Grassland Land and Resource Management Plans.

Theme	Desired Conditions	Standards and Guidelines	Railroad Alternative Consistency
Management emphasizes a diversity of native plants and animals and ecological functions and processes, while providing for livestock forage, a mix of other rangeland values and uses, minerals and energy development, and recreation opportunities.			The alternatives would be consistent with this theme.
	Vegetation composition and structure vary across the ecological sections to emphasize a broad range of multiple-use values. Generally, composition and structure will vary according to the following chart: Management Area — Percent mid to late seral composition <----- Vegetation Structure ----------> (See Geographic Area for Specific Desired Structure) 6.1a 80 High Moderate Low 6.1b 85 High Moderate Low 6.1c 90 High Moderate Low 6.1d 90 High Moderate Low		The alternatives would not affect vegetation composition and structure in this management areas.

Appendix A, Table 23. Proposed Management Prescription 8.4, Mineral Production and Development, Proposed Nebraska National Forest and Associated Units and Thunder Basin National Grassland Land and Resource Management Plans.			
Theme	**Desired Conditions**	**Standards and Guidelines**	**Railroad Alternative Consistency**
These areas are managed for solid mineral operations.			The alternatives would be consistent with this theme.
	Mineral operations of all types are emphasized to effectively and efficiently remove available commercial mineral resources, concurrent with other ongoing resource uses and activities. Operations include development and production of solid minerals, such as coal, bentonite, uranium and hard rock, open-pit mines, stock-piled overburden and top soil, and various ancillary facilities.		The alternatives would be consistent with this desired condition.
	Facilities and landscape modifications are visible but are reasonably mitigated to blend and harmonize with natural features. Reclamation activities restore the area to a reasonable level of its pre-mining condition.		The alternatives would be consistent with this desired condition.
	Restrictions on public use occur to ensure public safety and to avoid unreasonable interference with mineral operations. Visitors can experience frequent encounters with people, heavy equipment and noise.		The alternatives would be consistent with this desired condition.

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ATTACHMENTS

Proposed Amendment 8
Proposed Amendment 20

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Nebraska National Forest and Buffalo Gap National Grassland Land and Resource Management Plan Rocky Mountain Region - USDA Forest Service Proposed Amendment 8

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NEBRASKA NATIONAL FOREST AND BUFFALO GAP NATIONAL GRASSLAND LAND AND RESOURCE MANAGEMENT PLAN

ROCKY MOUNTAIN REGION
USDA FOREST SERVICE

PROPOSED AMENDMENT 8

MODIFICATION OF MANAGEMENT PRESCRIPTION 1D (UTILITY CORRIDORS) TO DESIGNATE RAIL LINE CORRIDOR ON BUFFALO GAP NATIONAL GRASSLAND

Page Code - Chapter III, pages 154-157

Digest: Chapter III, page 157 - Designates rail line corridor under Management Prescription 1D where rail line crossing the Buffalo Gap National Grassland is less than 10 miles in length.

Reason for Amendment: The existing Management Prescription, 1D, which provides for utility corridors, state's management emphasis is for major oil and gas pipelines, major water transmission and slurry pipelines, electrical transmission lines, and transcontinental telephone lines. Management activities within these linear corridors strive to be compatible with the management goals of the management areas through which they pass." Rail lines of 10 miles in length or greater were considered as part of this existing prescription. This amendment to the 1D Management Prescription is consistent with the original intent for management of a utility corridor. A new rail line corridor and route alternatives are being analyzed in the Powder River Basin Expansion Project Environmental Impact Statement. Based upon this analysis and if an action alternative is selected, this prescription will be modified to allow for a site-specific linear rail line corridor across a section of the Buffalo Gap National Grassland that will be less than 10 miles in length on the grasslands but approximately 1,000 miles in length in its totality. The purpose of this rail line is to transport coal from the Powder River Basin in Wyoming to eastern utility markets for national public use.

Goal: To provide for and administer a necessary special purpose corridor across a portion of the Buffalo Gap National Grassland to ensure safe, efficient use of the facilities necessitating use of these lands in the interest of the national public, consistent with the purposes of the National Grasslands that include developing energy resources, and to minimize impacts upon the resources, landscape, and environment.

Prescription: This prescription is applicable to strips of land or other relatively small land areas which are, or may be, occupied by high to moderately high investment facilities authorized by memorandums of understanding, easements, or special use permits. These specific, relatively

small areas (in relation to the overall planning area) are, or may become, primarily occupied for purposes other than renewable resource production. Although these lands are included in management areas that may differ along the length of the corridor, the corridor will be managed for complimentary resource objectives, where conditions permit. Where the corridor is inconsistent with management area standards and guidelines, mitigation will be developed, to the extent practicable to minimize impacts and affect compliance with the *Nebraska National Forest and Buffalo Gap National Grasslands Land and Resource Management Plan* and all other applicable laws. Those lands surrounding this linear corridor shall continue to be managed under the existing management prescriptions, standards and guidelines.

If a rail line corridor is approved, the management area map will be amended to show the location, length, and width of the corridor and/or easement, and identify the number of acres that will be modified.

NEPA Evaluation and Plan Amendment Significance Determination Process: The NEPA evaluation of this proposed amendment, as called for by 36 C.F.R. section 219.10(k), will be performed as part of the Powder River Basin Expansion Project EIS process, for which the U.S. Forest Service is a cooperating agency. As part of the proposed plan amendment evaluation, a determination as to whether the proposed amendment is a significant or non-significant amendment to the current plan will be made and documented in the final U.S. Forest Service decision on the right-of-way, easement, use and occupancy, or other permit for the project.

A consideration of the significance determination factors enumerated in the U.S. Forest Service Handbook and examples given in the U.S. Forest Service Manual suggests that the proposed amendment is a non-significant amendment to the Forest Plan. The location and size of the area involved in the change is relatively small - a linear special purpose corridor across a portion of the Buffalo Gap National Grassland, less than 10 miles in length - in comparison to the overall planning area for the *Nebraska National Forest and Buffalo Gap National Grassland Land and Resource Management Plan*. Under the Forest Service handbook factors, the smaller the area affected, "the less likely the change is to be a significant change in the Forest Plan." Id. Ch. 5.32(3)(b).

Secondly, the revision of the existing Management Prescription 1D should not alter the long-term relationship between the levels of goods and services projected by the Forest Plan. The proposed amendment is consistent with the original intent of Management Prescription 1D for management of a utility corridor, and mitigation will be developed to the extent practicable to minimize the impacts of the management prescription modification on other provisions of the *Nebraska National Forest and Buffalo Gap National Grasslands Land and Resource Management Plan*. Additionally, these lands adjacent to the linear special purpose corridor will continue to be managed under the existing management prescriptions, standards, and guidelines for those areas in the Forest Plan.

Thirdly, the change in management prescription is proposed only for the specific situation of the Powder River Basin Expansion Project new rail line and corridor. The provisions of a specific proposed permit or occupancy and use permit provides a basis for considering a proposed plan

amendment. *See* U.S. Forest Service Manual 1922.5(2); U.S. Forest Service Handbook 1909.12, Ch. 5.32. Because the change applies only to this situation and the change should not alter the desired future condition of the land and resources or the anticipated goods and services to be produced, based on the provisions discussed above (including limited scope of the special purpose corridor and the mitigation to be imposed together with continuation of existing management prescriptions for adjoining areas), the proposed plan amendment should not be significant. *See* U.S. Forest Service Handbook 1909.12, Ch. 5.32(3)(d).

This amendment is consistent with the *National Environmental Policy Act* (NEPA), 36 C.F.R. 219, 40 C.F.R. parts 1500 to 1508, and Chapters 10 and 40 of FSH 1909.15 (09/21/92). In addition, it has been determined that this amendment is a non-significant amendment under the criteria of the *National Forest Management Act* and in accordance with Forest Service Handbook 1909.12, Section 5.32.

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Medicine Bow National Forest and Thunder Basin National Grassland Land and Resource Management Plan Rocky Mountain Region - USDA Forest Service Proposed Amendment 20

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MEDICINE BOW NATIONAL FOREST AND THUNDER BASIN NATIONAL GRASSLAND LAND AND RESOURCE MANAGEMENT PLAN

ROCKY MOUNTAIN REGION
USDA FOREST SERVICE

PROPOSED AMENDMENT 20

MODIFICATION OF MANAGEMENT PRESCRIPTION 1D (UTILITY CORRIDORS) TO INCLUDE RAIL LINE CORRIDOR ON THUNDER BASIN NATIONAL GRASSLAND

Page Code - Chapter III, page 96

Digest: Chapter III, page 96 - Modifies Management Prescription 1D to include rail line corridor on Thunder Basin National Grassland.

Reason for Amendment: The existing Management Prescription 1D, which provides for utility corridors, states "Management emphasis is for major oil and gas pipelines, major water transmission and slurry pipelines, electrical transmissions lines, and transcontinental telephone lines. Management activities within these linear corridors strive to be compatible with the goals of the management areas through which they pass." Rail lines were not considered as part of this existing prescription. However, this amendment to the 1D Management Prescription is consistent with the original intent for management of a utility corridor. A new rail line corridor and route alternatives are being analyzed in the Powder River Basin Expansion Project Environmental Impact Statement. Based upon this analysis and if an action alternative is selected, this prescription will be modified to allow for a site-specific linear rail line corridor across a section of the Thunder Basin National Grasslands for the purpose of transporting coal from the Powder River Basin in Wyoming to eastern utility markets for national public use.

Goal: To provide for and administer a necessary special purpose corridor across a portion of the Thunder Basin National Grassland to ensure safe, efficient use of the facilities necessitating use of these lands in the interest of the national public, consistent with the purposes of the National Grasslands that include developing energy resources, and to minimize impacts upon the resources, landscape, and environment.

Prescription: This prescription is applicable to strips of land or other relatively small land areas which are, or may be, occupied by high to moderately high investment facilities authorized by memorandums of understanding, easements, or special use permits. These specific, relatively

small areas (in relation to the overall planning area) are, or may become, primarily occupied for purposes other than renewable resource production. Although these lands are included in management areas that may differ along the length of the corridor, the corridor will be managed for complementary resource objectives, where conditions permit. Where the corridor is inconsistent with management area standards and guidelines, mitigation will be developed, to the extent practicable, to minimize impacts and affect compliance with the *Medicine Bow National Forest and Thunder Basin National Grassland Land and Resource Management Plan* and all other applicable laws. Those lands surrounding this linear corridor shall continue to be managed under the existing management prescriptions, standards, and guidelines.

If a rail line corridor is approved, the management area map will be amended to show the location, length, and width of the corridor and/or easement and identify the number of acres that will be modified.

NEPA Evaluation and Plan Amendment Significance Determination Process: The NEPA evaluation of this proposed amendment, as called for by 36 C.F.R. Section 219.10(k), will be performed as part of the Powder River Basin Expansion Project EIS process, for which the U.S. Forest Service is a cooperating agency. As part of the proposed plan amendment evaluation, a determination as to whether the proposed amendment is a significant or non-significant amendment to the current plan will be made and documented in the final U.S. Forest Service decision on the right-of-way, easement, use and occupancy, or other permit for the Project.

A consideration of the significance determination factors enumerated in the U.S. Forest Service Handbook and examples given in the U.S. Forest Service Manual suggests that the proposed amendment is a non-significant amendment to the Forest Plan. The location and size of the area involved in the change is relatively small - a linear special purposed corridor across a portion of the Thunder Basin National Grassland - in comparison to the overall planning area for the *Medicine Bow National Forest and Thunder Basin National Grasslands Resource Management Plan.* Under the Forest Service Handbook factors, the smaller the area affected, "the less likely the change is to be a significant change in the Forest Plan." Id. Ch. 5.32(3)(b).

Secondly, the revision of the existing Management Prescription 1D should not alter the long-term relationship between the levels of goods and services projected by the Forest Plan. The proposed amendment is consistent with the original intent of Management Prescription 1D for management of a utility corridor, and mitigation will be developed to the extent practicable to minimize the impacts of the management prescription modification on other provisions of the *Medicine Bow National Forest and Thunder Basin National Grasslands Resource Management Plan.* Additionally, those lands adjacent to the linear special purpose corridor will continue to be managed under the existing management prescriptions, standards, and guidelines for those areas in the Land and Resource Management Plan.

Thirdly, the change in management prescription is proposed only for the specific situation of the Powder River Basin Expansion Project new rail line and corridor. The provisions of a specific proposed permit or occupancy and use permit provide a basis for considering a proposed plan amendment. *See* U.S Forest Service Manual 1922.5(2); U.S. Forest Service Handbook 1909.12,

Ch. 5.32. Because the change applies only to this situation and the change should not alter the desired future condition of the land and resources or the anticipated goods and services to be produced, based on the provisions discussed above (including the limited scope of the special purpose corridor and the mitigation to be imposed together with continuation of existing management prescriptions for adjoining areas) the proposed plan amendment should not be significant. *See* U.S. Forest Service Handbook 1909.12, Ch. 5.32(3)(d).

This amendment is consistent with the *National Environmental Policy Act (NEPA),* 36 CFR 219, 40 CFR parts 1500 to 1508, and Chapters 10 and 40 of FSH 1909.15 (09/21/92). In addition, it has been determined that this amendment is a non-significant amendment under the criteria of the *National Forest Management Act* and in accordance with Forest Service Handbook 1901.12, Section 5.32.

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APPENDIX M

Economic Impacts in Minnesota, South Dakota, and Wyoming of the Dakota, Minnesota & Eastern Railroad Corporation Powder River Basin Project

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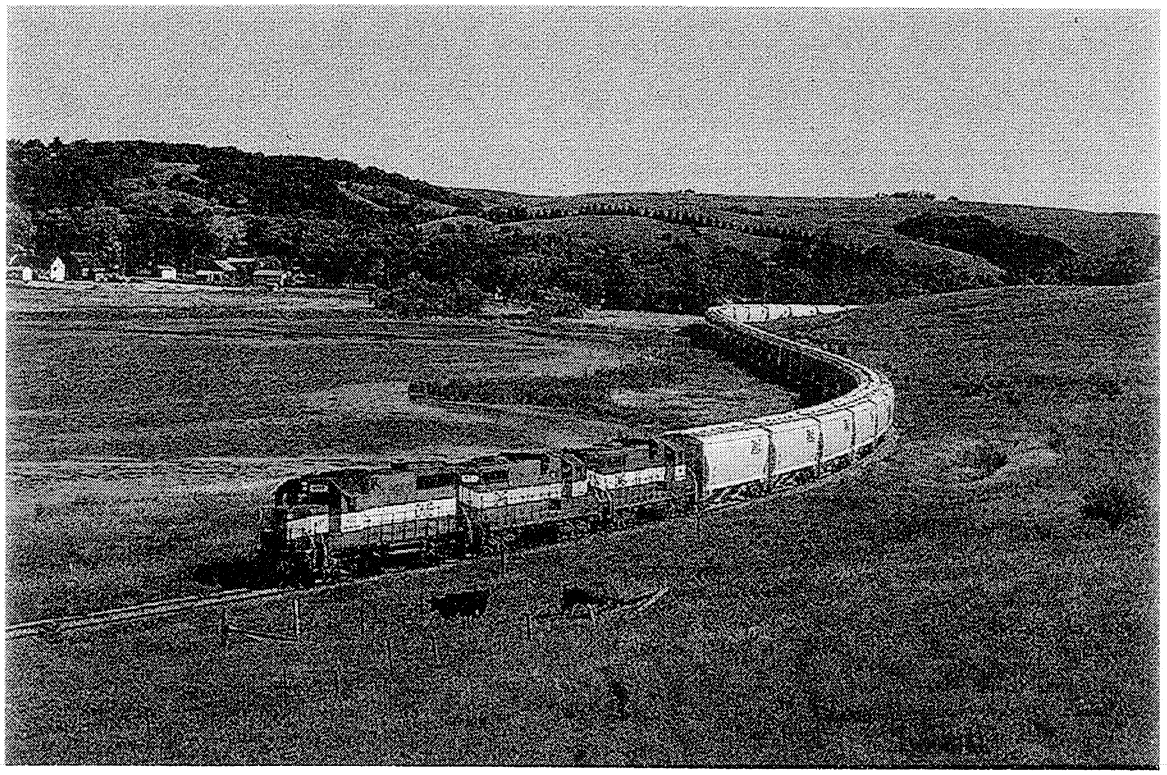
ECONOMIC IMPACTS IN MINNESOTA, SOUTH DAKOTA, AND WYOMING

OF THE

DAKOTA, MINNESOTA & EASTERN RAILROAD CORPORATION
POWDER RIVER BASIN PROJECT



October 15, 1998

Economic and Fiscal Estimates were prepared by:

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EXECUTIVE SUMMARY

In February 1998, the Dakota, Minnesota and Eastern Railroad filed an application with the U.S. Surface Transportation Board to construct and operate 278 miles of new rail lines extending from the DM&E's current lines in western South Dakota into eastern Wyoming. The purpose of the project is to revitalize rail service on the existing DM&E line, and to provide competitive transportation for Wyoming coal to markets primarily in the Midwest. The project has three components, to be constructed in three phases. The three components are the "New Construction", the "Rebuild" and the "Upgrade". The "New Construction" is the 278 miles of new track added to the DM&E system (shown in red on map 1 on page 3). The "Rebuild" is the complete rebuilding of 598 miles of existing DM&E track between Wasta, SD and Winona, MN (shown in dark blue on map 1 on page 3). The "Upgrade" is to make significant improvements on the remaining 239 mile portion of the DM&E system (shown in teal on map 1 on page 3).

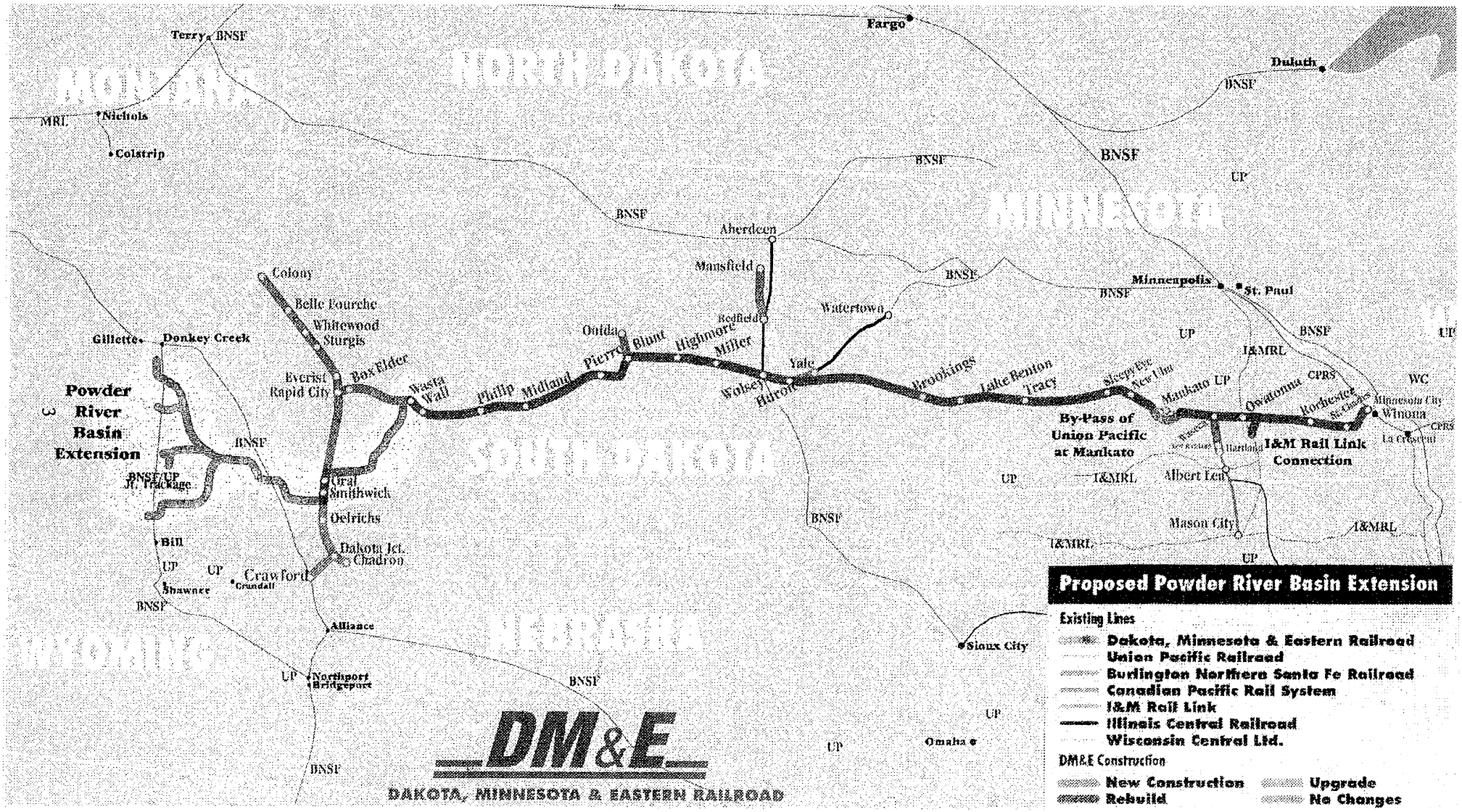
The three components of the project will be constructed in three phases:

Phase I	$1.2 billion for New Construction and Rebuild components of the DM&E project sufficient to provide for the capacity to handle 50 million tons of new traffic annually.
Phase II	$65 million for upgrading the other DM&E lines over a ten year period.
Phase III	$200 million for expanding capacity on the New Construciton and Rebuild components to handle an additional 50 million tons annually, which would take place if and when traffic levels necessitate the expenditure.

The estimated investment in Phase I of the project includes: $607 million for new track including the Mankato and Owatonna work (shown in map 1 on page 3 as red); $492 million for complete rebuilding of existing track (shown in map 1 on page 3 as dark blue); and $84 million in construction of yards (sites to be determined later on the red or dark blue lines). The purpose of this report is to provide an estimate for a portion of the impacts of the Phase I construction project and the subsequent rail operations (both at start-up and full capacity) on the economies of the three states - Wyoming, South Dakota, and Minnesota. The impacts are measured in terms of three variables: employment; earnings; and tax revenues. In addition to estimating the impacts for each of the three states, the report includes estimates of the impacts on property taxes for each of the counties affected by the proposed project.

The Phase III construction impact of $200 million resulting from further capacity expansion of DM&E (to be sited along the red and dark blue lines) and Phase II upgrade of DM&E's non-coal lines (shown in map 1 as teal) of $65 million have not been included in this study. These construction impacts will occur over a five to ten year period, have varying expenditures from year to year, and impact many different locations. Although the effects of this construction will be noticeable to various locations, the economic impact of the construction associated with Phase II and III have been omitted for the sake of brevity and clarity of this report.

The estimation of economic impacts required the application of estimates of costs and some assumptions as to project costs, development, wages, spending, and tax components. Certain assumptions are explained below under the two sections on construction and operations. The estimated project costs are based on a preliminary capital estimate conducted by Parsons-Brinckerhoff, Quade & Douglas, Inc. A more detailed capital design and estimate is currently underway. Similarly, the operations plan continues to be refined and developed, and is subject to change. The assumptions used have generally resulted in conservatively estimated economic impacts.


MONTANA
NORTH DAKOTA
MINNESOTA
SOUTH DAKOTA
NEBRASKA
WYOMING
Fargo
Duluth
Terry
Nichols
Colstrip
Aberdeen
Mansfield
Redfield
Watertown
Colony
Belle Fourche
Whitewood
Sturgis
Gillette
Donkey Creek
Everist
Rapid City
Box Elder
Wasta
Wall
Philip
Midland
Pierre
Oneida
Blunt
Highmore
Miller
Wolsey
Huron
Yale
Brookings
Lake Benton
Tracy
Sleepy Eye
New Ulm
Mankato
Owatonna
Rochester
St. Charles
Minneapolis
St. Paul
Minnesota City
Winona
La Crescent
Harland
Albert Lea
Mason City
Sioux City
Omaha
Powder River Basin Extension
BNSF/UP Jt. Trackage
Bill
Shawnee
Crawford
Grundall
Gra
Smithwick
Oelrichs
Dakota Jct.
Chadron
Alliance
Northport
Bridgeport
By-Pass of Union Pacific at Mankato
I&M Rail Link Connection
BNSF
UP
MRL
I&MRL
CPRS
WC
DM&E
DAKOTA, MINNESOTA & EASTERN RAILROAD
Proposed Powder River Basin Extension
Existing Lines
Dakota, Minnesota & Eastern Railroad
Union Pacific Railroad
Burlington Northern Santa Fe Railroad
Canadian Pacific Rail System
I&M Rail Link
Illinois Central Railroad
Wisconsin Central Ltd.
DM&E Construction
New Construction
Upgrade
Rebuild
No Changes

CONSTRUCTION IMPACTS

New track construction, track rehabilitation, and track upgrade investment costs are placed within the counties as reported in the engineering design study, however, the locations of the five large facilities such as new yards, shop facilities and section headquarters are less certain and are not reported to be in a specific community or county. The construction impacts of these facilities have been estimated separately.

Completion of the construction project will be two years. The economic impacts of the construction spending are expected to follow the usual time pattern with spending increasing to a maximum sometime during the two year period and then tapering off. The impacts will continue to be felt for two to three years after completion of the construction project as respending occurs.

The basis for the economic impact estimates is the engineering design studies for the project. These studies identify the cost of labor, materials, equipment, and other items for the various sections of the line and the type of work to be performed. It is assumed that 30% of the estimated labor costs will not be available for local spending. The number of direct construction jobs is calculated by dividing the remaining labor cost by an average construction annual labor cost of $45,000 per job year. The additional indirect jobs created are estimated using the U.S. Department of Commerce, Bureau of Economic Analysis job multipliers for the construction industry in each of the specific states. The direct and indirect jobs created will result from expenditures by workers on motels, restaurants, housing, recreation, service facilities, entertainment, etc. These multipliers are published in the BEA's Regional Input-Output Modeling System (RIMS II) handbook.

Indirect earnings are calculated by applying the corresponding RIMS II construction earnings multiplier for each of the states.

Summary of Construction Impacts

The following table shows the distribution of track miles by state and type of investment project.

Track Miles

	Minnesota	South Dakota	Wyoming	Total
New Track Construction	16.25	115.07	147.06	278.38
Track Rehabilitation	248.10	349.70		597.80
Track Upgrade	12.70	219.20	6.60	238.50
Total Miles	277.05	683.97	153.66	1,114.68

Construction Job Years Created

It is estimated that the entire project will create almost 4,750 direct construction job years, or an average of 2,375 jobs for the duration of the two year construction period. Approximately 5,500 indirect job years will be spread out over the two years of construction and continue for the following two to three year period.

	Minnesota	South Dakota	Wyoming	Facilities Not Sited	Total
Direct Job Years	1,076	2,258	852	564	4,750
Indirect Job Years	1,496	2,690	634	692	5,512
Total Job Years Created	2,572	4,948	1,486	1,256	10,262

Construction Earnings Created
(Thousands)

The project is expected to create some $336 million in added earnings in the three states during the four to five year period during and immediately after the construction project. These added earnings are about equally divided between direct construction earnings and indirect secondary earnings.

	Minnesota	South Dakota	Wyoming	Facilities Not Sited	Total
Direct Earnings	$ 37,586	$ 81,682	$ 30,599	$ 17,382	$ 167,249
Indirect Earnings	46,736	84,347	17,188	20,076	168,347
Total Earnings Created	$ 84,322	$ 166,029	$ 47,787	$ 37,458	$ 335,596

Construction Tax Revenues Created
(Thousands)

The assumptions used to estimate tax effects are explained in Appendix A. The following table shows the expected tax revenues attributable to the construction project for those taxes estimated.

	Minnesota	South Dakota	Wyoming	Facilities Not Sited	Total
Taxes Earnings	$ 7,214	$ 6,370	$ 3,466	$ 2,431	$ 19,481
Taxes Material	9,493	6,565	3,131	2,244	21,434
Other Business Tax	1,670	5,586	-	613	7,868
Total Tax Revenues	$ 18,377	$ 18,521	$ 6,597	$ 5,288	$ 48,783

A summary of the construction impacts by individual county in each state are shown on Schedule 1 in Appendix A.

OPERATION IMPACTS

The economic effects of coal train operations are estimated at two alternative levels of operations: a start up level of 40 million tons per year and a full capacity level of 100 million tons per year. The number of direct jobs is the number of DM&E jobs as presented in the company's operating plan for the project, including DM&E's current employees.

At the start up level, DM&E is expected to have approximately 827 employees. At full capacity level of operations 1,498 employees are projected. Current employment is 322. Therefore, the expanded operations will increase the number of jobs by 505 at the start up level and 1,176 at the target level.

The operating plan identifies the number of employees by job category. The total direct wage cost is estimated by applying the expected average wage rate for each of the job categories to the number of jobs in the corresponding category. The jobs are associated with specific facilities which have, for the most part, not yet been sited geographically. The facilities serve as the base operating location for employees. For example, train crews will be located at the yard facilities where one crew will hand over operation of the train to the next crew. Shop personnel will be located at the yards and at the main shop. Administrative personnel are primarily located at headquarters. Maintenance of way jobs will be located at various base stations established to cover a geographical territory.

At this time, DM&E has not yet determined the exact size or number of facilities that will be established, nor the locations that will be selected as the sites for such facilities. The determination of the number and location of these facilities will be made as part of the final design currently in progress. There is a great deal of discretion available to pick specific locations for each facility. Generally the geographic territory must be covered, but the facility locations may be concentrated together.

Indirect jobs and earnings created are estimated by applying the appropriate RIMS II multipliers to the direct jobs and earnings created.

Summary of Operations Impacts

The following tables summarize the annual economic effects associated with the expansion of DM&E operations. For each state a "high" value represents the impact if all the reasonably possible non-sited facilities are located in that state; a "low" value represents the minimum possible number of non-sited facilities located in that state. The minimum or "low" value is necessitated by the geographical nature of certain work functions. For example, the headquarters facility may be located anywhere and is not geographically tied to any location, therefore it is shown in the "high" value for each of the three states and is excluded from the "low" value for each state. For these facilities, each state has advantages and disadvantages which must be considered in arriving at location decisions. Wyoming has a favorable business tax climate and, as the source of the coal traffic, advantages for train assembly, car repair, and crew location. It is farthest from the coal markets, however, and lacks communities from which to draw employees.

South Dakota also has a favorable business tax climate and already has some of the DM&E yards and offices, avoiding relocation costs. More than one-half of DM&E track will be in South Dakota so locating more facilities in the state would reduce employee travel expenses.

Minnesota has larger communities and a greater labor supply from which the DM&E can draw. It will be home to the terminus of the coal traffic, advantages for car repair and crew locations. Minnesota's business and personal tax climate is, however, relatively unfavorable.

The table of facilities is shown in Appendix A, Schedule 2. The facilities that are currently anticipated are shown along with their status with regard to each of the three states. A "no" listing indicates that it is not at all likely that the facility listed will be located in that state. A "yes" indicates that the facility is expected to be located in that state due to geographical requirements. A "maybe" indicates that the facility could be located in that state, but is not required. The low number of jobs in a state are those listed as "yes", those associated with facilities that are required to be located within the state for geographical reasons. The high number of jobs includes all of the "maybes" in addition to the yeses.

The operations have been summarized at start up to be 40 million tons per year and full scale operations at 100 million tons per year.

Start Up Operations Level
(40 million tons per year)

Annual Jobs Created

At the start up level of operations, the project is expected to create 1,115 jobs. These include approximately 505 DM&E jobs, 45 additional jobs at the coal mines, and 636 jobs created by secondary respending effects.

	Minnesota		South Dakota		Wyoming		Total*
	High	Low	High	Low	High	Low	
Direct Jobs	293	29	462	72	309	14	505
Mining Jobs					45	45	45
Indirect Jobs **	345	34	506	79	405	86	636
Total Jobs Created	638	63	968	151	759	145	1,186

* Approximation. Indirect jobs may vary slightly depending on which state is selected.
** Includes indirect mining jobs in Wyoming.

Annual Earnings Created
(Thousands)

Total annual earnings attributable to the railroad are estimated to be over $54 million. This includes approximately $29 million in additional earnings of DM&E employees, $2.5 million of increased coal mining earnings, and $23 million in earnings attributable to jobs created by secondary impacts.

	Minnesota		South Dakota		Wyoming		Total
	High	Low	High	Low	High	Low	
Direct Earnings	$16,243	$ 1,534	$26,861	$ 3,755	$17,258	$ 606	$29,071
Mining Earnings					2,500	2,500	2,500
Indirect Earnings	13,171	1,244	18,401	2,572	12,981	2,016	22,493
Total Earnings Created	$29,414	$ 2,778	$45,262	$ 6,327	$32,739	$ 5,122	$54,064

Annual Tax Revenues Generated
(Thousands)

The increase in tax revenues for each of the three states is shown in the following table for those taxes estimated. The total will vary with the location of the facilities not sited.

	Minnesota		South Dakota		Wyoming	
	High	Low	High	Low	High	Low
Sales/Use	$ 659	$ 62	$ 1,743	$ 244	$ 947	$ 148
Income Tax *	968	91	-	-	-	-
Property Tax	8,699	8,699	14,123	14,123	2,597	2,597
Total Tax Revenues	$10,326	$ 8,853	$15,866	$14,367	$ 3,544	$ 2,745

* Not including corporate income taxes

Full Scale Operations Level
(100 million tons per year)

Annual Jobs Created

At the targeted full scale level of operations, the project is estimated to create approximately 4,020 jobs, generating $177 million in earnings.

	Minnesota		South Dakota		Wyoming		Total*
	High	Low	High	Low	High	Low	
Direct Jobs	720	45	1,117	86	711	14	1,176
Mining Jobs					591	591	591
Indirect Jobs **	848	53	1,223	94	1,707	953	2,253
Total Jobs Created	1,568	98	2,340	180	3,009	1,558	4,020

* Approximation. Indirect jobs may vary slightly depending on which state is selected.
** Includes indirect mining jobs in Wyoming.

Annual Earnings Created
(Thousands)

	Minnesota		South Dakota		Wyoming		Total
	High	Low	High	Low	High	Low	
Direct Earnings	$42,545	$ 2,422	$ 68,877	$ 4,446	$ 41,805	$ 606	$ 71,929
Mining Earnings					32,200	32,200	32,200
Indirect Earnings	34,496	1,964	47,187	3,046	48,766	21,636	72,889
Total Earnings Created	$77,041	$ 4,386	$116,064	$ 7,492	$122,771	$54,442	$177,018

Annual Tax Revenues Generated
(Thousands)

	Minnesota		South Dakota		Wyoming	
	High	Low	High	Low	High	Low
Sales/Use	$ 1,726	$ 98	$ 4,468	$ 288	$ 3,551	$ 1,575
Income Tax *	2,535	144	-	-	-	-
Property Tax	10,513	10,513	17,184	17,184	3,138	3,138
Total Tax Revenues	$14,773	$10,756	$ 21,652	$17,472	$ 6,689	$ 4,713

* Not including corporate income taxes

Property Taxes (Ad Valorem)

For detail see Appendix A, Schedule 6 which shows the property tax impact from DM&E's expansion by county. A team of outside economists representing each of the three states estimated individual county-by-county property tax impacts. The DM&E property tax will average $1,142,000 per county.

Railroads are centrally assessed by each state. Taxes are then allocated to each county by the state. Economists followed procedures specific to each state to calculate the taxes. In Wyoming the ad valorem is the property tax.

Coal Industry Increased Tax Revenues

In addition to the tax revenues shown in the previous table, the expansion of the coal mining industry in Wyoming will increase state and federal tax revenues. The amount of these tax revenues will depend upon the price of coal as well as the level of DM&E operations. The following tables show the estimated tax revenues with coal prices of both $4.99 and also $3.65 per ton and operations at the start up and full scale operational target levels.

Start Up Operations
Tax Revenues Due to
Wyoming Coal Expansion Impacts
(Thousands)

	Coal Price	
	$4.99/Ton	$3.65/Ton
Federal Royalties	$ 30,606	$ 22,387
Severence Tax	9,836	7,195
Ad Valorem Tax	8,675	6,345
Total Tax Revenues	$ 49,117	$ 35,927

Full Scale Operations
Tax Revenues Due to
Wyoming Coal Expansion Impacts
(Thousands)

	Coal Price	
	$4.99/Ton	$3.65/Ton
Federal Royalties	$ 51,010	$ 37,312
Severence Tax	24,591	17,987
Ad Valorem Tax	21,688	15,864
Total Tax Revenues	$ 97,289	$ 71,163

OTHER ECONOMIC IMPACTS

The state and county level analyses in this report include only the estimated impacts of the coal line construction and operations on the number of jobs created; the direct and indirect earnings created by the labor cost; and some of the primary additional tax revenues. A number of additional economic impacts can be expected but have not been estimated. Some of these are the following:

I. Other Direct DM&E Expenditures

In addition to its expenditure on labor, DM&E will incur significant local expenditures in the three states. During construction most of the materials purchased, such as rail, ties, and other track material, will necessarily be imported into the three states, however, there will need to be local purchases of fuel, fencing, hardware, equipment repair services, and fill material. The company is currently contemplating a rail welding facility and local fabrication of concrete ties, culverts and bridge components.

During operation of the line, the railroad will make such direct local purchases as vehicles, office equipment and supplies, fuel, energy, and communication services.

II. Improved, Lower Cost, Service

The rebuilt railroad will offer faster and more reliable service to existing customers. Transit times across the DM&E system are expected to be reduced by 75% and car cycle times by 50%. Improved car utilization and car turnaround times will reduce inventory, transportation, and equipment costs to shippers.

The rebuilt line will also allow the movement of additional lading per car. The railroad has already acquired some larger covered hopper cars in anticipation of the increased weight limits on the rebuilt line. For example, grain shippers will realize a 10-12% increase in the number of bushels per larger carload.

This improved, lower cost transportation service will attract increasing volumes of traffic from current shippers. It is anticipated that non-coal traffic volumes will increase by 33% following completion of the rebuild.

III. Highway Traffic

The improved, lower cost, access to rail transportation resulting from this investment project will reduce the amount of heavy truck traffic on the states' highways. This will be particularly beneficial in the case of the DM&E because the primary territory served by the line does not have direct access to Interstate highways. A significant share of the reduction in the number of heavy truck trips will occur across central South Dakota and western Minnesota where most of the east-west routes are two lane state highways. The benefits will be reflected in both reduced highway and bridge maintenance costs and improved highway safety.

IV. Industrial Development

Dependable and fast rail service is a requirement for many firms making industrial location decisions. Much of the area served by the DM&E, especially western Minnesota and across central South Dakota, has found it difficult to attract new industry because of inadequate access to the national transportation system.

With completion of this investment in improved railroad infrastructure, all of the communities along the line will have improved rail service. They will have access to the national transportation system. Most of the communities served by the DM&E are small towns which have been losing

population. Only five large towns have access to Interstate or other multilane highways. The improved rail line, serving as the Interstate transportation connection for all of these communities, large and small, will significantly enhance communities opportunities to attract new industries and jobs to the region.

V. Wage Rates

Most of the new jobs created by the expansion of railroad services will be skilled jobs paying wage rates significantly higher than those now prevailing in much of the service territory. To acquire these skills, DM&E will need to pay the national wage rates in the railroad industry.

These are wages high enough to attract a family's primary wage earner to move their family to the region. Most of those moving to the region will be family purchasers of housing, transportation, clothing, food, entertainment, and all the other goods and services of the typical family. This represents the direct, positive impact on the region's retail businesses.

This bidding for employees at wages above the region's prevailing rate will also raise the general level of wages in the region, therefore, there will be an additional indirect effect as the greater incomes created by the increased wage rates are spent throughout the region's retail sector.

VI. Property Values

Some residents of the region have expressed concern about the potential loss of property value for real estate located adjacent to the rebuilt railroad. By creating as many as 3,736 new jobs in the region and by raising the general level in wages and incomes, the demand for real estate will be enhanced. The general level of real estate values will be increased. Enhanced economic development opportunities will further increase values of property adjacent to the rail line.

In communities which do not share significantly in the increased employment, property adjacent to the line may experience some initial reduction in value. It is not likely that real estate values will permanently decline as a result of the expansion of railroad traffic. For example, among the communities along the DM&E line, Brookings has some of the largest number of residential properties directly adjacent to the railroad. In the one year since the DM&E's public announcement of the project, seven properties adjacent to the track have been sold. Each of the properties sold at a price above both the seller's purchase price and the property's taxable value. The seven properties sold at prices which, on average, were 15% above their respective assessed values and 33% above their respective taxable values. This is true in spite of a great deal of media attention given to the public concern expressed about property values.

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APPENDIX A

IMPACTS BY COUNTY AND FACILITIES

This Appendix contains more detailed breakouts of the economic impact of the project - either by state and county or by individual facility.

Construction Impacts

Construction impacts are shown by county for the mainline and sidings. Several large facilities have not been sited as to their final location and are shown separately on Schedule 1.

DM&E construction and rebuild costs were estimated by county. These costs identified labor, material, equipment usage, profit and overheads. Certain large facilities were estimated separately and are listed at the bottom of Schedule 1. The large facilities are not sited with regard to county or state.

Jobs and earnings were calculated for the direct construction jobs using the construction estimates mentioned above. Indirect jobs and earnings were calculated using BEA multipliers to determine the secondary jobs that would result from the construction activity. The direct and indirect jobs are shown on the construction impact table as the amount of work to be performed, on average about two job years per job[1]. Earnings represent the total direct and indirect earnings (without fringes) for the entire two year project. Although these jobs are shown by county, workers may actually reside elsewhere and their expenditures may take place elsewhere.

Taxes have been calculated as follows: Contractor's excise taxes on contractor's billing - excluding material purchased directly by the railroad. Sales and use taxes on material purchased directly by the railroad. Sales and use taxes generated from the spending by construction workers and the secondary workers' earnings[2]. Income tax, where applicable, on the workers' earnings. It is estimated that construction activity in the three states will generate a total $51,000,000 in taxes.

Railroad Operational Impacts by Facility

The following tables are designed to identify specific facilities that are reasonably likely to be located throughout the reconstituted Dakota, Minnesota & Eastern Railroad following its extension and rebuilding project. Because it is impossible to determine the specific location of these facilities until the final alignment is determined and the operating plan is superimposed on that alignment, and until certain market issues are resolved, these facilities are listed generically in order to provide some understanding of the scope of facilities to be located on the new DM&E.

In the tables, existing facilities at Waseca, MN, Huron, SD and Rapid City, SD are incorporated by reference to reflect the existing operations at each of those locations. This is based on the existing operating plan and established company commitments to existing employees in those locations.

Under the heading of Transportation Department, four yards are listed in addition to the existing yard facilities. This is based on the current operating plan which assumes four yards. It is possible that there may be more than four yards added to the DM&E system, and it is also possible that any of the new yards may be co-located with existing facilities.

Under the heading of Maintenance of Way Department, 15 stations are identified in addition to the existing three stations. Again, it is entirely possible that the number of stations may fluctuate somewhat as

[1] However, it should be noted that the actual timing of the jobs may be of shorter duration, e.g. a situation where 30 jobs may be required for 1 1/2 years instead of 20 jobs for two years.

[2] The study assumes that for Minnesota and South Dakota 70% and for Wyoming 56% of workers' wages will be spent on taxable items.

the operating plan is finalized. Additionally, these stations may be co-located with existing DM&E Maintenance of Way stations.

The same is true with the Maintenance of Equipment Department heading classifications for the existing shops, the anticipated new main shop, and additional regional shops.

Under the heading of Administrative Department, it is expected that in addition to the overall operational headquarters, there will be administrative offices in each of the two states other than the headquarters. Staffing at those facilities has not been determined. While the numbers under the administrative department reflect a single administrative officer in each of the regional offices, it is likely that the regional office will be co-located with other departmental operations. Additionally, when the duties are ultimately assigned, there may be additions or a different allocation of resources between the headquarters and regional offices.

With respect to all four departments, it should be understood that in many cases the different departmental facilities will be co-located with each other at a single point. Also, it is important to keep in mind that this is a model. It is a reasonable model and considered to be fairly conservative with respect to the number of employees. While it should provide a reasonable estimation as to the type and number of facilities, it is subject to change.

Because it is impossible to determine with certainty where the individual facilities will be located, we have listed the economic impact assumptions listed under each of the three states, applying individual states tax laws, economic multipliers, and other state specific variables as they would relate to that facility. While the impact charts show economic impact figures for each state, obviously each facility can be located in only one state. There are a limited number of facilities where the state location is dictated or limited by a unique characteristic of the facility (e.g., Waseca yard can only be in Minnesota).

Finally, while it is impossible to determine the exact location of the facilities, certain assumptions were used to develop an estimated operating impact model for each of the three states to measure reasonably likely statewide impacts. For those purposes, we have assumed that somewhere between 13% and 92% of the unallocated facilities will be located in South Dakota; between 7% and 63% of the unallocated facilities will be located in Minnesota; and between 2% and 64% of the unallocated facilities will be located in Wyoming.

Existing operations sites for the DM&E located at Waseca, MN; Huron, SD; and Rapid City, SD will continue to be operational facilities for the DM&E. All other future facilities will be located at sites to be designated at a later date when the operational planning is more fully refined. The locations for the sites may be in any of the three states of Minnesota, South Dakota, or Wyoming.

Schedules 3 through 14 identify the total jobs, direct railroad jobs and secondary jobs, earnings, and taxes that will be associated with each facility. With the exception of the three existing DM&E sites noted above, the total jobs have been calculated for each of the three states[3]. Earnings have been calculated for each of the facilities. DM&E has estimated the direct railroad wages at what it believes average Class I rates will be at start-up. The actual wages paid by DM&E will be set by comparison with industry averages for Class I railroads. The secondary earnings have been calculated using BEA multipliers. The earnings were then used to calculate sales, use and income taxes associated with continuing rail operations.

The totals shown at the bottom of each page represent the minimum and maximum that each state can anticipate from the site selection process. Each state will receive a minimum number of facilities due to the geographical requirements of the rail system, however, there remains considerable flexibility in allowing the railroad to select sites for a large number of facilities which can shift their final location considerably.

[3] Different total jobs result because the BEA multiplier for indirect jobs differs between the states.

Schedules 3 through 8 identify the jobs, earnings and tax impacts of DM&E at the start of operations (40 million tons). The direct/indirect jobs, earnings, and taxes have been calculated as if each facility were located in the state listed for the heading (with the exception of Winona, MN, Huron and Rapid City, SD). The totals shown at the bottom of the page represent the potential range of economic impact the project will have on each state. The "high" figure represents the impact that will occur if all discretionary location decisions are made to locate facilities within that state. The "low" figure represents the impact that will occur if all discretionary location decisions are made to locate the facility in another state. The range of impact is significant.

Schedules 9 through 14 represent the same information as Schedules 3 through 8, only for the impact of DM&E operations at full capacity (100 million tons).

DAKOTA, MINNESOTA & EASTERN RAILROAD CORPORATION
CONSTRUCTION IMPACTS

	Job Years			
	Direct	Indirect	Earnings	Taxes
Minnesota				
Winona	84	118	6,780,000	1,534,206
Olmsted	114	162	9,311,000	1,988,952
Dodge	56	78	4,474,000	1,020,386
Steele	98	140	7,996,000	1,739,796
Waseca	98	140	7,965,000	1,665,135
Blue Earth	170	242	13,814,000	3,264,321
Brown	222	284	15,006,000	2,819,506
Redwood	82	116	6,609,000	1,524,588
Lyon	84	118	6,780,000	1,534,206
Lincoln	68	98	5,587,000	1,285,612
Total	1,076	1,496	$84,322,000	$18,376,708
South Dakota				
Brookings	124	152	$9,246,300	$1,072,800
Kingsbury	108	118	7,434,200	975,000
Beadle	138	152	9,492,500	1,205,400
Hand	92	102	6,385,300	826,200
Hyde	52	56	3,494,800	464,200
Hughes	172	190	12,421,300	1,436,500
Stanley	288	318	19,922,700	1,934,800
Jones	64	70	4,321,300	512,900
Haakon	182	200	12,588,900	1,416,900
Jackson	46	50	3,112,400	388,500
Pennington	316	536	30,844,800	3,037,800
Custer	298	328	20,585,500	2,238,100
Fall River	378	418	26,179,200	3,011,900
Total	2,258	2,690	$166,029,200	$18,521,000
Wyoming				
Niobrara	88	66	4,965,000	942,000
Weston	336	250	18,867,000	2,443,000
Converse	78	58	4,351,000	525,000
Campbell	350	260	19,604,000	2,687,000
Total	852	634	$47,787,000	$6,597,000
Facility Construction Impacts				
East Yard	126	180	$10,303,000	$1,552,100
Middle East Yard	56	62	3,833,800	309,200
Main Shop	178	196	12,285,400	937,300
Middle West Yard	56	62	0	309,200
West Yard	148	128	8,005,200	1,949,000
Other Ballast	0	64	3,030,600	231,100
Total	564	692	$37,458,000	$5,287,900
Grand Total	4,750	5,512	$335,596,200	$48,782,608

DAKOTA, MINNESOTA & EASTERN RAILROAD CORPORATION
FACILITY IMPACTS
Conditions

	MN	SD	WY
Transportation			
Waseca Yard	Yes	No	No
Huron Yard	No	Yes	No
Rapid City Yard	No	Yes	No
Yard #1	Yes	No	No
Yard #2	Maybe	Maybe	No
Yard #3	No	Yes	No
Yard #4	No	Maybe	Maybe
Maintenance of Way			
Waseca Station	Yes	No	No
Huron Station	No	Yes	No
Rapid City Station	No	Yes	No
Station #1	Yes	No	No
Station #2	Yes	No	No
Station #3	Yes	No	No
Station #4	Maybe	Maybe	No
Station #5	Maybe	Maybe	No
Station #6	No	Yes	No
Station #7	No	Yes	No
Station #8	No	Yes	No
Station #9	No	Yes	No
Station #10	No	Yes	No
Station #11	No	Yes	No
Station #12	No	Maybe	Maybe
Station #13	No	Maybe	Maybe
Station #14	No	No	Yes
Station #15	No	No	Yes
Maintenance of Equipment			
Waseca Shop	Yes	No	No
Huron Shop	No	Yes	No
Rapid City Shop	No	Yes	No
Main Shop	Maybe	Maybe	Maybe
Regional Shop #1	Yes	No	No
Regional Shop #2	No	Yes	No
Regional Shop #3	No	Maybe	Maybe
Administrative			
Waseca Office	Yes	No	No
Huron Office	No	Yes	No
Rapid City Office	No	Yes	No
Headquarters	Maybe	Maybe	Maybe
Regional Office #1	Maybe	Maybe	Maybe
Regional Office #2	Maybe	Maybe	Maybe

DAKOTA, MINNESOTA & EASTERN RAILROAD CORPORATION

FACILITY IMPACTS

Minnesota - 40MM Tons

High

	Change in Jobs			Change in Earnings	Change in Taxes
	Direct	Indirect	Total		
Transportation					
Waseca Yard	0	0	0	$0	$0
Huron Yard	0	0	0	0	0
Rapid City Yard	0	0	0	0	0
Yard #1	10	12	22	1,271,200	70,300
Yard #2	87	102	189	11,059,300	611,600
Yard #3	0	0	0	0	0
Yard #4	0	0	0	0	0
Maintenance of Way					
Waseca Station	0	0	0	0	0
Huron Station	0	0	0	0	0
Rapid City Station	0	0	0	0	0
Station #1	7	8	15	548,500	30,300
Station #2	0	0	0	0	0
Station #3	0	0	0	0	0
Station #4	1	1	2	78,400	4,300
Station #5	7	8	15	548,500	30,300
Station #6	0	0	0	0	0
Station #7	0	0	0	0	0
Station #8	0	0	0	0	0
Station #9	0	0	0	0	0
Station #10	0	0	0	0	0
Station #11	0	0	0	0	0
Station #12	0	0	0	0	0
Station #13	0	0	0	0	0
Station #14	0	0	0	0	0
Station #15	0	0	0	0	0
Maintenance of Equipment					
Waseca Shop	0	0	0	0	0
Huron Shop	0	0	0	0	0
Rapid City Shop	0	0	0	0	0
Main Shop	117	138	255	9,339,400	516,500
Regional Shop #1	12	14	26	957,900	53,000
Regional Shop #2	0	0	0	0	0
Regional Shop #3	0	0	0	0	0
Administrative					
Waseca Office	0	0	0	0	0
Huron Office	0	0	0	0	0
Rapid City Office	0	0	0	0	0
Headquarters	50	59	109	5,394,600	298,300
Regional Office #1	1	1	2	107,900	6,000
Regional Office #2	1	1	2	107,900	6,000
Total	293	345	638	$29,413,600	$1,626,600

DAKOTA, MINNESOTA & EASTERN RAILROAD CORPORATION

FACILITY IMPACTS

Minnesota - 40MM Tons

Low

	Change in Jobs			Change in Earnings	Change in Taxes
	Direct	Indirect	Total		
Transportation					
Waseca Yard	0	0	0	$0	$0
Huron Yard	0	0	0	0	0
Rapid City Yard	0	0	0	0	0
Yard #1	10	12	22	1,271,200	70,300
Yard #2	0	0	0	0	0
Yard #3	0	0	0	0	0
Yard #4	0	0	0	0	0
Maintenance of Way					
Waseca Station	0	0	0	0	0
Huron Station	0	0	0	0	0
Rapid City Station	0	0	0	0	0
Station #1	7	8	15	548,500	30,300
Station #2	0	0	0	0	0
Station #3	0	0	0	0	0
Station #4	0	0	0	0	0
Station #5	0	0	0	0	0
Station #6	0	0	0	0	0
Station #7	0	0	0	0	0
Station #8	0	0	0	0	0
Station #9	0	0	0	0	0
Station #10	0	0	0	0	0
Station #11	0	0	0	0	0
Station #12	0	0	0	0	0
Station #13	0	0	0	0	0
Station #14	0	0	0	0	0
Station #15	0	0	0	0	0
Maintenance of Equipment					
Waseca Shop	0	0	0	0	0
Huron Shop	0	0	0	0	0
Rapid City Shop	0	0	0	0	0
Main Shop	0	0	0	0	0
Regional Shop #1	12	14	26	957,900	53,000
Regional Shop #2	0	0	0	0	0
Regional Shop #3	0	0	0	0	0
Administrative					
Waseca Office	0	0	0	0	0
Huron Office	0	0	0	0	0
Rapid City Office	0	0	0	0	0
Headquarters	0	0	0	0	0
Regional Office #1	0	0	0	0	0
Regional Office #2	0	0	0	0	0
Total	29	34	63	$2,777,600	$153,600

DAKOTA, MINNESOTA & EASTERN RAILROAD CORPORATION

FACILITY IMPACTS

South Dakota - 40MM Tons

High

	Change in Jobs			Change in Earnings	Change in Taxes
	Direct	Indirect	Total		
Transportation					
Waseca Yard	0	0	0	$0	$0
Huron Yard	0	0	0	0	0
Rapid City Yard	4	4	8	473,200	18,200
Yard #1	0	0	0	0	0
Yard #2	87	95	182	10,291,600	396,200
Yard #3	19	21	40	2,247,600	86,500
Yard #4	109	119	228	12,894,000	496,400
Maintenance of Way					
Waseca Station	0	0	0	0	0
Huron Station	10	11	21	729,200	28,100
Rapid City Station	13	14	27	948,000	36,500
Station #1	0	0	0	0	0
Station #2	0	0	0	0	0
Station #3	0	0	0	0	0
Station #4	1	1	2	72,900	2,800
Station #5	7	8	15	510,500	19,700
Station #6	6	7	13	437,500	16,800
Station #7	1	1	2	72,900	2,800
Station #8	0	0	0	0	0
Station #9	10	11	21	729,200	28,100
Station #10	2	2	4	145,800	5,600
Station #11	2	2	4	145,800	5,600
Station #12	2	2	4	145,800	5,600
Station #13	4	4	8	291,700	11,200
Station #14	0	0	0	0	0
Station #15	0	0	0	0	0
Maintenance of Equipment					
Waseca Shop	0	0	0	0	0
Huron Shop	0	0	0	0	0
Rapid City Shop	0	0	0	0	0
Main Shop	117	128	245	8,691,100	334,600
Regional Shop #1	0	0	0	0	0
Regional Shop #2	4	4	8	297,100	11,400
Regional Shop #3	11	12	23	817,100	31,500
Administrative					
Waseca Office	0	0	0	0	0
Huron Office	0	0	0	0	0
Rapid City Office	1	1	2	100,400	3,900
Headquarters	50	55	105	5,020,100	193,300
Regional Office #1	1	1	2	100,400	3,900
Regional Office #2	1	1	2	100,400	3,900
Total	462	506	968	$45,262,300	$1,742,600

DAKOTA, MINNESOTA & EASTERN RAILROAD CORPORATION

FACILITY IMPACTS

South Dakota - 40MM Tons

Low

	Change in Jobs			Change in Earnings	Change in Taxes
	Direct	Indirect	Total		
Transportation					
Waseca Yard	0	0	0	$0	$0
Huron Yard	0	0	0	0	0
Rapid City Yard	4	4	8	473,200	18,200
Yard #1	0	0	0	0	0
Yard #2	0	0	0	0	0
Yard #3	19	21	40	2,247,600	86,500
Yard #4	0	0	0	0	0
Maintenance of Way					
Waseca Station	0	0	0	0	0
Huron Station	10	11	21	729,200	28,100
Rapid City Station	13	14	27	948,000	36,500
Station #1	0	0	0	0	0
Station #2	0	0	0	0	0
Station #3	0	0	0	0	0
Station #4	0	0	0	0	0
Station #5	0	0	0	0	0
Station #6	6	7	13	437,500	16,800
Station #7	1	1	2	72,900	2,800
Station #8	0	0	0	0	0
Station #9	10	11	21	729,200	28,100
Station #10	2	2	4	145,800	5,600
Station #11	2	2	4	145,800	5,600
Station #12	0	0	0	0	0
Station #13	0	0	0	0	0
Station #14	0	0	0	0	0
Station #15	0	0	0	0	0
Maintenance of Equipment					
Waseca Shop	0	0	0	0	0
Huron Shop	0	0	0	0	0
Rapid City Shop	0	0	0	0	0
Main Shop	0	0	0	0	0
Regional Shop #1	0	0	0	0	0
Regional Shop #2	4	4	8	297,100	11,400
Regional Shop #3	0	0	0	0	0
Administrative					
Waseca Office	0	0	0	0	0
Huron Office	0	0	0	0	0
Rapid City Office	1	1	2	100,400	3,900
Headquarters	0	0	0	0	0
Regional Office #1	0	0	0	0	0
Regional Office #2	0	0	0	0	0
Total	72	79	151	$6,326,700	$243,500

DAKOTA, MINNESOTA & EASTERN RAILROAD CORPORATION

FACILITY IMPACTS

Wyoming - 40MM Tons

High

	Change in Jobs			Change in	Change in
	Direct	Indirect	Total	Earnings	Taxes
Mining	45	71	116	$4,117,000	$119,100
Transportation					
Waseca Yard	0	0	0	0	0
Huron Yard	0	0	0	0	0
Rapid City Yard	0	0	0	0	0
Yard #1	0	0	0	0	0
Yard #2	0	0	0	0	0
Yard #3	0	0	0	0	0
Yard #4	109	118	227	12,690,500	367,100
Maintenance of Way					
Waseca Station	0	0	0	0	0
Huron Station	0	0	0	0	0
Rapid City Station	0	0	0	0	0
Station #1	0	0	0	0	0
Station #2	0	0	0	0	0
Station #3	0	0	0	0	0
Station #4	0	0	0	0	0
Station #5	0	0	0	0	0
Station #6	0	0	0	0	0
Station #7	0	0	0	0	0
Station #8	0	0	0	0	0
Station #9	0	0	0	0	0
Station #10	0	0	0	0	0
Station #11	0	0	0	0	0
Station #12	2	2	4	143,500	4,200
Station #13	4	4	8	287,100	8,300
Station #14	4	4	8	287,100	8,300
Station #15	10	11	21	717,700	20,800
Maintenance of Equipment					
Waseca Shop	0	0	0	0	0
Huron Shop	0	0	0	0	0
Rapid City Shop	0	0	0	0	0
Main Shop	117	127	244	8,553,900	247,400
Regional Shop #1	0	0	0	0	0
Regional Shop #2	0	0	0	0	0
Regional Shop #3	11	12	23	804,200	23,300
Administrative					
Waseca Office	0	0	0	0	0
Huron Office	0	0	0	0	0
Rapid City Office	0	0	0	0	0
Headquarters	50	54	104	4,940,800	142,900
Regional Office #1	1	1	2	98,800	2,900
Regional Office #2	1	1	2	98,800	2,900
Total	354	405	759	$32,739,400	$947,200

DAKOTA, MINNESOTA & EASTERN RAILROAD CORPORATION

FACILITY IMPACTS

Wyoming - 40MM Tons

Low

	Change in Jobs			Change in	Change in
	Direct	Indirect	Total	Earnings	Taxes
Mining	45	71	116	$4,117,000	$119,100
Transportation					
Waseca Yard	0	0	0	0	0
Huron Yard	0	0	0	0	0
Rapid City Yard	0	0	0	0	0
Yard #1	0	0	0	0	0
Yard #2	0	0	0	0	0
Yard #3	0	0	0	0	0
Yard #4	0	0	0	0	0
Maintenance of Way					
Waseca Station	0	0	0	0	0
Huron Station	0	0	0	0	0
Rapid City Station	0	0	0	0	0
Station #1	0	0	0	0	0
Station #2	0	0	0	0	0
Station #3	0	0	0	0	0
Station #4	0	0	0	0	0
Station #5	0	0	0	0	0
Station #6	0	0	0	0	0
Station #7	0	0	0	0	0
Station #8	0	0	0	0	0
Station #9	0	0	0	0	0
Station #10	0	0	0	0	0
Station #11	0	0	0	0	0
Station #12	0	0	0	0	0
Station #13	0	0	0	0	0
Station #14	4	4	8	287,100	8,300
Station #15	10	11	21	717,700	20,800
Maintenance of Equipment					
Waseca Shop	0	0	0	0	0
Huron Shop	0	0	0	0	0
Rapid City Shop	0	0	0	0	0
Main Shop	0	0	0	0	0
Regional Shop #1	0	0	0	0	0
Regional Shop #2	0	0	0	0	0
Regional Shop #3	0	0	0	0	0
Administrative					
Waseca Office	0	0	0	0	0
Huron Office	0	0	0	0	0
Rapid City Office	0	0	0	0	0
Headquarters	0	0	0	0	0
Regional Office #1	0	0	0	0	0
Regional Office #2	0	0	0	0	0
Total	59	86	145	$5,121,800	$148,200

DAKOTA, MINNESOTA & EASTERN RAILROAD CORPORATION

FACILITY IMPACTS

Minnesota - 100MM Tons

High

	Change in Jobs			Change in	Change in
	Direct	Indirect	Total	Earnings	Taxes
Transportation					
Waseca Yard	0	0	0	$0	$0
Huron Yard	0	0	0	0	0
Rapid City Yard	0	0	0	0	0
Yard #1	17	20	37	2,161,000	119,500
Yard #2	326	384	710	41,440,500	2,291,700
Yard #3	0	0	0	0	0
Yard #4	0	0	0	0	0
Maintenance of Way					
Waseca Station	0	0	0	0	0
Huron Station	0	0	0	0	0
Rapid City Station	0	0	0	0	0
Station #1	7	8	15	548,500	30,300
Station #2	0	0	0	0	0
Station #3	0	0	0	0	0
Station #4	1	1	2	78,400	4,300
Station #5	7	8	15	548,500	30,300
Station #6	0	0	0	0	0
Station #7	0	0	0	0	0
Station #8	0	0	0	0	0
Station #9	0	0	0	0	0
Station #10	0	0	0	0	0
Station #11	0	0	0	0	0
Station #12	0	0	0	0	0
Station #13	0	0	0	0	0
Station #14	0	0	0	0	0
Station #15	0	0	0	0	0
Maintenance of Equipment					
Waseca Shop	0	0	0	0	0
Huron Shop	0	0	0	0	0
Rapid City Shop	0	0	0	0	0
Main Shop	221	260	481	17,641,000	975,500
Regional Shop #1	21	25	46	1,676,300	92,700
Regional Shop #2	0	0	0	0	0
Regional Shop #3	0	0	0	0	0
Administrative					
Waseca Office	0	0	0	0	0
Huron Office	0	0	0	0	0
Rapid City Office	0	0	0	0	0
Headquarters	116	137	253	12,515,400	692,100
Regional Office #1	2	2	4	215,800	11,900
Regional Office #2	2	2	4	215,800	11,900
Total	720	848	1,568	$77,041,200	$4,260,200

DAKOTA, MINNESOTA & EASTERN RAILROAD CORPORATION

FACILITY IMPACTS

Minnesota - 100MM Tons

Low

	Change in Jobs			Change in	Change in
	Direct	Indirect	Total	Earnings	Taxes
Transportation					
Waseca Yard	0	0	0	$0	$0
Huron Yard	0	0	0	0	0
Rapid City Yard	0	0	0	0	0
Yard #1	17	20	37	2,161,000	119,500
Yard #2	0	0	0	0	0
Yard #3	0	0	0	0	0
Yard #4	0	0	0	0	0
Maintenance of Way					
Waseca Station	0	0	0	0	0
Huron Station	0	0	0	0	0
Rapid City Station	0	0	0	0	0
Station #1	7	8	15	548,500	30,300
Station #2	0	0	0	0	0
Station #3	0	0	0	0	0
Station #4	0	0	0	0	0
Station #5	0	0	0	0	0
Station #6	0	0	0	0	0
Station #7	0	0	0	0	0
Station #8	0	0	0	0	0
Station #9	0	0	0	0	0
Station #10	0	0	0	0	0
Station #11	0	0	0	0	0
Station #12	0	0	0	0	0
Station #13	0	0	0	0	0
Station #14	0	0	0	0	0
Station #15	0	0	0	0	0
Maintenance of Equipment					
Waseca Shop	0	0	0	0	0
Huron Shop	0	0	0	0	0
Rapid City Shop	0	0	0	0	0
Main Shop	0	0	0	0	0
Regional Shop #1	21	25	46	1,676,300	92,700
Regional Shop #2	0	0	0	0	0
Regional Shop #3	0	0	0	0	0
Administrative					
Waseca Office	0	0	0	0	0
Huron Office	0	0	0	0	0
Rapid City Office	0	0	0	0	0
Headquarters	0	0	0	0	0
Regional Office #1	0	0	0	0	0
Regional Office #2	0	0	0	0	0
Total	45	53	98	$4,385,800	$242,500

DAKOTA, MINNESOTA & EASTERN RAILROAD CORPORATION

FACILITY IMPACTS

South Dakota - 100MM Tons

Low

	Change in Jobs			Change in Earnings	Change in Taxes
	Direct	Indirect	Total		
Transportation					
Waseca Yard	0	0	0	$0	$0
Huron Yard	0	0	0	0	0
Rapid City Yard	4	4	8	473,200	18,200
Yard #1	0	0	0	0	0
Yard #2	0	0	0	0	0
Yard #3	22	24	46	2,602,500	100,200
Yard #4	0	0	0	0	0
Maintenance of Way					
Waseca Station	0	0	0	0	0
Huron Station	10	11	21	729,200	28,100
Rapid City Station	13	14	27	948,000	36,500
Station #1	0	0	0	0	0
Station #2	0	0	0	0	0
Station #3	0	0	0	0	0
Station #4	0	0	0	0	0
Station #5	0	0	0	0	0
Station #6	11	12	23	802,200	30,900
Station #7	1	1	2	72,900	2,800
Station #8	0	0	0	0	0
Station #9	10	11	21	729,200	28,100
Station #10	2	2	4	145,800	5,600
Station #11	2	2	4	145,800	5,600
Station #12	0	0	0	0	0
Station #13	0	0	0	0	0
Station #14	0	0	0	0	0
Station #15	0	0	0	0	0
Maintenance of Equipment					
Waseca Shop	0	0	0	0	0
Huron Shop	0	0	0	0	0
Rapid City Shop	0	0	0	0	0
Main Shop	0	0	0	0	0
Regional Shop #1	0	0	0	0	0
Regional Shop #2	10	11	21	742,800	28,600
Regional Shop #3	0	0	0	0	0
Administrative					
Waseca Office	0	0	0	0	0
Huron Office	0	0	0	0	0
Rapid City Office	1	1	2	100,400	3,900
Headquarters	0	0	0	0	0
Regional Office #1	0	0	0	0	0
Regional Office #2	0	0	0	0	0
Total	86	94	180	$7,492,000	$288,500

DAKOTA, MINNESOTA & EASTERN RAILROAD CORPORATION

FACILITY IMPACTS

Wyoming - 100MM Tons

High

	Change in Jobs			Change in	Change in
	Direct	Indirect	Total	Earnings	Taxes
Mining	591	938	1,529	$53,437,000	$1,545,600
Transportation					
Waseca Yard	0	0	0	0	0
Huron Yard	0	0	0	0	0
Rapid City Yard	0	0	0	0	0
Yard #1	0	0	0	0	0
Yard #2	0	0	0	0	0
Yard #3	0	0	0	0	0
Yard #4	330	357	687	38,420,800	1,111,300
Maintenance of Way					
Waseca Station	0	0	0	0	0
Huron Station	0	0	0	0	0
Rapid City Station	0	0	0	0	0
Station #1	0	0	0	0	0
Station #2	0	0	0	0	0
Station #3	0	0	0	0	0
Station #4	0	0	0	0	0
Station #5	0	0	0	0	0
Station #6	0	0	0	0	0
Station #7	0	0	0	0	0
Station #8	0	0	0	0	0
Station #9	0	0	0	0	0
Station #10	0	0	0	0	0
Station #11	0	0	0	0	0
Station #12	2	2	4	143,500	4,200
Station #13	4	4	8	287,100	8,300
Station #14	4	4	8	287,100	8,300
Station #15	10	11	21	717,700	20,800
Maintenance of Equipment					
Waseca Shop	0	0	0	0	0
Huron Shop	0	0	0	0	0
Rapid City Shop	0	0	0	0	0
Main Shop	221	239	460	16,157,300	467,300
Regional Shop #1	0	0	0	0	0
Regional Shop #2	0	0	0	0	0
Regional Shop #3	20	22	42	1,462,200	42,300
Administrative					
Waseca Office	0	0	0	0	0
Huron Office	0	0	0	0	0
Rapid City Office	0	0	0	0	0
Headquarters	116	125	241	11,462,700	331,500
Regional Office #1	2	2	4	197,600	5,700
Regional Office #2	2	2	4	197,600	5,700
Total	1,302	1,707	3,009	$122,770,600	$3,551,000

DAKOTA, MINNESOTA & EASTERN RAILROAD CORPORATION

FACILITY IMPACTS

Wyoming - 100MM Tons

Low

	Change in Jobs			Change in	Change in
	Direct	Indirect	Total	Earnings	Taxes
Mining	591	938	1,529	$53,437,000	$1,545,600
Transportation					
Waseca Yard	0	0	0	0	0
Huron Yard	0	0	0	0	0
Rapid City Yard	0	0	0	0	0
Yard #1	0	0	0	0	0
Yard #2	0	0	0	0	0
Yard #3	0	0	0	0	0
Yard #4	0	0	0	0	0
Maintenance of Way					
Waseca Station	0	0	0	0	0
Huron Station	0	0	0	0	0
Rapid City Station	0	0	0	0	0
Station #1	0	0	0	0	0
Station #2	0	0	0	0	0
Station #3	0	0	0	0	0
Station #4	0	0	0	0	0
Station #5	0	0	0	0	0
Station #6	0	0	0	0	0
Station #7	0	0	0	0	0
Station #8	0	0	0	0	0
Station #9	0	0	0	0	0
Station #10	0	0	0	0	0
Station #11	0	0	0	0	0
Station #12	0	0	0	0	0
Station #13	0	0	0	0	0
Station #14	4	4	8	287,100	8,300
Station #15	10	11	21	717,700	20,800
Maintenance of Equipment					
Waseca Shop	0	0	0	0	0
Huron Shop	0	0	0	0	0
Rapid City Shop	0	0	0	0	0
Main Shop	0	0	0	0	0
Regional Shop #1	0	0	0	0	0
Regional Shop #2	0	0	0	0	0
Regional Shop #3	0	0	0	0	0
Administrative					
Waseca Office	0	0	0	0	0
Huron Office	0	0	0	0	0
Rapid City Office	0	0	0	0	0
Headquarters	0	0	0	0	0
Regional Office #1	0	0	0	0	0
Regional Office #2	0	0	0	0	0
Total	605	953	1,558	$54,441,800	$1,574,700

DAKOTA, MINNESOTA & EASTERN RAILROAD CORPORATION
PROPERTY TAX IMPACTS

	1997 Taxes Paid (Net)	40MM Tons	100MM Tons
Minnesota			
Winona	$37,146	$841,000	$1,016,000
Olmsted	99,873	1,026,000	1,240,000
Dodge	29,306	607,000	733,000
Steele	19,376	710,000	858,000
Waseca	64,386	624,000	754,000
Blue Earth	41,243	1,158,000	1,400,000
Brown	89,280	1,350,000	1,632,000
Redwood	32,902	809,000	977,000
Lyon	61,549	847,000	1,024,000
Lincoln	29,638	727,000	879,000
Total	$504,698	$8,699,000	$10,513,000
South Dakota			
Brookings	$2,136	$1,125,600	$1,369,500
Kingsbury	1,615	1,113,200	1,354,500
Beadle	6,760	1,251,600	1,522,900
Hand	1,147	943,900	1,148,600
Hyde	908	562,500	684,400
Hughes	2,372	1,284,400	1,562,900
Stanley	0	821,400	999,400
Jones	234	429,900	523,100
Haakon	914	1,041,000	1,266,700
Jackson	0	343,400	417,900
Pennington	4,564	1,474,300	1,793,900
Custer	555	1,235,300	1,503,100
Fall River	784	2,496,100	3,037,100
Total	$21,990	$14,122,600	$17,184,000
Wyoming			
Niobrara	$0	$268,000	$323,000
Weston	0	1,129,000	1,365,000
Converse	0	221,000	267,000
Campbell	0	979,000	1,183,000
Total	$0	$2,597,000	$3,138,000
Grand Total	$526,689	$25,418,600	$30,835,000

APPENDIX B

METHOD OF ECONOMIC IMPACT ANALYSIS

The economic and fiscal impacts of construction of the Powder River Basin Project are based upon the construction design plans prepared by the DM&E's outside engineering design consultants. The design plans identify expected labor, materials and project construction costs. Direct job years, earnings and construction related tax revenues and indirect economic and fiscal impacts are estimated by the DM&E's outside economic consultants.

Real estate (ad valorem) taxes are centrally assessed by each of the tree states. Each state applies specific formulae to estimate the total value of the firm, to determine the share of that value attributable to that specific state, and to allocate that state share of firm value to the local taxing districts. In this report the estimated total value of the DM&E at the alternative operating levels is estimated by the engineering design consultants. (An estimate of the firm's total value was also calculated by the South Dakota economic consultant following the South Dakota central assessment formulae. This estimate was consistent with that of the engineering design consultant.)

The number of direct DM&E operating jobs and the corresponding direct earnings are taken from the DM&E's operating plan, including estimates of national railroad wage rates. Indirect jobs and earnings, and tax revenues, are estimated by the economic consultants. Since the location of several of the operating facilities has not been determined, and may be combined in a variety of locations and configurations, the range of potential economic and fiscal impacts for each state is necessarily quite large. When facility location decisions are made, and associated job locations determined, more precise local and state level economic and fiscal impacts can be estimated.

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APPENDIX N

Historical Structures Report

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Section 106 Evaluation
Architectural and Structural Resources
The Existing Rail Line of the DM&E Railroad
Powder River Basin Expansion Project
in Minnesota

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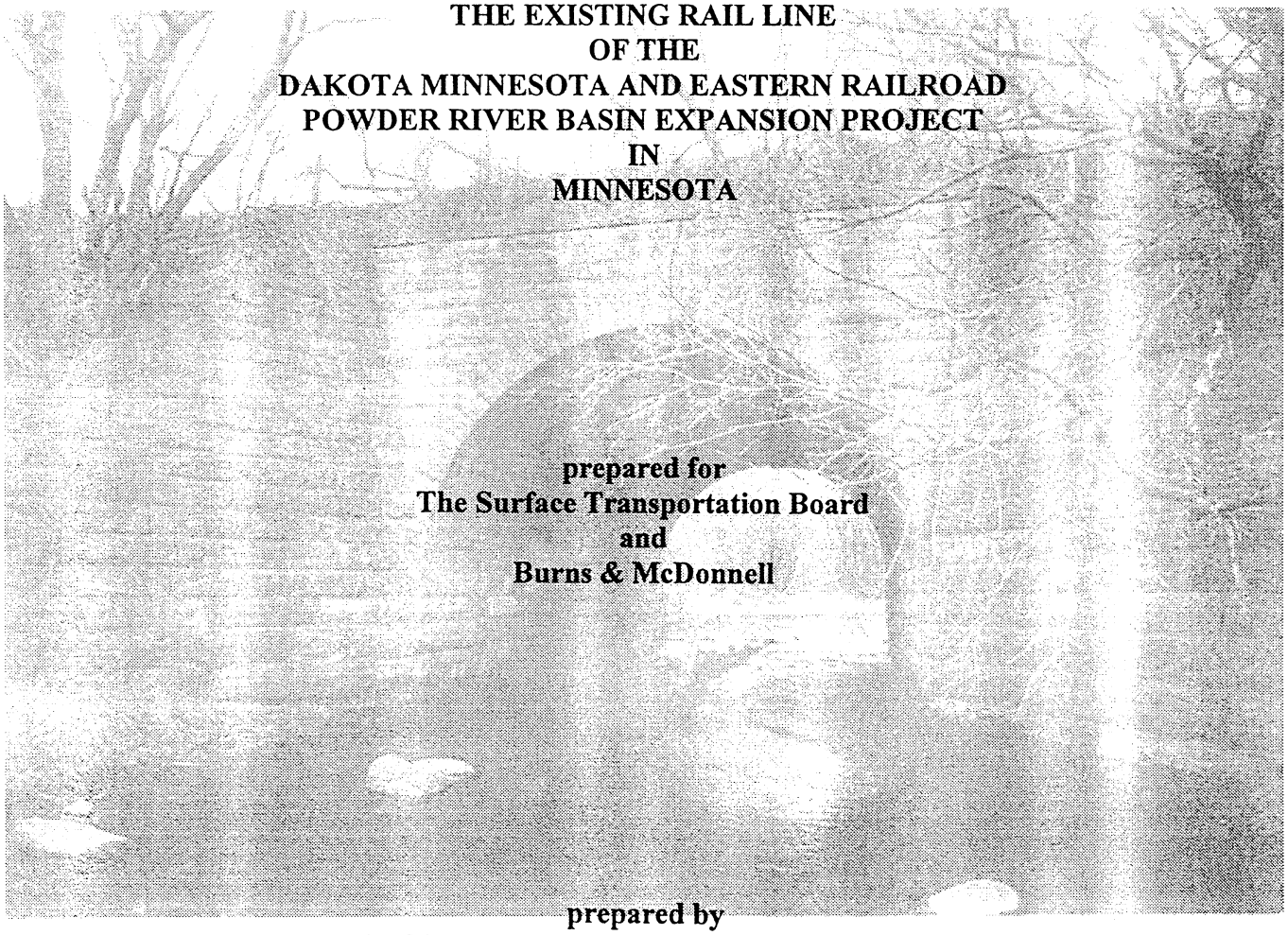
SECTION 106 EVALUATION
ARCHITECTURAL AND STRUCTURAL RESOURCES



THE EXISTING RAIL LINE
OF THE
DAKOTA MINNESOTA AND EASTERN RAILROAD
POWDER RIVER BASIN EXPANSION PROJECT
IN
MINNESOTA

prepared for
The Surface Transportation Board
and
Burns & McDonnell

prepared by
Architectural and Historical Research, LLC
and
Hess, Roise and Company

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Appendixes

Section 106 Evaluation: Architectural and Structural Resources of the Existing Rail Line of the Dakota Minnesota and Eastern Railroad Powder River Basin Expansion Project in Minnesota

1. Introduction

In January 1999, The Dakota Minnesota and Eastern (DM&E) Railroad contracted with Burns & McDonnell Engineering Company, Inc., Kansas City, Missouri, to prepare an Environmental Impact Study (EIS) for the Surface Transportation Board. The EIS encompasses the rebuild portion of the Powder River Basin Expansion Project, specifically the rebuilding of DM&E's existing system in Minnesota and South Dakota.

The EIS includes the preparation and completion of the Section 106 Compliance, Phase I tasks, for architectural and structural properties located within the DM&E right-of-way. The Section 106 report, including field work, research and photography, was preformed by Cydney E. Millstein, Architectural and Historical Research, L.L.C., Kansas City, Missouri, in association with Hess Roise and Company, Minneapolis, Minnesota, under contract with Burns & McDonnell. The Section 106 report, the subject of this document, commenced on February 1, 1999 and was completed on February 5, 2000. For the purpose of review and compliance, separate reports, covering the historic resources located along the project right-of-way in the respective state, were prepared for the preservation offices in Minnesota and South Dakota.

2. Survey Boundaries

The survey boundaries of the DM&E Powder River Basin Expansion Project, Section 106 Compliance on architectural and structural resources on the rebuild portion located in Minnesota, includes those resources sited between the western boundary of Winona, west to Verdi at the state line, a distance of approximately 320 miles. The exact width of the right-of-way, which essentially defines the Area of Potential Effect (APE), was not fully described in the most current draft Programmatic Agreement dated February 15, 2000, but essentially spans the width of the historic Winona and St. Peter/C&NW right-of-way. The APE varies in width from approximately 50 feet to 250 feet. In Minnesota, along the project study area there are 389 bridges and culverts (including eighty-two steel bridges, 180 stone box culverts, 108 open deck pile spans, seventeen stone arch spans, and two

timber bridges). Five buildings, comprised of three depots and two freight houses, were also included in the study.

3. Survey Objectives

This comprehensive study is designed to provide an inventory of architecturally and historically significant buildings and structures, characterizing the range of identified properties within the designated APE (right-of-way) as defined above. This study also identifies properties eligible and potentially eligible for listing in the National Register of Historic Places (NRHP) that may be adversely effected by the proposed reconstruction. Furthermore, this study is intended to be used as a tool in the identification of historic resources and for making decisions pertaining to engineering and architectural design and implementation. In addition, this study will also provide an outline of the cultural resources and history of the historic Winona and St. Peter Railroad and the Chicago and North Western Railroad as it pertains to the project area.

4. Methodology

Both field survey and archival research were used to obtain information regarding the identified properties along the right-of-way of the rebuild portion of the rail line. Nominations for those properties listed in the National Register of Historic Places have been identified and assembled. Information and data for each inventoried property were gathered from the following repositories:

4.1. Field Survey

- Reconnaissance Survey: The project area was initially examined to determine the approximate number of properties to be included in an intensive survey. This task was fulfilled by researching USGS maps and DM&E records.
- Site Visits: An on site analysis of each cultural resource was conducted in order to fully assess the present condition and integrity of the property (i.e., identification of style, type, design, approximate date, and obvious alterations and/or additions).

- Photography: At least one 3 1/2" x 5" black and white photograph of each property was taken using a 35mm camera. Each inventoried property is keyed with the corresponding roll and frame number and identified as such on the individual photographs and a keyed location form; in addition, all properties are keyed to USGS maps. Original negatives are housed at Architectural and Historical Research, L.L.C., Kansas City, Missouri.

4.2. Archival Research

- State Historic Preservation Offices, Pierre, South Dakota. Files on pertinent National Register and inventoried architecture, structures and sites; histories of rail lines; historic maps and atlases and railroad commission reports.

- DM&E office, Brookings, South Dakota. Track charts, building and structures maintenance reports, maps, plans and historic files.

- Chicago Historical Society, Chicago, Illinois. Annual reports of the Chicago and North Western Railroad Company. Biographical information, as well as histories of the railroad, historic photographs, and route maps.

- Chicago Public Library, Chicago, Illinois. Historical data of the Chicago and North Western Railroad Company. No information pertinent to the study was found.

- Minnesota Historical Society, St. Paul, Minnesota. Annual report*s* of the Chicago and North Western Railroad Company, railroad and engineering periodicals, historic photographs.
- Minneapolis Public Library, Minneapolis, Minnesota. Various publications related to the history of the C&NW.
- The Newberry Library, Chicago, Illinois. Annual reports of the Chicago and North Western Railroad Company, various C&NW publications; maps and atlases.

- The National Archives, College Park, Maryland. Interstate Commerce Commission Railroad Valuation Records.

- Northern Illinois University, Dekalb, Illinois. The Regional History Center, Swen Parson Hall, houses the Chicago and North Western Railroad Papers.

- The James J. Hill Reference Library, St. Paul, Minnesota. South Dakota Railroad Commission Reports.

- University of Minnesota's Wilson and Walter Libraries, Minneapolis, Minnesota. Annual reports of the C&NW.

- Linda Hall Library, Kansas City, Missouri. Railroad and engineering publications.

4.3. Completion and Assemblage of Inventory Forms

Each property within the DM&E right-of-way of the rebuild portion was site visited and photographed. Approved inventory forms for the Minnesota SHPO were prepared for all historic buildings, truss and girder bridges. In addition, approved inventory forms were prepared for representative examples of the numerous pile timber bridges and stone culverts. Bridge number, milepost marker and location in the master data-base, in addition to an abbreviated inventory form, list the remaining typical timber pile bridges and stone culverts. Cast iron, corrugated metal, concrete pipe and any other pre-manufactured or standardized culvert types, as well as properties less than fifty years old, were not inventoried. All forms are accompanied by one representative 3 1/2" x 5" black and white 35mm photograph of each historic resource.

4.4. Analysis of Information

Data recorded on individual inventory forms and applicable National Register of Historic Places Nominations was used to make recommendations for those properties potentially eligible for National Register designation. Recommendations and observations are based on NR criteria as outlined in *National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation*. In addition, an evaluation of the finding

of effects of the project on any cultural resources considered to be historic properties is also included in this report.

5. Final Report

The final report includes an overview of the history of the historic Winona and St. Peter Railroad (W&StP) and the Chicago & North Western Railroad (C&NW) as it applies to the DM&E rebuild route in Minnesota; a discussion of property types identified along the proposed reconstruction route; recommendation section outlining specific properties potentially eligible for National Register status; and statement of impact, if known. Inventoried properties are keyed by bridge number on copies of USGS maps submitted to the Minnesota SHPO.

6. A Brief Look at Section 106 Review

Section 106 of the National Historic Preservation Act (NHPA) requires that Federal agencies consider what effects their actions, and actions they may assist, permit or license, may have on historic properties, and that they give the Advisory Council on Historic Preservation a "reasonable opportunity to comment" on such actions.

Federal agencies participate in many projects and programs that affect local governments and local historic properties. Some of these are obvious: construction of highways and wastewater treatment plants, for example. Others are less so: the Corps of Engineers issues permits to dredge and fill in waterways; the Federal Deposit Insurance Corporation (FDIC) approves opening branch banks. Federal Community Development Block Grant and Urban Development Action Grant funds are used by local governments to assist in rehabilitation and redevelopment. All these activities are subject to review under Section 106.

Regulations for the Section 106 Process are issued by the Advisory Council on Historic Preservation, an independent Federal agency. Its role in the review of actions under Section 106 is to encourage agencies to consider, and where feasible adopt, measures that will preserve historic properties that would otherwise be damaged or destroyed. The Council does not have the authority to require agencies to halt or abandon projects that will affect historic properties; its regulations emphasize consultation among the responsible Federal agency, the State Historic Preservation Officer/Tribal

Historic Preservation Officer (SHPO/THPO), and other interested parties--including local governments--to identify and, if possible, to agree upon ways to protect the properties in question.

Section 106 applies to properties that have been listed in the National Register of Historic Places (NR), properties that have been determined to be eligible for inclusion in the NR, and properties that may be eligible but have not yet been evaluated. If a property has not yet been nominated to the NR or determined eligible for inclusion, it is the responsibility of the Federal agency involved to ascertain its eligibility, following procedures outlined in Council and National Park Service (NPS) regulations.

The Council's regulations are set forth in a process consisting of four basic steps as follows:

6.1. *Initiate the Section 106 Process*: The Federal agency makes the decision whether there are any historic properties (NR listed or eligible) that could be effected by the undertaking. If this is the case, then the SHPO/THPO should be consulted by the agency, and a plan to involve the public and other interested parties should be addressed. If there is no undertaking, or the undertaking will not affect the historic property(ies), then has completed its Section 106 obligations.

6.2. *Identification and Evaluation*: The Federal agency responsible for the action identifies the historic properties (if any) that exist in the area to be affected. Identification involves assessing the adequacy of existing survey data, inventories, and other information on the area's historic properties, conducting further studies, if warranted, consulting with the SHPO/THPO, local governments, and other interested parties, and documenting the results of the identification effort. If properties are found that may be eligible for the NR but have not been listed or determined eligible for listing, the agency consults with the SHPO/THPO and, if needed, the Keeper of the National Register to determine eligibility or ineligibility.

The regulations provide specific criteria for determining whether an action will have an effect, and whether the effect will be adverse. Generally, if the action may alter the characteristics that make a property eligible for the NR,

it is held to have effect, and if the alterations may be detrimental to those characteristics, including relevant qualities of the property's environment or use, they are held to be adverse.

In a nutshell, there are three possible findings:

6.2.1. No historic properties affected: if there are no historic properties or there will be no effect of any kind on the historic properties, the agency notifies the SHPO/THPO and interested parties of its determination of no effect. If the SHPO/THPO does not object, the agency proceeds with the project.

6.2.2. No historic properties adversely affected: if there could be an effect but the effect would not be harmful to any historic property, the agency obtains SHPO/THPO concurrence and submits to the Council a determination of no adverse effect. Or, the agency can submit its determination of no adverse effect directly to the Council for review and notify the SHPO/THPO of its determination. Unless the Council objects, the agency proceeds with its project or activity.

6.2.3. Adverse effect: If the parties agree that there is an adverse effect, or the SHPO/THPO or Council objects to a no historic properties affected finding, the agency begins consultation to identify ways to avoid, minimize, or mitigate adverse effects. Adverse effects occur when an undertaking may directly or indirectly alter characteristics of an historic property that qualify it for inclusion in the NR. Reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance, or be cumulative also need to be considered. Examples of adverse effects include physical destruction or damage; alteration not consistent with the Secretary of the Interior's *Standards*; relocation of a property; change of use or physical features of a property's setting; visual, atmospheric, or audible intrusions; neglect resulting in deterioration; or transfer, lease or sale of a property out of Federal ownership or control without adequate protections.

6.3. *Assess Adverse Effects*: If there could be a harmful effect to an historic property, the agency begins the consultation process.

If the action will have an adverse effect, the agency consults with the SHPO/THPO, other interested persons, and sometimes the Advisory Council, to seek agreement on ways to avoid or reduce the effects. Local governments, Indian tribes, affected property owners, and others concerned should be involved in the consultation, and the public should be given the opportunity to express their views. Local governments must be invited to participate in consultation regarding effects on historic properties within their jurisdictions, if they so request.

6.4. *Resolve Adverse effects*: The agency consults with the SHPO/THPO and others including members of the public. The Council may participate in consultation when there are substantial impacts to important historic properties, when a case presents important questions of policy or interpretation, when there is a potential for procedural problems, or when there are issues of concern to Indian tribes or Native Hawaiian organizations. If agreement is reached a Memorandum of Agreement (MOA) is drawn up and signed. If agreement cannot be reached, the formal comments of the Council are requested. Having obtained the Council's comments, the agency either carries out the terms of the MOA or considers the formal comments in making its final decisions about whether and how to proceed with the action.

7. Survey Findings

7.1 A summary of the development of the Winona & St. Peter Railroad and the Chicago and North Western Railroad in Minnesota from Verdi, east to the western boundary of Winona, Minnesota.

Incorporated in June 1862, the Winona & St. Peter Railroad (W&StP) was the second railroad to be constructed in the state of Minnesota.[1] After failed attempts to build from Winona through St. Peter by two other rail lines, the State of Minnesota conveyed to the W&StP the insolvent Winona, St. Peter & Missouri River Railroad Company on March 10, 1862.[2]

Government funding significantly bolstered the development of the W&StP in Minnesota. Over 443,000 acres of Federal land and $500,000 of state bonds were granted to the nascent company to finance construction of the line.[3] Initially, funds generated from the sale of the land grant lands allowed the W&StP to purchase construction equipment. In December 1862, track was completed to Stockton, eleven miles west from Winona.[4] After carving through some of the toughest terrain in Minnesota at the town of Lewiston via Stockton Hill, the line had reached Rochester by 1864. In 1866, after a slow-down caused by a shortage of both iron and workers, the W&StP reached Owatonna, linking with the Minnesota Central Railroad.

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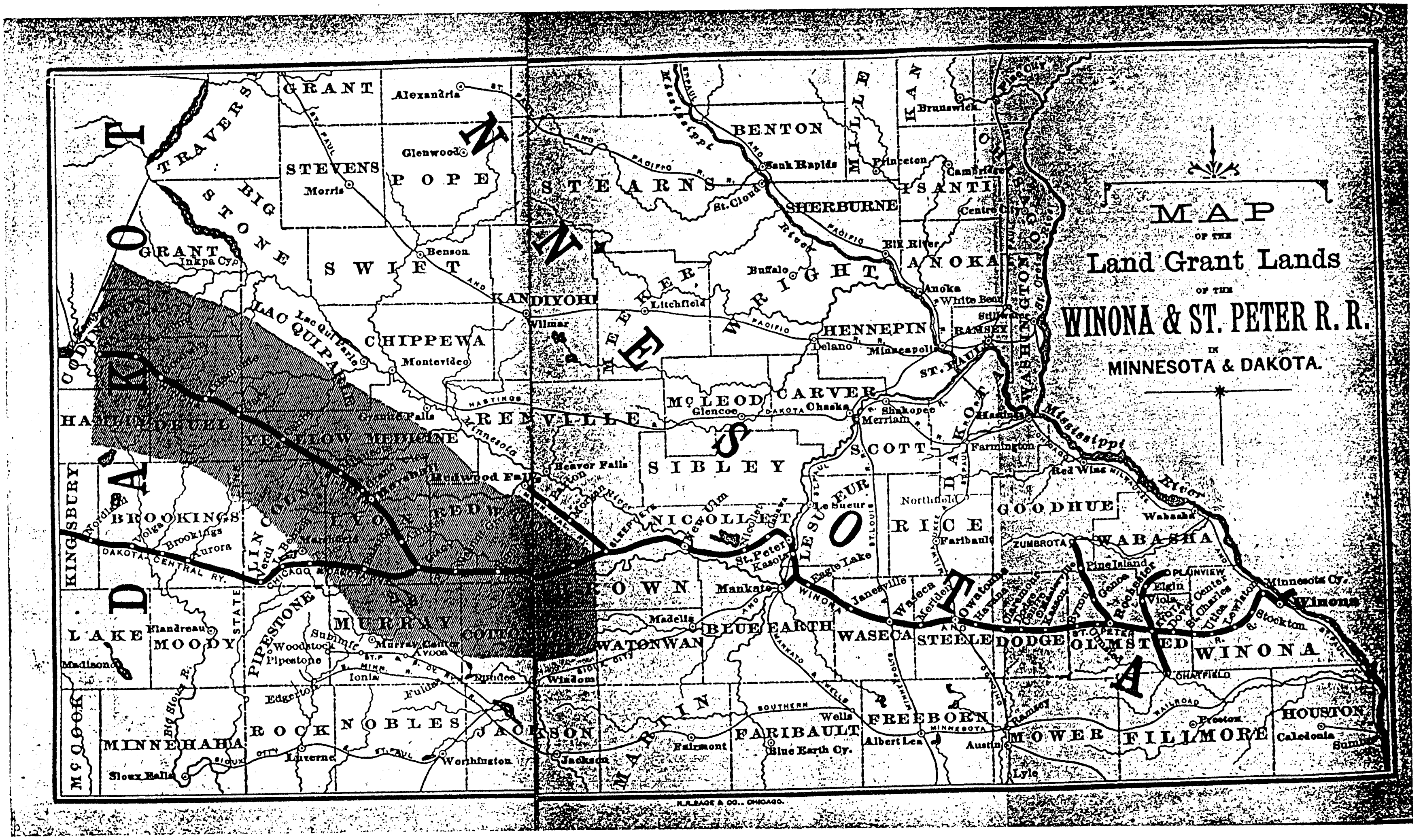
[1] The first railroad to operate in Minnesota was the St. Paul & Pacific.

[2] The Transit Railroad Company, chartered in 1855, began grading from Winona west in 1858, but further progress was halted by financial problems. The governor of Minnesota purchased the assets of the Transit Railroad in 1860 and one year later sold the interests to the Winona, St. Peter & Missouri River Railroad Company. After this company failed, their charter was transferred to the newly formed Winona & St. Peter on March 10, 1862.

[3] Joe Follmar, "The C&NW Across Minnesota," *North Western Lines* 23 (Winter 1996): 27. According to Follmar, "Congress enacted the original grant to the Territory of Minnesota for assignment to specific railroad companies on March 3, 1857. A land grant railroad usually received alternate sections of land six miles wide on each side of its track; the land could be sold to settlers or used as security for loans and sale of stock." A deadline for completion of track to a specific destination was a typical stipulation of every land grant. In 1865, the grant was increased to ten mile-wide sections. The Minnesota grant was the final land grant for railroad construction in the United States.

[4] The initial charter mandated that ten miles of track had to be completed by January 1, 1863.


MAP
OF THE
Land Grant Lands
OF THE
WINONA & ST. PETER R. R.
IN
MINNESOTA & DAKOTA.
DAKOTA
MINNESOTA
GRANT
STEVENS
POPE
SWIFT
CHIPPEWA
KANDIYOHI
STEARNS
BENTON
SHERBURNE
ISANTI
ANOKA
WRIGHT
HENNEPIN
RAMSEY
CARVER
SCOTT
SIBLEY
NICOLLET
LE SUEUR
RICE
GOODHUE
WABASHA
OLMSTED
DODGE
STEELE
WASECA
BLUE EARTH
WATONWAN
FREEBORN
FARIBAULT
MARTIN
JACKSON
NOBLES
ROCK
PIPESTONE
MURRAY
LYON
LINCOLN
YELLOW MEDICINE
RENVILLE
MCLEOD
MOWER
FILLMORE
HOUSTON
WINONA
TRAVERS
BIG STONE
LAC QUI PARLE
BROOKINGS
KINGSBURY
LAKE
MOODY
MINNEHAHA
McCOOK
Alexandria
Glenwood
Morris
Benson
Montevideo
Willmar
Litchfield
Buffalo
St. Cloud
Sauk Rapids
Princeton
Cambridge
Brunswick
Elk River
Anoka
White Bear
Minneapolis
St. Paul
Delano
Glencoe
Chaska
Shakopee
Merriam
Hastings
Farmington
Red Wing
Wabasha
Northfield
Faribault
Le Sueur
St. Peter
Kasota
Eagle Lake
Mankato
Janesville
Waseca
Owatonna
Rochester
Winona
Minnesota Cy.
Stockton
Chatfield
Preston
Caledonia
Austin
Lyle
Albert Lea
Wells
Blue Earth Cy.
Fairmont
Jackson
Worthington
Luverne
Sioux Falls
Madison
Flandreau
Brookings
Aurora
Volga
Marshall
Redwood Falls
Beaver Falls
Granite Falls
Madelia
Windom
Pipestone
Woodstock
Edgerton
Ionia
Inkpa Cy.
DAKOTA CENTRAL RY.
Mississippi River
R. R. SAGE & CO., CHICAGO.

During this period, controlling factors of the W&StP shifted. The Barney group, comprised of Danford Barney, William Fargo and Angus Smith, now controlled the company and provided funds for the construction of a section of the new track from Winona to Waseca, Minnesota. After the Barney Group sold the W&StP to the Chicago and Northwestern Railroad (C&NW) in October 1867, the route of the former railroad's mainline changed. From 1867 until 1900, the W&StP operated as a proprietary line of the C&NW under its own corporate name.[5]

The Chicago and North Western was incorporated on June 6, 1859, as the Chicago and North Western Railway Company and chartered by the State of Illinois on June 7. Led by William Butler Ogden, the C&NW acquired the assets of the bankrupt Chicago, St. Paul and Fond du Lac Railroad. Following the takeover, track construction of the W&StP proceeded to Mankato (1870) and north to St. Peter (1871), while the erection of a permanent bridge across the Mississippi River at Winona was well underway.[6] A subsidiary rail company, the Winona, Mankato & Northern Railroad, was established for the line into Mankato and incorporated on June 1, 1870.[7]

After successfully crossing the Minnesota River at St. Peter and proceeding west through New Ulm by the winter of 1872, the W&StP set it sights toward the Dakota Territory. Due to stipulations in the land grant, the W&StP was originally required to reach the Big Sioux River by March 3, 1873, but because of weather delays caused by the severe winter storms, the deadline was extended to September 3 of that year. Finally, on August 18, 1873, the W&StP finished their line west from New Ulm to Tracy, turning northwest to Lake Kempeska in Dakota Territory at the banks of the Big Sioux River at Watertown.[8]

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[5] The W&StP maintained its own organization, capital and operations and remained self-sustaining. See: *The Ninth Annual Report of the Chicago and North Western Railway Company for the Fiscal Year Ending May 31, 1868* (Chicago: n.p., 1868), 9.

[6] The Mississippi River bridge was a priority for the C&NW due to the fact that the company wanted to connect the W&StP with the rest of their system via Wisconsin. In May 1871, the wood and iron swing bridge collapsed under the weight of the first train to attempt a return crossing. The second structure, built of iron, was completed in January 1872.

[7] This was Mankato's second railroad. It had been previously linked to the Twin Cities by the Minnesota Valley Railroad in 1868.

[8] Due to the fact that the land grant required that the W&StP was to build only to the eastern banks of the Big Sioux River, the C&NW was forced to drag the line back to what is now Watertown.

Emigration to Minnesota and subsequent land sales steadily increased in the 1870s, with a temporary halt in activity in the summer of 1876 due to a grasshopper plague and drought. Settlers were drawn to both Minnesota and the Dakota Territory for the productive prairie farmlands available through the Western Town Lot Company, a subsidiary of the C&NW. The C&NW, which circulated brochures touting the great expanses of available land, was in "daily receipt of numerous letters from all parts of the East and West, asking for information . . . pertaining to these lands."[9] Many inquiries were also "received from parties interested in locating colonies, and desiring to secure large tracts of land for that purpose."[10] Through the C&NW's land department office located in Chicago, potential buyers could purchase a "land exploring ticket" allowing travel for forty days. A credit for the full amount of the ticket against the price of the land was available.[11]

The subsequent development of the line took a turn when Marvin Hughitt, general manager of the C&NW, initiated a plan to extend the railroad from Tracy, Minnesota, to the Black Hills in [South] Dakota Territory, where gold had been discovered in 1874. In 1879, two years after making a personal visit to the Dakota Territory, Hughitt organized the Chicago & Dakota Railway Company to build from Tracy west to the border and the Dakota Central Railway Company to develop a line from the border to the banks of the Missouri River at Pierre. As a result, the original main line to Watertown became a branch line and Tracy became an important Division Point terminal.[12] The Chicago & Dakota Railway had laid over forty-six miles of track, reaching the Dakota border in 1879, thus completing the main lines along the W&StP route in Minnesota.
As a consequence of the congestion caused by four rail lines converging at Mankato and the great expense of maintaining a branch line into St. Peter, the W&StP constructed a new line from Mankato to New Ulm, under the control of C&NW's new subsidiary line, the Mankato & New Ulm (M&NU) Railway. This stretch of new line was completed on May 29, 1900, just weeks before the W&StP and the M&NU were merged with the C&NW. This arrangement, in turn, changed the complexion of the railroad: the former branch line into Mankato was switched to the main line, the original

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[9] *Annual Report of the Chicago and North Western Railway Company for the 19th Fiscal Year, Ending May 31, 1878* (New York: n.p., 1878), 27.
[10] Ibid.
[11] *Guide to an Unsurpassed Farming Region in Southern Minnesota and Eastern Dakota Along the Line of the Winona and St. Peter Railroad* (n.p.: n.p., [1879]), 9-10.
[12] Follmar, "The C&NW Across Minnesota, " 35.

branch line to St. Peter operated only as far as Kasota, and the old main line between St. Peter and New Ulm became a branch line.[13]

Following the completion of several extensions of their line in Minnesota at the turn of the century, the C&NW focused their construction activities in South Dakota, pushing to cross the Missouri River at Pierre to Rapid City. However, a major change to the C&NW line in Minnesota occurred in 1925 when the Minnesota Division was eliminated. This operational change made the lines east of Waseca part of the Madison (Wisconsin) Division and the lines west of Waseca part of the Dakota Division.

Other significant post-war activities of the C&NW in Minnesota included a temporary, but abrupt halting of operations at Tracy, the termination of passenger train service between Tracy and Watertown and the closing of the shops at Winona. Passenger revenues greatly declined between 1920 and 1932, due to the growing popularity of the automobile and the Great Depression. The increase in auto traffic, coupled with the stock market crash of 1929, a decrease in South Dakota's general population, a severe drought in 1934 and a drastic loss of farm production caused the C&NW to enter into bankruptcy in 1935. After this collapse, the company "never regained their high position."[14] Finally in 1939, the C&NW closed Tracy's car repair shops and centralized their operations at Huron, South Dakota. [15]

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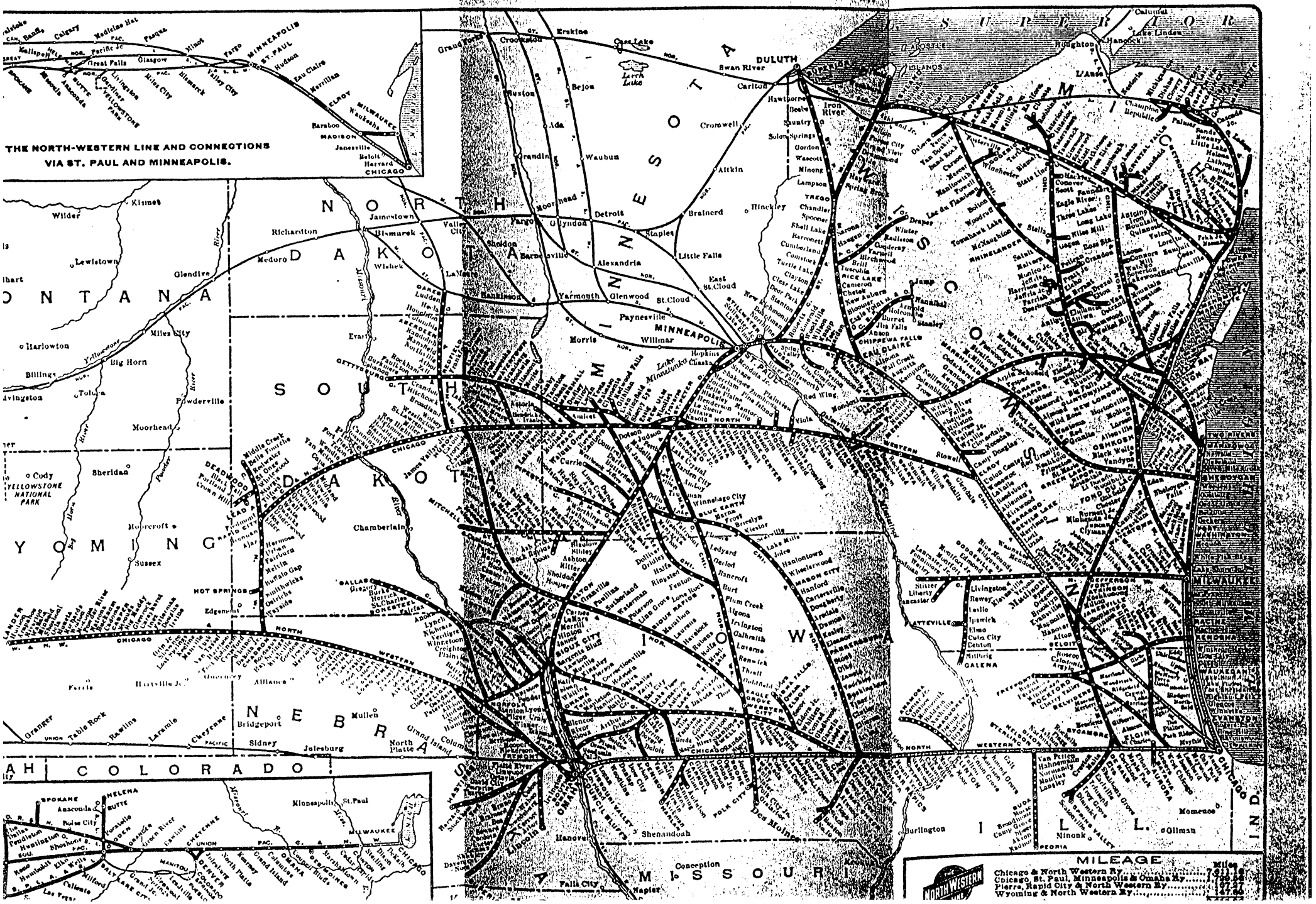
[13] Ibid, 41.

[14] H. Roger Grant, *The North Western: A History of the Chicago and Northwestern Railway System* (Dekalb, Illinois: Northern Illinois University Press, 1996), 151.

[15] Grenadier Publications and John C. Luecke,*The Chicago and Northwestern in Minnesota* (Eagan, Minnesota: Grenadier Publications, 1990), 154.

MAP OF THE CHICAGO & NORTH WESTERN SYSTEM—1908.



7.1. The Chicago and North Western's Abandonment Program in Minnesota and South Dakota.

The C&NW emerged from bankruptcy on June 1, 1944. Despite an increased volume of freight traffic during the late 1940s following the termination of wartime government possession of the railroads, the C&NW was in serious trouble by the mid-1950s. The company, left with post-war shortages of labor and supplies, was forced to shut down over 2300 facilities, including small town depots, shop buildings and minor structures. From mid-1949 to 1955 an average of 450,000 annual passenger train miles were trimmed and from 1956 to 1963, long distance passenger service, as well as passenger service from Mankato, Minnesota, west to Huron, was greatly down-sized. According to C&NW historian H. Roger Grant, "the railroad began to look like a transportation slum: bridges and buildings had gone for years without maintenance or paint."[16]

Beginning in the decade of the 1960s, the C&NW began its abandonment campaign and through the 1970s, the C&NW continued to shut down lines across South Dakota and Minnesota.[17] In 1983 officials of the C&NW announced their plan to abandon the Pierre to Rapid City line, but local protestors helped to preserve service temporarily.[18] The passing of an extraordinary era in railroad history for South Dakota, Minnesota, and the nation began in 1986 when the Dakota Minnesota & Eastern Railroad Corporation, Brookings, South Dakota, purchased the C&NW's Rapid City to Winona historic railroad system.[19]

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[16]Grant, *The North Western*, 190. Grant asserts that on November 5, 1957, the C&NW filed a petition with the South Dakota Public Utilities Commission to create a central agency system, thus eliminating unneeded stations. There were sixty-one, one-person stations in South Dakota in which duties of the agent did not require more than two hours per day. The company averaged about two closings a year.

[17]According to Grant, "the railroad quickly compiled a hit list of unneeded trackage." C&NW's President Provo told grain dealers in 1974 that "these lines have long since passed any kind of economic justification for keeping them in service. They are an enormous drain on the railroad. Just to operate over these lines is a big cash drain. But the damage goes far beyond that. These lines waste freight cars and locomotives like nothing else can. And they waste precious fuel."

[18]Rick W. Mills, "The North Western in the Black Hills Country, Part II—1927-1995," *North Western Lines* 24 (Spring 1997): 49. By 1980 60% of South Dakota's rails had been shutdown.

[19]Ibid., 244. The DM&E eventually purchased 965 miles of secondary and branch lines in the Dakotas, Iowa and Minnesota. These were just part of the C&NW's major route sales. After several bids to take over the C&NW materialized, the remaining common shares of the historic line were sold to the Union Pacific Railroad in 1995.

8. Description of Property Types: Bridges

8.1. Open Deck Pile Trestles (See Appendix B)

One of the largest categories of bridges serving the rail line in Minnesota is comprised of simple timber stringer spans with timber pile bents and open deck. This design is used alone (dates range from 1926-1975), or as approaches to longer steel or iron spans. A total of 108 bridges contain only timber stringer spans, while ten bridges have timber-stinger approach spans. Bridges and approaches range from one to eleven spans (this includes the total number of approaches, i.e., east and west); spans are an average of twelve feet in length. The general design and specifications for the open deck pile trestle were adopted from contemporary publications such as the *Manual for the American Railway Engineering Association*.[20] An example of the specifications for the year 1921 by the American Railway Engineering Association for wooden trestles, including wood type and grade for piles and flooring, pile driving, and metal details, can be found in Appendix L.

It is important to note that the Open Deck Pile Trestles constructed on the oldest section of the W&StP, from Winona through the area of Stockton Hill to Lewiston, have all been replaced. It appears that none of the nineteenth century spans have survived. While the first replacement campaign occurred as early as 1866 (several of the spans were continually damaged by flooding), the majority of these timber spans were supplanted with stone arch spans in the 1880s (see Section on Stone Arches).[21]

Of the existing pile spans, decks are open, consisting of timber ties supporting one or more sets of steel rails. Three or four square-section stringers are aligned below each rail. On earlier structures, three stringers are separated by about four inches, with the separation maintained by iron spacers situated at regular intervals. The stringers in this configuration are referred

[20] See also Wolcott Foster, *A Treatise on Wooden Trestle Bridges* (New York: John Wiley and Sons, 1906).
[21] The trestles located near Stockton were patrolled twenty-four hours a day. The patrolmen looked out for fallen rocks, fire damage from passing trains and flood damage.

> to as "open." Later, to increase the carrying capacity of the spans, stringers were placed immediately adjacent to each other, an arrangement known as "compressed." Initially, three stringers were grouped together; later, this was increased to four. In both the open and compressed configurations, the three or four stringers beneath one rail typically extend for two "spans," with the center of the stringers supported by a support (bent) midway. The sets of stringers are staggered: a bent supports the ends of the stringers beneath one rail, and the center of the stringers beneath the other rail. Each set of stringers is connected by metal tie rods.[22]

Bents are nearly always comprised of five cylindrical timber piles, although a sixth pile is occasionally present. Piles are spaced not closer than 2 1/2 feet between centers. Piles are driven in accordance with formulas for bearing power. The center piles are known as plumb piles, while the outermost piles are termed batter piles. Acting as a support, the exposed pile can sustain loads from 15 tons to 20 tons each. If over five feet of the piles in a bent are exposed, the bent is braced with timber planks (called the sway brace) in an "X" configuration. At deeper ravines, timber planks extend longitudinally between the outside piles of adjacent bents to bolster the substructure.

Timber piles also are used for abutments. Back walls are virtually always timber planks. Angled or straight wing walls sometimes extend behind the back walls, but usually appear to be later additions.

Nearly all of the timber is treated with creosote.[23] Occasionally an earlier untreated ("white") timber appears, apparently salvaged during a reconstruction project.

A number of the open deck pile trestles have been modified over the years. Evidence of substantial reconstruction includes decayed piles near existing bents; old ties and stringers alongside bridges; and

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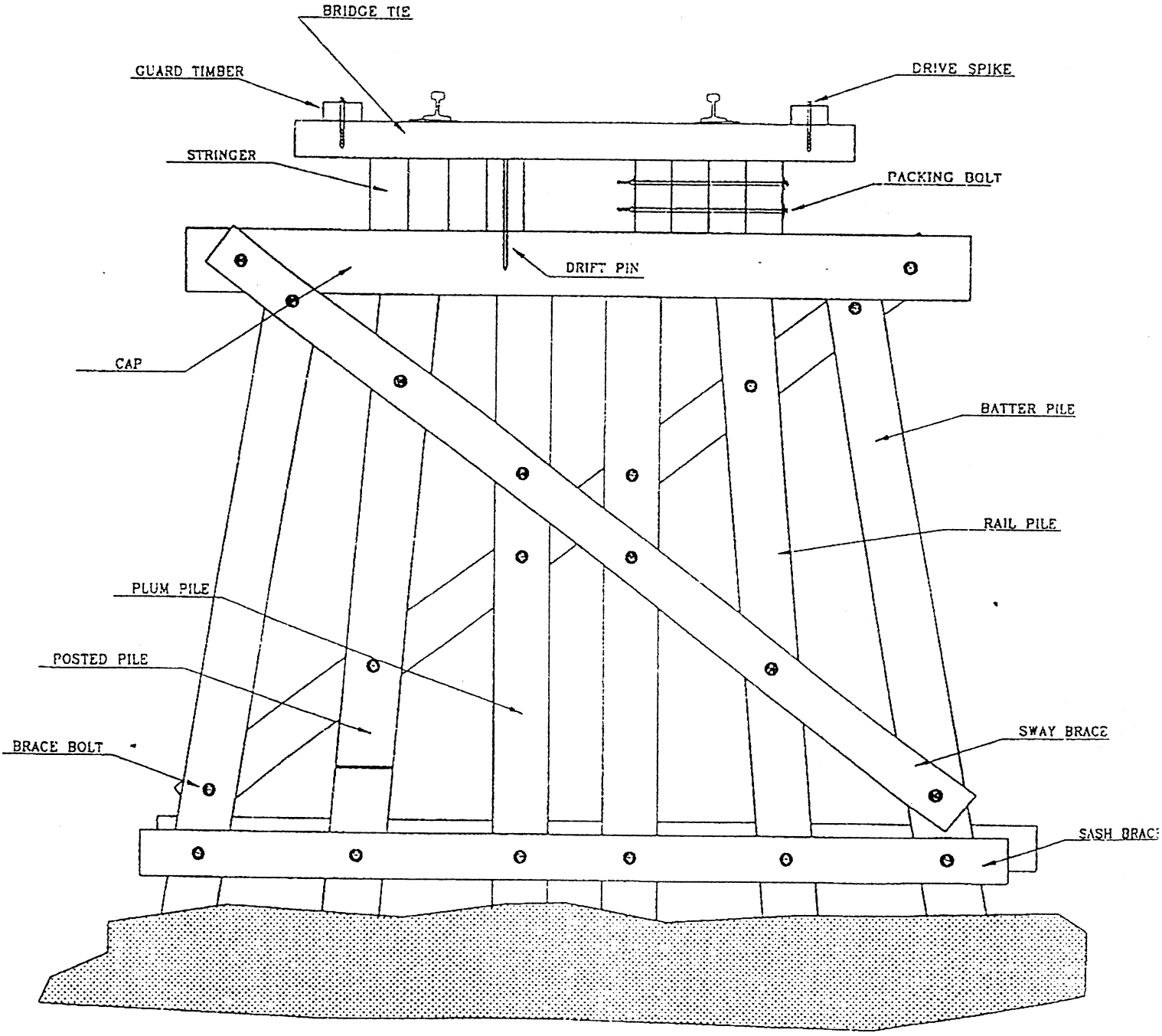
[22]For information on the construction and maintenance of DM&E bridges, the authors are indebted to DM&E employees Cody Schonbaum who drove the high rail for the Minnesota segment of the survey. Both men have been involved with repairing and reconstructing bridges along the route.

[23] A bridge replacement program began in 1937 where a number of timber trestles were replaced with treated timbers. See C&NW *Annual Report*, 1939, 7.

BRIDGE DIAGRAM

OPEN DECK PILE TRESTLE BENT



anecdotal information from men who have worked on railroad crews. A common alteration is full or partial stringer replacement. Partial replacement is apparent, for example, when three open stringers are beneath one rail and three compressed stringers beneath the other. In some cases, existing stringers have been fortified with "helpers," an additional stringer attached to the outside of a set of stringers. To raise the track level when bents have settled, blocks of wood ("false caps") are inserted between the stringers and the horizontal caps over the bent piles. Metal caps were installed on the top of some piles to slow deterioration, a technique that was subsequently found to be counterproductive.

It is important to note that due to their physical makeup, timber trestles have been in constant need of maintenance. Timber piles, for example, are often renewed, strengthened or replaced. Because of the general characteristics of this bridge type and the somewhat limited life span of its materials, changes are anticipated and warranted. In most cases the alterations/additions to this property type have not impacted the overall integrity of materials and design (see Section below).

8.2. I-Beams (See Appendix C)

I-beam bridges are a simple bridge type used to span distances that timber trestles cannot reach or to provide a more permanent crossing. On the W&StP/C&NW line in Minnesota there are thirty-six I-beam spans, constructed from 1902 through 1966. Spans measure from 9.5 feet to 47.5 feet in length. The bridges are all single-span, steel structures with two sets of three rolled I-beams supporting the timber ties that comprise the deck. Each set of I-beams is centered beneath a rail on top of the deck. The bridges originally featured coursed ashlar limestone abutments; a number of these abutments have been modified or totally replaced with concrete.

8.3. Plate Girders (See Appendixes D and E)

On the W&StP/C&NW line in Minnesota, eighteen bridges have through plate girder spans and nineteen have deck plate girder spans. Dates for these spans range from 1896 through 1951. Like I-beam bridges, they are used for crossings requiring longer clear spans than timber trestles could provide. Girder spans were

also seen as an alternative to trusses in some situations, enabling the railroad to simplify bridge design and eliminate overhead obstructions associated with through trusses.

The approach spans of the girder bridges on the W&StP/C&NW line vary in construction. Some feature have timber trestle approach spans, a few have I-beam approaches, while others have deck plate girders. The substructure for the bridges varies from timber pile piers (generally in association with timber approach spans) to stone, concrete, or steel pile piers. Abutments similarly vary. The girders are characterized by their curved or straight ends. Some spans display both curved and straight ends, indicating that alterations were done at some point, perhaps to repair damage resulting from derailment or possible relocation. Decks are open and follow the same design as those on the Open Deck Pile Trestle bridge type.

8.4. Trusses (See Appendix F)

Trusses, commonly used to provide large clear-span crossings, are relatively rare on the W&StP/C&NW railroad in Minnesota. Two truss styles are present: Triangular Lattice and Double Intersection Warren. The two through trusses are triangular lattice, while the double intersection Warren is a deck truss.

The dates of fabrication for the trusses range from 1902 to 1920. Approximately a dozen of the lattice trusses from the Mississippi River crossing at Winona, Minnesota may have been recycled in South Dakota along the C&NW rail line. Those trusses were fabricated in 1885 and 1886 and are iron rather than steel. Approach spans of two of the existing bridges are timber trestles, while the remainder is a deck plate girder. All trusses feature open decks. The decks follow the same configuration found on the Open Deck Pile Trestle type. Abutments are limestone or timber (with a back wall of timber). The trusses themselves rest either on concrete or limestone piers.

8.5. Stone Box Culverts (See Appendix G)

In several locations where the flow of water was too slight to warrant the erection of a bridge, a variety of culverts were constructed instead. A total of 178 single stone box culverts, laid in cement mortar, carry the line over drainages between Winona west to the state line. The culverts, constructed between 1871 and 1913, feature essentially the same design, differing primarily in scale and the size of opening. Large blocks of buff ashlar limestone, many displaying quarry drill marks, are laid in regular courses. On the culvert's face, the coping course projects slightly. Surveyors' marks are sometimes installed on top of this course. One course separates the coping from the culvert opening. Openings typically range from three to six feet in height. The size of the opening was determined by using standard drainage tables.[24] Some of the openings have straight walls, perpendicular to the lintel. On other culverts, the top two courses edging the opening are slightly corbeled, suggesting a false arch. The integrity of the culverts generally ranges from good to poor; many culverts have all but failed due to spalling and corrosion. The dimensions of the original openings are sometimes difficult to determine or may not be apparent due to environmental changes, i.e., where ground height has shifted due to erosion or water flow.

In addition, there were two cast-iron pipe culverts and three concrete box culverts that were identified as part of this survey.

8.6. Stone Arches (See Appendix H)

Some of the most picturesque spans along the W&StP/C&NW line are the distinctive stone arch bridges. Built between 1880 and 1919, the seventeen arch spans range in length from four to thirty-two feet. With the exception of one twin span (Milepost

[24] For example, see "Approximate Areas of Waterways for Drainage Areas of 0.1 to 6,000 square miles," computed by Chief Engineer, James Dun, M. Am. Soc. C. E., as reprinted in *Transactions, A. S. C. E.* 51 (December 1903): 441. Curiously, the Bridge Record files indicated that some of the stone culverts with larger openings were used for cattle passes as well. Their use for a cattle pass, of course, would be highly impractical, if not impossible. Nonetheless, the culverts that were indicated in the Bridge Records as cattle passes were noted as such on the respective inventory forms.

14.25; Bridge No. M32), all spans feature a single arch. With very few exceptions, the spans feature a barrel vaulted arch with smooth cut interior face, filled spandrels faced with coursed limestone ashlar, projecting capstones, angled, stepped, and raked wing walls of coursed limestone ashlar, and radiating voussoirs with projecting keystone. Most spans remain in relatively good condition, while a few have suffered from deteriorating mortar.

The stone arch spans located along the bluffs in Winona County from milepost 14.25 to 25.90 were constructed as part of a major rebuilding project along the W&StP/C&NW line, beginning in 1880. Replacing deteriorated timber trestles that had endured continuing maintenance mostly caused by constant flooding in the area, these stone arches eliminated costly repairs.[25] In addition, due to the increase in weight of cars and freight, railroad officials were eager to begin the construction program.

To expedite the erection of the stone spans along the oldest section of the W&StP, the C&NW reopened a quarry near Stockton Hill.[26] Marvin Simon, who recorded interviews of three generations of railroaders, wrote about the Stockton quarry as follows:

At first they were called "The Tillman Arches" after the man in charge. The stones came from the Stockton quarry, more often called "The Crusher," located one-half mile upgrade from the Arches. Rock in that quarry, as elsewhere, was laid down in seams or strata by water. Each layer represents deposition of a separate erosion. Time and pressure turned these depositions into sedimentary rock. Since these sedimentary rocks were laid by water, the upper and lower surfaces of each stratum were smooth. These strata varied from a few inches to over twenty inches of uniform thickness. Hence the masons could be choosy

[25] Replacement spans included stone arches, as well as iron spans, and numerous stone culverts. See Follmar, "The C&NW Across Minnesota," 37.

[26] This section of the W&StP/C&NW is the steepest grade along the entire line. The road rises 480 feet in a distance of four miles. See Marvin J. Simon, "Chicago Northwestern Railroad From Stockton to Lewiston," c. 1980, 2. Files, Minnesota Historical Society, St. Paul, Minnesota.

for size and uniformity. The rest was run through the stone crusher and used for ballast around the ties. Rock drills powered by steam engines were available. Cuttings along a precise line on the desired stratum produced building blocks of uniform length, width and thickness with the quarried side rough and the seam side smooth. Only a small amount of trimming with sharp tow hammers was necessary.[27]

With regard to the actual construction of the arches, Simon recorded that:

Because of the extreme weight of the rocks, especially in the overhand positions, a wooden form was built to carry the load and also to provide the desired shape. The wooden arch or form was made from heavy timber, well reinforced and checked for symmetry and accuracy before placing the rock. The creek was never dammed but allowed to flow through a wooden box.

A dinky railroad engine and a flat car or two brought the quarried rocks to the site. A small hand-powered crane on another car grabbed the rock with iron thongs and placed them for the masons. The trestles were never removed but parts had to be rebuilt. Stones were reworked to fit their positions.

Stone blocks were laid with the smooth side turned toward the inside giving the interior of the arch that smooth, admired and well-finished appearance. The quarried or rough sides became top and [the] bottom and was held in place with a small amount of mortar that knit well in the rough rock surface. In the greater curve the rock had to be cut some and also tilted. The inside edge was held by mortar while the rest of the enlarged opening produced by tilting the rock was filled with packed sand which carried the load well.

The faces, front and rear of the arches, required more detailed fitting than the rock on the inside of the arches. Rocks were cut wedge shaped and held by mortar full length. Sand here would have crumbled out. When the wedge shaped stones, called

[27] Simon, "Chicago Northwestern Railroad From Stockton to Lewiston," 7-8.

keystones, were placed on top and along the exact center, the arches became self-sustaining. Because of the shape and design, the heavier the load the stronger the arches became. Wings made of rocks laid horizontally helped hold the fill, added rigidity and nice appearance.[28]

8.7. Miscellaneous Property Types (See Appendix I)

There are three additional types of spans inventoried as part of this project: a concrete and I-beam span (Mile Post 147.80), a wood stringer bridge (Mile Post 013.50) and a timber frame bridge (Mile Post 007.35). Information regarding these singular types can be found on the individual bridge forms.

[28] Ibid, 8-10.

9. **Description of Property Types: Buildings** (See Appendix J)

8.8. Depots

Four depots located along the W&StP/C&NW line in Minnesota were identified and inventoried. Three of these buildings are listed in the National Register of Historic Places. The remainder, a single-story modestly designed brick passenger station built in 1912, was based on a standardized plan (Milepost No. 102.5; Waseca), typical of many railroads.

8.9. Miscellaneous buildings

The only other extant property sited on the W&StP/C&NW line is a grain storage facility located in Tyler at Mile Post No. 253.7. In good condition, it stands as the sole building of its type found on the historic line.

10. Comments Concerning National Register of Historic Places Evaluation

In evaluating the historic importance of a property or resource, the National Register of Historic Places is the mechanism by which properties are determined to be significant enough to warrant protection under the National Historic Preservation Act of 1966. Determinations of eligibility are based on criteria as set forth in 36 CFR Part 60.4 (70) and are delineated in *National Register Bulletin 15 How to Apply the National Register Criteria for Evaluation*. Furthermore, as stated in *Bulletin 15* "To be listed in the National Register of Historic Places a property must not only be shown to be significant under the National Register criteria but it must also have integrity."[29] The Bulletin also states that integrity is the ability of the property to convey its significance. This may be expressed through the following aspects of integrity: location, design, setting, materials, workmanship, feeling and association.[30] To retain historic integrity a property must always possess several, and usually most, of the seven aspects.

For purposes of evaluating aspects of integrity of the historic bridges inventoried as part of this Section 106 documentation (many of the structures have been modified to a greater or lesser degree), it is very beneficial to refer to the 1983 Transportation Research Board publication *Historic Bridges-Criteria For Decision Making*, chapter four, "Evaluation of Relative Importance":

10.1. Integrity of location deals simply with whether the property is at its original site or has been moved. For many properties, including many bridges (i.e., stone masonry and concrete arches, long suspension bridges, etc.) the issue is moot because they are for practical purposes immovable. However, for others, such as some of the metal truss bridges, exceptions are usually made particularly if there is no strong association with other cultural features. The very nature of early truss fabrication and erection enabled them to be conveniently removed to other sites as crossings were upgraded.

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[29] U.S. Department of the Interior, *National Register Bulletin 15 How to Apply the National Register Criteria for Evaluation* (Washington, D.C.: U.S. Department of the Interior, 1991), 44.
[30] Ibid., 44-45.

10.2. Integrity of design relates to whether the property retains the features of its class; that is, the essential elements of what it is intended to represent. Where paving over a timber deck in a truss bridge to better serve modern traffic may not be perceived as a serious compromise of design integrity, the addition of stiffening cables to the truss might, because the principal focus of interest is usually the truss itself. Likewise, replacement of deteriorated parapets on a concrete arch bridge or grouting of the facia of an unmortared stone arch would likely be seen as altering an essential design element.

10.3. Integrity of setting addresses changes that have occurred to the immediate surroundings and how these changes (buildings, land use, foliage, topography, etc.) have affected the relationship of the property to its setting. Truss bridges for instance, built over railroads or canals may have distinctive features in some regions. Removal of the trackage or filling of the canal in such instances would probably be interpreted as compromising the integrity of their setting.

10.4. Integrity of materials has to do with whether original materials of historic importance associated with the property have been substantially altered by deterioration or replacement and, if replaced, whether the new materials are equivalent to or compatible with the original. A bridge that has had its original random unmortared stone abutments replaced with reinforced concrete might suffer from a loss of materials integrity.

10.5. Integrity of workmanship deals with the relationship between the specific form of different materials and the way they are combined, and the technology of producing these forms and combinations. This attribute is more subtle and difficult to define for bridges, but may be illustrated by a covered timber bridge in which some hand-hewn members with mortised and tenoned joints have been replaced by machine-sawn timbers using modern connectors. In this instance, integrity of materials has been maintained but integrity of workmanship compromised. Similarly, replacement of a damaged truss member consisting of a riveted built-up section with one that was welded would entail a loss of integrity of workmanship.

Most of these attributes are interrelated (for instance, design and materials or location and setting), and it is hard to lose a total of one without some of another as well. The last two attributes are more interpretive than the first five and are typically considered together.

10.6. Integrity of feeling and association is considered to be present if the property communicates to an informed observer a sense of what it was like in its historic period. This generally occurs if the other five attributes are present to a high degree. However, for older highway bridges one could argue that only those on unpaved roads in rural areas could truly communicate such a sense.

In applying the criteria, it is obvious that each integrity attribute may vary in degree from property to property. However, in order to be judged significant, it has usually been assumed that a candidate property must not be totally lacking in any of the seven categories. It is also true in practice that the more important a property is, the greater the propensity to compromise on integrity.[31]

In determining eligibility, two of the four National Register criteria apply:

Criterion A is assigned to those properties "that are associated with events that have made significant contributions to the broadpatterns of history."

Criterion C is assigned to those properties "that embody the distinctive characteristics of a type, period, or method of construction or that represent the work of a master, or that possess
high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction."

[31] Transportation Research Board, "Evaluation of Relative Importance," *Historic Bridges-Criteria for Decision Making* (Washington, D.C.: TRB, October 1983): 16.

11. Recommendations

The following comprehensive lists of historic resources along the W&StP/C&NW line in Minnesota (found in Appendix K) includes comments regarding integrity, National Register of Historic Places eligibility, NRHP criteria and period of significance. Although the accompanying lists cite NRHP eligibility of resources on an individual basis, it is recommended that the entire historic W&StP/C&NW line across the state of Minnesota should be listed as a linear district. This district would include the rail line generally running from Winona west to the state line in Minnesota. The *National Register Bulletin 15* states that "a district possess a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development."[32] This district definition certainly applies to the rail corridor of the W&StP/C&NW in Minnesota, which features intact and significant historic bridges and buildings built by the railroad company. With regard to the W&StP/C&NW resources that no longer retain their integrity, they should be included in the district as non-contributing elements.

The period of significance begins with the date of construction of the rail line in each state and ends in 1949. Despite the ongoing development of the national highway system, C&NW's freight business was still very active through the late 1940s, when company records continued to be set in certain tonnages, including carloads of cattle, machinery, and cement shipped to the west.[33]

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[32] National Park Service. *National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation* (Washington, D.C.: U.S. Department of the Interior, 1990; 1991), 5.

[33] Heavy loads of construction materials were delivered to Oral, South Dakota for construction of the Angustora Dam and irrigation project in 1947. In 1949, a $1.5 million expansion of the South Dakota Cement Plant in Rapid City increased car loadings.

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Appendix A:

The Chicago and North Western Railroad:
An Historic Chronology of the Development of the Line in Minnesota and South Dakota

The Chicago and North Western Railroad:
An Historic Chronology of the Development of the Line in Minnesota and South Dakota

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Records indicate that the Chicago and North Western Railroad (C&NW) in Minnesota and a portion of the line in South Dakota was originally built as the Winona & St. Peter Railroad. The W&StP was constructed for the "stated purpose of benefiting the people of Minnesota by providing a means for the farmers who settled in Minnesota Territory to get their produce to a profitable market." The line also made it possible "for settlers to move to the vast prairies of South Dakota and the line across Minnesota became primarily a funnel to deliver immigrants to the Dakotas."[1]

1851 The Treaty Traverse des Sioux was signed near St. Peter, Minnesota, which opened up settlement of the area.

The Treaty of 1851 ceded the Black Hills and surrounding land to the Sioux.

1855 The Territory of Minnesota chartered The Transit Railroad Company (TRC) to build from Winona through St. Peter, Minnesota, to a point on the Big Sioux River on March 3.

The U.S. Government undertook the first official reconnaissance of the Black Hills region in Dakota Territory.

1857 March 3, Congress enacted a Federal Land Grant to the Territory of Minnesota to finance railroad construction of specific companies.

Mapmaker G.K. Warren explored the Black Hills region that resulted in the first "routes" map to the area.

1858 Grading of the TRC began; financial crisis halts construction one year later.
Minnesota granted Statehood.

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[1] Joe Follmar, "The C&NW Across Minnesota," *North Western Lines* 23 (Winter 1996): 23. This chronology includes the history of Minnesota and South Dakota, both inextricably linked to the C&NW.

1859 June 2, court-appointed receivers sold the Chicago, St. Paul and Fond du Lac Rail-Road Company (established in 1855) to a group of affiliated investors. The successor firm, The Chicago & North Western Railway Company, chartered by the State of Illinois on June 7, acquired the assets of the bankrupt line.

1860 The TRC sold under foreclosure to the State of Minnesota on June 23. The State then owned a fifty-mile, raised earthen pathway between Winona and Rochester.

1861 The State's interest in the TRC was purchased by the Winona, St. Peter & Missouri River Railroad Company, but the line was never built. Hardships as the result of the Civil War discouraged efforts to attract interested investors.

Dakota Territory established.

1862 On March 10, the legislature of Minnesota transferred the charter of the Winona, St. Peter & Missouri River Railroad Company to the Winona & St. Peter Railroad.

The W&StP was incorporated on June 10. The new charter required that 10 miles of track had to be completed by the new line by January 1, 1863.

On December 6, the W&StP track was completed to Stockton, approximately 11 miles west of Winona.

1863 443,314.7 acres of Federal land in Minnesota and [South] Dakota were granted to finance the construction of the W&StP line.

By an act of the Legislature of the State of Illinois, the Chicago and North Western Railway Company (C&NW) was recognized as an existing corporation.

1864 The W&StP constructed its first brick shop buildings in Winona, Minnesota.

The Chicago & North Western merged with the Galena and Chicago Union Railroad on June 2. Known as "The Great Consolidation."

The W&StP reached Rochester, Minnesota.

1865 The Chicago and North Western's route included 860 miles of line. The company claimed to be the "longest carrier in America."

The Civil War ended.

1866 On July 13, 640 acres (within 20 miles of completed right-of-way) were awarded to the W&StP by the State of Minnesota by Congressional approval. This was the final land grant to a state for railroad construction in the United States.

The W&StP line reached Owatonna, where it connected with the Minnesota Central Railroad.

1867 The W&StP, in addition to the La Cross, Trempealeau & Prescott Railroad, was sold to the Chicago & North Western on October 1. The development of the W&StP trackage continued under its own corporate name and operated as a proprietary road. The Winona, Mankato & Northern RR, as a subsidiary line, was created to construct the line into Mankato.

The W&StP reached Waseca.

1870 The W&StP reached Mankato.

1871 The W&StP reached St. Peter.

On October 8 the Chicago fire destroyed C&NW's property causing disruption of business and loss of income.

Congress granted an extension of the previous March 3 deadline (which stipulated as a part of the land grant that the W&StP had to complete the line to the Big Sioux River), to September 3, 1873.

1872	The W&StP reached New Ulm.
	The W&StP reached Dakota Territory at Gary.
1873	The W&StP was completed to Lake Kempeska, Dakota Territory, on August 18. Even though the land grant extended only to the Big Sioux River, the W&StP built its line to the west of its banks.
	The Panic of 1873, a four-year nationwide economic depression, began.
1874	W&StP trains stopped operations west of New Ulm due to extensive work load.
	Gold discovered in the Black Hills of Dakota Territory; prospectors poured into the area.
1876	Marvin Hughitt became general manager of the C&NW.
	Battle of Little Big Horn.
	A grasshopper plague and a severe drought temporarily halted settlement in the fertile prairies of Minnesota and Dakota.
1877	Hughitt made a personal exploration of the [South] Dakota Territory and initiated a plan to extend the C&NW railroad from Tracy, Minnesota, to the Black Hills.
	Surrender of the majority of Sioux and Cheyenne in the Black Hills region.
	Black Hills made a part of Dakota Territory.
1877-78	Several branch lines of the W&StP were constructed in Minnesota.

1878 Due to poor economic conditions Minnesota settlers had removed ties along the W&StP for firewood. Prairie fires had destroyed bridges along the line in Minnesota.

The W&StP was forced to pull back its tracks to the east of the Big Sioux River. As a result, Watertown was established as a county seat and the former town of Kampeska was abandoned.

1879 The Chicago & Dakota Railway Company was established by the C&NW to build a line from Tracy, Minnesota, east to the [South] Dakota border on May 6.

The Dakota Central Railway Company was established by the C&NW to build a line from the [South] Dakota border west to the Missouri River at Pierre. Unlike the W&StP, the Dakota Central did not receive public lands to help off-set the cost of construction. The C&NW financed the new mileage through bond and stock issues. Its Western Town Lot Company developed properties, often profitably.

As a result of the new railroad development, the original main line of the W&StP to Watertown became a branch line and Tracy, Minnesota, became an important Division terminal.

Grading and track construction progressed to Aurora, [South] Dakota Territory and pushed west through to the new communities of Brookings and on to a winter camp located at Volga.

Surveyors completed field work 175 miles west of the Missouri River by fall.

1880 The Great Dakota Land Boom began, with the C&NW as a major catalyst.

Would-be farmers and families flocked west as the Dakota Central constructed new line.

Arlington, Lake Preston, and DeSmet, [South] Dakota Territory, were platted by C&NW's Western Town Lot Company.

June 25, the first train crossed the James River Bridge at the site of "Ragtown", later renamed Huron by C&NW's president Hughitt.

C&NW surveyors plated the Missouri River terminus at Pierre. (Pierre was planned as a transfer point with riverboats on the Missouri and as the point from which goods could be freighted across western Dakota to the Black Hills until the line extended west). Trackage reached Pierre.

1880-81 Record snowstorms buried the Dakotas. The C&NW had to make cuts in the deep snow; they helped to save the immigrant population by delivering corn and fuel oil during the months of October through May.

1882 The commencement of a bridge program to replace numerous deteriorated trestle spans in the area of Stockton Hill quarry in Minnesota.

1883 Winona, Minnesota, machine shops and engine house destroyed by fire on April 11.

1884 Federal ruling prohibited any railroad lines from crossing the Sioux Reservation from Eastern Dakota Territory to get to the Black Hills.

The C&NW assumed the assets of the Fremont, Elkhorn & Missouri Valley ("Elkhorn") Railroad, an eastern Nebraska shortline, which gave the company direct access to western Dakota.

1886 Winona building campaign, including a roundhouse and associated buildings, completed.

1889	A Congressional act opened a transportation corridor through the Sioux reservation, setting the stage to link eastern South Dakota and the Black Hills by rail.
	South Dakota granted Statehood.
1893	Wall Street Panic, a devastating financial three-year period of economic depression, began in May.
1895	One-quarter of the nation's railroads were in bankruptcy.
1900	Construction of a new main line from Mankato to New Ulm, called the Mankato and New Ulm Railway (M&NU), was completed on May 29.
	The W&StP, along with the M&NU, merged into the Chicago & North Western Railroad. The line west of Tracy, Minnesota, was renamed the Dakota Division with headquarters at Huron, South Dakota.
1903	On February 28, the C&NW officially took control of the "Elkhorn" Railroad.
1904	Pierre, instead of Mitchell, declared the official State Capitol of South Dakota.
1905	A temporary wood trestle was constructed across the Missouri River between Ft. Pierre and Pierre.
1906	Construction of the C&NW from Pierre to Rapid City began on the Pierre, Rapid City and North Western Railway (PRC), a subsidiary line.
1907	The Missouri River drawbridge linking Pierre to Ft. Pierre was completed. This project was undertaken by the Pierre & Ft. Pierre Bridge Railway, a subsidiary of the C&NW.
	The 44.8 mile segment of line from Wasta to Philip was completed.

The first train operated on the Pierre, Rapid City and Northwestern Railway over the newly completed Missouri River bridge on July 11.

Panic of 1907.

Public service on the C&NW commenced between Pierre to Rapid City and on to Deadwood, South Dakota, on July 14.

1910 Marvin Hughitt resigned the presidency of the C&NW.

1917 World War I began.

1919 World War I ends.

Operations of the nation's rail lines were under control and direction of the United States Railroad Administration.

On April 30, the C&NW acquired the railway and property of the following proprietary companies: Pierre, Rapid City and North Western Railway Company, and the Pierre and Fort Pierre Bridge Railway Company.

1920 The C&NW regains jurisdiction of their rail line.

1920s An increase in automobile traffic on a new highway system took a toll on passenger train business. During a 12 year period (1920-1932), passenger revenues declined by a total of 73%.

1922 Shopmen's Strike occurred on July 1. Nearly all of the shop crafts employees and foremen stopped work (similar strikes occurred on all rail lines across the U.S.). Over 12,000 employees of the C&NW participated for nearly 2 1/2 months. Work resumed on September 17, 1922.

1924 After struggling with the South Dakota Railroad Commission, the C&NW won the right to discontinue two Sunday trains that operated between Huron and Pierre.

To cut expenses, the C&NW began operating mixed trains (freight and passenger).

1929 Stock Market Crash.

1931 The C&NW drastically reduced tariffs in South Dakota for carload lots of hay, straw and feed grains; cattle were often transported free of charge to save their owner's investments.

1934 Severe drought in Minnesota and South Dakota.

1935 The C&NW sought protection from creditors in bankruptcy court.

1939 Reorganization of the C&NW on December 15.

1943 On December 27, the President of the U.S., acting through the Secretary of War, took possession and control of the railroads in order to avoid a threatened interruption of vital transportation service.

1944 Government control of the railroads ended on January 18.

The C&NW emerged from bankruptcy on June 1 and reincorporated under the laws of Wisconsin.

During and after the war years, the C&NW retired 137 coal and water facilities, 249 small town depots, 659 shop buildings and 1,344 "minor structures."

1947 The Interstate Commerce Commission approved the C&NW application for authority to construct an 18-mile extension in South Dakota across the state line into Wyoming to serve "extensive deposits of bentonite and processing plants now being erected or to be erected, at the site."

1949 Beginning in 1949, an average of 450,000 annual passenger train miles were cut from operation on the C&NW line.

1950s	The C&NW was in serious financial trouble.
1956	Permanent retirement of steam and the adoption of dieselization on May 11.
	Beginning in 1956, the C&NW greatly reduced its long-distance passenger service, including trains between Mankato, Minnesota, and Huron, South Dakota.
1957	On November 5, the C&NW filed a petition with the South Dakota Public Utilities Commission to create a "central agency" system to eliminate unneeded stations throughout the state.
1970	On October 5, a leveraged buyout of the C&NW by its employees occurred. Northwest Industries (a holding company) entered into an agreement with the North Western Employees Transportation Company (NETCO) to sell all assets of the C&NW ($19 million and assumption of $340 million in company debt).
1972	NETCO renamed the Chicago and North Western Transportation Company.
1973	The C&NW begins the Coal Line Project in the Powder River Basin in southeastern Wyoming, for the lucrative trade in low-sulphur, subbituminous coal.
1981	The C&NW begins negotiations to reduce its amount of trackage. The deteriorated tracks between Pierre and Rapid City were put up for abandonment; the State of South Dakota objected to plan.
	The ICC gave approval to the Coal Line Project on July 24.
1983	The C&NW notifies the ICC that the PRC line could be subject to abandonment.
	Construction of the Coal Line Project in Wyoming began on June 27.

1984 A prairie fire touched off by a welder's torch destroyed seven bridges near Wall forcing diversion of eastbound trains from the Black Hills. The line reopened later that year.

1985 South Dakota Sen. Larry Pressler spearheaded negotiations between the C&NW and L. B. Foster Inc., a Pittsburgh-based railway equipment and shortline concern. The company, affiliated with the Dakota, Minnesota and Eastern Railroad, agreed to a $26 million purchase price for the track and other assets.

1986 The Rapid City, South Dakota, to Winona, Minnesota, trackage was officially sold to the Dakota, Minnesota and Eastern Railroad (DM&E), Brookings, South Dakota, on September 4.

On September 5, the DM&E operated its first train out of Huron. The former C&NW roundhouse and shops in Huron become the line's maintenance base.

Appendix B:

Minnesota Open Deck Pile Trestles

Minnesota Open Deck Pile Trestles

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
192.70	491	MN	Open Deck Pile Trestle	1926	n/a	No	n/a	n/a
147.25	M 1643	MN	Open Deck Pile Trestle	1927	n/a	No	n/a	n/a
151.41	M1657	MN	Open Deck Pile Trestle	1927	Yes	Yes	A	1927-1949
158.74	M 1691	MN	Open Deck Pile Trestle	1927	Yes	Yes	A	1927-1949
159.50	M 1698	MN	Open Deck Pile Trestle	1927	Yes	Yes	A	1927-1949
160.80	M 1700	MN	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1944
152.30	M 1663	MN	Open Deck Pile Trestle	1929	Yes	Yes	A	1929-1949
154.21	M 1675	MN	Open Deck Pile Trestle	1929	Yes	Yes	A	1929-1949
144.90	M 1625	MN	Open Deck Pile Trestle	1931	No	No	A	n/a
152.80	M 1665	MN	Open Deck Pile Trestle	1931	Yes	Yes	n/a	1931-1949
160.35	M 1699	MN	Open Deck Pile Trestle	1931	Yes	Yes	A	1931-1949
161.47	M 1701	MN	Open Deck Pile Trestle	1931	Yes	Yes	A	1931-1949
248.42	1347	MN	Open Deck Pile Trestle	1931	Yes	Yes	A	1931-1949
258.90	1375	MN	Open Deck Pile Trestle	1931	Yes	Yes	A	1931-1949
158.94	M 1694	MN	Open Deck Pile Trestle	1935	Yes	Yes	A	1935-1949
260.30	1376	MN	Open Deck Pile Trestle	1935	Yes	Yes	A	1935-1949

Minnesota Open Deck Pile Trestles

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
214.85	544	MN	Open Deck Pile Trestle	1936	Yes	Yes	A	1936-1949
31.70	M 78	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
31.80	M79	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
47.01	M 121	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
144.52	M 1622	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
151.63	M 1658	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
154.98	M 1679	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
158.84	M 1693	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
152.08	M 1661	MN	Open Deck Pile Trestle	1939	Yes	Yes	A	1939-1949
153.38	M 1668	MN	Open Deck Pile Trestle	1939	Yes	Yes	A	1939-1949
44.10	M 111	MN	Open Deck Pile Trestle	1940	Yes	Yes	A	1940-1949
213.90	541	MN	Open Deck Pile Trestle	1940	Yes	Yes	A	1940-1949
34.85	M 90	MN	Open Deck Pile Trestle	1941	Yes	Yes	AA	1941-1949
41.85	M 106	MN	Open Deck Pile Trestle	1942	Yes	Yes	A	1942-1949
45.45	M 115	MN	Open Deck Pile Trestle	1942	Yes	Yes	A	1942-1949
51.90	M 133	MN	Open Deck Pile Trestle	1942	Yes	Yes	A	1942-1949

Minnesota Open Deck Pile Trestles

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
127.83	MA 311	MN	Open Deck Pile Trestle	1942	Yes	Yes	A	1942-1949
150.53	M 1650	MN	Open Deck Pile Trestle	1942	Yes	Yes	A	1942-1949
237.59	1319	MN	Open Deck Pile Trestle	1943	Yes	Yes	A	1943-1949
237.76	1320	MN	Open Deck Pile Trestle	1943	Yes	Yes	A	1943-1949
69.90	M 177	MN	Open Deck Pile Trestle	1944	Yes	Yes	A	1944-1949
154.51	M 1677	MN	Open Deck Pile Trestle	1944	Yes	Yes	A	1944-1949
42.50	M 107	MN	Open Deck Pile Trestle	1945	Yes	Yes	A	1945-1949
146.85	M 1641	MN	Open Deck Pile Trestle	1945	Yes	Yes	A	1945-1949
244.20	1333	MN	Open Deck Pile Trestle	1945	Yes	Yes	A	1945-1949
46.40	M 117	MN	Open Deck Pile Trestle	1946	Yes	Yes	A	1943-1949
197.50	505	MN	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
259.80	1374.5	MN	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
267.10	1392	MN	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
271.29	1398	MN	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
234.45	1312.5	MN	Open Deck Pile Trestle	1948	Yes	Yes	A	1948-1949
144.21	M 1617	MN	Open Deck Pile Trestle	1949	Yes	Yes	A	1949

Minnesota Open Deck Pile Trestles

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
195.66	498	MN	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
235.90	1315	MN	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
265.20	1387	MN	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
268.47	1394	MN	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
263.63	1384	MN	Open Deck Pile Trestle	1950	n/a	No	n/a	n/a
36.30	M 93	MN	Open Deck Pile Trestle	1951	n/a	No	n/a	n/a
98.94	M 239	MN	Open Deck Pile Trestle	1951	n/a	No	n/a	n/a
204.29	524	MN	Open Deck Pile Trestle	1952	n/a	No	n/a	n/a
243.42	1332	MN	Open Deck Pile Trestle	1952	n/a	No	n/a	n/a
247.35	1342	MN	Open Deck Pile Trestle	1952	n/a	No	n/a	n/a
250.05	1353	MN	Open Deck Pile Trestle	1952	n/a	No	n/a	n/a
43.10	M 108	MN	Open Deck Pile Trestle	1953	n/a	No	n/a	n/a
93.69	M 228	MN	Open Deck Pile Trestle	1953	n/a	No	n/a	n/a
171.14	451	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a
181.66	468	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a
238.31	1321	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a

Minnesota Open Deck Pile Trestles

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
238.65	1322	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a
248.06	1345	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a
263.86	1385	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a
46.10	M 116	MN	Open Deck Pile Trestle	1956	n/a	No	n/a	n/a
95.30	M 231	MN	Open Deck Pile Trestle	1956	n/a	No	n/a	n/a
127.96	MA 312	MN	Open Deck Pile Trestle	1956	n/a	No	n/a	n/a
145.85	M 1637	MN	Open Deck Pile Trestle	1956	n/a	No	n/a	n/a
146.70	M 1641	MN	Open Deck Pile Trestle	1956	n/a	No	n/a	n/a
267.90	1393	MN	Open Deck Pile Trestle	1956	n/a	No	n/a	n/a
29.40	M 71	MN	Open Deck Pile Trestle	1957	n/a	No	n/a	n/a
44.60	M 112	MN	Open Deck Pile Trestle	1957	n/a	No	n/a	n/a
50.80	M 130	MN	Open Deck Pile Trestle	1957	n/a	No	n/a	n/a
50.84	M 131	MN	Open Deck Pile Trestle	1957	n/a	No	n/a	n/a
172.20	453	MN	Open Deck Pile Trestle	1957	n/a	No	n/a	n/a
29.90	M 74	MN	Open Deck Pile Trestle	1959	n/a	No	n/a	n/a
84.10	M 205	MN	Open Deck Pile Trestle	1960	n/a	No	n/a	n/a

Minnesota Open Deck Pile Trestles

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
237.07	1317	MN	Open Deck Pile Trestle	1961	n/a	No	n/a	n/a
261.80	1380	MN	Open Deck Pile Trestle	1961	n/a	No	n/a	n/a
264.70	1386	MN	Open Deck Pile Trestle	1961	n/a	No	n/a	n/a
265.55	1388	MN	Open Deck Pile Trestle	1961	n/a	No	n/a	n/a
269.82	1397	MN	Open Deck Pile Trestle	1961	n/a	No	n/a	n/a
242.12	1330	MN	Open Deck Pile Trestle	1963	n/a	No	n/a	n/a
245.30	1337	MN	Open Deck Pile Trestle	1963	n/a	No	n/a	n/a
263.42	1383	MN	Open Deck Pile Trestle	1963	n/a	No	n/a	n/a
35.70	M 92	MN	Open Deck Pile Trestle	1964	n/a	No	n/a	n/a
44.50	M 111.5	MN	Open Deck Pile Trestle	1966	n/a	No	n/a	n/a
152.20	M 1662	MN	Open Deck Pile Trestle	1968	n/a	No	n/a	n/a
118.08	M 286	MN	Open Deck Pile Trestle	1969	n/a	No	n/a	n/a
146.33	M 1640	MN	Open Deck Pile Trestle	1969	n/a	No	n/a	n/a
244.60	1334	MN	Open Deck Pile Trestle	1969	n/a	No	n/a	n/a
251.72	1357	MN	Open Deck Pile Trestle	1969	n/a	No	n/a	n/a
34.90	M 91	MN	Open Deck Pile Trestle	1970	n/a	No	n/a	n/a

Minnesota Open Deck Pile Trestles

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
153.98	M 1672	MN	Open Deck Pile Trestle	1970	n/a	No	n/a	n/a
45.70	M 115.5	MN	Open Deck Pile Trestle	1971	n/a	Yes	n/a	n/a
151.72	M 1659	MN	Open Deck Pile Trestle	1971	No	No	n/a	n/a
120.25	M 291	MN	Open Deck Pile Trestle	1972	n/a	No	n/a	n/a
128.53	MA 316	MN	Open Deck Pile Trestle	1972	n/a	No	n/a	n/a
128.72	MA 317	MN	Open Deck Pile Trestle	1972	n/a	No	n/a	n/a
129.40	MA 322	MN	Open Deck Pile Trestle	1972	n/a	No	n/a	n/a
150.96	M 1654	MN	Open Deck Pile Trestle	1972	n/a	No	n/a	n/a
32.45	M 83	MN	Open Deck Pile Trestle	1974	n/a	No	n/a	n/a
45.40	M 113.5	MN	Open Deck Pile Trestle	1975	n/a	No	n/a	n/a
128.90	MA 319	MN	Open Deck Pile Trestle	ca.1940	Yes	Yes	A	ca. 1940-1949
129.15	MA 321	MN	Open Deck Pile Trestle	ca.1940	Yes	Yes	A	ca. 1940-1949

Appendix C:

Minnesota I-Beam Bridges

Minnesota I-Beam Bridges

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
016.10	M 41	MN	I-Beam	1902	Yes	Yes	A, C	1902-1949
016.75	M 45	MN	I-Beam	1902	No	No	n/a	n/a
013.05	M 29	MN	I-Beam	1903	Yes	Yes	A, C	1903-1949
013.40	M 30	MN	I-Beam	1903	Yes	Yes	A, C	1941-1949
016.90	M 46	MN	I-Beam	1903	Yes	Yes	A, C	1903-1949
019.50	M 53	MN	I-Beam	1904	Yes	Yes	A, C	1904-1949
027.80	M 66	MN	I-Beam	1904	Yes	Yes	A, C	1904-1949
016.30	M 42	MN	I-Beam	1905	No	No	n/a	n/a
016.40	M 43	MN	I-Beam	1905	Yes	Yes	A, C	1905-1949
016.50	M 44	MN	I-Beam	1905	Yes	Yes	A, C	1905-1949
063.40	M 161	MN	I-Beam	1907	Yes	Yes	A, C	1907-1949
103.30	M 249	MN	I-Beam	1908	Yes	Yes	A, C	1908-1949
147.90	M 1645	MN	I-Beam	1909	Yes	Yes	A, C	1909-1949
167.10	444	MN	I-Beam	1909	Yes	Yes	A, C	1909-1949
258.63	1371	MN	I-Beam	1909	Yes	Yes	A, C	1909-1949
272.85	1399	MN	I-Beam	1909	Yes	Yes	A	1909-1949

Minnesota I-Beam Bridges

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
031.87	M 80	MN	I-Beam	1910	Yes	Yes	A, C	1910-1949
047.30	M 122	MN	I-Beam	1910	Yes	Yes	A, C	1910-1949
047.40	M 123	MN	I-Beam	1910	Yes	Yes	A, C	1910-1949
047.90	M 125	MN	I-Beam	1910	Yes	Yes	A, C	1910-1949
177.78	462	MN	I-Beam	1910	Yes	Yes	A	1910-1949
198.01	506	MN	I-Beam	1910	Yes	Yes	A, C	1910-1949
203.39	520	MN	I-Beam	1910	No	No	n/a	n/a
166.50	442.75	MN	I-Beam	1911	Yes	Yes	A, C	1911-1949
253.20	1359	MN	I-Beam	1912	Yes	Yes	A, C	1912-1949
076.10	M 188	MN	I-Beam	1913	Yes	Yes	A, C	1913-1949
168.63	446	MN	I-Beam	1913	Yes	Yes	A, C	1913-1949
207.71	531	MN	I-Beam	1913	Yes	Yes	A, C	1916-1949
030.90	M 76	MN	I-Beam	1914	Yes	Yes	A, C	1914-1949
097.12	M 235	MN	I-Beam	1916	Yes	Yes	A, C	1916-1949
207.46	530	MN	I-Beam	1916	Yes	Yes	A, C	1916-1949
206.73	528	MN	I-Beam	1918	Yes	Yes	A, C	1918-1949

Minnesota I-Beam Bridges

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
206.45	527	MN	I-Beam	1919	Yes	Yes	A, C	1919-1949
093.40	M 227	MN	I-Beam	1940	Yes	Yes	A, C	1940-1949
046.50	M 118	MN	I-Beam	1946	Yes	Yes	A	1946-1949
046.55	M 120	MN	I-Beam	1966	n/a	No	n/a	n/a

Appendix D:

Minnesota Through Plate Girders

Minnesota Deck Plate Girders

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
015.60	M 39	MN	Deck Plate Girder	1898	Yes	Yes	A,C	1898-1949
015.00	M 34	MN	Deck Plate Girder	1901	Yes	Yes	A,C	1901-1949
007.25	M 13	MN	Deck Plate Girder	1904	Yes	Yes	A,C	1904-1949
008.10	M 15	MN	Deck Plate Girder	1904	Yes	Yes	A,C	1904-1949
113.68	M 270	MN	Deck Plate Girder	1908	Yes	Yes	A,C	1908-1949
013.75	M 31	MN	Deck Plate Girder	1910	Yes	Yes	A,C	1910-1949
006.30	M 10	MN	Deck Plate Girder	1912	Yes	Yes	A,C	1912-1949
152.95	M 1666	MN	Deck Plate Girder	1914	Yes	Yes	A,C	1914-1949
220.20	556.5	MN	Deck Plate Girder	1915	Yes	Yes	A,C	1915-1949
049.60	M 128	MN	Deck Plate Girder	1916	Yes	Yes	A,C	1916-1949
113.54	M 269	MN	Deck Plate Girder	1916	Yes	Yes	A,C	1916-1949
186.79	478	MN	Deck Plate Girder	1917	Yes	Yes	A,C	1917-1949
220.10	556	MN	Deck Plate Girder	1917	Yes	Yes	A,C	1917-1949
049.00	M 126	MN	Deck Plate Girder	1919	Yes	Yes	A,C	1919-1949
071.05	M 179	MN	Deck Plate Girder	1919	Yes	Yes	A,C	1919-1949
206.20	526	MN	Deck Plate Girder, Triangular Lattice Through Truss	1919, 1920	Yes	Yes	A,C	1919-1949

Minnesota Deck Plate Girders

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
196.74	502	MN	Deck Plate Girder	1924	Yes	Yes	A,C	1924-1949
040.05	M 101.5	MN	Deck Plate Girder	1930	Yes	Yes	A,C	1930-1949
143.39	M 1612	MN	Deck Plate Girder	1951	n/a	No	n/a	n/a

Appendix E:

Minnesota Deck Plate Girders

Minnesota Deck Plate Girders

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
015.60	M 39	MN	Deck Plate Girder	1898	Yes	Yes	A,C	1898-1949
015.00	M 34	MN	Deck Plate Girder	1901	Yes	Yes	A,C	1901-1949
007.25	M 13	MN	Deck Plate Girder	1904	Yes	Yes	A,C	1904-1949
008.10	M 15	MN	Deck Plate Girder	1904	Yes	Yes	A,C	1904-1949
113.68	M 270	MN	Deck Plate Girder	1908	Yes	Yes	A,C	1908-1949
013.75	M 31	MN	Deck Plate Girder	1910	Yes	Yes	A,C	1910-1949
006.30	M 10	MN	Deck Plate Girder	1912	Yes	Yes	A,C	1912-1949
152.95	M 1666	MN	Deck Plate Girder	1914	Yes	Yes	A,C	1914-1949
220.20	556.5	MN	Deck Plate Girder	1915	Yes	Yes	A,C	1915-1949
049.60	M 128	MN	Deck Plate Girder	1916	Yes	Yes	A,C	1916-1949
113.54	M 269	MN	Deck Plate Girder	1916	Yes	Yes	A,C	1916-1949
186.79	478	MN	Deck Plate Girder	1917	Yes	Yes	A,C	1917-1949
220.10	556	MN	Deck Plate Girder	1917	Yes	Yes	A,C	1917-1949
049.00	M 126	MN	Deck Plate Girder	1919	Yes	Yes	A,C	1919-1949
071.05	M 179	MN	Deck Plate Girder	1919	Yes	Yes	A,C	1919-1949

Minnesota Deck Plate Girders

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
206.20	526	MN	Deck Plate Girder, Triangular Lattice Through Truss	1919, 1920	Yes	Yes	A,C	1919-1949
196.74	502	MN	Deck Plate Girder	1924	Yes	Yes	A,C	1924-1949
040.05	M 101.5	MN	Deck Plate Girder	1930	Yes	Yes	A,C	1930-1949
143.39	M 1612	MN	Deck Plate Girder	1951	n/a	No	n/a	n/a

Appendix F:

Minnesota Truss Bridges

Minnesota Truss Bridges

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
246.85	1641	MN	Double Intersection Warren Deck Truss	1902	Yes	Yes	A, C	1902-1949
162.80	M 1703	MN	Tringular Lattice Through Truss	1913	Yes	Yes	A, C	1913-1949
206.20	526	MN	Deck Plate Girder Triangular Lattic Through Truss	1919, 1920	Yes	Yes	A, C	1919-1949

Appendix G:

Minnesota Culverts

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
168.30	445	MN	Single Stone Box Culvert	1871	Yes	Yes	A	1871-1949
011.75	M 25	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
018.20	M 48	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
018.80	M 51	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
020.40	M 55	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
038.15	M 96	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
043.50	M 109	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
080.20	M 196	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
177.40	460	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
183.50	473	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
207.80	532	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
055.10	M 138	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
055.50	M 140	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
055.90	M 142	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
171.90	452	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
173.30	455	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
178.40	463	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
198.80	507	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
226.20	567	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
055.40	M 139	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
055.60	M 141	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
056.05	M 143	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
056.10	M 144	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
100.80	M 244	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
102.10	M 246	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
196.10	501	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
027.50	M 65	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949
056.20	M 145	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949
056.60	M 146	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
067.90	M 170	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949
093.85	M 229	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949
116.55	M 281	MN	Single Stone Box Culvert	1895	No	No	n/a	n/a
116.65	M 282	MN	Single Stone Box Culvert	1895	No	No	n/a	n/a
117.20	M 284	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949
059.90	M 152	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
060.40	M 153	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
064.70	M 165	MN	Single Stone Box Culvert	1896	No	No	n/a	n/a
066.20	M 168	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
077.30	M 191	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
078.10	M 192	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
078.75	M 194	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
105.45	M 252	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
115.10	M 274	MN	Single Stone Box Culvert	1896	No	No	n/a	n/a

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
115.50	M 276	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
115.90	M 278	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
116.80	M 283	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
118.80	M 287	MN	Single Stone Box Culvert	1896	No	No	n/a	n/a
119.10	M 288	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
119.30	M 289	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
120.60	M 293	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
020.95	M 56	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
022.20	M 59	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
065.40	M 166	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
074.40	M 184	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
075.40	M 186	MN	Single Stone Box Culvert	1897	No	No	n/a	n/a
083.60	M 204	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
084.90	M 207	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
085.10	M 208	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
092.20	M 224	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
094.40	M 230	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
095.70	M 232	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
095.80	M 233	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
096.20	M 234	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
097.90	M236	MN	Single Stone Box Culvert	1897	No	No	n/a	n/a
098.45	M 237	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
099.25	M 240	MN	Single Stone Box Culvert	1897	No	No	n/a	n/a
112.40	M 266	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
123.50	M 301	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
193.80	495	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
197.40	504	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
202.10	517	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
217.30	548	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
010.25	M 22	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
015.45	M 37	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
015.87	M 40	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
037.25	M 95	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
059.80	M 151	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
082.50	M 202	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
091.10	M 221	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
092.75	M 225	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
107.25	M 256	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
197.30	503	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
205.75	525	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
211.90	539	MN	Single Stone Box Culvert	1898	No	No	n/a	n/a
038.55	M 97	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
039.50	M 100	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
123.30	M 300	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
164.60	438	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
164.80	439	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
193.50	494	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
198.90	508	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
008.25	M 16	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
009.50	M 20	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
041.05	M 105	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
085.80	M 209	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
086.35	M 210	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
088.98	M 219	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
092.90	M 226	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
101.20	M 245	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
107.50	M 257	MN	Single Stone Box Culvert	1900	No	No	n/a	n/a
110.60	M 263	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
112.10	M 265	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
113.90	M 271	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
114.55	M 273	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
180.40	465	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
182.10	469	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
187.50	480	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
191.80	489	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
194.20	496	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
195.90	500	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
203.60	521	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
203.90	522	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
209.25	534	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
222.10	561	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
239.80	1326	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
021.45	M 57	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
054.10	M 136	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
061.60	M 156	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
073.50	M 183	MN	Single Stone Box Culvert	1901	No	No	n/a	n/a
109.90	M 262	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
164.10	436	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
170.10	449	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
174.90	457	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
181.30	466	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
182.60	470	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
182.70	471	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
183.25	472	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
184.12	474	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
184.90	475	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
185.50	476	MN	Single Stone Box Culvert	1901	No	No	n/a	n/a
191.10	487	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
191.50	488	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
199.50	510	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
219.30	554	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
221.20	559	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
033.80	M 88	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
169.20	448	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
227.70	1302	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
236.20	1316	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
239.20	1324	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
239.62	1325	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
245.80	1338	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
245.90	1339	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
246.25	1340	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
017.80	M 47	MN	Single Stone Box Culvert	1903	Yes	Yes	A	1903-1949
038.95	M 98	MN	Single Stone Box Culvert	1903	Yes	Yes	A	1903-1949
100.50	M 243	MN	Single Stone Box Culvert	1903	Yes	Yes	A	1903-1949
186.20	477	MN	Single Stone Box Culvert	1903	No	No	n/a	1903-1949
216.20	546	MN	Single Stone Box Culvert	1903	Yes	Yes	A	1903-1949
268.95	1395	MN	Cast-Iron Pipe Culvert	1903	Yes	Yes	A	1903-1949
079.30	M 195	MN	Single Stone Box Culvert	1904	Yes	Yes	A	1904-1949
253.76	1361	MN	Single Stone Box Culvert	1904	Yes	Yes	A	1904-1949
256.40	1366	MN	Single Stone Box Culvert	1904	Yes	Yes	A	1904-1949
043.75	M 110	MN	Single Stone Box Culvert	1905	Yes	Yes	A	1905-1949
053.50	M 134	MN	Single Stone Box Culvert	1905	No	No	n/a	n/a

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
057.90	M 148	MN	Single Stone Box Culvert	1905	Yes	Yes	A	1905-1949
068.10	M 171	MN	Single Stone Box Culvert	1905	Yes	Yes	A	1905-1949
089.75	M 220	MN	Single Stone Box Culvert	1905	Yes	Yes	A	1905-1949
220.38	557	MN	Cast-Iron Pipe Culvert	1905	Yes	Yes	A	1905-1949
257.30	1368	MN	Single Stone Box Culvert	1905	Yes	Yes	A	1905-1949
082.10	M 201	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
084.80	M 206	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
150.60	M 1651	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
151.80	M 1660	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
152.50	M 1664	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
154.30	M 1676	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
155.60	M 1682	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
269.19	1396	MN	Single Stone Box Culvert	1907	Yes	Yes	A	1907-1949
143.60	M 1614	MN	Single Stone Box Culvert	1908	Yes	Yes	A	1908-1949

Minnesota Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
158.72	M 1690	MN	Single Stone Box Culvert	1908	Yes	Yes	A	1908-1949
122.40	M 298	MN	Concrete Box Culvert	1909	Yes	Yes	A	1909-1949
024.15	M 61	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949
157.50	M 1686	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949
225.95	566	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949
245.20	1336	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949
251.30	1356	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949
253.90	1363	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949
105.60	M 253	MN	Single Stone Box Culvert	1911	Yes	Yes	A	1911-1949
249.40	1351	MN	Single Stone Box Culvert	1913	Yes	Yes	A	1913-1949
192.30	490	MN	Concrete Box Culvert	1916	Yes	Yes	A	1916-1949
222.70	562	MN	Concrete Box Culvert	1923	Yes	Yes	A	1923-1949
029.80	M 73	MN	Single Stone Box Culvert	ca. 1900	Yes	Yes	A	ca. 1900-1949
030.50	M 75	MN	Single Stone Box Culvert	ca. 1900	Yes	Yes	A	ca. 1900-1949

Appendix H:

Minnesota Arches

Minnesota Arches

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
14.70	M 33	MN	Stone Arch	1880	Yes	Yes	A, C	1880-1949
15.14	M 35	MN	Stone Arch	1880	Yes	Yes	A, C	1880-1949
14.25	M 32	MN	Stone Arch	1882	Yes	Yes	A, C	1882-1949
15.30	M 36	MN	Stone Arch	1883	Yes	Yes	A, C	1883-1949
40.10	M 102	MN	Stone Arch	1883	Yes	Yes	A, C	1883-1949
102.80	M 248	MN	Stone Arch	1884	No	Yes	n/a	n/a
129.55	MA 324	MN	Stone Arch	1887	Yes	Yes	A, C	1874-1949
54.80	M 137	MN	Stone Arch	1892	Yes	Yes	A, C	1892-1949
212.25	540	MN	Stone Arch	1904	Yes	Yes	A, C	1904-1949
223.50	564	MN	Stone Arch	1905	Yes	Yes	A, C	1905-1949
24.45	M 62	MN	Stone Arch	1907	Yes	Yes	A, C	1907-1949
25.90	M 63	MN	Stone Arch	1907	Yes	Yes	A, C	1907-1949
266.50	1391	MN	Stone Arch	1908	Yes	Yes	A, C	1908-1949
40.90	M 103	MN	Stone Arch	1910	Yes	Yes	A,C	1910-1949
165.90	442	MN	Stone Arch	1910	Yes	Yes	A, C	1910-1949
221.81	560	MN	Stone Arch	1910	Yes	Yes	A, C	1910-1949

Minnesota Arches

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
119.75	M 290	MN	Concrete Arch	1915	Yes	Yes	A	1915-1949
224.80	565	MN	Stone Arch	1919	Yes	Yes	A, C	1919-1949

Appendix I:

Minnesota Miscellaneous Bridge Types

Minnesota: Miscellaneous Bridge Types

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
147.80	M 1644	MN	Concrete and I-Beam	1908	Yes	Yes	A, C	1908-1949
7.35	M 14	MN	Timber Frame Bridge	1909	Yes	Yes	A	1909-1949
13.50	M 30.5	MN	Wood Stringer Bridge	1962	n/a	No	n/a	n/a

Appendix J:

Minnesota Buildings

Minnesota Buildings

listed by year built

Mile Post	Name	State	Historic Use	Current use	Year Built	Retains Integrity	NRHP Eligibility	NRHP Criteria	Period of Significance
179.90	Winon & Saint Peter Freight Depot	MN	depot	storage	1887	Yes	Listed	A	1887-1929
165.20	Chicago A & North Western Depot, New Ulm (DM&E Building 909)	MN	passenger depot	office	1895	Yes	Listed	A	1895-1929
179.80	Chicago & North Western Depot, Sleepy Eye	MN	passenger depot	museum	1902	Yes	Listed	A	1902-1941
102.50	Chicago & North Western Passenger Station, Waseca (DM&E Building 904)	MN	passenger station	office	1912	Yes	Yes	A	1912-1949
253.70	Tyler Grain Building	MN	grain storage	not in use	ca. 1910	Yes	Yes	A	ca. 1910-1949

Appendix K:

Minnesota Eligibility Summary

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
6.10	M 9.5	MN	Through Plate Girder	1940	Yes	Yes	A, C	1940-1949
6.30	M 10	MN	Deck Plate Girder	1912	Yes	Yes	A, C	1912-1949
6.50	M 12	MN	Through Plate Girder	1906	Yes	Yes	A, C	1906-1949
7.25	M 13	MN	Deck Plate Girder	1904	Yes	Yes	A, C	1904-1949
7.35	M 14	MN	Timber Frame Bridge	1909	Yes	Yes	A	1909-1949
8.10	M 15	MN	Deck Plate Girder	1904	Yes	Yes	A, C	1904-1949
8.25	M 16	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
9.50	M 20	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
10.25	M 22	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1891-1949
10.50	M 23	MN	Through Plate Girder	1909	Yes	Yes	A, C	1909-1949
11.05	M 24	MN	Through Plate Girder	1909	Yes	Yes	A, C	1909-1949
11.75	M 25	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
12.00	M 26	MN	Through Plate Girder	1910	Yes	Yes	A, C	1910-1949
12.40	M 27	MN	Through Plate Girder	1913	Yes	Yes	A, C	1913-1949

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
12.80	M 28	MN	Through Plate Girder	1919	Yes	Yes	A, C	1919-1949
13.05	M 29	MN	I-Beam	1903	Yes	Yes	A, C	1903-1949
13.40	M 30	MN	I-Beam	1903	Yes	Yes	A, C	1941-1949
13.50	M 30.5	MN	Wood Stringer Bridge	1962	n/a	No	n/a	n/a
13.75	M 31	MN	Deck Plate Girder	1910	Yes	Yes	A, C	1910-1949
14.25	M 32	MN	Stone Arch	1882	Yes	Yes	A, C	1882-1949
14.70	M 33	MN	Stone Arch	1880	Yes	Yes	A, C	1880-1949
15.00	M 34	MN	Deck Plate Girder	1901	Yes	Yes	A, C	1901-1949
15.14	M 35	MN	Stone Arch	1880	Yes	Yes	A, C	1880-1949
15.30	M 36	MN	Stone Arch	1883	Yes	Yes	A, C	1883-1949
15.45	M 37	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
15.60	M 39	MN	Deck Plate Girder	1898	Yes	Yes	A, C	1898-1949
15.87	M 40	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
16.10	M 41	MN	I-Beam	1902	Yes	Yes	A, C	1902-1949

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
16.30	M 42	MN	I-Beam	1905	No	No	n/a	n/a
16.40	M 43	MN	I-Beam	1905	Yes	Yes	A, C	1905-1949
16.50	M 44	MN	I-Beam	1905	Yes	Yes	A, C	1905-1949
16.75	M 45	MN	I-Beam	1902	No	No	n/a	n/a
16.90	M 46	MN	I-Beam	1903	Yes	Yes	A, C	1903-1949
17.80	M 47	MN	Single Stone Box Culvert	1903	Yes	Yes	A	1903-1949
18.20	M 48	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
18.80	M 51	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
19.50	M 53	MN	I-Beam	1904	Yes	Yes	A, C	1904-1949
20.40	M 55	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
20.95	M 56	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
21.45	M 57	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
22.20	M 59	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
24.15	M 61	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
24.45	M 62	MN	Stone Arch	1907	Yes	Yes	A, C	1907-1949
25.90	M 63	MN	Stone Arch	1907	Yes	Yes	A, C	1907-1949
27.50	M 65	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949
27.80	M 66	MN	I-Beam	1904	Yes	Yes	A, C	1904-1949
29.40	M 71	MN	Open Deck Pile Trestle	1957	n/a	No	n/a	n/a
29.80	M 73	MN	Single Stone Box Culvert	ca. 1900	Yes	Yes	A	ca. 1900-1949
29.90	M 74	MN	Open Deck Pile Trestle	1959	n/a	No	n/a	n/a
30.50	M 75	MN	Single Stone Box Culvert	ca. 1900	Yes	Yes	A	ca. 1900-1949
30.90	M 76	MN	I-Beam	1914	Yes	Yes	A, C	1914-1949
31.10	M 77	MN	Through Plate Girder	1910	Yes	Yes	A, C	1910-1949
31.70	M 78	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
31.80	M 79	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
31.87	M 80	MN	I-Beam	1910	Yes	Yes	A, C	1910-1949
32.45	M 83	MN	Open Deck Pile Trestle	1974	n/a	No	n/a	n/a

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
33.10	M 85	MN	Through Plate Girder	1919	Yes	Yes	A, C	1919-1949
33.25	M 86	MN	Through Plate Girder	1919	Yes	Yes	A, C	1919-1949
33.45	M 87	MN	Through Plate Girder	1919	Yes	Yes	A, C	1919-1949
33.80	M 88	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
34.40	M 89	MN	Through Plate Girder	1907	Yes	Yes	A, C	1907-1949
34.85	M 90	MN	Open Deck Pile Trestle	1941	Yes	Yes	A	1941-1949
34.90	M 91	MN	Open Deck Pile Trestle	1970	n/a	No	n/a	n/a
35.70	M 92	MN	Open Deck Pile Trestle	1964	n/a	No	n/a	n/a
36.30	M 93	MN	Open Deck Pile Trestle	1951	n/a	No	n/a	n/a
36.75	M 94	MN	Through Plate Girder	1904	Yes	Yes	A, C	1904-1949
37.25	M 95	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
38.15	M 96	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
38.55	M 97	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
38.95	M 98	MN	Single Stone Box Culvert	1903	Yes	Yes	A	1903-1949

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
39.50	M 100	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
40.05	M 101.5	MN	Deck Plate Girder	1930	Yes	Yes	A, C	1930-1949
40.10	M 102	MN	Stone Arch	1883	Yes	Yes	A, C	1883-1949
40.90	M 104	MN	Stone Arch	1910	Yes	Yes	A, C	1910-1949
41.05	M 105	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
41.85	M 106	MN	Open Deck Pile Trestle	1942	Yes	Yes	A	1942-1949
42.50	M 107	MN	Open Deck Pile Trestle	1945	Yes	Yes	A	1945-1949
43.10	M 108	MN	Open Deck Pile Trestle	1953	n/a	No	n/a	n/a
43.50	M 109	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
43.75	M 110	MN	Single Stone Box Culvert	1905	Yes	Yes	A	1905-1949
44.10	M 111	MN	Open Deck Pile Trestle	1940	Yes	Yes	A	1940-1949
44.50	M 111.5	MN	Open Deck Pile Trestle	1966	n/a	No	n/a	n/a
44.60	M 112	MN	Open Deck Pile Trestle	1957	n/a	No	n/a	n/a
45.40	M 113.5	MN	Open Deck Pile Trestle	1975	n/a	No	n/a	n/a

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
45.45	M 115	MN	Open Deck Pile Trestle	1942	Yes	Yes	A	1942-1949
45.70	M 115.5	MN	Open Deck Pile Trestle	1971	n/a	No	n/a	n/a
46.10	M 116	MN	Open Deck Pile Trestle	1956	n/a	No	n/a	n/a
46.40	M 117	MN	Open Deck Pile Trestle	1946	Yes	Yes	A	1943-1949
46.50	M 118	MN	I-Beam	1946	Yes	Yes	A	1946-1949
46.55	M 120	MN	I-Beam	1966	n/a	No	n/a	n/a
47.01	M 121	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
47.30	M 122	MN	I-Beam	1910	Yes	Yes	A, C	1910-1949
47.40	M 123	MN	I-Beam	1910	Yes	Yes	A, C	1910-1949
47.90	M 125	MN	I-Beam	1910	Yes	Yes	A, C	1910-1949
49.00	M 126	MN	Deck Plate Girder	1919	Yes	Yes	A, C	1919-1949
49.60	M 128	MN	Deck Plate Girder	1916	Yes	Yes	A, C	1916-1949
50.80	M 130	MN	Open Deck Pile Trestle	1957	n/a	No	n/a	n/a
50.84	M 131	MN	Open Deck Pile Trestle	1957	n/a	No	n/a	n/a

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
51.90	M 133	MN	Open Deck Pile Trestle	1942	Yes	Yes	A	1942-1949
53.50	M 134	MN	Single Stone Box Culvert	1905	No	No	n/a	n/a
54.10	M 136	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
54.80	M 137	MN	Stone Arch	1892	Yes	Yes	A, C	1892-1949
55.10	M 138	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
55.40	M 139	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
55.50	M 140	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
55.60	M 141	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
55.90	M 142	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
56.05	M 143	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
56.10	M 144	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
56.20	M 145	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949
56.60	M 146	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949
57.90	M 148	MN	Single Stone Box Culvert	1905	Yes	Yes	A	1905-1949

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
59.80	M 151	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
59.90	M 152	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
60.40	M 153	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
61.60	M 156	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
63.40	M 161	MN	I-Beam	1907	Yes	Yes	A, C	1907-1949
64.70	M 165	MN	Single Stone Box Culvert	1896	No	No	n/a	n/a
65.40	M 166	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
66.20	M 168	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
67.90	M 170	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949
68.10	M 171	MN	Single Stone Box Culvert	1905	Yes	Yes	A	1905-1949
69.90	M 177	MN	Open Deck Pile Trestle	1944	Yes	Yes	A	1944-1949
71.05	M 179	MN	Deck Plate Girder	1919	Yes	Yes	A, C	1919-1949
73.50	M 183	MN	Single Stone Box Culvert	1901	No	No	n/a	n/a
74.40	M 184	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
75.40	M 186	MN	Single Stone Box Culvert	1897	No	No	n/a	n/a
76.10	M 188	MN	I-Beam	1913	Yes	Yes	A, C	1913-1949
77.30	M 191	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
78.10	M 192	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
78.75	M 194	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
79.30	M 195	MN	Single Stone Box Culvert	1904	Yes	Yes	A	1904-1949
80.20	M 196	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
82.10	M 201	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
82.50	M 202	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
83.60	M 204	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
84.10	M 205	MN	Open Deck Pile Trestle	1960	n/a	No	n/a	n/a
84.80	M 206	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
84.90	M 207	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
85.10	M 208	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
85.80	M 209	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
86.35	M 210	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
88.98	M 219	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
89.75	M 220	MN	Single Stone Box Culvert	1905	Yes	Yes	A	1905-1949
91.10	M 221	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
92.20	M 224	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
92.75	M 225	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
92.90	M 226	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
93.40	M 227	MN	I-Beam	1940	Yes	Yes	A, C	1940-1949
93.60	M 228	MN	Open Deck Pile Trestle	1953	n/a	No	n/a	n/a
93.85	M 229	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949
94.40	M 230	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
95.30	M 231	MN	Open Deck Pile Trestle	1956	n/a	No	n/a	n/a
95.70	M 232	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
95.80	M 233	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
96.20	M 234	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
97.12	M 235	MN	I-Beam	1916	Yes	Yes	A, C	1916-1949
97.90	M 236	MN	Single Stone Box Culvert	1897	No	No	n/a	n/a
98.45	M 237	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
98.94	M 239	MN	Open Deck Pile Trestle	1951	n/a	No	n/a	n/a
99.25	M 240	MN	Single Stone Box Culvert	1897	No	No	n/a	n/a
100.50	M 243	MN	Single Stone Box Culvert	1903	Yes	Yes	A	1903-1949
100.80	M 244	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
101.20	M 245	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
102.10	M 246	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
102.80	M 248	MN	Stone Arch	1884	No	No	n/a	n/a
103.30	M 249	MN	I-Beam	1908	Yes	Yes	A, C	1908-1949
105.45	M 252	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
105.60	M 253	MN	Single Stone Box Culvert	1911	Yes	Yes	A	1911-1949
107.25	M 256	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
107.50	M 257	MN	Single Stone Box Culvert	1900	No	No	n/a	n/a
109.90	M 262	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
110.60	M 263	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
112.10	M 265	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
112.40	M 266	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
113.54	M 269	MN	Deck Plate Girder	1916	Yes	Yes	A, C	1916-1949
113.68	M 270	MN	Deck Plate Girder	1908	Yes	Yes	A, C	1908-1949
113.90	M 271	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
114.55	M 273	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
115.10	M 274	MN	Single Stone Box Culvert	1896	No	No	n/a	n/a
115.50	M 276	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
115.90	M 278	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
116.55	M 281	MN	Single Stone Box Culvert	1895	No	No	n/a	n/a
116.65	M 282	MN	Single Stone Box Culvert	1895	No	No	n/a	n/a
116.80	M 283	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
117.20	M 284	MN	Single Stone Box Culvert	1895	Yes	Yes	A	1895-1949
118.08	M 286	MN	Open Deck Pile Trestle	1969	n/a	No	n./a	n/a
118.80	M 287	MN	Single Stone Box Culvert	1896	No	No	n./a	n./a
119.10	M 288	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
119.30	M 289	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
119.75	M 290	MN	Concrete Arch	1915	Yes	Yes	A	1915-1949
120.25	M 291	MN	Open Deck Pile Trestle	1972	n/a	No	n./a	n/a
120.60	M 293	MN	Single Stone Box Culvert	1896	Yes	Yes	A	1896-1949
122.40	M 298	MN	Concrete Box Culvert	1909	Yes	Yes	A	1909-1949
123.30	M 300	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
123.50	M 301	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
127.83	MA 311	MN	Open Deck Pile Trestle	1942	Yes	Yes	A	1942-1949
127.96	MA 312	MN	Open Deck Pile Trestle	1956	n/a	No	n./a	n/a
128.53	MA 316	MN	Open Deck Pile Trestle	1972	n/a	No	n./a	n/a
128.72	MA 317	MN	Open Deck Pile Trestle	1972	n/a	No	n./a	n/a
128.90	MA 319	MN	Open Deck Pile Trestle	ca.1940	Yes	Yes	A	ca. 1940-1949
129.15	MA 321	MN	Open Deck Pile Trestle	ca.1940	Yes	Yes	A	ca. 1940-1949
129.40	MA 322	MN	Open Deck Pile Trestle	1972	n/a	No	n./a	n/a
129.55	MA 324	MN	Stone Arch	1887	Yes	Yes	A,C	1874-1949
143.39	M 1612	MN	Deck Plate Girder	1951	n/a	No	n./a	n/a
143.60	M 1614	MN	Single Stone Box Culvert	1908	Yes	Yes	A	1908-1949
144.21	M 1617	MN	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
144.52	M 1622	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
144.90	M 1625	MN	Open Deck Pile Trestle	1931	No	No	n/a	n/a
145.85	M 1637	MN	Open Deck Pile Trestle	1956	n/a	No	n./a	n/a

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
146.33	M 1640	MN	Open Deck Pile Trestle	1969	n/a	No	n./a	n/a
146.70	M 1641	MN	Open Deck Pile Trestle	1956	n/a	No	n./a	n/a
146.85	M 1641	MN	Open Deck Pile Trestle	1945	Yes	Yes	A	1945-1949
147.25	M 1643	MN	Open Deck Pile Trestle	1927	n/a	No	n./a	n/a
147.80	M 1644	MN	Concrete and I-Beam	1908	Yes	Yes	A,C	1908-1949
147.90	M 1645	MN	I-Beam	1909	Yes	Yes	A,C	1909-1949
150.53	M 1650	MN	Open Deck Pile Trestle	1942	Yes	Yes	A	1942-1949
150.60	M 1651	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
150.96	M 1654	MN	Open Deck Pile Trestle	1972	n/a	No	n./a	n/a
151.41	M 1657	MN	Open Deck Pile Trestle	1927	Yes	Yes	A	1927-1949
151.63	M 1658	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
151.72	M 1659	MN	Open Deck Pile Trestle	1971	n/a	No	n./a	n/a
151.80	M 1660	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
152.08	M 1661	MN	Open Deck Pile Trestle	1939	Yes	Yes	A	1939-1949

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
152.20	M 1662	MN	Open Deck Pile Trestle	1968	n/a	No	n./a	n/a
152.30	M 1663	MN	Open Deck Pile Trestle	1929	Yes	Yes	A	1929-1949
152.50	M 1664	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
152.80	M 1665	MN	Open Deck Pile Trestle	1931	Yes	Yes	A	1931-1949
152.95	M 1666	MN	Deck Plate Girder	1914	Yes	Yes	A,C	1914-1949
153.38	M 1668.	MN	Open Deck Pile Trestle	1939	Yes	Yes	A	1939-1949
153.98	M 1672	MN	Open Deck Pile Trestle	1970	n/a	No	n./a	n/a
154.21	M 1675	MN	Open Deck Pile Trestle	1929	Yes	Yes	A	1929-1949
154.30	M 1676	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
154.31	M 1677	MN	Open Deck Pile Trestle	1944	Yes	Yes	A	1944-1949
154.98	M 1679	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
155.60	M 1682	MN	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
157.50	M 1686	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949
157.81	M 1687	MN	Through Plate Girder	1919	Yes	Yes	A,C	1919-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
158.72	M 1690	MN	Single Stone Box Culvert	1908	Yes	Yes	A	1908-1949
158.74	M 1691	MN	Open Deck Pile Trestle	1927	Yes	Yes	A	1927-1949
158.84	M 1693	MN	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
158.94	M 1694	MN	Open Deck Pile Trestle	1935	Yes	Yes	A	1935-1949
159.50	M 1698	MN	Open Deck Pile Trestle	1927	Yes	Yes	A	1927-1949
160.35	M 1699	MN	Open Deck Pile Trestle	1931	Yes	Yes	A	1931-1949
160.80	M 1700	MN	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1944
161.47	M 1701	MN	Open Deck Pile Trestle	1931	Yes	Yes	A	1931-1949
162.80	M 1703	MN	Triangular Lattice Through Truss	1913	Yes	Yes	A,C	1913-1949
164.10	436	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
164.60	438	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
164.80	439	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
165.90	442	MN	Stone Arch	1910	Yes	Yes	A, C	1910-1949
166.10	442.5	MN	Through Plate Girder	1896	Yes	Yes	A, C	1896-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
166.50	442.75	MN	I-Beam	1911	Yes	Yes	A, C	1811-1949
167.10	444	MN	I-Beam	1909	Yes	Yes	A, C	1909-1949
168.30	445	MN	Single Stone Box Culvert	1871	Yes	Yes	A	1871-1949
168.63	446	MN	I-Beam	1913	Yes	Yes	A, C	1913-1949
169.20	448	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
170.10	449	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
171.14	451	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a
171.90	452	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
172.20	453	MN	Open Deck Pile Trestle	1957	n/a	No	n/a	n/a
173.30	455	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
174.90	457	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
177.40	460	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
177.78	462	MN	I-Beam	1910	Yes	Yes	A	1910-1949
178.40	463	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
179.90	464.5	MN	Through Plate Girder	1940	Yes	Yes	A	1940-1949
180.40	465	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
181.30	466	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
181.66	468	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a
182.10	469	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
182.60	470	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
182.70	471	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
183.25	472	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
183.50	473	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
184.12	474	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
184.90	475	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
185.50	476	MN	Single Stone Box Culvert	1901	No	No	n/a	n/a
186.20	477	MN	Single Stone Box Culvert	1903	No	No	n/a	1903-1949
186.76	477.75	MN	Through Plate Girder	1932	Yes	Yes	A	1932-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
186.79	478	MN	Deck Plate Girder	1917	Yes	Yes	A, C	1917-1949
187.50	480	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
191.10	487	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
191.50	488	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
191.80	489	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
192.30	490	MN	Concrete Box Culvert	1916	Yes	Yes	A	1916-1949
192.70	491	MN	Open Deck Pile Trestle	1926	n/a	No	n/a	n/a
193.50	494	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
193.80	495	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
194.20	496	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
195.66	498	MN	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
195.90	500	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
196.10	501	MN	Single Stone Box Culvert	1894	Yes	Yes	A	1894-1949
196.74	502	MN	Deck Plate Girder	1924	Yes	Yes	A, C	1924-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
197.30	503	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
197.40	504	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
197.50	505	MN	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
198.01	506	MN	I-Beam	1910	Yes	Yes	A, C	1910-1949
198.80	507	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
198.90	508	MN	Single Stone Box Culvert	1899	Yes	Yes	A	1899-1949
199.50	510	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
202.10	517	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
203.39	520	MN	I-Beam	1910	No	No	n/a	n/a
203.60	521	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
203.90	522	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
204.29	524	MN	Open Deck Pile Trestle	1952	n/a	No	n/a	n/a
205.75	525	MN	Single Stone Box Culvert	1898	Yes	Yes	A	1898-1949
206.20	526	MN	Deck Plate Girder, Triangular Lattice Through Truss	1919, 1920	Yes	Yes	A, C	1919-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
206.45	527	MN	I-Beam	1919	Yes	Yes	A, C	1919-1949
206.73	528	MN	I-Beam	1918	Yes	Yes	A, C	1918-1949
206.98	529	MN	Through Plate Girder	1919	Yes	Yes	A, C	1919-1949
207.46	530	MN	I-Beam	1916	Yes	Yes	A, C	1916-1949
207.71	531	MN	I-Beam	1913	Yes	Yes	A, C	1916-1949
207.80	532	MN	Single Stone Box Culvert	1891	Yes	Yes	A	1891-1949
209.25	534	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
211.90	539	MN	Single Stone Box Culvert	1898	No	No	n/a	n/a
212.25	540	MN	Stone Arch	1904	Yes	Yes	A, C	1904-1949
213.90	541	MN	Open Deck Pile Trestle	1940	Yes	Yes	A	1940-1949
214.85	544	MN	Open Deck Pile Trestle	1936	Yes	Yes	A	1936-1949
216.20	546	MN	Single Stone Box Culvert	1903	Yes	Yes	A	1903-1949
217.30	548	MN	Single Stone Box Culvert	1897	Yes	Yes	A	1897-1949
219.30	554	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
220.10	556	MN	Deck Plate Girder	1917	Yes	Yes	A, C	1917-1949
220.20	556.5	MN	Deck Plate Girder	1915	Yes	Yes	A, C	1915-1949
220.38	557	MN	Cast-Iron Pipe Culvert	1905	Yes	Yes	A	1905-1949
221.20	559	MN	Single Stone Box Culvert	1901	Yes	Yes	A	1901-1949
221.81	560	MN	Stone Arch	1910	Yes	Yes	A, C	1910-1949
222.10	561	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
222.70	562	MN	Concrete Box Culvert	1923	Yes	Yes	A	1923-1949
223.50	564	MN	Stone Arch	1905	Yes	Yes	A, C	1905-1949
224.80	565	MN	Stone Arch	1919	Yes	Yes	A, C	1919-1949
225.95	566	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949
226.20	567	MN	Single Stone Box Culvert	1892	Yes	Yes	A	1892-1949
227.70	1302	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
234.45	1312.5	MN	Open Deck Pile Trestle	1948	Yes	Yes	A	1948-1949
235.90	1315	MN	Open Deck Pile Trestle	1949	Yes	Yes	A	1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
236.20	1316	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
237.07	1317	MN	Open Deck Pile Trestle	1961	n/a	No	n/a	n/a
237.59	1319	MN	Open Deck Pile Trestle	1943	Yes	Yes	A	1943-1949
237.76	1320	MN	Open Deck Pile Trestle	1943	Yes	Yes	A	1943-1949
238.31	1321	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a
238.65	1322	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a
239.20	1324	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
239.62	1325	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
239.80	1326	MN	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
242.12	1330	MN	Open Deck Pile Trestle	1963	n/a	No	n/a	n/a
243.42	1332	MN	Open Deck Pile Trestle	1952	n/a	No	n/a	n/a
244.20	1333	MN	Open Deck Pile Trestle	1945	Yes	Yes	A	1945-1949
244.60	1334	MN	Open Deck Pile Trestle	1969	n/a	No	n/a	n/a
245.20	1336	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
245.30	1337	MN	Open Deck Pile Trestle	1963	n/a	No	n/a	n/a
245.80	1338	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
245.90	1339	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
246.25	1340	MN	Single Stone Box Culvert	1902	Yes	Yes	A	1902-1949
246.85	1341	MN	Double Intersection Warren Deck Truss	1902	Yes	Yes	A, C	1902-1949
247.35	1342	MN	Open Deck Pile Trestle	1952	n/a	No	n/a	n/a
248.06	1345	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a
248.42	1347	MN	Open Deck Pile Trestle	1931	Yes	Yes	A	1931-1949
249.40	1351	MN	Single Stone Box Culvert	1913	Yes	Yes	A	1913-1949
250.05	1353	MN	Open Deck Pile Trestle	1952	n/a	No	n/a	n/a
251.30	1356	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949
251.72	1357	MN	Open Deck Pile Trestle	1969	n/a	No	n/a	n/a
253.20	1350	MN	I-Beam	1912	Yes	Yes	A, C	1912-1949
253.76	1361	MN	Single Stone Box Culvert	1904	Yes	Yes	A	1904-1949

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
253.90	1363	MN	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949
256.40	1366	MN	Single Stone Box Culvert	1904	Yes	Yes	A	1904-1949
257.30	1368	MN	Single Stone Box Culvert	1905	Yes	Yes	A	1905-1949
258.63	1371	MN	I-Beam	1909	Yes	Yes	A, C	1909-1949
259.80	1374.5	MN	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
259.90	1375	MN	Open Deck Pile Trestle	1931	Yes	Yes	A	1931-1949
260.30	1376	MN	Open Deck Pile Trestle	1935	Yes	Yes	A	1935-1949
261.80	1380	MN	Open Deck Pile Trestle	1961	n/a	No	n/a	n/a
263.42	1383	MN	Open Deck Pile Trestle	1963	n/a	No	n/a	n/a
263.63	1384	MN	Open Deck Pile Trestle	1950	n/a	No	n/a	n/a
263.86	1385	MN	Open Deck Pile Trestle	1955	n/a	No	n/a	n/a
264.70	1386	MN	Open Deck Pile Trestle	1961	n/a	No	n/a	n/a
265.20	1387	MN	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
265.55	1388	MN	Open Deck Pile Trestle	1961	n/a	No	n/a	n/a

Minnesota: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
266.50	1391	MN	Stone Arch	1908	Yes	Yes	A, C	1908-1949
267.10	1392	MN	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
267.90	1393	MN	Open Deck Pile Trestle	1956	n/a	No	N/A	n/a
268.47	1394	MN	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
268.95	1395	MN	Cast-Iron Pipe Culvert	1903	Yes	Yes	A	1903-1949
269.19	1396	MN	Single Stone Box Culvert	1907	Yes	Yes	A	1907-1949
269.82	1397	MN	Open Deck Pile Trestle	1967	n/a	No	n/a	n/a
271.29	1398	MN	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
272.85	1399	MN	I-Beam	1909	Yes	Yes	A	1909-1949

Appendix L:

Excerpts from the *Manual of the American Railway Engineering Association*, Edition of 1921.

MANUAL

ARCHIVAL STANDARD
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OF THE

American Railway Engineering Association

Definitions, Specifications
and Principles of Practice

FOR

RAILWAY ENGINEERING

EDITION OF 1921

Published by
AMERICAN RAILWAY ENGINEERING ASSOCIATION
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CHICAGO, ILLINOIS

WOODEN BRIDGES AND TRESTLES.

[1] DEFINITIONS.

General

Wooden Trestle.—A wooden structure composed of upright members supporting simple horizontal members or beams, the whole forming a support for loads applied to the horizontal members.

Frame Trestle.—A structure in which the upright members or supports are framed timbers.

Pile Trestle.—A structure in which the upright members or supports are piles.

Bent.—The group of members forming a single vertical support of a trestle, designated as pile bent where the principal members are piles, and as framed bent where of framed timbers.

Post.—One of the vertical or battered members of the bent of a framed trestle.

Pile.—(See definition under subject of Piles and Pile Driving.)

Batter.—A deviation from the vertical in upright members of a bent.

Cap.—A horizontal member upon the top of piles or posts, connecting them in the form of a bent.

Sill.—The lowest horizontal member of a framed bent.

Mud-Sill or Sub-Sill.—A timber bedded in the ground to support a framed bent.

Intermediate Sill.—A horizontal member in the plane of the bent forming the cap of a lower section and the sill of an upper section.

Sway Brace.—A member bolted or spiked to the bent and extending diagonally across its face.

Longitudinal Strut or Girt.—A stiffening member running horizontally, or nearly so, from bent to bent.

Longitudinal X Brace.—A member extending diagonally from bent to bent in a vertical or battered plane.

Sash Brace.—A horizontal member secured to the posts or piles of a bent.

[1] Adopted, Vol. 6, 1905, pp. 35, 36, 42, 55-67; Vol. 7, 1906, pp. 683, 684; Vol. 11, Part 1, 1910, pp. 178, 228; Vol. 16, 1915, pp. 894, 1179; Vol. 21, 1920, pp. 1281, 1434.

STRINGER.—A longitudinal member extending from bent to bent and supporting the track.

JACK STRINGER.—A stringer placed outside of the line of main stringers.

BRIDGE TIE.—A transverse timber resting on the stringers and supporting the rails.

INNER GUARD RAIL.—A longitudinal member, usually a metal rail, secured on top of the ties inside of the track rail, to guide derailed car wheels.

GUARD TIMBER.—A longitudinal timber placed outside of the track rail, to maintain the spacing of the ties.

PACKING BLOCK.—A small member, usually wood, used to secure the parts of a composite member in their proper relative positions.

PACKING SPOOL OR SEPARATOR.—A small casting used in connection with packing bolts to secure the several parts of a composite member in their proper relative positions.

DRIFT BOLT.—A piece of round or square iron of specified length, with or without head or point, driven as a spike.

DOWEL.—An iron or wooden pin, extending into, but not through, two members of the structure to connect them.

SHIM.—A small piece of wood or metal placed between two members of a structure to bring them to a desired relative elevation.

FISH-PLATE.—A short piece lapping a joint, secured to the side of two members, to connect them end to end.

BULKHEAD.—Timbers placed against the embankment side of an end bent to retain the embankment.

[3]PILES AND PILE DRIVING.

PILE.—A member usually driven or jetted into the ground and deriving its support from the underlying strata, and by the friction of the ground on its surface.

The usual functions of a pile are: (*a*) To carry a superimposed load; (*b*) To compact the surrounding ground; (*c*) To form a wall to exclude water and soft material, or to resist the lateral pressure of adjacent ground.

HEAD OF PILE.—The upper end of a pile.

FOOT OF PILE.—The lower end of a pile.

BUTT OF PILE.—The larger end of a pile.

TIP OF PILE.—The smaller end of a pile.

BEARING PILE.—One used to carry a superimposed load.

[3]Adopted, Vol. 10, 1909, p. 565; Vol. 16, 1915, pp. 894, 1179; Vol. 21, 1920, pp. 1282, 1434.

SCREW PILE.—One having a broad-bladed screw attached to its foot to provide a larger bearing area.

DISC PILE.—One having a disc attached to its foot to provide a larger bearing area.

BATTER PILE.—One driven at an inclination to resist forces which are not vertical.

SHEET PILES.—Piles driven in close contact in order to provide a tight wall, to prevent leakage of water and soft materials; or driven to resist the lateral pressure of adjacent ground.

PILE DRIVER.—A machine for driving piles.

HAMMER.—A weight used to drive piles.

DROP HAMMER.—One which is raised by means of a rope and then allowed to drop.

STEAM HAMMER.—One which is automatically operated by the action of a steam cylinder and piston supported in a frame which rests on the pile.

LEADS.—The upright parallel members of a pile driver which support the sheaves used to hoist the hammer and piles, and which guide the hammer in its movement.

PILE CAP, HOOD OR BONNET.—A block used to protect the head of a pile and to hold it in the leads during driving.

RING.—A metal hoop used to bind the head of a pile during driving.

SHOE.—A metal protection for the point or foot of a pile.

FOLLOWER.—A member interposed between the hammer and pile to transmit blows to the latter when below the foot of the leads.

[3]SPECIFICATIONS FOR TIMBER PILES.

RAILROAD HEART GRADE.

1. This grade includes white, burr, and post oak; dense pine, Douglas fir, tamarack, Eastern white and red cedar, chestnut, Western cedar, redwood and cypress.

2. Piles shall be cut from sound trees; shall be close grained and solid, free from defects, such as injurious ring shakes, large and unsound or loose knots, decay or other defects, which may materially impair their strength or durability. In Eastern red or white cedar a small amount of heart rot at the butt, which does not materially injure the strength of the pile, will be allowed.

3. Piles must be butt cut above the ground swell and have a uniform taper from butt to tip. Short bends will not be allowed. A line drawn

[3]Adopted, Vol. 10, 1909, pp. 537, 541, 542, 603-611.

from the center of the butt to the center of the tip shall lie within the body of the pile.

4. Unless otherwise allowed, piles must be cut when sap is down. Piles must be peeled soon after cutting. All knots shall be trimmed close to the body of the pile.

5. The minimum diameter at the tips of round piles shall be 9 inches for lengths not exceeding 30 feet; 8 inches for lengths over 30 feet but not exceeding 50 feet, and 7 inches for lengths over 50 feet. The minimum diameter at one-quarter of the length from the butt shall be 12 inches and the maximum diameter at the butt 20 inches.

6. The minimum width of any side of the tip of a square pile shall be 9 inches for lengths not exceeding 30 feet; 8 inches for lengths over 30 feet but not exceeding 50 feet, and 7 inches for lengths over 50 feet. The minimum width of any side at one-quarter of the length from the butt shall be 12 inches.

7. Square piles shall show at least 80 per cent. heart on each side at any cross-section of the stick, and all round piles shall show at least 10½ inches diameter of heart at the butt.

Railroad Falsework Grade.

8. This grade includes red and all other oaks not included in Railroad Heart grade, sycamore, sweet, black and tupelo gum, maple, elm, hickory, Norway pine or any sound timber that will stand driving.

9. The requirements for size of tip and butt taper and lateral curvature are the same as for Railroad Heart grade.

10. Unless otherwise specified piles need not be peeled.

11. No limits are specified as to the diameter or proportion of heart.

12. Piles which meet the requirements of Railroad Heart grade except the proportion of heart specified will be classed as Railroad Falsework grade.

[1]PILE DRIVING—PRINCIPLES OF PRACTICE.

(1) A thorough exploration of the soil by borings, or preliminary test piles, is the most important prerequisite to the design and construction of pile foundations.

[1]Adopted, Vol. 12, 1911, Part 1, pp. 279, 307; Vol. 16, 1916, pp. 894, 1181.

(2) Soil consisting wholly or chiefly of sand is most favorable to the use of the water jet.

(3) In harder soils containing gravel the use of the jet may be advantageous, if sufficient volume and pressure be provided.

(4) In clay it may be economical to bore several holes in the soil with the aid of the jet before driving the pile, thus securing the accurate location of the pile, and its lubrication while being driven.

(5) In general, the water jet should not be attached to the pile, but handled separately.

(6) Two jets will often succeed where one fails. In special cases a third jet extending a part of the depth aids materially in keeping loose the material around the pile.

(7) Where the material is of such a porous character that the water from the jets may be dissipated and fail to come up in the immediate vicinity of the pile, the utility of the jet is uncertain, except for a part of the penetration.

(8) A steam or drop hammer should be used in connection with the water jet, and used to test the final rate of penetration.

(9) The use of the water jet is one of the most effective means of avoiding injury to piles by overdriving.

(10) There is danger from overdriving when the hammer begins to bounce. Overdriving is also indicated by the bending, kicking or staggering of the pile.

(11) The brooming of the head of the pile dissipates a part, and in some cases all, of the energy due to the fall of the hammer.

(12) The steam hammer is usually more effective than the drop hammer in securing the penetration of a wooden pile without injury, because of the shorter interval between blows.

(13) Where shock to surrounding material is apt to prove detrimental to the structure, the steam hammer should always be used instead of the drop hammer. This is especially true in the case of sheet piling which is intended to prevent the passage of water. In some cases also the jet should not be used.

(14) In general, the resistance of piles, penetrating soft material, depending solely upon skin friction, is materially increased after a period

of rest. This period may be as short as fifteen minutes, and rarely exceeds twelve hours.

(15) Where a pile penetrates a soft yielding material and bears upon hard stratum at its foot, its strength should be determined as a column; omitting the resistance, if any, due to skin friction.

(16) Unless the record of previous experience at the same site is available, the approximate bearing power may be obtained by loading test piles. The results of loading test piles should be used with caution, unless their condition is fairly comparable with that of the piles in the proposed foundation.

(17) In case the piles in a foundation are expected to act as columns, the results of loading test piles should not be depended upon unless they are sufficient in number to insure their action in a similar manner; and unless they are stayed against lateral motion.

(18) Before testing the penetration of a pile in soft material where its bearing power depends principally, or wholly, upon skin friction, the pile should be allowed to rest for 24 hours after driving.

(19) Where the resistance of piles depends mainly upon skin friction it is possible to diminish the combined strength, or bearing capacity, of a group of piles by driving additional piles within the same area.

(20) Where piles will foot in a hard stratum, investigation should be made to determine that this stratum is of sufficient depth and strength to carry the load.

(21) Timber piles may be advantageously pointed, in some cases to a 4-inch or 6-inch square at the end.

(22) Piles should not be pointed when driven into soft material.

(23) Shoes should be provided for piles when the driving is very hard, especially in riprap or shale. These shoes should be so constructed as to form an integral part of the pile.

(24) The use of a cap is advantageous in distributing the impact of the hammer more uniformly over the head of the pile, as well as in holding it in position during driving.

*PILE RECORD FORM.

Size 8½x11 or 8x10½ Inches. Form M. W. 701.

North and South Railroad.

Pile Record of Bridge ....
LOCATION ....
Weight and Kind of Hammer .... **Date** .... **19** ....

Bents Numbered from North or East End   Piles numbered from Left to Right

Date	Bent No.	No. of Pile	Size of Pile			Kind of Wood	[illegible]	Base rail to Ground	Total Penetrat.	Av. Last Five Blows		Kind of Soil	Remarks
			Tip End	Butt End	Length					Drop of Ham'r	Penetrat.		

*Adopted, Vol. 12, Part 1, 1911, pp. 278, 307.

*SPECIFICATIONS FOR WORKMANSHIP FOR PILE AND FRAME TRESTLES OF UNTREATED MATERIAL TO BE BUILT UNDER CONTRACT.

Site.

1. The trestle to be built under these specifications is located on the line of ..... Railway at ..... County of .....State of .....

General Description.

2. The work to be done under these specifications covers the construction of a ..... track wooden trestle about ..... feet long and an average of ..... feet high.

General Clauses.

3. The contractor shall furnish all necessary labor, tools, machinery, supplies, temporary staging and outfit required. He shall build the complete trestle ready for the track rails, in a workmanlike manner, in strict accordance with the plans and the true intent of these specifications, to the satisfaction and acceptance of the Engineer of the Railway Company.

4. The workmanship shall be of the best quality in each class of work. Details, fastenings and connections shall be of the best method of construction in general use on first-class work.

5. Holes shall be bored for all bolts. The depth of the hole and the diameter of the augur shall be as specified by the Engineer.

6. Framing shall be accurately fitted. No blocking or shimming will be allowed in making joints. Timbers shall be cut off with the saw; no axe to be used.

7. Joints and points of bearing, for which no fastening is shown on the plans, shall be fastened as specified by the Engineer.

8. The Engineer or his authorized agents shall have full power to cause any inferior work to be condemned, and taken down or altered, at the expense of the contractor. Any material destroyed by the contractor on account of inferior workmanship or carelessness of his men must be replaced by the contractor at his own expense.

9. Figures shown on the plans shall govern in preference to scale measurements. If any discrepancies should arise or irregularities be discovered in the plans, the contractor shall call on the Engineer for instructions. These specifications and the plans are intended to coincide, and if any question arises as to the proper interpretation of the plans or specifications, it shall be referred to the Engineer for a ruling.

*Adopted, Vol. 8, 1907, pp. 397-400, 442-450.

10. The contractor shall, when required by the Engineer, furnish a satisfactory watchman to guard the work.

11. On the completion of the work, all refuse material and rubbish that may have accumulated on top and under and near the trestle, by reason of its construction, shall be removed by the contractor.

Detail Specifications.

12. Piles shall be carefully selected to suit the place and ground where they are to be driven. When required by the Engineer, pile butts shall be banded with iron or steel for driving, and the tips shod with suitable iron or steel shoes. Such shoes will be furnished by the Railway Company.

13. Piles shall be driven to firm bearing, satisfactory to the Engineer; or until five blows of a hammer weighing 3000 lb., falling 15 feet (or a hammer and fall producing the same mechanical effect), are required to cause an average penetration of ½ inch per blow, except in soft bottom, where special instructions will be given.

14. Batter piles shall be driven to the inclination shown by the plans, and shall require but slight bending before framing.

15. Butts of all piles in a bent shall be sawed off to one plane and trimmed so as not to leave any horizontal projection outside of the cap.

16. Piles injured in driving, or driven out of place, shall either be pulled out or cut off, and replaced by new piles.

Caps.

17. Caps shall be sized and brought to a uniform thickness and even bearing on piles or posts. The side with most sap shall be placed downward.

Posts.

18. Posts shall be sawed to proper length for their position (vertical or batter), and to even bearing on cap and sill.

Sills.

19. Sills shall be sized at the bearing of posts to one plane.

Sash and Sway Braces.

20. Sash and sway bracing shall be properly framed and securely fastened to piles or posts. When necessary, filling pieces shall be used between the braces and the piles of a bent on account of the variation in size of piles, and securely fastened and faced to obtain a bearing against all piles.

Longitudinal Braces.

21. Longitudinal X braces shall be properly framed and securely fastened to piles or posts.

Girts.

22. Girts shall be properly framed and securely fastened to caps, sub-sills, intermediate sills, posts or piles, as the plans may require.

Stringers.

23. Stringers shall be sized to a uniform depth at supports. The edges with most sap shall be placed downward.

Jack Stringers.

24. Jack stringers, if required on the plans, shall be neatly framed on caps, and their tops shall be in the same plane as the track stringers.

Ties.

25. Ties shall be sized to a uniform thickness and shall be placed with the rough side upward. They shall be spaced regularly and cut to even length and line, as called for on the plans.

Guard Timbers.

26. Guard timbers shall be framed as called for on the plans, laid to line and to a uniform top surface. They shall be firmly fastened to the ties as required.

Bulkheads.

27. Bulkheads shall be of sufficient dimensions to keep the embankment clear of the caps, stringers and ties, at the end bents of the trestle. There shall be a space of not less than 2 inches between the back of the end bent and the face of the bulkhead. The projecting ends of the bulkhead shall be sawed off to conform to the slope of the embankment, unless otherwise specified.

Time of Completion.

28. The work shall be completed in all its parts on or before ..... 19....

Payments.

29. Payments will be made under the usual regulations of the Railway Company.

[1]USE OF GUARD RAILS AND GUARD TIMBERS FOR WOODEN BRIDGES AND TRESTLES.

(1) It is recommended as good practice to use guard timbers on all open-floor bridges, and same should be so constructed as to properly space the ties and hold them securely in their places.

(2) It is recommended that the guard timber and the inner guard rail, when used, shall be so spaced in reference to the track rail that a derailed truck will strike the inner guard rail without striking the guard timber. The inner guard rail should not be higher nor more than one inch lower than the running rail.

(3) It is recommended as good practice in the installation of inner guard rails to extend them beyond the ends of the bridges for such distance as is required by local conditions, but that this distance, in any case, be not less than 50 feet; that inner guard rails be fully spiked to every tie, and spliced at every joint; that the inner guard rails be some form of metal section; and that the ends be beveled, bent down, or otherwise protected against direct impact with moving parts of equipment.

(4) It is recommended as good practice to use inner guard rails on all open-floor and on the outside tracks of all solid-floor bridges and similar structures longer than 20 feet in main-line tracks, and on similar bridges and structures in branch-line tracks on which the speed of trains is 20 miles per hour or more.

[2]USE OF LAG SCREWS IN TRESTLE CONSTRUCTION.

(1) Lag screws require greater care than ordinary bolts and nuts to properly install, but are cheaper on account of ease of general maintenance.

(2) Lag screws, where properly applied, hold ties from bunching equally as well as bolts and nuts, and better than daps, in guard timbers.

(3) If the lag screws are tightened after timber has shrunk, there is less cost of maintenance than with bolts and nuts.

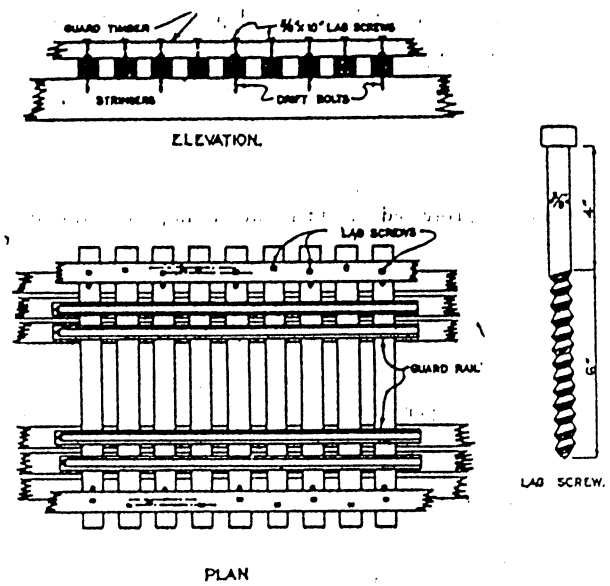
(4) Use of lag screws renders unnecessary the dapping of guard timbers, and, therefore, decreases cost of trestles without impairing quality.

[1]Adopted, Vol. 14, 1913, pp. 652, 653, 1136-1143; Vol. 15, 1914, pp. 403, 1036-1044; Vol. 21, 1920, pp. 1285, 1434.
[2]Adopted, Vol. 19, 1918, pp. [illegible] 1225

(5) Surfacing (sizing) ties and guard timbers is better construction than dapping.

(6) For proper application of lag screws, holes in guard timbers should be bored with auger bits 1/16 in. less in diameter and holes in ties 1/4 in. less in diameter than the nominal size of lag screws used.

(7) Lag screws must be screwed in, not driven.



NOTE.—Ties and guard timbers to be sized one dimension. Omit dapping of guard timbers and ties. Use lag screws in every tie. Holes to be bored for lag screws one inch deeper than penetration of lag screw. Holes to be bored 1/16 in. smaller than diameter of lag in guard timber, and 1/4 in. smaller than diameter of lag in ties. Lag screws must not be driven but screwed to position. Fasten alternate ties to stringers. Lag screws to be staggered 2 in. in guard timbers.

*SPECIFICATIONS FOR METAL DETAILS USED IN WOODEN BRIDGES AND TRESTLES.

Wrought-Iron.

1. Wrought-iron shall be double-rolled, tough, fibrous and uniform in character. It shall be thoroughly welded in rolling and be free from surface defects. When tested in specimens of the form of Fig. 1 or in full-sized pieces of the same length, it shall show an ultimate strength of at least 50,000 lbs. per square inch, an elongation of 18 per cent. in 8 in., with fracture wholly fibrous. Specimens shall bend cold, with the fiber, through 135 degrees, without sign of fracture, around a pin the diameter of which is not over twice the thickness of the piece tested. When nicked and bent, the fracture shall show at least 90 per cent. fibrous.

Steel.

2. Steel shall be made by the open-hearth process and shall be of uniform quality. It shall contain not more than 0.05 per cent. sulphur. If made by the acid process it shall contain not more than 0.06 per cent. phosphorus; and if made by the basic process, not more than 0.04 per cent. phosphorus. When tested in specimens of the form of Fig. 1, or full-

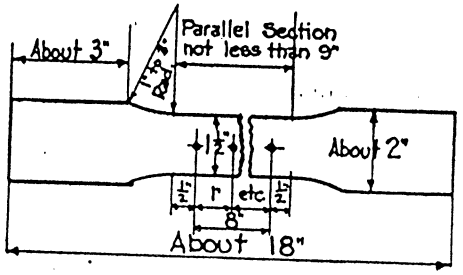


FIG. 1.

sized pieces of the same length, it shall have a desired ultimate tensile strength of 60,000 lbs. per square inch. If the ultimate strength varies more than 4000 lbs. from that desired, a retest shall be made on the same gage, which, to be acceptable, shall be within 5000 lbs. of the desired ultimate. It shall have a minimum percentage of elongation in 8 inches of $\frac{1{,}500{,}000}{\text{ultimate tensile strength}}$; and shall bend cold without fracture 180 degrees flat. The fracture for tensile tests shall be silky.

Cast-Iron.

3. Except where chilled iron is specified, castings shall be made of tough gray iron, with sulphur not over 0.10 per cent. They shall be true to pattern, out of wind and free from flaws and excessive shrinkage. If

*Adopted, Vol. 7, 1906, pp. 692-694, 719-724; Vol. 11, 1910

tests are demanded, they shall be made on the "Arbitration Bar" of the American Society for Testing Materials, which is a round bar 1¼ inches in diameter and 15 inches long. The transverse test shall be made on a supported length of 12 inches, with load at middle. The minimum breaking load so applied shall be 2900 lbs., with a deflection of at least 1/10 inch before rupture.

Bolts.

4. Bolts shall be of wrought-iron or steel, made with square heads, standard size, the length of thread to be 2½ times the diameter of bolt. The nuts shall be made square, standard size, with thread fitting closely the thread of bolt. Threads shall be cut according to U. S. standards.

Drift Bolts.

5. Drift bolts shall be of wrought-iron or steel, with or without square head, pointed or without point, as may be called for on plans.

Spikes.

6. Spikes shall be of wrought-iron or steel, square or round, as called for on the plans. Steel wire spikes, when used for spiking planking, shall not be used in lengths more than 6 inches; if greater lengths are required, wrought or steel spikes shall be used.

Packing Spools or Separators.

7. Packing spools or separators shall be of cast-iron, made to size and shape called for on plans. The diameter of hole shall be ⅛ inch larger than diameter of packing bolts.

Cast Washers.

8. Cast washers shall be of cast-iron. The diameter shall be not less than 3½ times the diameter of bolt for which it is used, and its thickness equal to the diameter of bolt. The diameter of hole shall be ⅛ inch larger than the diameter of the bolt.

Wrought Washers.

9. Wrought washers shall be of wrought-iron or steel, the diameter shall be not less than 3½ times the diameter of bolt for which it is used, and not less than ¼ inch thick. The hole shall be ⅛ inch larger than the diameter of the bolt.

Special Castings.

10. Special castings shall be made true to pattern, without wind, free from flaws and excessive shrinkage; size and shape to be as called for by the plans.

"RELATIVE ECONOMY OF REPAIRS AND RENEWALS OF WOODEN BRIDGES AND TRESTLES.

It is good practice to repair wooden bridges and trestles by parts until such time as the general condition of the structure requires entire renewal.

"COMPARATIVE MERITS OF BALLAST DECK AND REINFORCED CONCRETE TRESTLES.

(1) While in certain locations there is little probability of fire loss in creosoted ballast deck timber trestles, yet due to the very nature of the material used the reinforced concrete trestle has a decided advantage.

(2) The concrete structure is slightly superior to the timber structure for bridging waterways subject to flood currents, or wide fluctuations in elevation of water surface.

(3) Although the concrete trestle may possibly afford better service qualities than the wooden trestle, the matter is so intangible in character as to preclude a definite statement of relative merit.

(4) Where selection of type of trestle is optional and not influenced by other considerations, neither type of trestle has the advantage of the other in the matter of appearance.

(5) Notwithstanding the fact that the two materials are, with certain limitations, equally suitable for the construction of trestles, the use of concrete is more in accord with the theory of conservation of natural resources and industrial economy.

(6) Adoption of either type should be the result of carefully weighing, for each individual bridge, the greater economy of the timber trestle against the several advantages of the concrete not susceptible of mathematical demonstration.

(7) Creosoted timber trestles are more economical than concrete, except when the cost of the concrete structure is less than one and one-half times the cost of the wooden structure.

"Adopted, Vol. 16, 1915, pp. 891, 1179.
"Adopted, Vol. 19, 1918, pp. 592, 603, 1223

"WORKING STRESSES PERMISSIBLE FOR STRUCTURAL TIMBERS (Pounds per Square Inch)

Species	Bending. Allowable stress in extreme fiber. Damp or wet location (docks, piling, and sills)	Bending. Allowable stress in extreme fiber. Outside, not in contact with soil (bridges and open sheds)	Bending. Allowable stress in extreme fiber. Under shelter in a dry location (factories and warehouses)	Bending. Allowable horizontal shear stress. All locations	Compression. Allowable stress parallel to grain "Short Columns." Wet location	Compression. Allowable stress parallel to grain "Short Columns." Outside location	Compression. Allowable stress parallel to grain "Short Columns." Dry location	Compression. Allowable stress perpendicular to grain. Wet location	Compression. Allowable stress perpendicular to grain. Outside location	Compression. Allowable stress perpendicular to grain. Inside location
Cedar, western red	750	800	900	80	650	700	700	125	150	200
Cedar, northern white	600	650	750	70	450	500	550	100	140	175
Chestnut	700	850	950	90	600	700	800	150	200	300
Cypress	900	1100	1300	100	800	1100	1100	225	250	350
Douglas fir—										
No. 1 structural	1100	1400	1600	100	900	1100	1200	225	250	350
No. 2 structural	900	1100	1300	90	800	900	1000	200	225	300
Rocky Mountain region	700	900	1100	85	700	800	800	200	225	275
Fir, balsam	600	750	900	70	500	600	700	100	125	150
Gum, red	800	900	1100	100	650	750	800	150	200	300
Hemlock, western	900	1100	1300	75	800	900	900	200	225	300
Hemlock, eastern	800	900	1000	70	600	700	700	200	225	400
Hickory	1200	1500	1900	140	1000	1200	1500	350	[illegible]	600
Larch, western	900	1100	1200	100	800	1000	1100	200	225	325
Maple, sugar or hard	1000	1300	1500	150	900	1100	1200	300	375	500
Maple, silver or soft	700	900	1000	100	600	700	800	200	250	350
Oak, white or red	1000	1200	1400	125	800	900	1000	300	375	500
Pine—										
Southern yellow (dense)	1100	1400	1600	125	900	1100	1200	225	250	350
Southern yellow (sound)	900	1100	1300	105	800	900	1000	200	225	300
Eastern white	750	800	900	85	650	750	750	125	150	250
Western white	750	800	900	85	650	750	750	125	150	250
Norway	800	1000	1100	85	700	800	800	150	175	300
Redwood	800	1000	1200	70	750	900	1000	125	150	250
Spruce, red, white and Sitka	800	900	1100	85	650	750	800	125	150	250
Spruce, Engelmann	500	650	750	70	450	550	600	100	140	175
Tamarack, eastern	900	1100	1200	95	800	900	1000	200	225	300

"Adopted, Vol. 21, 1920, pp. 1337, 1434.

"SPECIFICATIONS AND CLASSIFICATION AND GRADING RULES FOR LUMBER AND TIMBER TO BE USED IN THE CONSTRUCTION AND MAINTENANCE OF WAY DEPARTMENTS OF RAILROADS.

Structural Timber.

Definitions.

Axis.—The line connecting the centers of successive cross-sections of a stick.

Corner.—The line of intersection of the planes of two adjacent longitudinal surfaces.

Cross-Section.—A section of a stick at right angles to the axis.

Edge.—Either of the two narrower longitudinal surfaces of a stick.

Face.—The surface of a stick which is exposed to view in the finished structure.

Full Length.—Long enough to "square" up to the length specified in the order.

Girth.—The perimeter of a cross-section.

Heartwood.—The older and central part of a log, usually darker in color than sapwood. It appears in strong contrast to the sapwood in some species, while in others it is but slightly different in color.

Out of Wind.—Having the longitudinal surfaces plane.

Side.—Either of the two wider longitudinal surfaces of a stick.

Solid.—Without cavities; free from loose heart, wind shakes, bad checks, splits or breaks, loose slivers and worm or insect holes.

Sound.—Free from decay.

Springwood.—The inner part of the annual ring formed in the earlier part of the season, not necessarily in the spring, and often containing vessels or pores.

Square-Cornered.—Free from wane.

Straight.—Having a straight line of an axis.

Summerwood.—The outer part of the annual ring formed later in the season, not necessarily in the summer, being usually dense in structure and without conspicuous pores.

True.—Of uniform cross-section. Defects are caused by wavy or jagged sawing or consist of trapezoidal instead of rectangular cross-sections.

Names for Varieties of Structural Timber.

Cedar covers White Cedars: Thuya occidentalis, Maine to Minnesota and northward; Chamæcyparis thyoides, Atlantic Coast from Maine to Mississippi; Chamæcyparis lawsoniana, along the coast line of Oregon; Libocedrus decurrens, Cascades and Sierra Nevada of Oregon and California. Red Cedars: Thuya gigantea, Washington to North-

"Adopted, Vol. 22, 1921, pp. 494, 1072.

ern California and eastward to Montana; Juniperus virginiana, throughout United States. Western Red Cedar; Thuja plicata.

CYPRESS (Taxodium distichum) covers bald cypress, black, white and red cypress, from swamp and overflow land along the coast and rivers of the Southern States.

DOUGLAS FIR.—The term "Douglas Fir" covers the timber known as yellow fir, red fir, Western fir, Washington fir, Oregon or Puget Sound fir or pine, Northwest and West Coast fir.

HEMLOCK covers Southern or Eastern hemlock; that is, hemlock from all states east of and including Minnesota.

IDAHO WHITE PINE covers the variety of white pine from Western Montana, Northern Idaho and Eastern Washington.

NORWAY PINE covers what is known also as "Red Pine" and Banksian (Pinus Banksiana).

OAK.—Under this heading three classes of timber are used: (a) White Oak, to include White Oak, Burr Oak and Post Oak; (b) Red Oak, to include Red Oak, Scarlet Oak, Black Oak and all bastard oaks; (c) Chestnut Oak, to include only Chestnut Oak.

REDWOOD includes the California wood usually known by that name.

SOUTHERN YELLOW PINE.—This term includes the species of yellow pine growing in the Southern States from Virginia to Texas, that is, the pines hitherto known as longleaf pine (Pinus palustris), shortleaf pine (Pinus echinata), loblolly pine (Pinus taeda), Cuban pine (Pinus heterophylla) and pond pine (Pinus serotina).

SPRUCE covers Eastern spruce; that is, the spruce timber coming from points east of and including Minnesota.

TAMARACK covers the timber known as "Tamarack," or "Eastern Tamarack," from states east of and including Minnesota.

WESTERN HEMLOCK covers hemlock from the Pacific Coast.

WESTERN LARCH covers the species of Larch or Tamarack from the Rocky Mountains and Pacific Coast regions.

WESTERN PINE covers the timber sold as white pine coming from Arizona, California, New Mexico, Colorado, Oregon and Washington. This is the timber sometimes known as "Western Yellow Pine," or "Ponderosa Pine," or "California White Pine," or "Western White Pine."

WESTERN OR SITKA SPRUCE covers spruce timber from the Pacific Coast.

WHITE PINE covers the timber which has hitherto been known as white pine, from Maine, Michigan, Wisconsin and Minnesota.

Classification Terms.

LUMBER is the product of the saw and planing mill not further advanced in manufacture than by sawing, resawing and passing lengthwise through a standard planing machine, crosscutting to length, and end matching.

Lumber is classified as yard lumber, shop or factory lumber and structural timber. Different grading rules apply to each class of lumber.

YARD LUMBER is lumber that is less than six inches in thickness and is intended for general building and construction purposes. The grading of yard lumber is based upon the use of the entire piece, except when a stated amount of waste to remove defects is provided in the classification of the material under consideration.

SHOP OR FACTORY lumber is intended to be cut up for use in further manufacture and is graded on the basis of the percentage of the area which will produce a limited number of cuttings of a given minimum size and quality.

STRUCTURAL TIMBER is lumber that is six inches or over in thickness and width. The grading of structural timber is based upon the strength of the piece and the use of the entire piece.

Yard lumber is classified roughly as finishing and construction lumber. There is no sharp line between finishing and construction lumber. The medium grades may be used for either purpose.

FINISHING is yard lumber of the higher grades in which appearance, perfection of the surface and finishing qualities are primarily the basis on which the grade is determined. The higher finishing grades are more suitable for "natural" or transparent finishes while the lower finishing grades are smooth and free from serious defects and are particularly adapted to the use of paint.

CONSTRUCTION LUMBER is yard lumber which is graded primarily upon the basis of its strength as affected by defects, and its fitness for general construction purposes.

STRIPS are yard lumber less than two inches thick and under eight inches wide. Strips are usually manufactured into matched and patterned lumber.

BOARDS are yard lumber less than two inches thick and eight inches or over wide.

PLANKS are yard lumber two inches and under four inches thick and eight inches and over in width.

SCANTLINGS are yard lumber two inches and under six inches thick and under eight inches wide.

HEAVY JOISTS are yard lumber that is four inches and under six inches thick and eight inches and over wide.

DIMENSION includes all yard lumber except boards and strips; that is, yard lumber two inches and under six inches thick and of any width.

MANUFACTURED lumber is classified as rough, surfaced and worked.

ROUGH lumber is undressed lumber left as it comes from the saw.

SURFACED lumber is lumber that is dressed by running through a planer. It may be surfaced on one side (S1S), two sides (S2S), one edge (S1E), two edges (S2E), or a combination of sides and edges (as S1S1E, S2S1E, or S1S2E).

WORKED lumber is lumber which has been run through a matching machine, sticker or moulder. Worked lumber may be matched, shiplapped or patterned. Patterned lumber is usually matched or shiplapped.

MATCHED lumber is lumber that is edge dressed and shaped to make a close tongue and groove joint at the edges or ends when laid edge to edge or end to end.

SHIPLAPPED lumber is lumber that is edge dressed to make a close rabbeted or lap joint when laid edge to edge.

PATTERNED lumber is worked lumber that is shaped to a patterned or moulded form.

Definitions of Defects and Blemishes.

The terms "Defect" and "Blemish" as applied to wood usually imply the idea of imperfections. These are not always detrimental.

DEFECT.—Any irregularity or want occurring in or on wood that may lower some of its strength value.

BLEMISH.—Any mark or formation of wood structure marring the appearance.

The presence of a defect or blemish may or may not be detrimental to the value of the material, depending upon the character of the defect or blemish and the use of the material.

Knots.

KNOT.—The hard mass of wood formed in a trunk of a tree at a branch with the grain distinct and separate from the grain of the trunk.

KNOTS shall be classified according to size, form and quality.

The average of the maximum and minimum diameters shall be used in measuring the size of knots unless otherwise stated.

In all grades of material all knots should be sound and tight unless otherwise specified.

PIN KNOT.—One not over ⅜ of an inch in diameter.

SMALL KNOT.—One between ⅜ and ¾ of an inch in diameter.

STANDARD KNOT.—One between ¾ and 1½ inches in diameter.

LARGE KNOT.—One over 1½ inches in diameter.

ROUND KNOT.—One whose maximum diameter is not over one and one-half times as great as its minimum diameter.

OVAL KNOT.—One having its maximum diameter one and one-half to three times as great as its minimum diameter.

SPIKE KNOT.—One sawed in a lengthwise direction whose maximum diameter is over three times as great as its minimum diameter.

SOUND KNOT.—One which is solid across its face, and is as hard as the wood surrounding it and shows no indications of decay.

UNSOUND OR ROTTEN KNOT.—One not as hard as the wood surrounding it or one in which decay has started.

TIGHT KNOT.—One so fixed by growth or position that it will firmly retain its place in the piece.

LOOSE KNOT.—One not held firmly in place by growth or position.

LIVE KNOT.—One whose growth rings are completely intergrown with those of the surrounding wood.

ENCASED KNOTS.—One whose growth rings are not intergrown and homogeneous with the growth rings of the surrounding wood. The encasement may be partial or complete.

WATERTIGHT KNOT.—One whose growth rings are completely intergrown with those of the surrounding wood on one face of the piece, and which is sound on that face.

PITH KNOT.—Sound knot except that it has a pith hole in the central growth ring. The hole rarely exceeds ¼ of an inch in diameter.

Holes.

HOLES in wood may extend partially or entirely through the piece. They are enumerated as knot, dog, picaroon, bird, insect (including pin, shot, spot, grub worms, etc.) metal and wooden rafting pin holes, through pitch pockets and the like.

When holes are permitted, the average of the maximum and minimum diameters at right angles to the direction of the hole shall be used in measuring the size, unless otherwise stated.

WOODEN RAFTING PINHOLES sometimes appear on river timber which has been rafted when holes have been bored in the solid wood for securing the timber, and a solid plug or pin driven in the hole, completely filling it. These defects must be treated and considered the same as Knot Defects. Ordinary Metal Rafting Pin, Cant Hook or Chain Dog-hole is not considered a defect.

GRUB WORM HOLES are usually from about ⅛-inch to 3/16-inch in width, and vary in length from about 1 inch to 1½ inches and are caused by grubs working in the wood.

PIN WORM HOLES are very small holes caused by minute insects or worms. These holes are usually not over 1/16-inch in diameter, the wood surrounding them is sound and does not show any evidence of the worm hole having any effect on the wood other than the opening.

SPOT WORM DEFECTS (also known as Flagworm Defects) are caused, like pin worm holes, by minute insects or worms working on the timber during the growth. The size of the hole is about the same as Pin-worm holes, but the surrounding wood shows a colored spot as evidence of the blemish. This spot is usually sound and does not affect the strength of the piece.

Checks.

CHECK is a separation of the wood cells along a radial plane of the tree due to unequal shrinkage du[illegible]ning.

SURFACE CHECK is a shallow check occurring on the surface of a piece.

END CHECK is one occurring on an end of a piece.

THROUGH CHECK is one extending from one surface through the piece to the opposite surface or to an adjoining surface.

HEART CHECK is one starting at the pith and extending towards but not to the surface of a log and is not necessarily due to seasoning.

STAR CHECK is the combination of several heart checks occurring together.

HONEYCOMBING is checking occurring in the interior of a piece; often the checks are not visible on the surface. On a cross-section they usually appear as slits, or as open pockets whose width may appear very large in proportion to the radial length.

ORDINARY season checks such as occur in lumber properly covered in yard, or season checks of equal size in kiln-dried lumber shall not be considered defects.

Shakes and Splits.

SHAKE is a cylindrical separation of the wood following in general the annual layers (rings) of growth. Thus any shake is a ring shake.

ROUND SHAKE is one completely encircling the pith.

CUP SHAKE is one that does not completely encircle the pith.

THROUGH SHAKE is one extending from one surface through the piece to the opposite surface or to an adjoining surface.

PITCH SHAKE.—A clearly defined seam or opening between the grain of the wood and may be either filled or not with granulated pitch.

SPLIT is a lengthwise separation of the wood due to tearing apart of the wood cells in rough handling, felling the tree or similar causes. It may run in any direction across the end of a piece.

PITH is the small soft core occurring in the center growth ring of a log. In some woods it is large enough to mar the surface of the piece on which it appears. The wood immediately surrounding the pith often contains small checks, shakes or numerous pin knots and is often discolored; any such combination of defects and blemishes is known as Heart Center.

Pockets.

PITCH POCKET.—A well defined opening between the annual layers of growth usually containing more or less pitch, either solid or liquid. Bark may also be present in the pocket. On an edge-grain surface they appear as narrow open seams, and on flat grain surface they vary in appearance from narrow open seams to oval cavities sometimes called "Scab Pitch Pockets." On either surface they are known as very small, small, medium or large, depending upon their size.

VERY SMALL PITCH POCKET.—One not over ⅛ of an inch in width and not over 2 inches in length.

SMALL PITCH POCKET.—One whose maximum width may vary from ⅛ of an inch to ¼ of an inch provided a maximum limit of length of four inches decreases to two inches proportionately as the width increases.

MEDIUM PITCH POCKET.—One whose maximum width may vary from ⅛ of an inch to ⅜ of an inch provided a maximum limit of length of nine inches decreases to three inches proportionately as the width increases.

LARGE PITCH POCKET.—One whose width or length exceeds the sizes stated as permissible for a medium pitch pocket.

BARK POCKET is a patch of bark partially or wholly enclosed in the wood. It may result from wood and bark forming over a place where the tree has been injured. As a defect it is measured in the same manner as a Pitch Pocket.

Streaks and Discolorations.

PITCH STREAK.—A well defined and conspicuous accumulation of pitch in the wood cells. It is usually not considered an important blemish unless both springwood and summerwood appear saturated. They are known as small, medium or large depending upon their size with respect to the piece they are in.

SMALL PITCH STREAK.—One whose area does not exceed the product of one-twelfth the width by one-sixth the length of the face on which it occurs.

MEDIUM PITCH STREAK.—One whose area does not exceed the product of one-sixth the width by one-third the length of the face on which it occurs.

LARGE PITCH STREAK.—One whose area exceeds the product of one-sixth the width by one-third the length of the face on which it occurs.

PITH FLECK is a narrow streak, usually brownish, up to several inches in length on the face of a piece resulting from the larvæ of an insect having burrowed in the growing tissue or cells of the tree.

BIRD PECK is a small hole or patch of distorted grain resulting from birds pecking through the growing cells in the tree. It usually resembles a carpet tack in shape with the point towards the bark and it is usually accompanied by a discoloration extending along the grain and usually to a smaller extent around the layers of growth. A section through the discoloration produced by the bird peck produces what is commonly known as "Mineral Streak."

GUM SPOT OR STREAK is an accumulation of gum-like substance occurring as a small patch or streak in the piece. It may occur in conjunction with a bird peck or other injuries to the growing wood.

DISCOLORATIONS on or in lumber are enumerated as weather, sticker, water or fungus (such as blue stain, etc.) stain, brown stain, kiln burn and similar color changes due to a combination of temperature, moisture, chemicals, etc. Discoloration may follow insect attack, bird peck, etc. Well defined discoloration

LIGHT DISCOLORATION is paler than the medium discoloration and occurs in approximately one-fourth of the stained stock.

MEDIUM DISCOLORATION is a shade most commonly found and which occurs in approximately one-half of the stained stock.

HEAVY DISCOLORATION is darker than the medium discoloration and occurs in approximately one-fourth of the stained stock.

DECAY is disintegration of the wood substance due to the action of certain kinds of fungi. A few of the rot-producing fungi which start in the standing tree do not seem to seriously develop after the tree is cut into lumber.

RED HEART of the pines, spruces, Douglas fir and some other conifers, and peck of cypress and incense cedar are produced by fungi of this type. Decay may be classified as incipient and advanced decay.

INCIPIENT DECAY is the early stages of decay, usually detected by a discoloration of the wood which seems to be firm and solid.

ADVANCED DECAY or rot is noticeable as a decided softening or breaking down of the wood.

WATER STAIN, or what are sometimes called scalded or burnt spots, usually caused by timber lying in the water under certain conditions before it is sawed, and burnt spots where timber is improperly piled while green, are not considered defects, as they do not affect the strength of the piece.

"SAP"—SAPWOOD is the alburnum of the tree—the exterior part of the wood next to the bark. Sapwood is not considered a defect except as provided herein.

SOUND HEART.—The term "Sound Heart" is used whenever that part of the piece which was originally the central part or core of the tree is sound and solid, not decayed.

CROSS GRAINED WOOD is that in which the wood cells or fibers do not run parallel with the axis or sides of a piece. It may be classified as spiral, diagonal, wavy, dip, curly and interlocked grain. The slope of the grain can be determined by observing the direction of surface checks, resin ducts, pores of the wood, annual layers of growth, etc. A drop of stained liquid such as ink tends to elongate in the direction of the grain when placed on a smooth surface of the piece.

SPIRAL GRAINED WOOD is that in which the fibers take a more or less winding or spiral course, such as occurs in a twisted tree. It may be detected on the flat grain (plain sawed or tangential) surface.

DIAGONAL GRAINED WOOD is that in which the fibers extend at an angle (i. e., diagonally) across a piece as a result of sawing at an angle across the annual layers of growth. It may appear on either the radial or tangential surface.

WAVY GRAINED WOOD is that in which the fibers take the form of waves or undulations as indicated by the wavy surface of the split piece. It may appear on either the radial or tangential surface.

DIP GRAINED WOOD is that which has one wave or undulation of the fibers such as occurs around knots, pitch pockets, etc.

CURLY GRAINED WOOD is that in which the fibers are distorted so that they take a curled direction as in "Birdseye Wood." These patches may vary up to several inches in diameter.

INTERLOCKED GRAIN is wood that shows spiral grain in one direction for a number of years and then the slope of the grain in the succeeding annual layers of growth turns in a reverse direction around the tree, then later reverses back, etc.

Distortions and Crooks.

CROSS BREAK is a separation of the wood cells across the grain. It may be due to tension resulting from unequal longitudinal shrinkage or mechanical stresses.

COMPRESSION FAILURE is a wrinkling or buckling of the wood cells extending in a more or less irregular plane across the grain. It is due to longitudinal crushing or compression.

COLLAPSE is a caving in of the surface of a piece. It sometimes occurs in streaks giving the surface a corrugated appearance, and is often due to the flattening of the cells when drying wet wood at high temperatures.

WARPING is any variation from a true or plane surface. It includes crook, bow, twist or any combination of these.

CROOK is a deviation edgewise from a straight line drawn from end to end of a piece and is measured at the point of greatest departure from a straight line. It is known as slight, small, medium and large.

Unless otherwise specified, the different degrees of crook based on a piece four (4) inches wide and 16 feet long shall be as follows:

SLIGHT CROOK, a departure of one (1) inch.

SMALL CROOK, a departure of 1½ inches.

MEDIUM CROOK, a departure of 2 inches.

LARGE CROOK, a departure of over 2 inches.

For wider pieces it shall be ⅛-inch less for each additional 2 inches of width.

Shorter or longer pieces shall have the same limits for curvature.

BOW is a deviation flatwise from a straight line drawn from end to end of a piece, measured at the point of greatest distance from a straight line.

CUPPING is the curvature of a piece across the grain or width of a piece.

TWISTING is the turning or winding of the edges of a piece so that four corners of any face are no longer in the same plane (i. e., it is the twisting of an edge around the axis of the piece).

WANE is bark or the lack of wood from any cause on the edge of a piece.

SPECIFICATIONS.

Defects of Manufacture, Applicable to All Timber and Lumber.

1. Defects in rough stock caused by improper manufacture and drying will reduce grade, unless they can be removed in dressing such stock to standard sizes.

2. In structural timber defects of manufacture have usually been omitted, being of minor significance.

3. Imperfect manufacture in dressed stock, such as torn grain, loosened grain, slight skips in dressing, wane, broken knots, mismatched, insufficient tongue or groove for flooring, ceiling, drop siding, etc., shall be considered defects, and will reduce the grade according as they are slight or serious in their effects on the use of the stock.

4. Torn grain consists of a part of the wood having been torn out in dressing. It occurs around knots and curly places and is of four distinct characters: slight, medium, heavy and deep. Slight torn grain shall not exceed 3/32-inch in depth; medium 1/16 and heavy 1/8-inch. Any torn grain heavier than 1/8-inch shall be termed deep.

5. Loosened grain consists in a point of one grain being torn loose from the next grain. It occurs on the heart side of the piece and is a serious defect, especially in flooring.

6. Chipped grain consists in a part of the surface being chipped or broken out in small particles below the line of cut and, as usually found, should not be classed as torn grain, and shall be considered a defect only when it unfits the piece for use intended.

7. Pieces of Flooring, Drop Siding or Partition with 3/16-inch or more of tongue; and pieces of Ceiling with 1/8-inch or more of tongue; and pieces of Ship Lap with 3/16-inch of lap will be admitted in any grade.

8. Pieces of Flooring, Drop Siding, Ceiling or Partition having not less than 1/16-inch tongue will be admitted in No. 2 Common. Pieces of Ship Lap having less than 3/16-inch and not less than 1/8-inch lap shall be admitted in No. 2 Common.

Standard Sizes.

1. In the absence of a special agreement between buyer and seller for each order, the following sizes shall be standard for all lumber and timber.

2. "Rough timbers sawed to standard size" means that they shall not vary over one-quarter (1/4) inch scant from the nominal size specified. For instance, a 12x12-inch timber shall measure not less than 11¾x11¾ inches.

3. "Standard Dressing" means that not more than 1/4-inch shall be allowed for dressing each surface. For instance, a 12x12-inch timber, after being dressed on four sides, will measure 11¼x11¼ inches.

Dimension S1S1E.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
2	1⅝	4	3⅝
2½	2⅛	5	4⅝
3	2⅝	6	5⅝
4	3⅝	7	6⅝
5	4⅝	8	7½
...	...	9	8½
...	...	10	9½
...	...	12	11½
...	...	14	13½
...	...	16	15½

Standard lengths are multiples of two feet, 4 to 24 feet, inclusive, but lengths shorter than 10 feet shall not be included in miscellaneous or mixed shipments except by agreement.

Common Boards and Strips.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
1 R	13/16	4	3⅝
1 S 1 S	⅞	6	5⅝
1 S 2 S	13/16	8	7½
1¼	1 1/16	10	9½
1½	1 5/16	12	11½

Dressed Finishing Lumber S1S

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
⅜	9/16	4	3⅝
½	7/16	5	4⅝
⅝	11/16	6	5⅝
¾	13/16	7	6⅝
1	13/16	8	7½
1¼	1⅛	9	8½
1½	1⅜	10	9½
2	1¾	12	11½
2½	2⅛	14	13½
3	2⅝	16	15½

The standard lengths are multiples of one foot

Flooring.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
3/8	...	...	....
1/2	...	...	....
5/8	...	...	....
			Tongue and Groove
3/4	11/16	3	2 3/8
1	13/16	4	3 1/4
1 1/4	1 1/16	5	4 1/4
1 1/2	1 5/16	6	5 1/4
2	1 5/8	6 Factory	5 1/8
2 1/2	2 1/8	...	....
			Splined
3	2 5/8	6	5 1/2
3 1/2	3 1/8	7	6 1/2
4	3 5/8	8	7 1/2
...	...	9	8 1/2
...	...	10	9 1/2
...	...	12	11 1/2
			Shiplap
...	...	6	5
...	...	7	6
...	...	8	7
...	...	9	8
...	...	10	9
...	...	12	11

Standard lengths are multiples of one foot from 4 to 20 feet. Five per cent. of 8 or 9 foot lengths is allowed in mixed length shipments of "B and Better" and in addition five per cent. of 6 or 7 feet in C, D and No. 1 Common, and in addition five per cent. of four or five feet in No. 2 Common, No. 3 Common, 4 to 20 feet inclusive.

The above percentage of short lengths is customary, and in the interest of conservation will be included, as far as practicable, in all shipments of mixed lengths.

Ceiling.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
3/8	5/16	3	2 3/8
1/2	7/16	4	3 1/4
5/8	9/16	5	4 1/4
...	...	6	5 1/4
1	3/4	7	6 1/8

Standard lengths are multiples of one foot, from 4 to 20 feet.

Five per cent. of 8 or 9 feet is allowed in mixed length shipments of "B and Better" Ceiling and in addition five per cent. of 6 or 7 feet in No. 1 Common, and in addition five per cent. of 4 or 5 feet in No. 2 Common.

The above percentage of short lengths is customary, and in the interest of conservation will be included, as far as practicable, in all shipments of mixed lengths.

Partition.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
3/8	5/16	3	2 3/8
1/2	7/16	4	3 1/4
5/8	9/10	5	4 1/4
3/4	11/16	6	5 1/4
1	3/4	7	6 1/8

Standard lengths are multiples of one foot.

Same percentage of short lengths is allowed as in ceiling.

Grooved Roofing.

Nominal thickness one (1) inch, actual thickness 13/16-inch.

Nominal Width Inches	*Actual Width Inches*
8	7 1/2
10	9 1/2
12	11 1/2

Roofers.

Roofers shall be made of No. 2 boards, 13/16-inch machine run, center matched and of nominal widths 6 or 8 inches as specified.

Fencing.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
1	13/16	3	2 5/8
1 1/4	1 1/16	4	3 5/8
1 1/2	1 5/16	5	4 5/8
...	...	6	5 5/8

Drop Siding, D&M.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
⅝	9/16	3	2¼
¾	11/16	4	3¼
1	¾	5	4¼
1¼	...	6	5¼
1½	...	...	...

Drop Siding, Worked Shiplap and Rustic.

Nominal thickness one (1) inch, actual thickness three-fourths (¾) inch.

Nominal Width Inches	*Actual Width Inches*
6	5⅛
8	7⅛
10	9⅛

Standard Lengths are multiples of 2 feet from 4 to 20 feet.

Five per cent. of 8 or 9 feet is allowed in mixed length shipments of "B and Better Drop Siding," and in addition five per cent. of 6 or 7 feet in "No. 1 Common" and in addition five per cent. of 4 or 5 feet in No. 2 Common.

The above percentage of short lengths is customary and in the interest of conservation will be included, so far as practicable, in all shipments of mixed lengths.

Shiplap.

Nominal thickness one (1) inch, actual thickness three-fourths (¾) inch, ⅜-inch lap.

Nominal Width Inches	*Actual Width Inches*
4	3⅛
6	5⅛
8	7⅛
10	9⅛
12	11⅛

Bevel Siding.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
½ ¼ E	7/16 and 9/16	4	3½
.....	.....	5	4½
.....	.....	6	5½
⅝ ¼ E	9/16 and 11/16	...	...
¾ ¼ E	.....	8	7¼
.....	.....	10	9¼
.....	.....	12	11¼

Standard lengths are multiples of one foot, from 4 to 20 feet. Five per cent. of 8 or 9 feet is allowed in mixed shipments of "B and Better," Bevel Siding, and in addition five per cent. of 6 or 7 feet in "No. 1 Common" and in addition, five per cent. of 4 or 5 feet in "No. 2 Common."

The above percentage of short lengths is customary, and in the interest of conservation will be included, so far as practicable, in all shipments of mixed lengths.

General Instructions on Grading Timber and Lumber.

1. No arbitrary rules for the inspection of lumber can be maintained with satisfaction. The combinations and evaluations of defects are numerous and the interpretation of classification in grading lumber must be left to practical common sense. The general features of these classes are given by the following description of grades.

2. All lumber is graded with special reference to its suitability for the use intended.

3. With this in view each piece is considered and its grade determined by its general character, including the sum of all its defects.

4. Inspection of lumber is not an exact science and a reasonable variation of opinion between inspectors should be recognized; therefore, a variation of not more than 5 per cent. upon reinspection should not disturb the original inspection.

5. The enumerated defects herein described in any grade are intended to be descriptive of the coarsest piece such grades may contain.

6. In construing and applying these rules, the defects allowed are understood to be equivalent in damaging effect to those mentioned applying to stock under consideration.

7. In case of a piece of lumber which lies so close to the boundary line between two grades that there is doubt as to which grade it belongs in, it shall be given the lower grade.

8. A shipment of any grade must consist of a fair average of that grade and shall not include an unfair proportion of the better or poorer pieces that would pass in that grade. A shipment of mixed widths shall contain a fair assortment of each width. A shipment of mixed lengths shall contain a fair assortment of each length.

9. Defects in lumber are to be considered in connection with the size of the piece, and for this reason wider and longer pieces will carry more defects than smaller pieces in the same grade. Defects in flooring, ceiling, partition, casing and base, drop siding and rustic are based on a piece 4 inches wide and 12 feet long, except where otherwise specified.

10. Lumber must be accepted on grade in the form in which it was shipped. Any subsequent change in manufacture or condition will prohibit a reinspection for the adjustment of claims, except with the consent of all parties interested.

11. What is known as "Yard Lumber," such as Dimension, Common Boards and Finish, etc., is graded from the face side, which is the best

side, except that lumber which is dressed one side only is graded from the dressed side.

12. Factory lumber, which is used for the manufacture of doors, sash, etc., and must show both sides, is always graded from the poorer side. The grade is determined by the quantity of suitable cuttings obtainable in each piece.

13. All dressed lumber shall be measured and sold at the full size of rough material used in its manufacture.

14. All lumber one inch or less in thickness shall be counted as one inch thick.

15. The term "Vertical Grain" is here used as synonymous with edge grain, rift sawed or quarter sawed. The term "Flat Grain" is synonymous with slash grain or plain sawed.

Structural Grades for Bridge and Trestle Timbers.

Southern Yellow Pine and Douglas Fir Specifications.

Density Requirements.

Shall contain only Southern Yellow Pine or Douglas Fir timbers graded in two grades by the following density rules:

Density Rule for Southern Yellow Pine.

1. Dense Southern Yellow Pine shall show on either one end or the other an average of at least six annual rings per inch or eighteen rings in three inches as measured over the third, fourth and fifth inches of a radial line from the pith, and at least one-third (⅓) summerwood for girders not exceeding 20 inches in height, and for columns 16 inches square or less. For larger timbers the inspection shall be made over the central three inches on the longest radial line from the pith to the corner of the piece. Wide ringed material excluded by the above will be accepted, provided the amount of summerwood, as above measured, shall be at least 50 per cent.

2. The contrast in color between summerwood and springwood shall be sharp, and the summerwood shall be dark in color, except in pieces having considerably above the minimum requirement for summerwood.

3. In cases where timbers do not contain the pith, and it is impossible to locate it with any degree of accuracy, the same inspection shall be made over three inches of an approximate radial line beginning at the edge nearest the pith in timbers over three inches in thickness and on the second inch (on the piece) nearest to the pith in timbers three inches or less in thickness.

4. In dimension material containing the pith but not a five-inch radial line, which is less than two by eight inches in section or less than eight inches in width, that does not show over sixteen square inches on the cross-section, the inspection shall apply to the second inch from the pith. In larger material which does not show a five-inch radial line, the inspection shall apply to the three inches farthest from the pith.

5. The radial line chosen shall be representative. In case of a disagreement between purchaser and seller as to what is a representative radial line, the average summerwood and number of rings shall be the average of the two radial lines chosen.

Density Rule for Douglas Fir.

1. Dense Douglas Fir shall show, on either one end or the other, an average of at least six annual rings per inch and at least one-third summerwood measured over three inches on a line located as described hereinafter. Coarse-grained material excluded by this rule shall be acceptable provided the amount of summerwood measured as described shall be at least one-half. Material in which the proportion of summerwood is not clearly discernible shall not be accepted.

2. Any timber whose least dimension is less than five inches shall not show the pith (heart) on the inspection end; pieces whose least dimension is five inches or more may contain the pith.

3. When the least dimension is five inches or more, the pith being present, the line over which the rate of growth and per cent. of summerwood measurements shall be made shall run from the pith to the corner farthest from the pith. To find the beginning of the three-inch line, measure a distance of one-half the least dimension of the piece, less two inches, from the pith. This distance may be expressed as follows:

$$a = \tfrac{1}{2}\, d - 2,$$

where a = distance in inches from pith to beginning of three-inch line.
d = least dimension of piece in inches.

4. When the rings are very irregular it may be necessary to shift the line somewhat around the piece to get a fair average for inspection, but the distance from the pith to the beginning of the three-inch line must not be changed.

5. For all pieces where the pith is not present the center of the three-inch line shall be at the center of the end of the piece, and the direction of the three-inch line shall be at right angles to the annual rings.

6. If a radial line of 3 inches cannot be obtained, the measurement shall be made over the entire radial line that is available.

General Requirements.

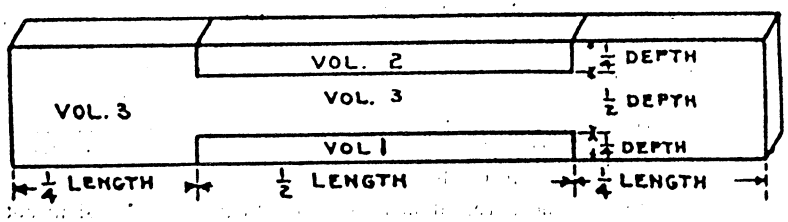
1. Shall consist of lumber well manufactured, square edges and sawed standard size.

2. When the timbers 4x4 inches and larger are ordered sized, they will be ½ inch less than nominal size, either S1S1E or S4S, unless otherwise specified.

3. Structural timbers shall be sound and free from rotten or unsound knots, knots in clusters, decay, round or ring shakes occupying more than one-fourth (¼) the least dimension on either end of a timber (a round or ring shake shall be measured on its vertical projection), injurious diagonal grain or other defects that will materially impair its strength. Shakes shall not show on any face of the timber.

4. Knots limited in size and position as hereinafter provided will be permitted if so fixed by growth or position that they will retain their place in the piece as at time of manufacture.

5. For the limitation of knots in beams in size and location, a beam shall be considered as divided into three volumes as shown below:



Measurement of Knots.

1. In beams, the diameter of a knot on the narrow or horizontal face shall be taken as its projection on a line perpendicular to the edge of the timber. On the wide or vertical face, the smallest dimension of a knot is to be taken as its diameter.

2. In columns, the mean or average dimension of a knot on any face shall be taken as its diameter.

3. Beams shall not have diagonal or spiral grain in Volumes 1 and 2 with slope greater than 1 in 20; in posts the angle shall not be greater than 1 in 15.

4. Posts and beams have different restrictions as to knots and angle of grain and must be listed accordingly in bills of material.

No. 1 Structural.

1. No. 1 Structural timbers shall be of Dense Southern Yellow Pine or Dense Douglas Fir, and shall meet the General Requirements for Structural Grades.

2. This grade shall not have tight pitch pockets over six (6) inches long or over ⅜ inch wide or wane exceeding one (1) inch on one corner or over one-sixth (1/6) the length of the piece.

3. Loose knots larger than one-half (½) inch shall not be permitted.

Beams, Stringers, Girders and Deep Joists.

1. Beams, Stringers, Girders and Deep Joists shall show not less than 85 per cent. of heart on each side of the four sides measured across the sides anywhere in the length of the piece.

2. Beams, Stringers, Girders and Deep Joists shall not have knots in Volumes 1 and 2 larger in diameter than one-fourth (¼) the width of the face of the beam in which they occur, up to and including six (6) inches, nor larger than one and one-half (1½) inches in a face over six (6) inches. Knots within the center half of the length of a beam shall not exceed in the aggregate the width of the surface of the beam in which they occur.

3. Beams shall not have knots in Volume 3 larger in diameter than one-fourth the width of the face in which they occur, with a maximum for any one knot of 3 inches in diameter.

4. When beams are of two spans length and so marked in bill of materials, Volumes 1 and 2 on inspection shall be considered as extending between points located one-eighth (⅛) the length of the beam from each end.

5. The inspector shall place his stamp on the edge of the beam or stringer to be placed up in service.

Caps and Sills.

1. Caps and Sills shall show 85 per cent. of heart on each of the four sides, measured across the surface anywhere in the length of the piece.

2. Caps and Sills shall be free from knots larger than one-fourth (¼) the width of the surface in which they occur with maximum for any one knot of 3 inches in diameter. Knots shall not be in groups.

Posts.

1. Posts shall show not less than 85 per cent. of heart on each of the four sides, measured across the surface anywhere in the length of the piece.

2. Posts shall not have knots larger than one-fourth (¼) the least dimension of the posts nor larger than three inches. Knots shall not be in groups.

Longitudinal Struts or Girts.

1. Longitudinal Struts or Girts shall show all heart on one surface; the other surface and two sides shall show not less than 85 per cent. of heart, measured across the face or side anywhere in the length of the piece.

2. Longitudinal Struts or Girts shall be free from knots over two inches in diameter.

Longitudinal Cross Braces, Sash Braces and Sway Braces.

1. Longitudinal Cross Braces, Sash Braces and Sway Braces shall show not less than 85 per cent. heart on two faces.

2. Longitudinal Cross Braces, Sash Braces and Sway Braces shall be free from knots larger than one-third the width of the face in which they occur, with a maximum of 2 inches in diameter.

Ties and Guard Timbers.

1. Ties and Guard Timbers shall show one side all heart; the other side and two edges shall show not less than 75 per cent. heart, measured across the surface anywhere in the length of the piece.

2. Ties and Guard Timbers shall be free from any large knots or other defects which will materially injure their strength; and where surfaced the remaining rough face shall show all heart.

No. 2 Structural.

1. No. 2 Structural Timbers shall meet the General Requirements for Structural Grades, and shall include timbers not passing the No. 1 Grade because of having less density than is required or greater defects than are permitted.

2. This grade shall not have pitch pockets longer than twelve (12) inches or over ⅜ inch wide or wane exceeding two (2) inches on one corner or the equivalent on two or more corners of 10x10 timbers, with wane in proportion on small or large sizes.

Beams, Stringers, Girders and Deep Joists.

1. Beams, Stringers, Girders and Deep Joists shall not have knots in Volumes 1 and 2 larger than as follows:

2. If of Dense Southern Yellow Pine or Dense Douglas Fir, one-third (⅓) the width of the face of the beam in which they occur, up to and including nine (9) inches, nor larger than three (3) inches in a face over nine (9) inches.

3. If not of Dense Southern Yellow Pine or Dense Douglas Fir, one-fourth (¼) the width of the face of the beam in which they occur, up to and including six (6) inches, nor larger than one and one-half (1½) inches, in a face over six (6) inches.

4. Knots in the center half of the length of a beam shall not exceed in the aggregate twice the width of the surface of the beam in which they occur.

5. Beams shall not have knots in Volume 3 larger in diameter than one-third (⅓) the width of the face in which they occur.

6. Loose knots larger than one-half (½) the size of knots allowed above shall not be permitted; beams shall not have loose knots, in Volume 3, larger than one and one-half (1½) inches.

Caps and Sills.

Caps and Sills shall be free from knots larger than one-half (½) the width of the face in which they occur with a maximum for any one knot of three (3) inches in diameter. Knots shall not be in groups.

Posts.

Posts shall not have knots, if of Dense Southern Yellow Pine or Dense Douglas Fir, larger than one-third (⅓) of the least dimension of the post, nor larger than four inches; if not of Dense Southern Yellow Pine or Dense Douglas Fir, larger than one-fourth (¼) the least dimension of the post, nor larger than three (3) inches.

Longitudinal Struts or Girts.

Longitudinal Struts or Girts shall be free from knots over 2 inches in diameter.

Longitudinal Cross Braces, Sash Braces and Sway Braces.

Longitudinal Cross Braces, Sash Braces and Sway Braces shall be free from knots larger than one-third the width of the face in which they occur, with a maximum of 2 inches in diameter.

Specifications for Timber to be Treated.

1. Specifications for timber to be treated are the same as for untreated timber, except that no restriction is to be placed upon the amount of sap wood allowed in the timber which is to be treated.

2. Many varieties of timber can be used, if treated, that would not be satisfactory to use in the untreated state on account of being subject to rapid decay if they are not treated.

Commercial Timber and Lumber Grades.

TIMBER.

Selected Common.

1. Selected Common shall be sound, strong timber, well manufactured and free from defects that materially impair its strength. Must be suitable for high-class construction purposes, free from shake, splits, loose or rotten knots. Will allow sound and tight knots, if not in clusters and which in no case shall exceed in diameter one-sixth the width of the face in which such knots occur up to and including 12x12-inch; and further providing that such sound and tight knots in 14x14-inch and larger shall in no case exceed 2½ inches in diameter.

2. The select common grade also will allow tight pitch pockets, not over six inches in length, wane not to exceed one inch on one corner and not exceeding one-sixth the length of the piece.

3. White sap or a slight amount of sound stained sap on the back shall not be considered a defect in this grade.

NOTE.—Commercial Timber and Lumber Grades here given apply to Southern Yellow Pine, Douglas Fir, White Pine, Western Pine, Idaho White Pine, Norway Pine, Spruce, Tamarack and Redwood products.

No. 1 Common.

1. No. 1 Common Timber 6x10 inches and larger shall be sound stock well manufactured and free from defects that will materially weaken the piece. Occasional slight variation in sawing allowed, provided such variation will not reduce size of stick below standard for dressed lumber.

2. Ten by ten-inch timbers may have a 2-inch wane on one corner or the equivalent on two or more corners, checks and season checks not extending over one-eighth the length of the piece. Smaller and larger timbers may have wane in proportion. In addition will allow large sound and tight knots, which approximately should not be more than one-fourth the width in diameter of any one side in which they may appear, spike knots, stained sap one-third the width and slight streak of heart stain extending not more than one-fourth the length of the piece.

No. 2 Common.

No. 2 Common Timbers will admit large, loose or rotten knots; a 10x10-inch may have a 3-inch wane on one corner or the equivalent on two or more corners, larger and smaller sizes in proportion; shake or rot that does not impair its utility for temporary work.

Dimension Plank, Joists, Scantling and Small Timbers.

Selected Common.

1. Selected Common shall be sound, strong lumber well manufactured and free from defects that materially impair the strength. Must be suitable for high-class construction purposes and free from shake, loose or rotten knots.

2. Will allow occasional variation in sawing, sound and tight, small and standard knots and tight pitch pockets not over 6 inches in length.

3. Twelve inches and wider may contain, in addition to the above, a couple of large knots not to exceed 2 inches in diameter when well placed, a slight amount of sap admissible.

No. 1 Common.

1. No. 1 Common must be sound stock, well manufactured and suitable for all ordinary construction purposes without waste and must be sound and tight-knotted stock.

2. Will admit knots which in a 2x4 or 3x4 piece may be approximately 1½ inches; in a 2x6-inch or 3x6-inch piece, 2 inches; in a 2x8-inch or 3x8-inch or 2x10-inch or 3x10-inch piece, 2½ inches; and one-fourth the width of the piece in 12 inches and wider; spike knots that do not materially weaken the piece; wane not over one-fourth the thickness of the piece 1 inch wide on face up to 6 inches, and 1½ inches wide on face of 8 inches and wider, extending not more than one-third the length of the piece or a proportionate amount for a shorter distance on both edges; in any case one side and two edges should provide a good nailing surface and in no case shall wane extend over one-half the side of the piece.

3. Pith knots or small defective knots which do not weaken the piece more than the knots above allowed are admitted, solid pitch, pitch pockets, sap stain, a limited number of worm holes well scattered, limited torn grain, seasoning checks, splits in ends, not exceeding in length the width of the piece, firm red heart, heart shakes that do not go through.

4. May contain crook of 1½-inch in 2x4—16 feet, and ⅛ inch less in each additional 2 inches in width up to and including 2x12—16 feet. Length longer or shorter than 16 feet of No. 1 Common Dimension may contain crook in proportion to the above.

No. 2 Common.

1. This grade shall consist of lumber suitable for a cheaper class of construction than No. 1 Common.

2. Will admit large, coarse sound knots, which in a 2x4 and 3x4-inch piece should not be larger than 2½ inches in diameter; in 2x6 or 2x8 or 3x6 or 3x8-inch pieces, 3 inches, and in 2x10 or 3x10 or wider pieces one-third the width of the piece in diameter, spike knots, smaller, loose, hollow or rotten knots that do not weaken the piece more than the knots aforesaid, worm holes well scattered, large pitch pockets, rotten streaks, small amount of fine shake, split not to exceed one-quarter the length of the piece, heart and sap stains in any amount, decayed sap, wane if leaving a fair nailing surface.

3. May contain crook of 2 inches in 2x4—16 feet, and ⅛ inch less in each additional 2 inches in width up to and including 2x12—16 feet. Length shorter or longer than 16 feet may contain crook in proportion to the above.

4. Miscut 2-inch Common which does not fall below 1½ inches in thickness or ⅛ inch scant in width from standard size, shall be admitted in No. 2 Common, provided such pieces are in all other respects as good as No. 1 Common at point of miscut.

5. A very serious combination of above defects must not be permitted in any one piece.

No. 3 Common.

1. No. 3 Common will include all pieces falling below No. 2 Common which are sound enough to use for cheap building material by wasting 25 per cent. of each piece or one-third of number of pieces in any one item of a shipment but it must not be more than ½ inch scant of standard finished width nor ⅜ inch scant of standard finished thickness. This grade will admit a greater degree of all the imperfections allowed in No. 1 and No. 2 Common, but shall not admit useless culls.

Boards, Ship Lap and D & M.

Selected Common.

Selected Common shall be square edged, well manufactured. Will admit sound tight knots not over 1 inch in diameter in 4-inch and 6-inch, not over 1½ inches diameter in 8-inch, medium sized tight pitch pockets not over 6 inches in length, two pith knots, the equivalent of one split not to exceed in length the width of the piece, torn grain, pitch pockets, slight shake, sap stain, seasoning checks, firm red heart, small amount of slightly stained sap. These boards must be of a sound, strong character.

No. 1 Common.

1. No. 1 Common will admit any two of the following or their equivalent of combined defects:

2. Sound and tight knots approximately 1½ inches in diameter in 4 and 6-inch; 2 inches in diameter in 8 and 10-inch; 2½ inches in 12-inch and not over 3 inches in diameter in widths over 12 inches.

3. Pitch pockets, seasoning checks, one straight split not longer than the width of the piece, sap stain, slight streak of heart stain, pith knots, torn grain, slight shake, firm red heart, wane ½ inch deep on edge not exceed-

ing 1 inch in width on face and extending not over one-third the length of the piece, a limited number of pin worm holes well scattered.

4. These boards must be firm, sound and suitable for use in ordinary construction except finishing purposes without waste.

5. No. 1 Common Ship Lap or D & M or Barn Siding shall be graded by rules governing No. 1 Common Boards except as to wane which shall not be so deep as to extend into the tongue or one-half the thickness of the top lip on the groove in D & M, or over one-half the thickness of the lap in Ship Lap on the face side; pieces of Ship Lap with $\frac{3}{16}$ inch of lap will be admitted in any grade.

No. 2 Common.

1. No. 2 Common will admit large coarse knots not necessarily sound, approximately 2 inches in diameter in 4 and 6-inch stock; 2½ inches in 8 and 10-inch and one-third the width of the piece in 12-inch and wider, spike knots, solid heart or sap stain, solid pitch or pitch pockets, a limited number of well scattered worm holes, splits one-fourth the length of the piece. Small amount of fine shake, wane 2 inches wide if it does not extend into the opposite face, or through heart shakes over one-half the piece or through rotten streaks when firm, ½ inch wide over one-fourth the length of the piece or its equivalent of unsound red heart or combination of defects equivalent to the above but a serious combination of above defects in any one piece not permitted.

2. A knot hole 2 inches in diameter will be admitted provided the piece is otherwise as good as No. 1 Common.

3. Miscut 1-inch Common Boards which do not fall below ¾ inch in thickness shall be admitted in No. 2 Common, provided the grade of such thin stock is otherwise as good as No. 1 Common.

No. 3 Common.

No. 3 Common will admit of stock below the grade of No. 2 Common that is suitable for cheap sheathing. The general appearance is coarse. It will admit large coarse knots without restrictions as to size, loose knots, unsound knots, knot holes, pitch pockets, solid pitch, very wormy pieces, shake, heart or sap stain, decayed sap, decayed streaks, well scattered small rotten spots, split, blue sap, wane, but a serious combination of above defects in any one piece not permitted. It should cut 75 per cent. of lumber as sound as No. 2 Common.

No. 4 Common.

1. No. 4 Common shall include all pieces that fall below the grade of No. 3 Common, excluding such pieces as will not be held in place by nailing, after wasting one-fourth the length of the piece by cutting into two or three pieces.

2. The predominating defect characterizing this grade is red rot. Other defects are numerous large worm holes, several knot holes, or pieces that are extremely coarse knotted, wany, shaky or badly split, extremely cross-checked.

No. 5 Common.

No. 5 Common is the lowest grade and admits of all defects known in lumber, provided the piece is strong enough to hold together when carefully handled.

Thick Common Lumber.

Common lumber, 1¼ inches and thicker, shall be graded the same as 1-inch lumber.

Rough Stock for Finish.

1. Finish must be evenly manufactured and shall embrace all sizes from 1 to 2 inches inclusive in thickness by 3 inches and over in width.

2. One, 1¼ and 1½-inch finishing lumber unless otherwise ordered shall measure when dry not more than $\frac{1}{16}$ inch scant in thickness and 2-inch not more than ⅛ inch scant in thickness when seasoned.

3. Stock width shipments of "C" and "Better," either rough or dressed on one or two sides, shall be accepted as standard where not more than 20 per cent. of any shipment is ¼ inch scant on 8-inch widths and under; ⅜ inch scant on 9 or 10-inch; and ½ inch scant on 11 and 12-inch and wider when seasoned; pieces narrower than the above and pieces in excess of 20 per cent. of the shipment that are of the minimum measurement given, should be measured as of the next lower standard width and not reduced in grade.

4. Standard lengths are 8 to 20 feet; and in shipments of mixed lengths, 5 per cent. of 8 feet in grade of "C" and "Better," shall be admitted. The above percentage of short lengths is customary and in the interest of conservation will be included as far as practicable in all shipments of mixed lengths.

5. Wane and other defects that will dress out in working standard sizes are admissible.

6. Finishing lumber ordered rough if thicker than count thickness for dry or green stock, may be dressed to such count thickness, and when so dressed, shall be considered as rough.

7. Rough finish shall be graded on the best side, but the reverse side must not be more than one grade lower.

8. Subject to the foregoing provisions, Rough Finishing Lumber shall be graded according to the rules applying to Dressed Finishing Lumber.

9. When like grade on both faces is required, special contract must be made.

Dressed Finishing Lumber.

Selected Flat Grain.

1. Selected Flat Grain shall be finishing lumber free from all sap or defects on face and edges and shall be selected for beauty and character of grain.

2. "A" Finishing, inch, 1¼, 1½ and 2-inch dressed one or two sides up to and including 12 inches in width, must show one face practically clear of all defects, except that it may have such wane as would dress off if surfaced four sides; 13-inch and wider "A" Finishing will admit two small defects or their equivalent. "B" Finishing, inch, 1¼, 1½ and 2-inch dressed one or two sides, up to and including 10 inches in width in addition to the equivalent of one split in end which should not exceed in length the width of the piece, will admit any two of the following or their equivalent of combined defects: slightly torn grain, three pin knots, one standard knot, three small pitch pockets, one standard pitch pocket, one standard pitch streak, 5 per cent. of sap stain or firm red heart; wane not to exceed 1 inch in width, ¼ inch in depth and one-sixth the length of the piece, small seasoning checks.

3. Eleven-inch and wider "B" Finishing will admit three of the above defects or their equivalent, but sap stain or firm red heart shall not exceed 10 per cent.

4. "C" Finishing up to and including 10-inch in width will admit in addition to the equivalent of one split in end which should not exceed in length the width of the piece, any two of the following, or their equivalent of combined defects: 25 per cent. of sap stain, 25 per cent. firm red heart, two standard pitch streaks, medium torn grain in three places, slight shake, seasoning checks that do not show an opening through, two standard pitch pockets, six small pitch pockets, two standard knots, six pin knots, wane 1 inch in width, ½ inch in depth and one-third the length of the piece. Defective dressing or slight skips in dressing will also be allowed that do not prevent its use as finish without waste. Eleven-inch and 12-inch "C" Finishing will admit one additional defect or its equivalent. Pieces wider than 12 inches will admit two additional defects to those admitted in 10-inch or their equivalent, except sap stain which shall not be increased.

Selected Flat Grain.

Pieces otherwise as good as "B" will admit of twenty worm holes.

Special Finish.

In case both sides are desired, "A," "B" or "C" grade, or free from all defects, special contract must be made. Defective dressing or slight skips in dressing on the reverse side of Finishing are admissible.

Moulded Casing, Base, Window and Door Jambs.

1. Moulded Casing and Base shall be worked to ¾ inch thick as per established patterns.

2. Window and Door Jambs are to be dressed, rabbeted and plowed as ordered.

Grades A, B and C.

1. "A" Grade must be practically free from defects on the face side and well manufactured.

2. "B" Grade shall admit the same defects as are admissible in the same widths of "B" Finishing except wane.

3. "C" Grade shall admit the same defects as are admissible in the same widths of "C" Finishing except wane.

Moulding.

1. "B and Better" Moulding. One-third of any item may contain any one of the following defects or its equivalent: One pin knot, small pitch pockets, pitch 1 inch wide, 6 inches long, three pin worm holes, slight defects in dressing.

2. Standard lengths; 8 feet and longer, and in shipments of mixed lengths 5 per cent. of 6 or 7 feet shall be admitted, even though the number of feet of each length be specifically stated.

Drop Siding.

1. Defects named in Drop Siding are based upon a piece manufactured from 1x6—12 feet, and pieces larger or smaller than this will take a greater or lesser number of defects, proportioned to their size on this basis.

2. The amount of crook permissible in No. 1 Common and Better Drop Siding may be as follows:

3. Sixteen-foot lengths as a basis for 4-inch widths, 3-inch crook.

4. Sixteen-foot lengths as a basis for 6-inch widths, 2½-inch crook.

5. Lengths longer or shorter than 16 feet may have a proportional amount of crook.

6. In all grades of Drop Siding wane on the reverse side, not exceeding one-third the width and one-sixth the length of any piece is admissible, providing the wane does not extend into the tongue.

"A" Drop Siding.

1. "A" Drop Siding must be practically free from defects on the face side and well manufactured.

2. Slight roughness in dressing admissible.

3. A piece 14 feet or longer may have one defect located 4 feet or more from the end that can be cut out by wasting not more than 1½ inches of the length, provided balance of piece be practically free from other defects.

"B" Drop Siding.

1. "B" Drop Siding will admit any two of the following defects: Medium torn grain, three pin knots, one standard knot, 15 per cent. sap stain, 15 per cent. firm red heart, small seasoning checks, six pin worm holes or any one of the above defects combined with either three small pitch pockets or one small pitch streak.

2. A piece that is otherwise as good as "B" grade may have a defect that can be cut out by wasting not more than 2½ inches in the length of the piece, providing the defect is 4 feet or more from the end.

No. 1 Drop Siding.

1. No. 1 Common Drop Siding will admit numerous small or several medium or one large pitch pocket, one standard pitch streak and in addition sound knots not over one-half the width of the piece in the rough, a couple of small knot holes, pin worm holes or a few well scattered grub worm holes, sap stain, firm red heart, slight shake, heavy torn grain, seasoning checks that do not show an opening through, defects in manufacturing that will lay without waste. A very serious combination of above defects not permissible in any one piece.

2. Pieces otherwise as good as "B" Drop Siding may have one defect (like a knot hole) that can be cut out by wasting 2½ inches of the length of the piece, provided both pieces are 16 inches or over in length after cutting out such defects.

No. 2 Common Drop Siding.

No. 2 Common Drop Siding admits of all pieces not as good as No. 1 Common that can be used without waste of more than one-fourth the length of any one piece.

Bevel Siding.

Bevel Siding shall be graded according to the rules for Drop Siding and will admit in addition slight imperfections on the thin edge, which will be covered by the lap when laid 2½ and 4½ inches to the weather.

Rustic Siding.

Rustic Siding shall be graded according to the rules for Drop Siding.

FLOORING.

Special.

1. Defects named in Flooring are based upon a piece manufactured from 1x4—12 feet long, and pieces larger or smaller than this will take a greater or lesser number of defects proportioned to their size on this basis, except that standard knots shall not exceed 1¼ inches in diameter in 3-inch flooring.

2. The amount of crook permissible in No. 1 Common and Better Flooring may be as follows:

3. Sixteen-foot lengths as a basis for 3-inch widths, 3½-inch crook.

4. Sixteen-foot lengths as a basis for 4-inch widths, 3 -inch crook.

5. Sixteen-foot lengths as a basis for 6-inch widths, 2½-inch crook.

6. Lengths longer or shorter than 16 feet may have a proportionate amount of crook.

7. Standard Matched Flooring to be surfaced two sides with scored back.

8. Center Matched Flooring (S2S and C. M.) shall be required to come up to grade on one side only, and the defects admissible on the reverse side of standard match shall be allowed.

GRADES A, B, C, D, AND No. 1 COMMON EDGE OR VERTICAL GRAIN.

GRADES A, B, C, D, No. 1 COMMON, No. 2 COMMON, No. 3 COMMON OR No. 3 SHEATING, FLAT GRAIN.

Grade "A" Edge Grain Flooring.

Admits no piece in which angle of the grain exceeds 45 degrees from vertical at any point. This grade shall be well milled on face, must have perfect edges and be practically free from all defects on the face side. Bright sap showing not more than one-third of face half the length of piece will be admitted.

Grade "B" Grain Flooring.

Admits no piece in which angle of the grain exceeds 45 degrees from vertical at any point. This grade will admit any two of the following or their equivalent of combined defects: Five per cent. sap stain, 15 per cent. firm red heart, three pin knots, one standard pitch streak, slight torn grain, small seasoning checks.

Grade "C" Edge or Vertical Grain Flooring.

1. Admits no piece in which angle of the grain exceeds 45 degrees from vertical at any point. This grade will admit any two of the following defects or their equivalent or combined defects. Fifteen per cent. sap stain, 25 per cent. firm red heart, six pin knots, two standard knots, small pitch pockets, two standard pitch pockets, two standard pitch streaks, twelve pin worm holes, slight shake that does not go through, seasoning checks that do not show an opening through, medium torn grain or other machine defects that will lay without waste.

2. A piece 12 feet or longer otherwise as good as "B" may have a defect that can be cut out and the piece laid with a loss of not more than 2½ inches in its length, providing the defect is 4 feet or more from the end of the piece.

Grade "D" Edge or Vertical Grain Flooring.

1. Admits no piece in which angle of the grain exceeds 45 degrees from vertical at any point. This grade will admit the following defects or their equivalent of combined defects: Sap stain, firm red hearts, sound knots not over one-half the cross-section of the piece in the rough and any one point throughout its length, three pith knots, pitch, pitch pockets, a limited number of pin worm holes, well scattered, shake that does not show an opening through, loosened or heavy torn grain or other machine defects that lay without waste.

2. Pieces otherwise as good as "B" Flooring may have one defect (like a knot hole) that can be cut out by wasting 20 inches of the length of the piece, provided both pieces are 16 inches or over in length after cutting out such defects.

3. It is generally understood that this grade will admit such defects or combination of defects as will not impair its utility for cheap floors.

4. No. 1 Common Flooring is the combined grade of C and D Flooring and will admit all pieces that will not grade "B" and are better than No. 2 Common Flat Grain Flooring.

5. Flat Grain Flooring shall take the same inspection as Edge or Vertical Grain, except as to requirement of angle of the grain.

No. 2 Common Flooring.

1. Admits all pieces that will not grade as good as "D" Flooring that can be used for cheap floors without waste of more than one-fourth the length of any one piece.

2. Pieces of flooring having not less than 1/8 inch tongue will be admitted in No. 2 Common.

No. 3 Common or No. 3 Sheathing.

Admits all pieces that cannot be used as No. 2 Common Flooring but are still available as cheap sheathing or lathing without waste of more than one-fourth the length of any one piece.

Ceiling.

1. Defects in Ceiling are based upon a piece manufactured from 1x4—12 feet long and pieces larger or smaller than this will take a greater or lesser number of defects, proportionate to their size on this basis.

2. The amount of crook permissible in No. 1 Common and Better Ceiling may be as follows:

3. Sixteen-foot lengths as a basis for 3-inch widths, 3½-inch crook.

4. Sixteen-foot lengths as a basis for 4-inch widths, 3 -inch crook.

5. Sixteen-foot lengths as a basis for 6-inch widths, 2½-inch crook.

6. Lengths longer or shorter than 16 feet may have a proportionate amount of crook. In all grades of Ceiling wane on the reverse side, not exceeding one-third the width and one-sixth the length of any piece is admissible providing the wane does not extend into the tongue.

7. Ceiling may be specified either as Edge or Vertical Grain or Flat Grain. The inspection will be the same for either kind.

"A" Ceiling.

"A" Ceiling must be practically free from defects on the face side, well manufactured, will admit of slight roughness in dressing, through close pitch pockets, each not to exceed 2 inches in length, or one sound and tight smooth pin knot, or the equivalent of combined defects.

"B" Ceiling.

1. "B" Ceiling will admit of any two of the following defects or their equivalent of combined defects: Slight torn grain, three pin knots, two small or one standard knot, three small pitch pockets, any two of which may be open, one standard pitch pocket, one small pitch streak, small seasoning checks, 15 per cent. sap stain, 15 per cent. firm red heart, six pin worm holes.

2. A piece otherwise as good as No. 2 may have a defect that can be cut out and the piece laid with a waste of not more than 2½ inches in length, providing the defect is 4 feet or more from the end of the piece.

No. 1 Common Ceiling.

1. No. 1 Common Ceiling will admit the following defects or their equivalent of combined defects: Heavy torn grain, sound knots not over one-half the cross-section of the piece in the rough, pitch, pitch pockets, seasoning checks that do not show an opening through, a sap stain, firm red heart, slight shake, defects in manufacture that will lay without waste, a limited number of pin worm holes well scattered.

2. Pieces otherwise as good as "B" Ceiling may have one defect (like a knot hole) that can be cut by wasting 2½ inches of the length of the piece, providing both pieces are 10 inches or over in length after cutting out such defects.

No. 2 Common Ceiling.

1. No. 2 Common Ceiling admits of all pieces not as good as No. 1 Common that can be used without waste of more than one-fourth the length of any one piece.

2. Pieces of Ceiling having not less than 1/8 inch tongue, will be admitted in No. 2 Common.

Partition.

Grades "A," "B," No. 1 Common and No. 2 Common. Partition shall be graded according to Ceiling rules and must meet the requirements of the specified grades on the face side only, but the reverse side shall not be more than one grade lower, and shall not cause waste in No. 1 Common and Better.

Specifications for Construction Oak.

General Instructions.

Those who are not familiar with the anatomy of the oak tree should, when reading over these rules, take into consideration that the rule describes the poorest piece that goes into the grade and that a large per cent. is above the grade described.

Definition of Oak for Construction Purposes.

1. The term "Construction Oak" means all such products of oak in which the strength and durability of the timber is the controlling element in its selection and use. The following is a list of products which are recommended for consideration as "Construction Oak."

2. Firsts are to be sound and free from heart shakes and checks, but may have other defects as follows:

Construction Oak.

Trestle and Bridge Timbers.—Mud Sills, Stringers, Caps, Posts, Bracing, Bridge Ties, Struts, Guard Rails, Girts, Sash and Sway Braces.

Docking and Platform Timbers.—Mud Sills, Posts, Bracing Caps, Stringers, Joists, Dock and Platform or Flooring Plank and Wales.

Platform or flooring plank can be either square-edged or matched.

Framing for Building.—Mud Sills, Posts, Girders, Framing Joists, etc.

Bridge and Crossing Plank.—Railroad Crossing Plank, Bridge Floor Planking.

Sheet Piles.—Same as Crossing Plank, except may contain an unlimited amount of heart.

Round Piling.

Stock Guards.

Track or Bumper Posts.

Standard Names for Construction Oak.

Unless specifically mentioned, the terms "White Oak" and "Red Oak" include the following:

"White Oak."	"Red Oak."
White Oak	Red Oak
Chestnut or Tanbark Oak	Pin Oak
Burr or Mossy Cup Oak	Black Oak
Rock Oak	Water Oak
Post or Iron Oak	Willow Oak
Overcup Oak	Spanish Oak
Live Oak	Turkey Oak
Basket or Cow Oak	Black Jack or Barn Oak
Swamp Post Oak	Shingle or Laurel Oak
Yellow or Chinquapin Oak	Scarlet Oak

The term "Mixed Oak" means any kind of oak.

Specifications for Structural Oak Timbers.

General Requirements.

(1) Except as noted, all Structural Timbers shall be White Oak, to be sound timber and sawed specified sizes, free from ring shakes, crooked grain, rotten knots, large knots in groups, rot, dote, wane in amounts greater than allowed in these specifications.

Boxed Hearts.

(2) Boxed Hearts are permitted in pieces of 5 by 5 inches square and larger. The center of the heart should be boxed as near the center of the piece as practical, and not to exceed 30 per cent. of the pieces can have the center of the heart nearer than 1½ inches from any face; 20 per cent. may show one heart face, corner or edge, not to exceed 75 per cent. of the length of the piece.

Wane.

1. The term 20 per cent. of number of pieces or amount shipped refers to each item and size of each car shipped.

2. Pieces 5x5 to 8x8 inches square may show 1 inch wane, side measurement, on any two corners or edges, and this wane not to exceed more than 25 per cent. of the length of the piece singly, or 50 per cent. in aggregate. In the absence of wane on all corners excepting one, the one corner may contain wane 50 per cent. of the length of the piece as above described; not to exceed 20 per cent. of number of pieces may have this defect.

3. Pieces over 8x8, including 12x12 inches square, may show 1½ inch wane, side measurement, edge of any two corners or edges, and this wane not to exceed more than 33⅓ per cent. of the length of the piece singly or 66⅔ per cent. in aggregate. In the absence of wane on all of the length of the piece as above described, not to exceed 20 per cent. of the number of pieces may have this defect.

4. Pieces over 12 by 12 inches square may show 1¾ inch side measurement, any two corners or edges, and this wane not to exceed more than 40 per cent. of the length of the piece singly, or 80 per cent. in aggregate, in the absence of wane on all corners, excepting one, the corner may contain wane 80 per cent. of the length of the piece as above described; not to exceed 20 per cent. of number of pieces may have this defect.

5. In event that pieces have two faces as wide as above described and two faces narrower, the proportion of the amount of wane is admissible.

6. Pieces 1 inch to 5 inches thick, not exceeding 8 inches wide, are governed by defect specifications above mentioned, with the exception that they shall not contain wane, and not to exceed 20 per cent. of pieces 2 inches and thicker may show sound heart on one face; pieces under 2 inches thick must be free of heart. Pieces 8 inches and wider may contain wane as per paragraphs b and d.

7. Rough sizes of Structural Timber shall not vary more than ¼ inch from specified size. Dressed sizes shall be ½ inch less than nominal size after dressing.

Bridge, Dock, Crossing Plank.

1. Lengths, cut to order.
   Widths, cut to order.
   Thickness, cut to order.

2. Sizes cut to order, probably 2 inches, 3 inches and 4 inches thick, 6 inches, 8 inches, 10 inches and 12 inches wide, 12 feet, 14 feet and 16 feet long.

3. This product is intended to work full one good sound face, and this face side must be square edge. Sound knots, small pin and spot worm holes no defect on face side.

4. Must be free from rot and shake; practically square edges, admitting 1 inch of wane on each edge of reverse face, running two-thirds the length. Sound hearts on one side, rafting pin holes, knot holes or grub holes not exceeding 2 inches in diameter admitted.

Sheet Piles.

Same as Ties, except that it may contain sound heart in heart check.

Stock Guards.

To be governed by specifications for Construction Oak.

Track End or Bumping Posts.

To be governed by specifications for Structural Timbers.

Classification and Grading Rules for Cypress Lumber and Shingles.

General Instructions.

Cypress lumber shall be graded according to the following rules and specifications, bearing in mind that as no arbitrary set of rules and specifications can be maintained in every case each must be left to the common sense and best judgment of the inspector.

1. Lumber shall be manufactured and shipped in standard lengths and thickness.

2. Tank, 1st and 2d and worked partition shall be graded from the poorer side.

3. Select lumber, flooring, ceiling, bevel siding and finishing shall be graded from the better or finished side, but the reverse side should in no case be more than one grade lower.

4. All lumber shall be tallied surface or face measure, the tally counted up, and the one-quarter or one-half added to the total where the lumber is one and one-quarter or one and one-half inches thick, and 2 inches and thicker to be multiplied by the thickness.

5. In the measurement of all lumber, fractions exactly on the one-half foot are to be given alternately to the buyer and seller; the fractions below the one-half foot are to be dropped, and all fractions above one-half foot are to be counted to the next higher figure on the board rule.

6. In "line boards," pieces 14 feet and longer shall be given the advantage in grade; pieces 12 feet and shorter shall be reduced in grade.

7. Recognized defects in cypress are knots, knot holes, shakes, splits, wane, wormholes, stained sap and peck.

Standard Lengths.

1. Random standard length stock may be furnished in odd as well as even foot lengths, but there shall not be to exceed 20 per cent. of odd lengths in any one item.

2. Tank stock and No. 1 barn shall be 8 feet and longer.

3. 1st and 2d and select shall be 10 to 20 feet.

4. Finish flooring, ceiling partition, bevel and drop siding shall be 10 to 20 feet.

5. Moldings and battens of all sizes 6 to 20 feet, in both odd and even foot lengths, but not exceeding 10 per cent. of 6, 7, 8 and 9 foot lengths.

6. No. 2 barn, 6 feet and longer.

7. Cull or peck, 4 feet and longer.

Standard Finished Sizes of Cypress.

1. Lumber shipped in the rough (except 8/4 inch No. 1 and No. 2 "Dimension," which grades may be ¼ inch under or ¼ inch over the size specified, both in thickness and width) shall be of sufficient thickness to S2S to standard thickness, as follows:

2. 4/4 Lumber S1S or S2S shall be 13/16 inch thick.

3. 5/4 Select, 1st and 2d clear, selected common tank and tank lumber S1S or S2S, shall be 1⅛ inches thick.

4. 6/4 Select, 1st and 2d clear, selected common tank and tank lumber S1S or S2S, shall be 1⅛ inches thick.

5. 6/4 Peck, No. 1 and No. 2 barn and finishing lumber S1S or S2S shall be 1 5/16 inches thick.

6. 8/4 Lumber, except No. 1 and No. 2 barn dimension S1S or S2S, shall be 1¾ inches thick.

7. 8/4 No. 1 and No. 2 barn or dimension S1S or S2S, shall be 1⅝ inches thick.

8. 10/4 Lumber S1S or S2S, shall be 2¼ inches thick.

9. 12/4 Lumber S1S or S2S, shall be 2¾ inches thick.

10. All lumber S1E takes off ⅛ inch. S2E, ½ inch.

11. All flooring shall be S2S and CM.

12. 4/4 Flooring shall be 13/16 inch by 2¼ inch, 3¼ inch, 4¼ inch, 5¼ inch face.

13. 5/4 Flooring shall be 1 1/16, 6/4 shall be 1 5/16, by same widths as 4/4.

14. 3/8 Ceiling shall be worked 5/16 inch, S1S only.

15. 1/2 Ceiling shall be worked 7/16 inch, S1S only.

16. 5/8 Ceiling shall be worked 9/16 inch, S1S only.

17. 3/4 Ceiling shall be worked 11/16 inch, S1S only.

18. Widths of ceiling to be same as flooring, unless otherwise specified. Ceiling up to ¾ inch face to have one bead on one edge and ceiling wider than 3¼ inch face to be beaded center and edge.

19. Partition to be finished the same as ceiling, but on both faces.

20. Drop siding shall be worked ¾ inch by 3¼ inch, 4½ inch, 5¼ inch, 7¼ inch, 9¼ inch face, S2S and CM or shiplapped.

21. Bevel siding or bevel cribbing shall be worked ½ inch less in width than the rough strip measure.

Tank Stock.

1. Shall be random widths, and will not be furnished in specified widths, and shall be graded from the poorer side.

2. Shall be 5 inches and wider, 1½ inches to 4 inches thick and 8 feet and over in length. Pieces up to 7 inches shall be free from sap. Pieces 7 inches to 13 inches may have one inch of sound sap on one edge, not to exceed half the length and half the thickness of the piece. Pieces 14 inches and wider may have 1 inch of sound sap on both edges not to exceed half the length and half the thickness of the piece. In all widths sound knots that do not impair usefulness for tank purposes may be admitted.

First and Second Clear.

1. Shall be random widths, and will not be furnished in specified widths, and shall be graded from the poorer side.

2. Shall be 8 inches and wider, 1 inch to 4 inches thick and 10 feet and over in length. Pieces 8 to 10 inches may have 1 inch of bright sap on each edge, or its equivalent on one or both edges, otherwise they must be clear. Pieces 10 inches and under 12 inches may have 1½ inches of bright sap on each edge or 3 inches on one edge, and may have one standard knot or its equivalent. Pieces 12 inches wide may have 2 inches of bright sap on each edge, or 4 inches on one edge and may have one standard knot; or, in lieu of sap, may have two standard knots or their equivalent. Pieces wider than 12 inches may admit of defects as specified above in proportion as width increases. Pieces 10 inches and wider may admit of one end split, which shall not exceed in length the width of the piece. Pieces 12 inches and less in width, free from other defects, may have bright sap across one face at one end, but this sap shall not exceed in length one-tenth of the length of the piece. In pieces 13 inches and wider bright sap is not a defect.

Selects.

1. Shall be random widths, and will not be furnished in specified widths, and shall be graded from the better side, but the reverse side shall not be of a lower grade than No. 1 shop or No. 1 barn.

2. Shall be 7 inches and wider, but will not be furnished wider than 12 inches; shall be 1 inch to 4 inches thick, 10 feet and longer. Pieces 10 inches and under in width shall admit two standard knots or their equivalent and an additional standard knot or its equivalent for every two inches in width over 10 inches. Pieces free from other defects, 10 inches and over in width, to admit pin wormholes on one edge one-tenth the width of the piece. Bright sap is not a defect in this grade. Slight wane on pieces 10 inches and over in width is allowed on one edge not over 3 feet in length. When no other defect appears, slight amount of stained sap may be allowed. Pieces 10 inches and wider may admit of one end split, which shall not exceed in length the width of the piece.

Selected Common Tank Stock.

Shall be 4 inches wide, or wider, 1½ inches and 2 inches thick, 8 feet and over in length. Sound sap no defect in this grade, but must be free from unsound knots or other defects that extend through the thickness of the piece, and must be square edged to work the full length of the piece.

No. 1 Barn or Dimension.

Shall be specified widths only, shall be 3 inches and wider, 1 inch and thicker, 8 feet and over in length, admitting sap, bright or stained, shake, season checks, knots, pin wormholes a small amount of peck on one side and one edge, or very slight peck on both sides and both edges of pieces comparatively free from coarse defects; which defects, however, shall not be sufficient to seriously impair the strength, or prevent the use of each piece for "common" purposes in its full length and full width.

No. 2 Barn or Dimension.

Shall be specified widths, 3 inches and wider, 1 inch and thicker, 6 feet and over in length, admitting all the defects allowed in No. 1 barn, but same may be larger and coarser, and in addition will admit peck on both sides; however, the defects shall not be sufficient to prevent the use of each piece in full length and full width for low-grade fencing and other very common purposes.

Cull or Peck.

May be random or specified widths 3 inches and wider, 1 inch to 4 inches thick, 4 feet and over in length. Shall admit all pieces below the grade of No. 2 boxing, and shall also admit the product of that part of the log known as "pecky;" however, each piece shall have sufficient strength and nailing surface to permit its use as a low-grade boxing, crating, sheathing and foundation material.

Finishing.

1. Shall be specified widths 4 inches and wider, 1 inch to 2 inches thick, 10 feet and over in length, and shall be graded from the better side, A, B and C, but the reverse side should not be more than one grade lower. All grades of finish, rough or S1S or S2S may vary ¼ inch from the width specified.

2. "A" Finish.—Pieces 4 inches and 5 inches wide shall be clear of sap, knots and other defects. Pieces 6 inches wide may have 1 inch of bright sap, or, in lieu of sap, one small sound knot. Pieces 7 inches and 8 inches wide may have 2 inches of bright sap, or, in lieu of sap, one small sound knot. Pieces 9 inches and 10 inches wide may have 3 inches of bright sap, or, in lieu of sap, two small

sound knots, or 1½ inches of bright sap and one small sound knot. Pieces 12 inches wide may have 4 inches of bright sap, or, in lieu of sap, one standard knot, or two small sound knots, or two inches of bright sap and one small sound knot. Pieces 14 inches or wider may have more defects in proportion as the width increases.

3. "B" Finish.—Pieces 4 inches, 5 inches and 6 inches wide may have 2 inches of bright sap and one or two small sound knots, or in lieu of knots may have all bright sap. Pieces 7 inches and 8 inches wide may have 3 inches of bright sap and two small sound knots, or in lieu of knots may have all bright sap. Pieces 9 inches and 10 inches wide may have 4 inches of bright sap and one standard knot or three small sound knots, or in lieu of knots may have all bright sap. Pieces 12 inches wide may have 6 inches of bright sap and one standard or four small sound knots, or in lieu of knots may have all bright sap. This grade will not be furnished wider than 12 inches.

4. "C" Finish.—All widths in this grade shall admit small sound knots, stained sap, pin worms and other defects except shake; but none that will prevent the use of same in its full width and length as a paint grade, and will admit pieces containing one coarse defect which can be removed by making two cuts with a waste of not to exceed 5 per cent. in the one piece removed, but which pieces are otherwise "B" grade or better. This grade will not be furnished wider than 12 inches.

5. "D" Finish.—All widths will admit sound knots, stained sap, pin worms, slight shakes and other defects; but none that will prevent the use of same in its full width and length as a common paint grade. This grade will not be furnished wider than 12 inches.

Siding.

1. Siding shall be 4 inches and 6 inches in width, 10 feet to 20 feet in length, and graded from the finished side, A, B, C and D.

2. "A" Siding.—May have one inch of bright sap on thin edge and may contain one small sound knot.

3. "B" Siding.—May have any amount of bright sap, or, if not all bright sap, may have three small sound knots, shake, split or pin worm holes not exceeding in damage the three small knots as above, and may have slight wane on the thin edge. In the absence of other defects a small amount of stained sap will be permitted.

4. "C" Siding.—May have one to 5 knots, the whole not aggregating over 3 inches in diameter, or knots, splits or other defects that can be removed in two cuts with waste not exceeding 10 per cent. of the length, or may have small amount of stained sap and pin worm holes not exceeding in damage the five small knots above described.

5. "D" Siding.—May have stained sap and pin worm holes, or may have other defects that will not cause a waste to exceed one-third the piece.

Flooring and Ceiling.

1. Shall be specified widths, 10 feet to 20 feet in length and graded from the finished side, or, if both sides are finished, it shall be graded from the better side, A, B, C and D.

2. "A"—May have bright sap on one edge one-fourth its width, otherwise must be clear.

3. "B"—May have one-half of its face bright sap if otherwise clear, or, in lieu of sap, may contain two small sound knots, or may have a split not to exceed 9 inches at one end.

4. "C" (10 to 20 feet)—May have all bright sap, or may have one to five knots, the whole not aggregating over 3 inches, or knots or other defects that can be removed in two cuts with waste not exceeding 10 per cent. of the length, or may have three pin worm holes, or may have check or split at one end, not to exceed 10 per cent. of the length.

5. "C" (4 to 9 feet)—May have all bright sap, small sound knots, stained sap, pin worm holes and other defects except shake, but none that will prevent the use of each piece the full length.

6. "D"—May have stained sap and pin worm holes, or may have unsound knots or other defects that will not cause a waste to exceed one-third the piece.

Partition.

Shall be same widths and lengths as floooring and ceiling, but shall be graded from the poorer side, A, B, C and D, same grading to apply as in flooring and ceiling.

Pickets.

1. Shall be graded No. 1 and No. 2.

2. 1 inch by 1 inch shall be Headed and S4S. to $\frac{13}{16}$ inch by $\frac{13}{16}$ inch.

3. 1¼ inches by 1¼ inches shall be Headed and S4S to $1\frac{3}{16}$ inches by $1\frac{3}{16}$ inches.

4. 1½ inches by 1½ inches shall be Headed and S4S to $1\frac{3}{16}$ inches by $1\frac{3}{16}$ inches.

5. 1 inch by 3 inches shall be Headed and S4S to ¾ inch by 2½ inches.

6. No. 1—Shall be well manufactured, bright sap no defect, and may contain one small sound knot.

7. No. 2—Shall admit stained sap, sound knots, pin worm holes, slight shake, and pickets thrown out of the No. 1 grade because of poor manufacture.

Battens.

1. Battens, both flat and OG, are not moldings. Same are invariably used with "common" lumber and shall, therefore, be graded No. 1 barn and better, admitting all defects allowed in No. 1 barn, but none that will prevent the use of each piece in full length for batten pur-

poses. Three-eighths-inch battens shall be 1 inch strips S2S to 13/16 inch by 2½ inches and resawed, or 1 inch by 2¾ inches to 3 inches S2S and resawed. Unless otherwise specified, ⅜-inch or flat battens shall be S2S only and resawed.

2. OG battens shall be manufactured in the sizes and pattern shown in the Universal Molding Book.

Shingles.

1. **Bests.**—A dimension shingle, 4, 5 and 6 inches in width, 16 inches long, each width packed separately, 5 butts to measure 2 inches, to be all heart and free of shake, knots and other defects.

2. **Primes.**—A dimension shingle, 4, 5 and 6 inches in width, 16 inches long, each width packed separately, 5 butts to measure 2 inches, admitting tight knots and sap, but free of shake and other defects, but with no knots within 8 inches of the butts.

3. This grade may contain shingles clipped two-thirds of the width and one-eighth of the length on the point.

4. **Star-a-Star.**—A random width shingle, 3 inches and wider, 14 inches to 16 inches long, otherwise the same as primes.

5. **Economy.**—Dimensions, 4, 5 and 6 inches, each width separately bunched, admitting sap and sound knots; may have slight peck 5 inches from butts, imperfections on points no objection and admitting 14-inch shingles.

6. **Clippers.**—All shingles below the above grades which are sound for 5 inches from butts, wormholes and slight peck excepted, random widths 2½ inches and wider.

7. The count of manufacture of shingles, of all grades, is based on 4,000 linear inches in width, making 1,000 standard shingles, consequently there would be only 667 6-inch shingles packed and counted as 1,000 standard shingles; 5 inches dimension being counted in like proportion.

8. In making re-inspection of shingles, one bundle out of 20 bundles, taken at random, shall be cut open, the results of this investigation to form the basis of arriving at the grade of the entire shipment.

Classification and Grading Rules for Hemlock Lumber.

Sap.

White or bright sap shall not be considered a defect in any of the grades provided for and described in these rules, except where stipulated.

Water Stain.

In hemlock will often be found streaks or patches of red or brown discolorations, sound and firm, the presence of which does not weaken the wood, nor detract seriously from its utility. Water stain should not be confused with rot, being firm and strong, while rot is soft and leaves wood

Standard Sizes for Hemlock.

Rough Lumber.

Piece Stuff.

Standard lengths for Rough Piece Stuff are 4, 6, 8, 9, 10, 12, 14, 16, 18, 20, 22 and 24 ft. Standard widths are 4, 6, 8, 10 and 12 inches. Standard thickness is 1⅞ inches.

Boards.

Standard lengths for Rough Boards are 4, 6, 8, 10, 12, 14, 16, 18 and 20 ft. Standard widths are 4, 6, 8, 10 and 12 inches. Standard thickness is 13/16 inch.

Dressed Lumber.

Piece Stuff.

Standard sizes for Piece Stuff S1S1E are: 1¾x3¾, 1¾x5¾, 1¾x7¾, 1¾x9¾, 1¾x11¾.

Boards.

The standard thickness for inch lumber S1S is 13/16 inch.

Flooring, Ceiling, Shiplap, Drop Siding.

Standard widths are: 3¼, 5¼, 7¼, 9¼ and 11¼ in. face. Standard thickness is 13/16 in.

Estimated Weights of Hemlock Lumber.

Per M Feet, Shipping Dry

3 in. Plank, Rough	3,000
3 in. Plank and 4x4 to 8x8, S1S1E	2,700
3 in. Plank, S4S or D & M	2,500
4x10 to 12x12, Rough	3,500
4x10 to 12x12, S1S1E	3,200
4x4 to 8x8, Rough	3,000
Thick D & Better, S1S	2,500
Thick D & Better, S1S1	2,200
2 in. Piece Stuff, S1S1E	2,200
2 in. Piece Stuff, Rough or S1E	2,500
2 in. Piece Stuff, S4S or D & M	2,000
1 in. Boards, Rough	2,400
1 in. Boards, S1S or S2S	2,000
1 in. Clear and Select, S1S	2,000
Shiplap, D & M, or Drop Siding	1,800
1x6 Well Tubing, Beveled Edges	1,800
Sheathing Lath	1,500
Lath	500
32 in. Lath	300

Grading Rules.

Thick D and Better.

1. Thick D and Better shall be 4 in. wide and wider, 1¼ in., 1½ in. and dimension thickness.

2. This grade shall have sound, square edges, and be of grade of Inch D Stock and Better on the face side, and not below the grade of Inch No. 1 Common on the back of the piece.

Boards and Strips.

There are six grades made in Boards and Strips:

Inch Clear and Select.	No. 2 Common.
Inch D Stock.	No. 3 Common.
No. 1 Common.	No. 4 Common.

Inch Clear and Select.

1. Inch Clear and Select should be 4 in. and wider, and 8 ft. long and longer, not to exceed 10 per cent. 8 ft. long.

2. This grade is especially adapted for interior finish and only the face, or best side, is expected to show, although some attention should be given to the back of the piece.

3. The face shall show no wane, but the back may show such an amount of wane or other defects as will not interfere with the use of the piece for finishing purposes.

4. No shake or season check shall be allowed on the face side, but a very little tight shake and checks that are not deep may appear on the back of the piece.

5. This grade will admit on the face side several tight pin knots not over ⅛ in. in diameter. In a 4 or 6 in., 12 ft. and longer piece, not more than three knots are admissible, and proportionately more in a wider piece.

6. A 10 or 12 in. piece, 12 ft. and longer, will not admit of more than three sound, firmly set knots, not to exceed ¾ in. in diameter. Narrower and shorter pieces will admit of fewer large knots, but not a combination of large knots and other defects.

7. Pieces 12 ft. and longer are admissible that will, with not more than 10 per cent. of waste, produce two clear cuts, each four feet long or longer.

Inch D Stock.

1. Inch D Stock shall consist of Boards and Strips below the grade of Clear and Select 4 in. and wider, and 8 ft. long and longer, not to exceed 10 per cent. 8 ft. long, and must be of a sound and water-tight character.

2. All knots must be sound and firmly set. Red knots must not exceed 1¼ in. in diameter, and spike knots must not exceed in length one-fourth the width of the piece. Black knots must not exceed ¾ in. in diameter, and must be especially well set.

3. A 6-in. strip 12 ft. long shall not contain more than three defects of the extreme sizes. A wider or longer piece may contain relatively more of these defects, and narrower and shorter pieces relatively less. The general appearance of the piece must be taken into consideration.

4. No shake shall be allowed in this grade, but slight season checks and water stain shall not be considered defects.

5. This grade shall be suitable for sound Drop Siding, Ceiling and Flooring, and shall have a smooth appearance, especially on the edges.

Inch No. 1 Common.

1. The grade of No. 1 Common in Boards or Strips includes stock of a generally sound character.
2. Some shake is admissible.
3. Numerous knots, whether red or black.
4. Some water stain of a firm character.

Inch No. 2 Common.

1. Boards or Strips will admit of considerable shake.
2. Black, unsound knots.
3. Two or three good-sized knot holes, or more of small ones.
4. Streaks, or patches of discoloration, showing partial decay.
5. This grade can be safely recommended for general building purposes.

Inch No. 3 Common.

1. The defects may consist of excessive shake.
2. Very coarse, unsound knots.
3. Some soft rot.
4. Some cross checks.

Inch No. 4 Common.

4 In. and Wider, 4 Feet and Longer.

This grade includes all serviceable lumber below the grade of No. 3.

Piece Stuff or Dimension.

No. 1 Dimension.

1. The grade of No. 1 Dimension will admit of shake that will not materially affect the strength of the piece.

2. Also knots, either black or red, that are well located and fairly sound.

3. Or some slight cross checks or sound water stain.

4. This grade, while admitting the above defects, must at the same time retain the element of strength required for any building purpose.

No. 2 Dimension.

1. The grade of No. 2 Dimension includes stock not good enough to be classed as No. 1, and the defects admissible are of the same gen-

eral character as the defects found in No. 1, except that they are more pronounced.

2. Considerable shake, large unsound knots, loose knots, knot holes and cross checks are all admissible in this grade, but not a serious combination of these defects in any one piece.

Merchantable.

The grade of Merchantable is a combination of No. 1 and No. 2, consisting of approximately 50 per cent of each.

No. 3 Dimension.

1. The defects are excessive shake, numerous knot holes, coarse, rotten knots, or considerable rot.

2. This grade can be recommended for cheap, light construction.

No. 4 Dimension.

2x4 and Wider, 4 Feet and Longer.

This grade includes all serviceable Dimension below the grade of No. 3.

CLASSIFICATION OF THE USES OF LUMBER.

1. Bridge and Construction Timber.

A. Combination and Howe Truss Spans.

1. Compression members.
2. Tension members.
3. Diagonals subject to reversal of stress.
4. Floor beams.
5. Stringers.
6. Ties.
7. Guard timbers.
8. Railing.
9. Stiffeners.
10. Splices.
11. Nailing strips.
12. Grillage.
13. Deck plank.
14. Bridging.

B. Pile and Frame Trestles.

1. Piles.
2. Sills and mud sills.
3. Posts.
4. Caps.
5. Cross bracing.
6. Sash bracing.
7. Longitudinal bracing.
8. Girts.
9. End plank.
10. Stringers.
11. Ties.
12. Guard timbers.
13. Planking for ballasted deck.
14. Railing.

C. Falsework.

1. Piles.
2. Sills and mud sills.
3. Posts.
4. Caps.
5. Stringers.
6. Truss timbers.
7. Centering.
8. Lagging.
9. Bracing.
10. Wedges.
11. Scaffolding.

D. Concrete Forms.

1. Dimension lumber.
2. D. & M. planks.
3. Bracing.

E. Tanks and Supports.

1. Piles.
2. Sills.
3. Posts.
4. Caps.
5. Bracing.
6. Joists.
7. D. & M. flooring.
8. Staves.
9. Rafters.
10. Roof.
11. Ladders, etc.
12. Frost-box material.

F. Docks and Wharves.

1. Piles.
2. Timber sheet piling.
3. Timber in cribs.
4. Caps.
5. Stringers.
6. Bracing.
7. Guard timber.
8. Ties.
9. Plank decking.
10. Mooring posts.
11. Fenders and wales.
12. Warehouse. (See II.)

G. Coaling Stations and Ore Stations.

1. Piles.
2. Sills and mud sills.
3. Posts.
4. Caps.
5. Bracing.
6. Stringers.
7. Joists.
8. Bin lining.
9. Rafters.
10. Flooring.
11. Chutes.
12. Decking.
13. Coal pockets or bins.
14. Roofing.

2. Frame Buildings.

A. Station Buildings, Passenger, Freight, Platform Shelters.

1. Piles.
2. Caps.
3. Sills.
4. Posts.
5. Stringers.
6. Joists.
7. Bridging.
8. Sub-flooring.
9. Finish flooring.
   (a) Pine.
   (b) Fir.
   (c) Maple or oak.
10. Studding and plates.
11. Sheathing.
12. Furring.
13. Siding.

14. Ceiling.
15. Lath.
16. Truss timbers.
17. Purlins.
18. Rafters.
19. Roof boards.
20. Shingles.
21. Door and window frames.
22. Outside finish lumber.
23. Inside finish lumber.
24. Millwork.
    (a) Mouldings.
    (b) Stairs.
    (c) Doors.
    (d) Windows.
25. Partitions.
26. Shelving.

B. Engine House.

1. Piling.
2. Caps.
3. Sills.
4. Posts.
5. Stringers.
6. Joists.
7. Bridging.
8. Flooring.
9. Pit timbers.
10. Studding.
11. Sheathing.
12. Furring.
13. Siding.
14. Ceiling.
15. Lath.
16. Truss timbers.
17. Purlins.
18. Rafters.
19. Roof boards.
20. Shingles.
21. Door and window frames.
22. Outside finish lumber.
23. Inside finish lumber.
24. Millwork.
25. Sleepers.

C. Machine Shops.

1. Piling.
2. Caps.
3. Sills.
4. Posts.
5. Stringers.
6. Joists.
7. Bridging.
8. Flooring.
9. Studding.
10. Sheathing.
11. Furring.
12. Siding.
13. Ceiling.
14. Lath.
15. Truss timbers.
16. Purlins.
17. Rafters.
18. Roof boards.
19. Shingles.
20. Door and window frames
21. Outside finish lumber.
22. Inside finish lumber.
23. Millwork.
24. Sleepers.

D. Section Houses.

1. Posts.
2. Sills.
3. Caps.
4. Stringers.
5. Joists.
6. Bridging.
7. Sub-flooring.
8. Finish flooring.
9. Studding and plates.
10. Sheathing.
11. Furring.
12. Siding.
13. Ceiling.
14. Lath.

15. Rafters.
16. Roof boards.
17. Shingles.
18. Door and window frames.
19. Outside finish lumber.
20. Inside finish lumber.
21. Millwork.

E. Miscellaneous Small Buildings.

1. Posts.
2. Sills.
3. Caps.
4. Stringers.
5. Joists.
6. Bridging.
7. Sub-flooring.
8. Finish flooring.
9. Studding and plates.
10. Sheathing.
11. Furring.
12. Siding.
13. Ceiling.
14. Lath.
15. Rafters.
16. Roof boards.
17. Shingles.
18. Door and window frames.
19. Outside finish lumber.
20. Inside finish lumber.
21. Millwork.

F. Warehouses.

1. Piling.
2. Caps.
3. Sills.
4. Posts.
5. Stringers.
6. Joists.
7. Bridging.
8. Sub-flooring.
9. Finish flooring.
10. Studding and plates.
11. Sheathing.
12. Furring.
13. Siding.
14. Ceiling.
15. Lath.
16. Truss timbers.
17. Purlins.
18. Rafters.
19. Roof boards.
20. Shingles.
21. Door and window frames.
22. Outside finish lumber.
23. Inside finish lumber.
24. Millwork.
25. Sleepers.

G. Ice Houses.

1. Piling.
2. Sills.
3. Caps.
4. Posts.
5. Stringers.
6. Joists.
7. Bridging.
8. Sleepers.
9. Sub-flooring.
10. Finish flooring.
11. Studding.
12. Sheathing.
13. Furring.
14. Siding.
15. Ceiling.
16. Lath.
17. Truss timbers.
18. Purlins.
19. Rafters.
20. Roof boards.
21. Shingles.
22. Door and window frames.
23. Outside finish lumber.
24. Inside finish lumber.
25. Millwork.

3. **Ties.**

A. Cross-Ties.

B. Switch Ties.

4. Miscellaneous Roadway Material.

A. Crossing Plank.

B. Platforms.

1. Posts.
2. Caps.
3. Sills.
4. Stringers.
5. Joists.
6. Bridging.
7. Planking.
8. Railing.
9. Steps.
10. Skids.

C. Stock Guards.

1. Posts.
2. Ties.
3. Wing fences and aprons.
4. Slats.
5. Fillers.

D Signs and Posts.

1 Posts.
2. Bracing.
3. Sign boards.
4. Moulding.

E. Fencing, Including Snow Fence.

1. Posts.
2. Bracing.
3. Stringers.
4. Fence boards.
5. Gate material.
6. Stakes.

F. Culverts and Drains.

1. Sills.
2. Bracing.
3. Timbers.
4. Planking.
5. Grillage.

G. Stock Pens.

1. Posts.
2. Sills.
3. Fencing.
4. Studding.
5. Sheathing.
6. Rafters.
7. Roof boards.
8. Shingles.
9. Outside finish lumber.

H. Poles.

I. Conduits.

J. Bumping Blocks.

K. Cross-arms.

COMMITTEE VIII.

MASONRY.

[1] DEFINITIONS.

ABUTMENT.—A supporting wall carrying the end of a bridge or span and generally sustaining the pressure of the abutting earth.

ARCH MASONRY.—That portion of the masonry in the arch ring only, or between the intrados and the extrados.

ARRIS.—The external edge formed by two surfaces, whether plain or curved, meeting each other.

BATTER.—The slope or inclination of the face or back of a wall from a vertical plane.

BENCH WALL.—The abutment from which an arch springs.

CEMENT.—A material of one of the two classes, Portland and natural, possessing the property of hardening into a solid mass when mixed with water.

CEMENT, NATURAL.—Natural cement is the finely pulverized product resulting from the calcination of an argillaceous limestone at a temperature only sufficient to drive off the carbonic acid gas.

CEMENT, PORTLAND.—Portland cement is the product obtained by finely pulverizing clinker produced by calcining to incipient fusion an intimate and properly proportioned mixture of argillaceous and calcareous materials, with no additions subsequent to calcination excepting water and calcined or uncalcined gypsum.

CENTERING.—A temporary support used in arch construction. (Also called centers.)

COPING.—A top course of stone or concrete, generally slightly projecting, to shelter the masonry from the weather, or to distribute the pressure from exterior loading.

CULVERT.—A covered passage for water under a roadway or embankment.

DOWELS.—Metal bars used to connect two sections of masonry. (See definition of "Dowel" under "Stone and Brick Masonry.")

EXTRADOS.—The outer or convex surface of an arch.

FINAL SET.—A stage of the process of setting marked by certain hardness. (See Cement Specifications.)

[1] Adopted, Vol. 7, 1906, pp. 596-601, 619; Vol. 12, Part 1, 1911, pp. 478, 579; Vol. 16, 1915, pp. 794, 1175; Vol. 19, 1918, pp. 721, 1227; Vol. 21, 1920, pp. 84, 1354.

Inspection.

19. The work of erection shall at all times be subject to the inspection and acceptance of the Engineer.

Engineer.

20. The term "Engineer," as used herein, shall be understood to mean the Chief Engineer of the Railway Company, or his accredited representative.

"GENERAL SPECIFICATIONS FOR STEEL RAILWAY BRIDGES

For Fixed Spans Less Than 300 Feet in Length

1920

NOTE.—The purpose of the Committee which wrote these specifications was to formulate specific and detailed rules for the design and manufacture of bridges, as a guide to both the designer and the shop, rather than to confine the specifications to a statement of principles or to limit them to rules defining the duties of the contractor. The intention was to describe the best general practice for standard American and Canadian railways, and to advance somewhat the causes of good design and workmanship. The requirements of light and branch railways and foreign practice have not been considered.

The Clearance Diagram in these specifications is intended to be applied to New Construction Work only. It provides for the future development of motive power to a width of eleven feet.

Information to Be Given Bidders.

		Article
1.	What is the live load to be used?	20
2.	Is the bridge on a tangent or curve?	13
	If on a curve, what is the superelevation of the outer rail and what is the degree of the curve?	
3.	What is the rate and the direction of grade on the bridge?	93
4.	What are the conditions at the site?	2
	Furnish plans showing the general dimensions necessary for designing the structure:	
	Length of spans	
	Types of spans	
	Number and spacing of tracks	
	Angle of skew	
	Type of floor	
	Limiting under-clearance	
5.	Shall the work be "Punched Work" or "Reamed Work?"	206
6.	What size of rivets shall be used?	59
7.	What kind of shop paint will be approved?	269
8.	Will other than two pilot nuts and two driving nuts be required for each size of pin?	256

"Adopted, Vol. 21, 1920, pp. 491, 1414.

(1) Proposals and Drawings.

Definitions of Terms.

1. The term "Engineer" refers to the Chief Engineer of the Company or his subordinates in authority. The term "Inspector" refers to the inspector or inspectors representing the Company. The term "Company" refers to the Railway Company or Railroad Company party to the contract. The term "Contractor" refers to the manufacturing or fabricating contractor party to the contract.

Proposals.

2. Bidders shall submit proposals to conform with the terms in the letter of invitation. The proposals preferably shall be based upon plans and specifications furnished by the Company showing the general dimensions necessary for designing the structure, the stresses and the general or typical details. Invitations covering work to be designed or erected by the Contractor shall state the general conditions at the site, such as track spacing, character of foundations, old structures, traffic conditions, etc.

Drawings to Govern.

3. Where the drawings and the specifications differ, the drawings shall govern.

Patented Devices.

4. The Contractor shall protect the Company against claims on account of patented devices or parts proposed by him.

Drawings.

5. After the contract has been awarded and before any work is commenced, the Contractor shall submit to the Engineer for approval duplicate prints of stress sheets and shop drawings, unless such drawings shall have been prepared by the Company. The tracings of these drawings shall be the property of and be delivered to the Company after the completion of the contract. Shop drawings shall be made on the dull side of the tracing cloth, 24 by 36 inches in size, including margins. The margin at the left end shall be 1½ inches wide, and the others ½-inch. The title shall be in the lower right-hand corner. No changes shall be made on any approved drawing without the consent, in writing, of the Engineer.

6. The Contractor shall be responsible for the correctness of his drawings, and for shop fits and field connections, although the drawings may have been approved by the Engineer.

7. Any material ordered by the Contractor prior to the approval of the drawings shall be at his risk.

(2) General Features of Design.

Materials Used.

8. Structures shall be made wholly of structural steel except where otherwise specified. Cast steel preferably shall be used for

shoes and bearings. Cast iron may be used only where specifically authorized by the Engineer.

Types of Bridges.

9. The different types of bridges may be used as follows:

Rolled beams for spans up to 35 feet.
Plate girders for spans from 30 feet to 125 feet.
Riveted trusses for spans from 100 feet to 300 feet.
Pin-connected trusses for spans from 150 feet to 300 feet.

Number of Trusses.

10. Unless otherwise specified, double-track through bridges shall have only two trusses or girders, and four-track bridges three.

Dimensions for Calculation.

11. The dimensions for the calculation of stresses shall be as follows:

SPAN LENGTH.

For trusses and girders, the distance center to center of end bearings.

For floor beams, the distance center to center of trusses or girders.

For stringers, the distance center to center of floor beams.

DEPTH.

For riveted trusses, the distance between centers of gravity of chord sections.

For pin-connected trusses, the distance center to center of chord pins.

For plate girders, floor beams and stringers, the distance between centers of gravity of flanges, but not to exceed the distance back to back of the flange angles.

Spacing of Trusses, Girders and Floorbeams.

12. The width center to center of girders or trusses shall be not less than one-fifteenth of the effective span, and not less than is necessary to prevent overturning under the assumed lateral loading. Panel lengths shall not exceed 1½ times the width c. to c. of trusses or girders.

Clearances.

13. If the alinement is straight, clearances shall be not less than shown on the diagram, Fig. 1. If the alinement is curved, the width of the diagram shall be increased so as to provide the same minimum clearances for a car 80 feet long, 14 feet high and 60 feet center to center of trucks, allowance being made for curvature and superelevation of rails. The height of rail shall be assumed as 6 inches.

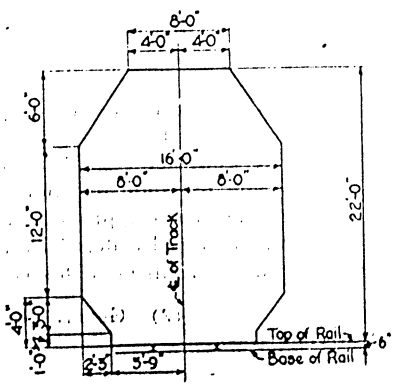


FIG. 1.

Deck Spans on Curves.

14. Deck spans on curves shall have the center line of the span placed, usually, so as to bisect the middle ordinate of and be parallel with the chord of the curve.

Skew Bridges.

15. In skew bridges without ballasted floors, the ends of stringers or girders for each track shall be square with the track.

Ambiguity of Stress.

16. Structures shall be designed so as to avoid, as far as practicable, ambiguity in the determination of the stresses.

(3) Loads

Loads.

17. The structures shall be proportioned for the following loads:

a. The dead load.
b. The live load.
c. The impact or dynamic effect of the live load.
d. The lateral loads and forces.
e. The centrifugal force, including impact.
f. The longitudinal force.

Stresses due to these loads and forces shall be shown separately on the stress sheets.

18. Members shall be proportioned for that combination of stresses which gives the maximum total stress, except as otherwise provided.

Dead Load.

19. The dead load shall consist of the estimated weight of the entire suspended structure. Timber shall be assumed to weigh 4½ pounds per foot B. M., ballast 120 pounds per cubic foot, reinforced concrete 150 pounds per cubic foot, waterproofing 150 pounds per cubic foot, and rails and fastenings 150 pounds per linear foot of track. If ballast is used, it shall be assumed level with the base of rail and the weight of the ties shall be neglected. Ballasted floors shall have at least 6 inches of ballast under the ties.

Live Load.

20. The minimum live load for each track shall be as shown in Figs. 2 and 3, except as modified in Article 21.

The loading that gives the larger stresses shall be used.

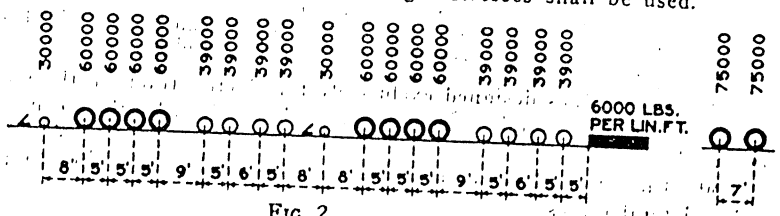


FIG. 2.

21. In special locations, where the conditions limit the loading to light engines, a lighter loading, as stipulated by the Engineer, may be used, but not in any case lighter than three-fourths of that specified in Article 20.

22. Other live loadings shall be proportional to the loading specified in Article 20 with the same wheel spacing.

Multiple Tracks.

23. In calculating the maximum stresses due to live load and centrifugal force when two, three or four tracks are simultaneously loaded, use the following percentages of the specified live load:

For two tracks, loaded, 90 per cent.
For three tracks, loaded, 80 per cent.
For four tracks, loaded, 75 per cent.

Floors.

24. Wooden ties shall be designed for the maximum wheel load specified distributed over three ties and with 100 per cent. impact added. The fiber stress shall not exceed 2,000 pounds per square inch. The ties shall be not less than 10 feet in length. They shall be placed with openings not to exceed 4 inches in width and shall be secured against bunching. The maximum dap of ties shall be 1¼ inches.

25. Floors consisting of beams transverse to the axis of the structure shall be designed for a uniform live load of 15,000 pounds per linear foot for each track, when the minimum live load specified in Article 20 is used. When heavier loadings are used, this uniform load shall be increased proportionately.

26. Floors consisting of longitudinal beams shall be designed for the wheel loads specified.

27. In ballasted floor bridges, the live load shall be considered as uniformly distributed laterally over a width of 10 feet.

Impact.

28. The dynamic increment of the live load shall be added to the maximum computed live load stresses and shall be determined by the formula,

$$I = S \frac{300}{300 + \frac{L^2}{100}}, \text{ in which}$$

I = impact or dynamic increment to be added to the live-load stress.
S = computed maximum live-load stress.
L = the length in feet of the portion of the span which is loaded to produce the maximum stress in the member.

29. For bridges designed exclusively for electric traction, the impact stresses shall be taken as one-half of those given by the formula in Article 28.

30. Impact shall not be added to stresses produced by longitudinal or lateral forces.

Eccentricity of Load on Curves.

31. For bridges on curves, provision shall be made for the increased load carried by any truss, girder or stringer due to the eccentricity of the load.

Lateral Forces.

32. The lateral (or wind) force shall consist of a moving load equal to 30 pounds per square foot on 1½ times the vertical projection of the structure on a plane parallel with its axis (but never less than 200 pounds per linear foot at the loaded chord, and 150 pounds per linear foot at the unloaded chord), and a moving load of 700 pounds per linear foot applied 8 feet above the base of rail.

33. If a moving load of 50 pounds per square foot on 1½ times the vertical projection of the unloaded structure on a plane parallel with its axis produces greater stresses than the lateral force defined in Article 32, it shall be provided for.

34. In calculating the stresses in viaduct towers due to lateral force, the viaduct shall be considered as loaded on either one or both tracks, with empty cars weighing 1,200 pounds per linear foot.

35. The lateral bracing between compression chords or flanges shall be capable of resisting a transverse shear in any panel equal to 2½ per cent. of the total axial stress in the chords in that panel.

Centrifugal Force.

36. On curves, the centrifugal force (assumed to act 6 feet above the rail) shall be taken equal to a percentage of the live load including impact according to the following table:

Degree of Curve	0° 20′	0° 40′	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°
Percentage	2½	5	7½	10	10	10	10	10	10	10	10	10	10	10
Speed in miles per hour	80	80	80	65	53	46	41	38	35	33	31	29	28	27

Longitudinal Force.

37. Provision shall be made in the design for the effect of a longitudinal force of 20 per cent. of the live load on one track only, applied 6 feet above the top of the rail. In structures (such as ballasted deck bridges of only three or four spans) where, by reason of continuity of members or frictional resistance, the longitudinal force will be largely directed to the abutments, its effect on the superstructure shall be taken as one-half that specified above.

(4) Unit Stresses and Proportioning of Parts.

38. The several parts of structures shall be so proportioned that the unit stresses will not exceed the following, except as modified in Articles 46 and 47:

	Pounds per sq. inch
Axial tension, net section	16,000
Axial compression, gross section	$15{,}000 - 50\frac{l}{r}$
but not to exceed	12,500
l = the length of the member in inches.	
r = the least radius of gyration of the member in inches.	
Tension in extreme fibers of rolled shapes, built sections and girders, net section	16,000
Tension in extreme fibers of pins	24,000
Shear in plate girder, webs, gross section	10,000
Horizontal shear in flange angles of girders	4,000
Shear in power-driven rivets and pins	12,000
Bearing on power-driven rivets, pins, outstanding legs of stiffener angles, and other steel parts in contact	24,000

The above mentioned values for shear and bearing shall be reduced 25 per cent. for countersunk rivets, hand-driven rivets, floor-connection rivets, and turned bolts.

Bearing on expansion rollers, per linear inch ..... $600d$

d = the diameter of rollers in inches.

	Pounds per sq. inch
Bearing on granite masonry	800
Bearing on sandstone and limestone masonry	400
Bearing on concrete masonry	600

39. For cast steel in shoes and bearings, the above mentioned unit stresses shall apply.

40. The diagonal tension in webs of girders and rolled beams at sections where maximum shear and bending occur simultaneously, shall not exceed 16,000 pounds per square inch.

Effective Bearing Area.

41. The effective bearing area of a pin, a bolt or a rivet shall be its diameter multiplied by the thickness of the piece, except that for countersunk rivets, half the depth of the countersink shall be omitted.

Effective Diameter of Rivets.

42. In proportioning rivets, the nominal diameter of the rivet shall be used.

Proportioning Web Members.

43. In proportioning web members of trusses, use two-thirds of the dead load stress plus one and one-sixth times the live load stress, including impact, where this sum is greater than the sum of the dead load stress and the live load stress, including impact.

Reversal of Stress.

44. Members subject to reversal of stress under the passage of the live load shall be proportioned as follows:

Determine the resultant tensile stress and the resultant compressive stress and increase each by 50 per cent. of the smaller; then proportion the member so that it will be capable of resisting either increased resultant stress. The connections shall be proportioned for the sum of the resultant stresses.

Combined Stresses.

45. Members subject to both axial and bending stresses (including bending due to floor beam deflection) shall be proportioned so that the combined fiber stresses will not exceed the allowed axial stress. In members continuous over panel points, only three-fourths of the bending stress computed as for simple beams shall be added to the axial stress.

46. Members subject to stresses produced by a combination of dead load, live load, impact and centrifugal force, with either lateral or longitudinal forces, or bending due to lateral action, may be proportioned for unit stresses 25 per cent. greater than those specified in Article 38; but the section shall not be less than that required for dead load, live load, impact and centrifugal force.

Secondary Stresses.

47. Designing and detailing shall be done so as to avoid secondary stresses as far as possible. In ordinary trusses without subpanelling, no account usually need be taken of the secondary stresses in any member whose width measured in the plane of the truss is less than one-tenth of its length. Where this ratio is exceeded, or where subpanelling is used, secondary stresses due to deflection of the truss shall be computed. The unit stresses specified in Article 38 may be increased one-third for a combination of the secondary stresses with the other stresses, but the section shall not be less than that required when secondary stresses are not considered.

Compression Flanges.

48. The gross area of the compression flanges of plate girders and rolled beams shall not be less than the gross area of the tension flanges, but the stress per square inch shall not exceed

$$14{,}000 - 200\frac{l}{b}, \text{ in which}$$

l = the length of the unsupported flange, between lateral connections or knee braces.

b = the flange width.

(5) Details of Design.

Limiting Lengths of Members.

49. The ratio of length to least radius of gyration shall not exceed 100 for main compression members nor 120 for wind and sway bracing.

50. The lengths of riveted tension members shall not exceed 200 times their least radius of gyration.

Depth Ratios.

51. The depth of trusses preferably shall be not less than one-tenth of the span. The depth of plate girders preferably shall be not less than one-twelfth of the span. The depth of rolled beams used as girders and the depth of solid floors preferably shall be not less than one-fifteenth of the span. If less depths than these are used, the section must be increased so that the maximum deflection will not be greater than if these limiting ratios had not been exceeded.

Parts Accessible.

52. Details shall be designed so that all parts will be accessible for inspection, cleaning and painting. Closed sections shall be avoided wherever possible.

Pockets.

53. Pockets or depressions which would hold water shall have efficient drain holes, or shall be filled with concrete.

Eccentric Connections.

54. Members shall be connected so that their gravity axes will intersect in a point. Eccentric connections shall be avoided if practicable, but, if unavoidable, the members shall be proportioned so that the combined fiber stress will not exceed the allowed axial stress.

Effective Area of Angles.

55. The effective area of single angles in tension shall be assumed as the net area of the connected leg plus 50 per cent. of the area of the unconnected leg. Single angles connected by lug angles shall be considered as connected by one leg.

Counters.

56. If web members are subject to reversal of stress, their end connections preferably shall be riveted. Adjustable counters shall have open turnbuckles.

Strength of Connections.

57. Connections shall have a strength at least equal to that of the members connected, regardless of the computed stress. Connections shall be made, as nearly as practicable, symmetrical about the axis of the members.

Limiting Thickness of Metal.

58. Metal shall not be less than 3/8-inch thick, except for fillers. Metal subject to marked corrosive influences shall be increased in thickness or protected against such influences.

Sizes of Rivets.

59. Rivets shall be 3/4 inch, 7/8 inch or 1 inch in diameter, as specified.

Pitch of Rivets.

60. The minimum distance between centers of rivet holes shall be three diameters of the rivet, but the distance preferably shall be not less than 3½ inches for 1 inch rivets, 3 inches for 7/8-inch rivets and 2½ inches for 3/4-inch rivets. The maximum pitch in the line of stress for members composed of plates and shapes shall be 7 inches for 1 inch rivets, 6 inches for 7/8-inch rivets and 5 inches for 3/4-inch rivets. For angles with two gage lines and rivets staggered, the maximum pitch in each line shall be twice the amounts given above. If two or more web plates are used in contact, stitch rivets shall be provided to make them act in unison. In compression members, the stitch rivets shall be spaced not more than 24 times the thickness of the thinnest plate in the direction perpendicular to the line of stress, and not more than 12 times the thickness of the thinnest plate in the line of stress. In tension members, the stitch rivets shall be not more than 24 times the thickness of the thinnest outer plate in either direction. In tension members composed of two angles in contact, a pitch of 12 inches may be used for riveting the angles together.

Edge Distance.

61. The minimum distance from the center of any rivet hole to a sheared edge shall be: 1¾ inches for 1 inch rivets, 1½ inches for 7/8-inch rivets and 1¼ inches for 3/4-inch rivets; to a rolled edge 1½ inches, 1¼ inches and 1⅛ inches, respectively. The maximum distance from any edge shall be eight times the thickness of the plate, but shall not exceed 6 inches.

Size of Rivets in Angles.

62. The diameter of the rivets in any angle whose size is determined by calculated stress shall not exceed one-fourth of the width of the leg in which they are driven. In angles whose size is not so determined 1 inch rivets may be used in 3½ inch legs, 7/8-inch rivets in 3 inch legs, and 3/4-inch rivets in 2½ inch legs.

Long Rivets.

63. Rivets which carry calculated stress and whose grip exceeds four and one-half diameters shall be increased in number at least one per cent. for each additional 1/16-inch of grip. If the grip exceeds six times the diameter of the rivet, specially designed rivets shall be used.

Pitch of Rivets at Ends.

64. The pitch of rivets at the ends of built compression members shall not exceed four diameters of the rivet for a distance equal to one and one-half times the maximum width of the member.

Compression Members.

65. In built compression members, the metal shall be concentrated in the webs and flanges. The thickness of each web shall be not less than one-thirtieth of the distance between the lines of rivets

connecting it to the flanges. The thickness of cover plates shall be not less than one-fortieth of the distance between the nearest rivet lines.

Outstanding Legs of Angles.

66. The width of the outstanding legs of angles in compression (except when reinforced by plates) shall not exceed the following:

a. For stringer flange angles, ten times the thickness.

b. For main members carrying axial stress, twelve times the thickness.

c. For bracing and other secondary members, fourteen times the thickness.

Stay Plates.

67. The open sides of compression members shall be provided with lacing bars and shall have stay plates as near each end as practicable. Stay plates shall be provided at intermediate points where the lacing is interrupted. In main members, the length of the stay plates shall be not less than 1¼ times the distance between the lines of rivets connecting them to the outer flanges, and the length of intermediate stay plates shall be not less than three-quarters of that distance. Their thickness shall be not less than one-fiftieth of the same distance.

68. Tension members composed of shapes shall have their separate segments stayed together. The stay plates shall have a length not less than two-thirds of the lengths specified for stay plates on compression members.

Lacing.

69. The lacing of compression members shall be proportioned to resist a shearing stress of 2½ per cent. of the direct stress. The minimum width of lacing bars shall be 3 inches for 1 inch rivets, 2¾ inches for ⅞-inch rivets, 2½ inches for ¾-inch rivets, and 2 inches for ⅝-inch rivets. The thickness shall be made as required by Article 38, in which "l" shall be taken as the distance between connections to the main sections.

70. In members composed of side segments and a cover plate, with the open side laced, one-half the shear shall be considered as taken by the lacing. Where double lacing is used, the shear in the plane of the lacing shall be equally distributed between the two systems.

71. Lacing bars of compression members shall be so spaced that the $\frac{l}{r}$ of the portion of the flange included between their connections will be not greater than 40, and not greater than two-thirds of the $\frac{l}{r}$ of the member.

72. In connecting lacing bars to flanges, ⅝-inch rivets shall be used for flanges less than 2½ inches wide, ¾-inch rivets for flanges

from 2½ to 3½ inches wide, and ⅞-inch rivets for flanges 3½ or more inches wide. Lacing bars with at least two rivets in each end shall be used for flanges over 5 inches wide.

73. The angle of lacing bars with the axis of the member shall be not less than 45 degrees for double lacing, and 60 degrees for single lacing. If the distance between rivet lines in the flanges is more than 15 inches and a single-rivet bar is used, the lacing shall be double and riveted at the intersections.

Splices.

74. Abutting joints in compression members faced for bearing shall be spliced on four sides. The gross area of the splice material shall be not less than 50 per cent. of the gross area of the smaller member.

75. Joints in riveted work not faced for bearing, whether in tension or compression, shall be fully spliced.

Net Section at Pins.

76. In pin connected riveted tension members, the net section across the pin hole shall be not less than 140 per cent. and the net section back of the pin hole not less than 100 per cent. of the net section of the body of the member, and there shall be sufficient rivets to make the material effective.

Net Section Defined.

77. The net section of riveted members shall be the least area which can be obtained by deducting from the gross sectional area the areas of holes cut by any plane perpendicular to the axis of the member and parts of the areas of other holes on one side of the plane within a distance of four inches, which are on gage lines one inch or more from those of the holes cut by the plane, the parts being determined by the formula:

$$A\left(1-\frac{P}{4}\right), \text{ in which}$$

A = the area of the hole.
P = the distance in inches of the center of the hole from the plane.

78. In determining the net section, the diameter of the rivet hole shall be taken one-eighth-inch larger than the nominal diameter of the rivet.

Pin Plates.

79. Where necessary to give the required section or bearing area, pin holes shall be reinforced on each segment by plates, one of which on each side must be as wide as the outstanding flanges will permit. These plates shall contain enough rivets and be so connected as to transmit and distribute the bearing pressure uniformly over the full cross-section and to reduce the eccentricity of the segment to a minimum. At least one full-width plate on each segment shall extend to

the far edge of the stay plate and the others not less than 6 inches beyond the near edge.

Indirect Splices.

80. If splice plates are not in direct contact with the parts which they connect, rivets shall be used on each side of the joint in excess of the number required in the case of direct contact to the extent of two extra lines for each intervening plate.

Fillers.

81. Where rivets carrying stress pass through fillers, the fillers shall be extended beyond the connected member and the extension sesured by additional rivets sufficient to develop the value of the filler.

Forked Ends.

82. Forked ends on compression members will be permitted only where unavoidable. Where forked ends are used, a sufficient number of pin plates shall be provided to make the jaws of twice the sectional area of the member and they shall be extended as far as necessary in order to carry the stress of the main member into the jaws, but shall not be shorter than required by Article 79.

Pins.

83. Pins shall be long enough to secure a full bearing of all parts connected upon the turned body of the pin. They shall be secured by chambered nuts or by solid nuts with washers. Where the pins are bored, through rods with cap washers may be used. The screw ends shall be long enough to admit of burring the threads.

84. Pin connected members shall be held against lateral movement on the pins.

Bolts.

85. Where members are connected by bolts, the turned bodies of the bolts shall be long enough to extend through the metal. A washer at least ¼-inch thick shall be used under the nut. Bolts shall not be used except by special permission.

Upset Ends.

86. Bars with screw ends shall be upset so that the area at the root of the thread will be at least 15 per cent. larger than in the body of the bar.

Sleeve Nuts.

87. Sleeve nuts shall not be used.

Expansion.

88. Provision shall be made for expansion and contraction at the rate of one inch for every 100 feet in length. The expansion ends shall be secured against lateral movement. In spans more than 250 feet in length, provision shall be made for expansion in the floor.

Expansion Bearings.

89. Spans more than 70 feet in length shall have rollers at one end. Spans of less length shall be arranged to slide on smooth surfaces.

Fixed Bearings.

90. Bearings and ends of spans shall be secured against lateral motion.

Rollers.

91. Expansion rollers shall be not less than 6 inches in diameter. They shall be coupled together with substantial side bars, which shall be so arranged that the rollers can be cleaned readily. Rollers shall be geared to the upper and lower plates.

Pedestals and Shoes.

92. Pedestals and shoes preferably shall be made of cast steel. The difference between the top and bottom bearing widths shall not exceed twice the depth. For hinged bearings, the depth shall be measured from the center of the pin. Where built pedestals and shoes are used, the web plates and the angles connecting them to the base plate shall be not less than ¾-inch thick. If the size of the pedestal permits, the webs shall be rigidly connected transversely. The minimum thickness of the metal in cast steel pedestals shall be one inch. Pedestals and shoes shall be so constructed that the load will be distributed uniformly over the entire bearing. Spans more than 70 feet in length shall have hinged bearings at each end.

Inclined Bearings.

93. For spans on an inclined grade and without hinged bearings, the sole or masonry plates shall be beveled so that the masonry surfaces will be level.

Name Plates.

94. There shall be a name plate, showing in raised letters and figures the name of the manufacturer and the year of construction, bolted to the bridge near each end at a point convenient for inspection.

(6) Floors.

Types of Floors.

95. Floors may consist of steel floor-beams and stringers, with timber cross-ties supporting the rails, or of one of the solid floor types.

Floor Members.

96. Floor members shall be designed with special reference to stiffness.

97. Specifications for plate girders shall apply to floor-beams and stringers.

Spacing of Stringers.

98. Stringers usually shall be spaced 6 feet 6 inches center to

center. If four stringers are used under one track, each pair shall be spaced symmetrically about the rail.

I-Beam Girders.

99. Rolled beams supporting timber decks shall be arranged with not more than four, and preferably not less than two beams under each rail. The beams in each group shall be placed symmetrically about the rail, and shall be spaced sufficiently far apart to permit cleaning and painting. They shall be connected by solid web diaphragms near the ends and at intermediate points, spaced not over twelve times the flange width. Bearing plates shall be continuous under each group of beams. End stiffeners shall be used if required by the provisions of Article 38.

Floor-Beam Connections.

100. Floor-beams preferably shall be square to the girders or trusses. They shall be riveted directly to the girders or between the posts of through and deck truss spans.

End Connection Angles.

101. The legs of stringer connection angles shall be not less than 4 inches in width, and not less than ⅝-inch in thickness before facing. Shelf angles shall be provided to support the stringers during erection, but the connection angles shall be sufficient to carry the whole load. Stringers in through spans shall be riveted between the floor-beams.

Stringer Frames.

102. Where two lines of stringers are used under each track in panels more than 20 feet in length, they shall be connected by cross frames.

Solid Floor Connections.

103. Solid floors shall be connected to the girders or trusses by angles not less than ⅝-inch thick if to be faced, or ½-inch thick if not to be faced; one angle on each side of the web of I-beams and one on each of the vertical members of troughs. (223)

Proportioning Solid Floors.

104. Solid floors shall be proportioned by the moments of inertia of the sections, using the net sections including the compression side.

(7) Bracing.

Design of Bracing.

105. Lateral, longitudinal and transverse bracing shall be composed of shapes with riveted connections. Lateral bracing shall have concentric connections to chords at end joints, and preferably throughout. The connections between the lateral bracing and the chords shall be designed to avoid, as far as practicable, any bending stress in the truss members.

106. When a double system of bracing is used, both systems may be considered simultaneously effective if the members meet the requirements, both as tension and compression members.

Lateral Bracing.

107. Bottom lateral bracing shall be provided in all bridges except deck plate girder spans less than 50 feet long, from which it may be omitted. Continuous steel or concrete floors will be considered lateral bracing.

108. Top lateral bracing shall be provided in deck spans and in through spans having sufficient head room.

Portal and Sway Bracing.

109. Deck truss spans shall have vertical sway bracing at each panel point. They shall also have bracing in the planes of the end posts. The end reaction of the top lateral system shall be carried through the vertical end bent to the masonry.

110. Through truss spans shall have portal bracing, with knee braces, as deep as the specified clearance will allow.

111. Through truss spans shall have sway bracing at each intermediate panel point if the height of the trusses is such as to permit of a depth of 6 feet or more for the bracing. When the height of the trusses will not permit of such depth, the top lateral struts shall be of the same depth as the chord and shall have knee braces.

Cross-Frames.

112. Deck plate girder spans shall be provided with cross-frames at each end proportioned to resist centrifugal and lateral forces, and shall have intermediate cross-frames at intervals not exceeding 18 feet.

Laterals.

113. The smallest angle to be used in lateral bracing shall be 3½ by 3 by ⅜ inches. There shall be not less than three rivets at each end connection of the angles. Angles shall be connected at their intersections by plates.

Clearance.

114. Lateral bracing beneath the track shall be low enough to clear the ties.

(8) Plate Girders.

Spacing of Girders.

115. The girders of deck bridges usually shall be spaced 6 feet 6 inches between centers, except that:

a. In single-track deck spans 75 or more feet in length, the girders shall be spaced in accordance with paragraph 12, but not less than 7 feet 6 inches between centers.

b. In bridges on curves, the girders shall be spaced as shown on the plans.

Design of Plate Girders.

116. Plate girders shall be proportioned either by the moment of inertia of their net section including compression side; or by assuming that the flanges are concentrated at their centers of gravity. In the latter case, one-eighth of the gross section of the web, if properly spliced, may be used as flange section. For girders having unusual sections, the moment of inertia method shall be used.

Flange Sections.

117. The flange angles shall form as large a part of the area of the flange as practicable. Side plates shall not be used except when flange angles exceeding one inch in thickness otherwise would be required.

118. Flange plates shall be equal in thickness, or shall diminish in thickness from the flange angles outward. No plate shall have a thickness greater than that of the flange angles.

119. Where flange cover plates are used, one cover plate of the top flange shall extend the full length of the girder. Other flange plates shall extend at least 18 inches beyond the theoretical end.

Thickness of Web Plates.

120. The thickness of web plates shall be not less than $\frac{1}{20}\sqrt{D}$, where "D" represents the distance between flanges in inches.

Flange Rivets.

121. The flanges of plate girders shall be connected to the web with a sufficient number of rivets to transfer to the flange section the horizontal shear at any point combined with any load that is applied directly on the flange. One wheel load, where ties rest on the flange, shall be assumed to be distributed over 3 feet.

Flange Splices.

122. Splices in flange members shall not be used except by special permission of the Engineer. Two members shall not be spliced at the same cross-section and, if practicable, splices shall be located at points where there is an excess of section. The net section of the splice shall exceed by 10 per cent. the net section of the member spliced. Flange angle splices shall consist of two angles, one on each side.

Web Splices.

123. Web plates shall be symmetrically spliced by plates on each side. The splice plates for shear shall be of the full depth of the girders between flanges. The splice shall be equal to the web in strength in both shear and moment. There shall be not less than two rows of rivets on each side of the joint.

End Stiffeners.

124. Plate girders shall have stiffener angles over end bearings, the outstanding legs of which will extend as nearly as practicable to the outer edge of the flange angles. These end stiffeners shall be proportioned for bearing of the outstanding legs on the flange angles, and shall be arranged to transmit the end reaction to the pedestals or distribute it over the masonry bearings. They shall be connected to the web by enough rivets to transmit the reaction. End stiffeners shall not be crimped.

Intermediate Stiffeners.

125. The webs of plate girders shall be stiffened by angles at intervals not greater than:

(a) Six feet.
(b) The depth of the web.
(c) The distance given by the formula $d = \frac{t}{40}(12{,}000 - S)$

d = the distance between rivet lines of stiffeners in inches.
t = the thickness of the web in inches.
S = web shear in pounds per square inch at the point considered.

126. If the depth of the web between the flange angles or side plates is less than 50 times the thickness of the web, intermediate stiffeners may be omitted.

127. Stiffener angles shall be placed at points of concentrated loading. Such angles shall not be crimped.

128. Intermediate stiffeners shall be riveted in pairs to the web of the girder. The outstanding leg of each angle shall not be less than 2 inches plus one-thirtieth of the depth of the girder, nor more than 16 times its thickness.

Gusset Plates in Through Girders.

129. In through plate girder spans, the top flanges shall be braced by means of gusset plates or knee braces with solid webs connected to the floor-beams and extending usually to the clearance line. If the unsupported length of the inclined edge of the gusset plate exceeds 18 inches, the gusset plate shall have one or two stiffening angles riveted along its edge. The gusset plate shall be riveted to a stiffener angle on the girder. Preferably it shall form no part of the floor-beam web.

130. In through plate girder spans with solid floors, there shall be knee-braces with ⅜-inch webs, extending usually to the clearance line, at intervals of about 12 feet. Each knee-brace shall be well riveted to the floor and the girder, especially at the top, and shall have its edge reinforced by one or two angles.

Ends of Through Girders.

131. If through plate girders project two feet or more above the base of the rail, the upper corners shall be rounded. In multiple span bridges, usually only the extreme ends shall be rounded. Exposed ends of through girders shall be neatly finished with end plates.

Spans Shipped Riveted.

132. Deck plate girder spans less than 50 feet in length shall be shipped riveted complete, unless otherwise specified.

Masonry Bearings.

133. End bearings on masonry preferably shall be raised above the coping by metal pedestals.

134. Sole plates shall be not less than ¾-inch thick and not less in thickness than the flange plus ⅛-inch. Preferably they shall not be longer than 18 inches.

Anchor Bolts.

135. Anchor bolts shall be 1¼ inches in diameter and shall extend 12 inches into the masonry. There shall be washers under the nuts. Anchor bolt holes in pedestals and sole plates shall be 1⅝ inches in diameter, except that at expansion joints the holes in the sole plates shall be slotted.

(9) Trusses.

Type of Truss and Sections of Members.

136. Trusses shall have single intersection web systems and, preferably, inclined end posts. The top chords and end posts shall be made usually of two side segments with one cover plate and with stay plates and lacing on the open side. The bottom chords of riveted trusses shall be symmetrically made, usually of vertical side plates with flange angles. Web members shall be made of symmetrical sections.

Camber.

137. The length of members of truss spans shall be such that the camber will be equal to the deflection produced by the combined dead and live loads without impact.

Riveted Members in Pin-Connected Trusses.

138. In pin-connected trusses, hip verticals (and members performing similar functions) and, in single track spans, the two panels at each end of the bottom chords shall be riveted members.

Eye-Bars.

139. The cross sectional area of the head through the center of the pin hole shall exceed that of the body of the eye-bar by at least 37½ per cent. The thickness of the bar shall be not less than one-eighth of the width nor less than one inch, and not greater than 2 inches. The form of the head shall be submitted to the Engineer for approval before the bars are made. The diameter of the pin shall be not less than seven-eighths of the width of the widest bar attached.

Packing.

140. The eye-bars of a set shall be packed symmetrically about the plane of the truss and as nearly parallel as practicable, but in no case shall the inclination of any bar to the plane of the truss exceed ⅛-inch per foot. They shall be packed as closely as practicable. They shall be held against lateral movement, and arranged so that adjacent bars in the same panel will not be in contact.

Gusset Plates.

141. The thickness of gusset plates connecting the chords and web members of the truss shall be proportionate to the stress to be transferred, but shall not be less than ½-inch.

Facilities for Lifting Span.

142. Provision shall be made for lifting the span at the ends.

Masonry Plates.

143. Masonry plates shall not be less than one inch thick.

(10) Viaducts.

Type of Viaduct.

144. Viaducts shall consist usually of alternate tower spans and free spans of plate girders or riveted trusses supported on bents. The tower spans usually shall be not less than 30 feet long.

Bents and Towers.

145. Viaduct bents shall be composed preferably of two supporting columns, and the bents usually shall be united in pairs to form towers. Horizontal diagonal bracing shall be placed in all towers having more than two vertical panels at alternate intermediate panel points. In double track towers, provision shall be made for the transmission of the longitudinal force to both sides.

Single Bents.

146. Where long spans are supported on short single bents, such bents shall have hinged ends, or else have their columns and anchorages proportioned to resist the bending stresses produced by changes in temperature.

Bottom Struts.

147. The bottom struts of viaduct towers shall be proportioned for the calculated stresses, but in no case for less than one-fourth of the dead load reaction on one pedestal, considered as compressive stress. Provision shall be made in the column bearings for expansion of the tower bracing.

Batter.

148. The columns usually shall have a batter transversely of one horizontal to six vertical for single track viaducts, or one horizontal to eight vertical for double track viaducts.

Depth of Girders.

149. The depth of girders in viaducts preferably shall be uniform.

Spacing of Girders.

150. In single track viaducts, the girder spacing usually shall be uniform throughout, and shall be determined by the spacing for the longest span in the viaduct, according to the rules specified for deck plate girder spans.

151. In double track viaducts, the girders under each track usually shall be spaced 6 feet 6 inches between centers, and the inner lines

of girders shall be supported by cross-girders framed between and riveted to the posts.

Girder Connections and Bracing.

152. Girders of tower spans shall be fastened at each end to the tops of the posts or cross-girders. Girders between towers shall have one end riveted, and shall be provided with an effective expansion joint at the other end. No bracing or sway frame shall be common to abutting spans.

153. If neither of the girders under a track rests directly over a tower post, bracing shall be provided to carry the longitudinal force into the tower bracing without producing lateral bending stress in the cross-girders or posts.

Sole and Masonry Plates.

154. Sole and masonry plates shall be not less than ¾-inch thick.

Anchorage for Towers.

155. Anchor bolts for viaduct towers and similar structures shall be designed to engage a mass of masonry the weight of which is at least one and one-half times the uplift.

(11) Materials.*

(a) Structural and Rivet Steel.

Process.

156. Structural and rivet steel shall be made by the open-hearth process.

Properties.

157. Test specimens of structural and rivet steel shall (except as modified in Articles 160, 163 and 164) conform to the following requirements as to chemical and physical properties:

	Structural Steel	*Rivet Steel*
Phosphorus, maximum		
Acid	.06 per cent.	.04 per cent.
Basic	.04 per cent.	.04 per cent.
Sulphur, maximum	.05 per cent.	.045 per cent.
Tensile strength, pounds per square inch	55,000 to 65,000	46,000 to 56,000
Yield point, pounds per sq. in., minimum	30,000	25,000
Elongation in 8 in., minimum, per cent	$\frac{1500000}{\text{Tens. Str.}}$	$\frac{1500000}{\text{Tens. Str.}}$
Elongation in 2 in., minimum, per cent	22	

Ladle Analyses.

158. An analysis of each melt of steel shall be made by the manufacturer to determine the percentages of carbon, manganese, phosphorus and sulphur. This analysis shall be made from a test ingot taken during the pouring of the melt. The chemical composition thus determined shall be reported to the Engineer.

*Specifications for materials conform to A. S. T. M. Standards, Serials A-7-16, A-27-16 and A-48-18 except as to the yield point requirements and Articles 178 and 179, and the footnote to Table II.

Check Analyses.

159. Analyses may be made by the Engineer from finished material representing each melt. The phosphorus and sulphur content thus determined shall not exceed that specified in Article 157 by more than 25 per cent.

Specimen Tension Tests of Eye-Bar Material.

160. In order to meet the minimum tensile strength of full size annealed eye-bars required in Article 284, the Contractor may determine the tensile strength to be obtained in specimen tests, the range not to exceed 14,000 lb. per sq. in. and the maximum not to exceed 74,000 lb. per sq. in. The material shall conform to the requirements as to physical properties other than that of tensile strength as specified in Articles 157, 163 and 166.

Yield Point.

161. The yield point shall be determined by the drop of the beam of the testing machine.

Speed of Testing Machine.

162. The cross-head speed of the testing machine shall be such that the beam of the machine can be kept balanced, but in no case shall the values given in the following table be exceeded:

Gage Length of Specimen	*Maximum Cross-head Speed (in. per minute) in Determining:* *Yield Point*	*Tensile Strength*
2 in.	0.5	2.0
8 in.	2.0	6.0

Modifications in Elongation.

163. For structural steel over ¾-inch in thickness, a deduction of one from the percentage of elongation in 8 inches specified in Article 157 shall be made for each increase of ⅛-inch in thickness above ¾-inch, to a minimum of 18 per cent.

164. For structural steel under $\frac{5}{16}$-inch in thickness, a deduction of 2.5 from the percentage of elongation in 8 inches specified in Article 157 shall be made for each decrease of $\frac{1}{16}$-inch in thickness below $\frac{5}{16}$-inch.

Bend Tests.

165. The test specimens for plates, shapes, and bars (except as specified in Articles 166, 167 and 168) shall bend cold through 180 degrees without cracking on the outside of the bent portion, as follows:

(a) For material ¾-inch or less in thickness, flat on itself.

(b) For material more than ¾-inch to and including 1¼ inches in thickness, around a pin the diameter of which is equal to the thickness of the specimen.

Surface Defects.

179. Finished rolled material shall be free from cracks, flaws, injurious seams, blisters, ragged and imperfect edges, and other surface defects. It shall have a smooth finish, and shall be straightened in the mill before shipment.

Permissible Variations in Weight and Thickness.

180. The cross-section or weight of each piece of steel shall not vary more than 2.5 per cent. from that specified, except in the case of sheared plates, which shall be covered by the following permissible variations. One cubic inch of rolled steel is assumed to weigh 0.2833 lb.

(a) When ordered to weight per square foot, the weight of each lot in each shipment shall not vary from the weight ordered more than the amount given in Table I. The term "lot" as applied to Table I means all of the plates of each group width and group weight.

(b) When ordered to thickness, the thickness of each plate shall not vary more than 0.01 inch under that ordered. The overweight of each lot in each shipment shall not exceed the amount given in Table II. The term "lot" as applied to Table II means all of the plates of each group width and group thickness.

Marking.

181. The name or brand of the manufacturer and the melt number shall be legibly stamped or rolled on all finished material, except that rivet and lattice bars and other small sections shall, when loaded for shipment, be separated properly and marked for identification. The identification marks shall be stamped legibly on the end of each pin and roller. The melt number shall be marked legibly by stamping if practicable, on each test specimen.

(b) CAST STEEL.

Process.

182. Cast steel shall be made by the open-hearth or the crucible process.

Heat Treatment.

183. Castings shall be annealed.

Chemical and Physical Properties.

184. Test specimens of cast steel shall conform to the following requirements as to chemical composition and tensile properties:

Elements Considered	*Min. Ten. Strength lb. per sq. in.*	*Min. Yield Point lb. per sq. in.*	*Min. Elongation in 2 in.*	*Min. Reduction of Area*
Phosphorus not over 0.05%	60,000	30,000	22%	30%
Sulphur not over 0.05%				

TABLE I.—PERMISSIBLE VARIATIONS OF PLATES ORDERED TO WEIGHT.

ORDERED WEIGHT, Lib. Per Sq. Ft.	PERMISSIBLE VARIATIONS IN AVERAGE WEIGHTS PER SQUARE FOOT OF PLATES FOR WIDTHS GIVEN, EXPRESSED IN PERCENTAGES OF ORDERED WEIGHTS																	
	Under 48 In.		48 to 60 In., Excl.		60 to 72 In., Excl.		72 to 84 In., Excl.		84 to 96 In., Excl.		96 to 108 In., Excl.		108 to 120 In., Excl.		120 to 132 In., Excl.		132 In. or Over.	
	Over.	Under.	Over.	Under.	Over.	Under.	Over.	Under.	Over.	Under.	Over.	Under.	Over.	Under.	Over.	Under.	Over.	Under.
Under 5	5	3	5.5	3	6	3	7	3	....	....	....	....	....	....	....	....	....	....
5 to 7.5, excl.	4.5	3	5	3	5.5	3	6	3	....	....	....	....	....	....	....	....	....	....
7.5 to 10 excl.	4	3	4.5	3	5	3	5.5	3	6	3	7	3	8	3	....	....	....	....
10 to 12.5, excl.	3.5	2.5	4	3	4.5	3	5	3	5.5	3	6	3	7	3	8	3	9	3
12.5 to 15, excl.	3	2.5	3.5	2.5	4	3	4.5	3	5	3	5.5	3	6	3	7	3	8	3
15 to 17.5, excl.	2.5	2.5	3	2.5	3.5	2.5	4	3	4.5	3	5	3	5.5	3	6	3	7	3
17.5 to 20, excl.	2.5	2	2.5	2.5	3	2.5	3.5	2.5	4	3	4.5	3	5	3	5.5	3	6	3
20 to 25, excl.	2	2	2.5	2	2.5	2.5	3	2.5	3.5	2.5	4	3	4.5	3	5	3	5.5	3
25 to 30, excl.	2	2	2	2	2.5	2	2.5	2.5	3	2.5	3.5	3	4	3	4.5	3	5	3
30 to 40, excl.	2	2	2	2	2	2	2.5	2	2.5	2.5	3	2.5	3.5	3	4	3	4.5	3
40 or over	2	2	2	2	2	2	2	2	2.5	2	2.5	2.5	3	2.5	3.5	3	4	3

NOTE.—The weight per square foot of individual plates shall not vary from the ordered weight by more than 1½ times the amount given in this table.

TABLE II.—PERMISSIBLE OVERWEIGHTS OF PLATES ORDERED TO THICKNESS.

ORDERED THICKNESS, Inches.	PERMISSIBLE EXCESS IN AVERAGE WEIGHTS PER SQUARE FOOT OF PLATES FOR WIDTHS GIVEN, EXPRESSED IN PERCENTAGES OF NOMINAL WEIGHTS.								
	Under 48 In.	48 to 60 In., Excl.	60 to 72 In., Excl.	72 to 84 In., Excl.	84 to 96 In., Excl.	96 to 108 In., Excl.	108 to 120 In., Excl.	120 to 132 In., Excl.	132 In. or Over.
Under 1/8	9	10	12	14	....	....	....	....	....
1/8 to 3/16, excl.	8	9	10	12	....	....	....	....	....
3/16 to 1/4, excl.	7	8	9	10	12	....	....	....	....
1/4 to 5/16, excl.	6	7	8	9	10	12	14	16	19
5/16 to 3/8, excl.	5	6	7	8	9	10	12	14	17
3/8 to 7/16, excl.	4.5	5	6	7	8	9	10	12	15
7/16 to 1/2, excl.	4	4.5	5	6	7	8	9	10	13
1/2 to 9/16, excl.	3.5	4	4.5	5	6	7	8	9	11
9/16 to 3/4, excl.	3	3.5	4	4.5	5	6	7	8	9
3/4 to 1	2.5	3	3.5	4	4.5	5	6	7	8
1 or over	2.5	2.5	3	3.5	4	4.5	5	6	7

NOTE.—The weight of individual plates ordered to thickness shall not exceed the nominal weight by more than 1½ times the amount given in this table.

Ladle Analyses.

185. An analysis of each melt of steel shall be made by the manufacturer to determine the percentages of carbon, manganese, phosphorus and sulphur. This analysis shall be made from drillings taken at least ¼-inch beneath the surface of a test ingot obtained during the pouring of the melt. The chemical composition thus determined shall be reported to the Engineer.

Check Analyses.

186. Check analyses may be made by the Engineer from a broken tension or bend test specimen. The phosphorus and sulphur content thus determined shall not exceed that specified in Article 184 by more than 20 per cent. Drillings for analysis shall be taken not less than ¼-inch beneath the surface.

Yield Point.

187. The yield point shall be determined by the drop of the beam of the testing machine. The speed of the machine shall conform to the requirements of Article 162.

Bend Test.

188. The test specimen shall bend cold through 120 degrees around a one inch pin without cracking on the outside of the bent portion.

Test Specimens.

189. Sufficient test bars from which the test specimens required by Article 192 may be selected, shall be attached to castings weighing 500 lb. or more, when the design of the castings will permit. If the castings weigh less than 500 lb., or are of such a design that test bars cannot be attached, two test bars shall be cast to represent each melt. Test bars shall be annealed with the castings they represent.

190. Tension test specimens shall conform to the dimensions shown in Fig. 6.

191. Bend test specimens shall be machined to 1 inch by ½-inch in section with corners rounded to a radius not over ⅛-inch.

Number of Tests.

192. One tension and one bend test shall be made from each annealing charge. If more than one melt is represented in the annealing charge, one tension and one bend test shall be made from each melt.

193. If the percentage of elongation of any tension test specimen is less than that specified in Article 184 and any part of the fracture is more than ¾-inch from the center of the gage length, as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

194. If the results of the physical tests of any test lot do not conform to the requirements specified, the manufacturer may re-anneal such lot not more than twice and retests shall be made as specified in Article 184.

Workmanship and Finish at Foundry.

195. The castings shall conform substantially to the drawings and shall be made in a workmanlike manner. The castings shall be free from injurious defects.

Inspection at Foundry.

196. Tests and inspection shall be made at the place of manufacture prior to shipment, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

Rejection.

197. Castings which show injurious defects subsequent to their acceptance at the manufacturer's works will be rejected, and the manufacturer shall be notified.

(c) CAST IRON.

Process.

198. Cast iron shall be of tough grey iron, and shall be made by the cupola process.

Finish.

199. Castings shall be true to pattern and free from excessive shrinkage. They shall be free from cracks, cold shuts, blow holes and other flaws.

Chemical Composition.

200. The sulphur content of cast iron shall not exceed the following:

Light castings	0.10 per cent.
Medium castings	0.10 per cent.
Heavy castings	0.12 per cent.

Drillings taken from the fractured ends of the transverse test bars shall be used for the sulphur determinations. One determination shall be made from each set of bars.

Classification.

201. Castings shall be classified as light, medium and heavy.

(a) Light castings are those having any section less than ½-inch thick.

(b) Heavy castings are those having no section less than two inches thick.

(c) Medium castings are those not included in either of the two classes above.

Test Bar.

202. Tests shall be made on the "Arbitration Test Bar" of the American Society for Testing Materials, as shown by Fig. 1, Serial A48-18.

Tension Tests.

203. Tension tests will be made only when specified by the Engineer and at the expense of the Company.

Number of Tests.

204. Two sets of two test bars each shall be cast from each melt in thoroughly dried green sand moulds, one set from the first iron poured and the other set from the last iron poured. Where the melt exceeds 20 tons, an additional set of two bars shall be cast from each additional 20 tons or fraction thereof.

Transverse Tests.

205. A transverse test of each bar cast shall be made. The load shall be applied at the middle, and the supports shall be spaced 12 inches apart. The load on the test bar at rupture shall be not less than the following:

Light castings	2500 pounds
Medium castings	2900 pounds
Heavy castings	3300 pounds

The deflection at rupture shall in no case be less than 0.10-inch. The rate of application of the load shall be such that a central deflection of 0.10-in. is produced in from 20 to 40 seconds.

(12) Workmanship.

Class of Work.

206. The work shall be "Punched Work" or "Reamed Work" as stipulated.

General.

207. The workmanship and finish shall be equal to the best general practice in modern bridge shops. Material at the shops shall be kept clean and protected from the weather as far as practicable.

Straightening Material.

208. Rolled material, before being laid off or worked, must be straight. If straightening or flattening is necessary, it shall be done by methods that will not injure the material. Sharp kinks and bends may be cause for rejection.

Finish.

209. Shearing and chipping shall be neatly and accurately done and all portions of the work exposed to view shall be neatly finished.

Punched Work.

210. In punched work, holes in material whose thickness is not greater than the diameter of the rivets plus ⅛-inch, may be punched full size. Holes in material of greater thickness shall be drilled.

Reamed Work.

211. In reamed work, holes in material ⅞-inch thick and less, used for lateral, longitudinal and sway bracing, lacing, stay plates and diaphragms, may be punched full size.

212. Holes in other material ¾-inch thick and less, shall be sub-punched and reamed.

213. Holes in material more than ¾-inch thick shall be drilled.

Punched Holes.

214. Full size punched holes shall be $\frac{1}{16}$-inch larger than the nominal diameter of the rivets. The diameter of the die shall not exceed the diameter of the punch by more than $\frac{3}{32}$-inch. If any holes must be enlarged to admit the rivets, they shall be reamed. Holes must be clean cut, without torn or ragged edges. Poor matching of holes may be cause for rejection.

Sub-Punched and Reamed Holes.

215. In sub-punched and reamed work, the holes shall be punched $\frac{1}{16}$-inch smaller and, after assembling, reamed $\frac{1}{16}$-inch larger than the nominal diameter of the rivet. The diameter of the punch used shall be $\frac{1}{16}$-inch smaller than the nominal diameter of the rivet and the diameter of the die not more than $\frac{3}{32}$-inch larger than the diameter of the punch. Outside burrs shall be removed with a tool making a $\frac{1}{16}$-inch fillet.

Accuracy of Punching in Reamed Work.

216. In sub-punched and reamed work, the punching shall be so accurately done that, after assembling and before reaming, a cylindrical pin ⅛-inch smaller in diameter than the nominal size of the punched hole may be entered, perpendicular to the face of the member, without drifting, in at least 75 of any group of 100 contiguous holes in the same plane. If this requirement is not fulfilled, the badly punched pieces shall be rejected. If any hole will not pass a pin $\frac{1}{16}$-inch smaller in diameter than the nominal size of the punched hole, this shall be cause for rejection.

Reaming After Assembling.

217. Reaming shall be done after the pieces forming a built member are assembled and so firmly bolted together that the surfaces are in close contact. Before riveting, they shall be taken apart, if necessary, and any shavings removed. When it is necessary to take the members apart for shipping or handling, the respective pieces reamed together shall be so marked that they may be reassembled in the same position in the final setting up. No interchange of reamed parts will be permitted.

Accuracy of Reaming and Drilling.

218. When holes are reamed or drilled, 85 of any group of 100 contiguous holes in the same plane shall, after reaming or drilling, show no offset greater than $\frac{3}{32}$-inch between adjacent thicknesses of metal.

Reamed Holes.

219. Reamed holes shall be cylindrical, perpendicular to the member, and not more than $\frac{3}{32}$-inch larger than the nominal diameter of the rivets. Reamers preferably shall not be directed by hand. Outside burrs shall be removed with a tool making a $\frac{1}{16}$-inch fillet.

Drilled Holes.

220. Drilled holes shall be 1/16-inch larger than the nominal size of the rivet. Burrs on the outside surfaces shall be removed.

Assembling for Drilling.

221. Connecting parts requiring drilled holes shall be assembled and securely held together while being drilled.

Shop Assembling.

222. The parts of riveted members shall be well pinned and firmly drawn together with bolts before riveting is commenced. The drifting done during assembling shall be only such as to bring the parts into position, and not sufficient to enlarge the holes or distort the metal. Surfaces in contact shall be painted. Bolts in field connection holes shall be left in place.

Field Connections.

223. Solid floor sections shall be assembled to the girders or trusses, or to suitable frames, in the shop, and the end connections made to fit. (103)

224. In reamed work, riveted trusses and skew portals shall be assembled in the shop, the parts adjusted to line and fit, and the holes for field connections drilled or reamed while so assembled. Holes for other field connections, except those in lateral, longitudinal and sway bracing, shall be drilled or reamed in the shop with the connecting parts assembled, or else drilled or reamed to a metal template.

225. In punched work, the field connections (except those in lateral, longitudinal and sway bracing) shall be reamed to metal templates.

Match-Marking.

226. Connecting parts assembled in the shop for the purpose of reaming or drilling holes in field connections shall be match-marked, and a diagram showing such marks shall be furnished the Engineer.

Rivets.

227. The size of rivets called for on the plans shall be the size of the rivet before heating.

228. Rivet heads, when not countersunk or flattened, shall be of approved shape and of uniform size for the same diameter of rivet. Rivet heads shall be full, neatly made, concentric with the rivet holes, and in full contact with the surface of the member.

Riveting.

229. Rivets shall be heated uniformly to a light cherry red and driven while hot. Rivets, when heated and ready for driving, shall be free from slag, scale and carbon deposit. When driven, they shall completely fill the holes. Loose, burned or otherwise defective rivets shall be replaced. In removing rivets, care shall be taken not to injure the adjacent metal, and, if necessary, they shall be drilled out. Caulking or re-cupping will not be permitted.

230. Rivets shall be driven by direct-acting riveters where practicable. The riveters shall retain the pressure after the upsetting is completed.

231. When necessary to drive rivets with a pneumatic riveting hammer, a pneumatic bucker shall be used for holding up, when practicable.

Field Rivets.

232. Field rivets shall be furnished in excess of the nominal number required to the amount of 15 per cent. plus ten rivets, for each size and length.

233. Field rivets shall be carefully selected, and shall be free from fins on the under side of the head.

Turned Bolts.

234. Where turned bolts are used to transmit shear, the holes shall be reamed parallel and the bolts shall make a tight fit with the threads entirely outside of the holes. A washer not less than ¼-inch thick shall be used under each nut.

Planing Sheared Edges.

235. Sheared edges of material more than 5/8-inch in thickness and carrying calculated stress shall be planed to a depth of ¼-inch. Re-entrant cuts shall be filleted before cutting.

Lacing Bars.

236. The ends of lacing bars shall be neatly rounded, unless otherwise called for.

Fit of Stiffeners.

237. Stiffeners under the top flanges of deck girders and at all bearing points shall be milled or ground to bear against the flange angles. Other stiffeners must fit sufficiently tight against the flange angles to exclude water after being painted. Fillers and splice plates shall fit within ¼-inch at each end.

Web Plates.

238. Web plates of girders which have no cover plates may be 1/16-inch above or below the backs of the top flange angles. Web plates of girders which have cover plates may be ½-inch less in width than the distance back to back of flange angles.

239. When web plates are spliced, not more than 3/8-inch clearance between ends of plates will be allowed.

Facing Floor Beams, Stringers and Girders.

240. Floor beams, stringers and girders having end connection angles shall be made of exact length after the connection angles are riveted. If facing is necessary, the thickness of the angles shall not be reduced more than ⅛-inch at any point.

Finished Members.

241. Finished members shall be true to line and free from twists, bends and open joints.

Abutting Joints.

242. Abutting joints in compression members and girder flanges, and, where so specified on the drawings, in tension members shall be faced and brought to an even bearing. Where joints are not faced, the opening shall not exceed ¼-inch.

Eye-Bars.

243. Eye-bars shall be straight, true to size, and free from twists, folds in the neck or head, and other defects. The heads shall be made by upsetting, rolling or forging. Welding will not be allowed. The form of the heads will be determined by the dies in use at the works where the eye-bars are made, if satisfactory to the Engineer. The thickness of the head and neck shall not overrun more than 1/16-inch for bars 8 inches or less in width, ⅛-inch for bars more than 8 inches and not more than 12 inches in width, and 3/16-inch for bars more than 12 inches wide.

244. Eye-bars which are to be placed side by side in the structure shall be bored so accurately that, upon being placed together, the pins will pass through the holes at both ends at the same time without driving. Eye-bars shall have both ends bored at the same time.

Annealing.

245. Eye-bars shall be annealed by heating uniformly to the proper temperature followed by slow and uniform cooling. Proper instruments shall be provided for determining at all times the temperature of the bars.

246. Other steel which has been partially heated shall be properly annealed except where used in minor parts.

Boring Pin Holes.

247. Pin holes shall be bored true to gage, smooth, straight, at right angles with the axis of the member and parallel with each other, unless otherwise required. The variation from the specified distance from outside to outside of pin holes in tension members, or from inside to inside of pin holes in compression members, shall not exceed 1/32-inch. In built-up members the boring shall be done after the member is riveted.

Boring Pins.

248. Pins larger than 9 inches in diameter shall have a hole bored longitudinally through the center of each not less than 2 inches in diameter.

Pin Clearances.

249. The difference in diameter between the pin and the pin hole shall be 1/50-inch for pins up to 5 inches in diameter, and 1/32-inch for larger pins.

Pins and Rollers.

250. Pins and rollers shall be accurately turned to gage and shall be straight, smooth and free from flaws.

Screw Threads.

251. Screw threads shall make close fits in the nuts and shall be U. S. Standard, except that for pin ends of diameters greater than 1⅜ inches, they shall be made with six threads to an inch.

Welds.

252. Welds in steel will not be allowed, except to remedy minor defects.

Forging Pins.

253. Pins larger than 7 inches in diameter shall be forged and annealed.

Bearing Surfaces Planed.

254. The top and the bottom surfaces of base and cap plates of columns and pedestals, except those in contact with masonry, shall be planed, or hot-straightened, and parts of members in contact with them shall be faced to fit. Connection angles for base plates and cap plates shall be riveted to compression members before the members are faced.

255. Sole plates of plate girders shall have full contact with the girder flanges. Sole plates and masonry plates shall be planed or hot-straightened. Cast pedestals shall be planed on the surfaces in contact with steel and shall have the bottom surfaces resting on masonry rough finished.

Pilot Nuts.

256. Two pilot nuts and two driving nuts shall be furnished for each size of pin, unless otherwise specified.

(13) Weighing and Shipping.

Weight Paid for.

257. The payment for pound price contracts shall be based on the scale weight of the metal in the fabricated structure, including field rivets shipped. The weight of the field paint and cement, if furnished, boxes and barrels used for packing, and material used for staying or supporting members on cars, shall be excluded.

Variation in Weight.

258. If the weight of any member is more than 2½ per cent. less than the computed weight, it may be cause for rejection.

259. The greatest allowable variation of the total scale weight of any structure from the weights computed from the approved shop drawings shall be 1½ per cent. Any weight in excess of 1½ per cent. above the computed weight shall not be paid for by the Company.

Computed Weight.

260. The weight of steel shall be assumed at 0.2833 lb. per cubic inch.

261. The weights of rolled shapes, and of plates, up to and including 36 inches in width, shall be computed on the basis of their nominal weights and dimensions, as shown on the approved shop drawings, deducting for copes, cuts and open holes.

262. The weights of plates wider than 36 inches shall be computed on the basis of their dimensions, as shown on the approved shop drawings, deducting for cuts and open holes. To this shall be added one-half of the allowed percentages of overrun in weight given in Article 180.

263. The weight of heads of shop driven rivets shall be included in the computed weight.

264. The weights of castings shall be computed from the dimensions shown on the approved shop drawings, with an addition of 10 per cent. for fillets and overrun.

Weighing of Members.

265. Finished work shall be weighed in the presence of the Inspector, if practicable. The Contractor shall furnish satisfactory scales and do the handling of the material for weighing.

Marking and Shipping.

266. Members weighing more than 5 tons shall have the weight marked thereon. Bolts and rivets of one length and diameter, and loose nuts or washers of each size, shall be packed separately. Pins, other small parts, and small packages of bolts, rivets, washers and nuts shall be shipped in boxes, crates, kegs or barrels, but the gross weight of any package shall not exceed 300 pounds. A list and description of the contained material shall be plainly marked on the outside of each package, box or crate.

267. Long girders shall be so loaded and marked that they may arrive at the bridge site in position for erection without turning.

268. Anchor bolts, washers and other anchorage or grillage materials shall be shipped in time for them to be built into the masonry.

(14) Shop Painting.

Shop Cleaning and Painting.

269. Unless otherwise specified, steel work, after it has been accepted by the Inspector and before leaving the shop, shall be thoroughly cleaned and given one coat of approved paint, applied in a workmanlike manner, and well worked into joints and open spaces. Cleaning shall be done with steel brushes, hammers, scrapers and chisels, or by other equally effective means. Oil, paraffin and grease shall be removed by wiping with benzine or gasoline. Loose dirt shall be brushed off with a dry bristle brush before the paint is applied.

Surfaces in Contact.

270. Surfaces coming in contact shall be cleaned and given one coat of paint on each surface before assembling.

Erection Marks.

271. Erection marks shall be painted on painted surfaces.

Painting in Damp or Freezing Weather.

272. Painting shall not be done in damp or freezing weather except under cover, and the steel must be free from moisture or frost when the paint is applied. Material painted under cover in damp or freezing weather shall be kept under cover until the paint is dry.

Mixing of Paint.

273. Paint shall be thoroughly mixed before applying, and the pigments shall be kept in suspension.

Machine Finished Surfaces.

274. Machine finished surfaces of steel (except abutting joints and base plates) shall be coated with white lead and tallow, applied hot as soon as the surfaces are finished and accepted by the Inspector.

(15) Mill and Shop Inspection.

Facilities for Inspection.

275. Facilities for inspection of material and workmanship in the mill and shop shall be furnished by the Contractor to the Inspectors, and the Inspectors shall be allowed free access to the necessary parts of the premises.

Mill Orders and Shipping Statements.

276. The Contractor shall furnish the Engineer with as many copies of material orders and shipping statements as the Engineer may direct. The weights of the individual members shall be shown.

Notice of Rolling.

277. The Contractor shall give ample notice to the Engineer of the beginning of rolling at the mill, and of work at the shop, so that inspection may be provided. No material shall be rolled nor work done before the Engineer has been notified where the orders have been placed.

Cost of Testing.

278. The Contractor shall furnish, without charge, test specimens, as specified herein, and all labor, testing machines and tools necessary to make the specimen and full size tests.

Inspector's Authority.

279. The Inspector shall have the power to reject materials or workmanship which do not come up to the requirements of these specifications; but in cases of dispute, the Contractor may appeal to the Engineer, whose decision shall be final.

Rejections.

280. The acceptance of any material or finished members by the Inspector shall not be a bar to their subsequent rejection, if found defective.

281. Rejected material and workmanship shall be replaced promptly or made good by the Contractor.

(16) Full-Size Tests.

Full-Size Tests of Eye-Bars.

282. The number and size of the bars to be tested shall be stipulated by the Engineer before the mill order is placed. The number shall not exceed 5 per cent. of the whole number of bars ordered, with a minimum of two bars on small orders.

283. The test bars shall be of the same section as the bars to be used in the structure and of the same length if within the capacity of the testing machine. They shall be selected by the Inspector from the finished bars preferably after annealing. Test bars representing bars too long for the testing machine shall be selected from the full length bar material after the heads on one end have been formed and shall have the second head formed upon them after being cut to the greatest length which can be tested.

284. Full-size tests of eye-bars shall show a yield point of not less than 29,000 pounds per square inch, an ultimate strength of not less than 54,000 pounds per square inch, and an elongation of not less than 10 per cent. in a length of 20 feet measured in the body of the bar. The fracture shall show a silky or finely granular structure throughout.

285. If a bar fails to meet the requirements of Article 284, two additional bars of the same size and from the same mill heat shall be tested. If the failure of the first test bar is on account of the character of the fracture only, the bars represented by the test may be reannealed before the additional bars are tested.

286. If two of the three bars tested fail, the bars of that size and mill heat shall be rejected.

287. A failure in the head of a bar shall not be cause for rejection if the other requirements are fulfilled.

288. A record of the annealing charges shall be furnished the Engineer showing the bars included in each charge and the treatment they receive.

289. Bars thus tested which meet the requirements of the specifications shall be paid for by the Company at the same unit prices as the structures. Bars which fail to meet the requirements of the specifications, and all bars rejected as a result of tests, shall be at the Contractor's expense.

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Section 106 Evaluation
Architectural and Structural Resources
The Existing Rail Line of the DM&E Railroad
Powder River Basin Expansion Project
in South Dakota

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SECTION 106 EVALUATION
ARCHITECTURAL AND STRUCTURAL RESOURCES

THE EXISTING RAIL LINE
OF THE
DAKOTA MINNESOTA AND EASTERN RAILROAD
POWDER RIVER BASIN EXPANSION PROJECT
IN
SOUTH DAKOTA

prepared for
The Surface Transportation Board
and
Burns & McDonnell

prepared by
Architectural and Historical Research, LLC
and
Hess, Roise and Company

May 2000

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Appendixes

Section 106 Evaluation: Architectural and Structural Resources of the Existing Rail Line of the Dakota Minnesota and Eastern Railroad Powder River Basin Expansion Project in South Dakota

1. Introduction

In January 1999, The Dakota Minnesota and Eastern (DM&E) Railroad contracted with Burns & McDonnell Engineering Company, Inc., Kansas City, Missouri, to prepare an Environmental Impact Study (EIS) for the Surface Transportation Board. The EIS encompasses the rebuild portion of the Powder River Basin Expansion Project, specifically the rebuilding of DM&E's existing system in South Dakota and Minnesota.

The EIS includes the preparation and completion of the Section 106 Compliance, Phase I tasks, for architectural and structural properties located within the DM&E right-of-way. The Section 106 report, including field work, research and photography, was preformed by Cydney E. Millstein, Architectural and Historical Research, L.L.C., Kansas City, Missouri, in association with Hess, Roise and Company, Minneapolis, Minnesota, under contract with Burns & McDonnell. The Section 106 report, the subject of this document, commenced on February 1, 1999, and was completed on September 30, 1999. For the purpose of review and compliance, separate reports, covering the historic resources located along the project right-of-way in the respective state, were prepared for the State Historic Preservation Office, South Dakota State Historical Society and the Minnesota State Historic Preservation Office.

2. Survey Boundaries

The survey boundaries of the DM&E Powder River Basin Expansion Project, Section 106 Compliance on architectural and structural resources on the rebuild portion located in South Dakota involves approximately 300 miles of existing rail line primarily situated between the cities of Wasta, east to Elkton along the historic C&NW rail line. The exact width of the right-of-way, which essentially defines the Area of Potential Effect (APE), was not fully described in the draft Programmatic Agreement dated February 15, 2000, but essentially spans the width of the C&NW right-of-way. The APE varies in width from approximately 50 feet to 250 feet. In South Dakota, along the project corridor, there are 239 bridges and culverts (including sixty-four iron and steel bridges, twenty-six stone box culverts, 148 open-

deck timber pile spans, and one pre-cast concrete slab). Bridge No. 1500, included in this study, is listed in the National Register of Historic Places. Additionally, there are seven buildings that were inventoried (two are listed in the Chicago and North Western Roundhouse, Huron South Dakota, National Register Nomination).

3. Survey Objectives

This comprehensive study is designed to provide an inventory of architectural and historically significant buildings and structures, characterizing the range of identified properties within the designated APE (right-of-way). This study also identifies eligible and potentially eligible properties (those that are more than fifty years old and are located with the APE) for listing in the National Register of Historic Places (NRHP) and may be adversely effected by the proposed reconstruction. Furthermore, this study is intended to be used as a tool in the identification of historic resources and for making decisions pertaining to engineering and architectural design and implementation. In addition, this study will also provide an outline of the cultural resources and history of the historic Chicago and North Western Railroad as it pertains to the project area.

4. Methodology

Both field survey and archival research were used to obtain information regarding the identified properties along the right-of-way of the rebuild portion of the rail line. Nominations for those properties listed in the National Register of Historic Places have been identified and assembled. Information and data for each inventoried property were gathered from the following repositories:

4.1. Field Survey

- Reconnaissance Survey: The project area was initially examined to determine the approximate number of properties to be included in an intensive survey. This task was fulfilled by researching USGS maps and DM&E records.

- Site Visits: An on site analysis of each cultural resource was conducted in order to fully assess the present condition and integrity of the property (i.e., identification of style, type,

design, approximate date, and obvious alterations and/or additions).

- Photography: At least one 3 1/2" x 5" black and white photograph of each property was taken using a 35mm. camera. Each inventoried property is keyed with the corresponding roll and frame number and identified as such on the individual photographs and a keyed location form; in addition, all properties are keyed to USGS maps. Original negatives are housed at Architectural and Historical Research, L.L.C., Kansas City, Missouri.

4.2. Archival Research

- State Historic Preservation Offices, Pierre, South Dakota. Files on pertinent National Register and inventoried architecture, structures and sites; histories of rail lines; historic maps and atlases and railroad commission reports.

- DM&E office, Brookings, South Dakota. Track charts, building and structures maintenance reports, maps, plans and historic files.

- Chicago Historical Society, Chicago, Illinois. *Annual Reports* of the Chicago and North Western Railroad Company. Biographical information, as well as histories of the railroad.

- Chicago Public Library, Chicago, Illinois. Historical data of the Chicago and North Western Railroad Company.

- Minnesota Historical Society, St. Paul, Minnesota. *Annual Reports* of the Chicago and North Western Railroad Company, railroad and engineering periodicals, historic photographs.

- Minneapolis Public Library, Minneapolis, Minnesota. Various publications related to the history of the C&NW.
- The Newberry Library, Chicago, Illinois. Annual reports of the Chicago and North Western Railroad Company, various C&NW publications; maps and atlases.

- The National Archives, College Park, Maryland. Interstate Commerce Commission Railroad Valuation Records.

- Northern Illinois University, Dekalb, Illinois. The Regional History Center, Swen Parson Hall, houses the Chicago and North Western Railroad Papers.

- The James J. Hill Reference Library, St. Paul, Minnesota. South Dakota Railroad Commission Reports.

- University of Minnesota's Wilson and Walter Libraries, Minneapolis, Minnesota.

- Linda Hall Library, Kansas City, Missouri. Railroad and engineering publications.

4.3. Completion and Assemblage of Inventory Forms

Each property within the DM&E right-of-way of the rebuild portion was site visited and photographed. Approved inventory forms for the South Dakota SHPO were prepared for all historic buildings, truss and girder bridges. In addition, approved inventory forms were prepared for representative examples of the numerous pile timber bridges and stone culverts. Bridge number, milepost marker and location in the master data-base, in addition to an abbreviated inventory form, list the remaining typical timber pile bridges and stone culverts. Cast iron, corrugated metal, concrete pipe and any other pre-manufactured or standardized culvert types, as well as properties less than fifty years old, were not inventoried. All forms are accompanied by one representative 3 1/2" x 5" black and white 35mm photographs of each historic resource.

4.4. Analysis of Information

Data recorded on individual inventory forms and applicable National Register of Historic Places Nominations was used to make recommendations for those properties potentially eligible for National Register designation. Recommendations and observations are based on NR criteria as outlined in *National*

Register Bulletin 15: How to Apply the National Register Criteria for Evaluation. In addition, an evaluation of the finding of effects of the project on any cultural resources considered to be historic properties is also included in this report.

5. Final Report

The final report includes an overview of the history of the historic Chicago & North Western Railroad as it applies to the DM&E rebuild route in South Dakota; a discussion of property types identified along the proposed reconstruction route; recommendation section outlining specific properties potentially eligible for National Register status; and statement of impact, if known. Inventoried properties are keyed by bridge number on copies of USGS maps submitted to the South Dakota SHPO.

6. A Brief Look at Section 106 Review

Section 106 of the National Historic Preservation Act (NHPA) requires that Federal agencies consider what effects their actions, and actions they may assist, permit or license, may have on historic properties, and that they give the Advisory Council on Historic Preservation a "reasonable opportunity to comment" on such actions.
Federal agencies participate in many projects and programs that affect local governments and local historic properties. Some of these are obvious: construction of highways and wastewater treatment plants, for example. Others are less so: the Corps of Engineers issues permits to dredge and fill in waterways; the Federal Deposit Insurance Corporation (FDIC) approves opening branch banks. Federal Community Development Block Grant and Urban Development Action Grant funds are used by local governments to assist in rehabilitation and redevelopment. All these activities are subject to review under Section 106.

Regulations for the Section 106 Process are issued by the Advisory Council on Historic Preservation, an independent Federal agency. Its role in the review of actions under Section 106 is to encourage agencies to consider, and where feasible adopt, measures that will preserve historic properties that would otherwise be damaged or destroyed. The Council does not have the authority to require agencies to halt or abandon projects that will affect historic properties; its regulations emphasize consultation among the responsible Federal agency, the State Historic Preservation Officer/Tribal

Historic Preservation Officer (SHPO/THPO), and other interested parties--including local governments--to identify and, if possible, to agree upon ways to protect the properties in question.

Section 106 applies to properties that have been listed in the National Register of Historic Places (NR), properties that have been determined to be eligible for inclusion in the NR, and properties that may be eligible but have not yet been evaluated. If a property has not yet been nominated to the NR or determined eligible for inclusion, it is the responsibility of the Federal agency involved to ascertain its eligibility, following procedures outlined in Council and National Park Service (NPS) regulations.

The Council's regulations are set forth in a process consisting of four basic steps as follows:

6.1. *Initiate the Section 106 Process*: The Federal agency makes the decision whether there are any historic properties (NR listed or eligible) that could be effected by the undertaking. If this is the case, then the SHPO/THPO should be consulted by the agency, and a plan to involve the public and other interested parties should be addressed. If there is no undertaking, or the undertaking will not affect the historic property(ies), then has completed its Section 106 obligations.

6.2. *Identification and Evaluation*: The Federal agency responsible for the action identifies the historic properties (if any) that exist in the area to be affected. Identification involves assessing the adequacy of existing survey data, inventories, and other information on the area's historic properties, conducting further studies, if warranted, consulting with the SHPO/THPO, local governments, and other interested parties, and documenting the results of the identification effort. If properties are found that may be eligible for the NR but have not been listed or determined eligible for listing, the agency consults with the SHPO/THPO and, if needed, the Keeper of the National Register to determine eligibility or ineligibility.

The regulations provide specific criteria for determining whether an action will have an effect, and whether the effect will be adverse. Generally, if the action may alter the

characteristics that make a property eligible for the NR, it is held to have effect, and if the alterations may be detrimental to those characteristics, including relevant qualities of the property's environment or use, they are held to be adverse.

In a nutshell, there are three possible findings:

6.2.1. No historic properties affected: if there are no historic properties or there will be no effect of any kind on the historic properties, the agency notifies the SHPO/THPO and interested parties of its determination of no effect. If the SHPO/THPO does not object, the agency proceeds with the project.

6.2.2. No historic properties adversely affected: if there could be an effect but the effect would not be harmful to any historic property, the agency obtains SHPO/THPO concurrence and submits to the Council a determination of no adverse effect. Or, the agency can submit its determination of no adverse effect directly to the Council for review and notify the SHPO/THPO of its determination. Unless the Council objects, the agency proceeds with its project or activity.

6.2.3. Adverse effect: If the parties agree that there is an adverse effect, or the SHPO/THPO or Council objects to a no historic properties affected finding, the agency begins consultation to identify ways to avoid, minimize, or mitigate adverse effects. Adverse effects occur when an undertaking may directly or indirectly alter characteristics of an historic property that qualify it for inclusion in the NR. Reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance, or be cumulative also need to be considered. Examples of adverse effects include physical destruction or damage; alteration not consistent with the Secretary of the Interior's *Standards*; relocation of a property; change of use or physical features of a property's setting; visual, atmospheric, or audible intrusions; neglect resulting in deterioration; or transfer, lease or sale of a property out of Federal ownership or control without adequate protections.

6.3. *Assess* Adverse *Effects*: If there could be a harmful effect to an historic property, the agency begins the consultation process. If the action will have an adverse effect, the agency consults with the SHPO/THPO, other interested persons, and sometimes the Advisory Council, to seek agreement on ways to avoid or reduce the effects. Local governments, Indian tribes, affected property owners, and others concerned should be involved in the consultation, and the public should be given the opportunity to express their views. Local governments must be invited to participate in consultation regarding effects on historic properties within their jurisdictions, if they so request.

6.4. *Resolve Adverse effects*: The agency consults with the SHPO/THPO and others including members of the public. The Council may participate in consultation when there are substantial impacts to important historic properties, when a case presents important questions of policy or interpretation, when there is a potential for procedural problems, or when there are issues of concern to Indian tribes or Native Hawaiian organizations. If agreement is reached a Memorandum of Agreement (MOA) is drawn up and signed. If agreement cannot be reached, the formal comments of the Council are requested. Having obtained the Council's comments, the agency either carries out the terms of the MOA or considers the formal comments in making its final decisions about whether and how to proceed with the action.

7. Survey Findings

7.1. An overview of the development of the Chicago and North Western Railroad, from Elkton to Wasta, South Dakota, 1872 to 1907.

> "The timing of the construction of the rail network in Dakota Territory was excellent. The North Western took considerable risk with this ambitious expansion; it constructed track mostly ahead of substantial population."[1]

It has been said that the economic and social history of South Dakota was shaped by the railroads. The Chicago and North Western (C&NW) and the Chicago, Milwaukee and St. Paul Railroad (The Milwaukee Road) were the two prominent lines that traversed the state, bringing immigrants, revenue and ultimately, developing townsites along their routes as early as the 1870s.[2] Central South Dakota, stretching from Elkton on the east to Rapid City on the west, was pioneered by the C&NW. With a presence in South Dakota for over a century, the C&NW was a huge factor in promoting the state's growth.

The Chicago and North Western was incorporated on June 6, 1859, as the Chicago and North Western Railway Company and chartered by the State of Illinois on June 7. Led by William Butler Ogden, the C&NW acquired the assets of the bankrupt Chicago, St. Paul and Fond du Lac Railroad. Subsequently in 1867, the C&NW purchased the Winona & St. Peter Railroad (W&StP), which had completed rail line in Minnesota from from Winona at the banks of the Mississippi, to Owatonna by 1866.[3]

In the summer of 1872, the C&NW had constructed its first trackage into [South] Dakota Territory, through the benefit of the Dakotas' only land grant

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[1] H. Roger Grant, *The North Western: A History of the Chicago and Northwestern Railway System* (DeKalb, Illinois: Northern Illinois University Press, 1996), 61.

[2] Mark A. Hufstetler and Michael A. Bedeau. "Historic Railroads of South Dakota." National Register of Historic Places Multiple Property Documentation Form, March 1, 1998, E-10. Although other railroads were operating in the state, the C&NW and the Milwaukee Road controlled approximately 73% of South Dakota's 19th century lines. This NR nomination provides an excellent account of the importance of the rail line to the state's history and development.

[3] Incorporated in 1862, the W&StP continued rail development in Minnesota and South Dakota under its own corporate name until it was formally absorbed into the C&NW in 1900.

support.[4] The W&StP, as a C&NW subsidiary line, extended their track from the terminus at Tracy, Minnesota, to Gary, Dakota Territory, at the border. The line was later extended to Lake Kampeska, but due to the fact that the land grant stipulated they were to build only to the eastern banks of the Big Sioux River, the C&NW was forced to drag the line back to what is now Watertown.[5]

Although the W&St.P had ventured into Dakota Territory in 1872, several factors temporarily halted further appreciable railroad development during the early part of these formative years. The financial Panic of 1873, followed three years later by a severe grasshopper plague and drought, "measurably deterred emigration and restricted sales [of land]."[6] In spite of these hardships, prospectors began to pour into [South] Dakota Territory, looking for gold and taking advantage of the area's well-publicized agricultural potential. The Great Dakota Land Boom that began in the Spring of 1880 was brought on, to a large degree, by the arrival of the C&NW, and the dynamism and brilliance of C&NW's managing director, Marvin Hughitt.

In 1877, the year that the Black Hills were made a part of Dakota Territory, Hughitt made a personal inspection of the high plains west of Tracy to the banks of the Missouri River at Pierre. Armed with the knowledge that the Milwaukee Road, a strongly competitive rail line, also was intent on expanding its line through the uncharted lands of southern Dakota Territory, Hughitt persuaded the C&NW's Board of Directors to begin construction along the 250- mile stretch. "After visiting the territory in the late 1870s, he

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[4] Land grants stimulated scores of western railroad projects. A Congressional approval on July 13, 1866 gave the W&StP 640 acres within 20 miles of their completed right-of-way. When the W&StP reached Watertown, Dakota Territory, in 1874, it had obtained nearly 1.7 million acres of the public domain. See Grant, *The North Western,* 30.

[5] Rick W. Mills, "The Chicago & North Western in the Black Hills Country Part I, 1885-1927," *North Western Lines* 24 (Winter 1997): 49. "The Historic Railroads of South Dakota" NR states that the W&StP received a land grant to build their line to Lake Kampeska and that because the line "was of such tenuous construction, the trains only operated only as far as the town of Gary on the state line." According to the C&NW *Annual Report of 1874* (15th fiscal year), the "W&StP extension between the Minnesota border and the Big Sioux River in Dakota opened September 17, 1873"; the *Annual Report of 1878* stated that the "regular operation of the Dakota portion of the W&StP road to Lake Kampeska...will give a still greater impetus to the sale of lands along that part of our line and open up a new and most desirable section of country." Finally, the *Annual Report of 1879* stated that an engine house, a turn-table and station house were constructed at Watertown, to provide accommodations at the western terminus of the W&StP Road. Just why Kampeska was not mentioned as the western terminus in the NR nomination remains unclear.

[6] *Chicago and North Western Railway Company Annual Report for the 18th Fiscal Year Ending May 31, 1877* (New York: C&NW, 1877), 25.

concluded that 'it was good business to extend railroads across [open land]...as an inducement to settlement.' "[7]

Like other railroad companies, the C&NW roused public interest in settling along the pioneer line by printing colorful and elaborate brochures that exalted "the virtues of Dakota Territory, pridefully [sic] touting the region's climate, agricultural capacity and industrial potential. Literature was printed in numerous languages and distributed across the eastern United States, Canada and northern and central Europe."[8] In addition, the C&NW advertised special immigrant trains at low rates and "land exploring tickets" good for 40 days with a full credit against land purchases.[9]

Apparently the advertising campaign was a success. According to the C&NW's 1878 *Annual Report*, the company received numerous inquiries regarding the sales of land. In order to buy available property, plat town sites and ultimately market their real estate holdings, the C&NW created, as a subsidiary, the Western Town Lot Company. This rail-affiliated company aided in residential and commercial development along the line through [South] Dakota Territory. Cities such as Brookings, Huron, Pierre, DeSmet and Lake Preston were all surveyed and platted by the Western Town Lot Company and lots were often sold at very low prices.[10] Hughitt's plan to "blaze an iron trail" for homesteading was a success. Concurrently with the expansion of the rail line, the population of the southern half of Dakota Territory swelled from 11,776 in 1870 to 263,411 in 1885.[11]

C&NW's transformation of central southern Dakota Territory, from the Minnesota border west to Pierre, began in the fall of 1878, when an

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[7]Grant, *The Northwestern*, 58. The first official reconnaissance of the Black Hills was undertaken in 1855 by the U.S. government. The Treaty of 1851 had ceded the Black Hills to the Sioux and the government wanted an inventory of what had been given away. Map maker G.K. Warren prepared the first "routes map" of the area in 1857. See Mills, *The C&NW in the Black Hills Country*, 45.

[8]"Historic Railroads of South Dakota," E10, 12. CF, The C&NW's publication, *The North and West Illustrated: Facts for Tourist, Business & Pleasure Travel The Popular Resorts*, N. p. n. d.

[9] C&NW. *Guide to An Unsurpassed Farming Region in Southern Minnesota and Eastern Dakota Along the Line of the Winona & St. Peter Railroad.* N. p. [1879], 9. The brochure stated that "parcels of 40 or more acres could be purchased on credit of six years with interest on deferred payments of only 6%." Discounts of 12 1/2% were given for cash payments.

[10] *The Early History and Rapid Progress of That Wonderland Central Dakota* (Chicago: Poole Bros., 1883), 6. Peter Fulson, a civil engineer and employee of the C&NW, was active in survey for the railroad during the 1880s. See also W.H. Stennett. *A History of the Origin of the Place Names Connected with the Chicago and North Western and The Chicago, St. Paul, Minneapolis and Omaha Railways, including States, Counties, Towns, Villages and Stations* (Chicago: np., 1908), 47, 64, 86, 92, 113.

[11] James Frederick Hamburg. *The Influence of Railroads Upon the Process and Patterns of Settlement in South Dakota.* (New York: Arno Press, 1981), 4.

abundance of construction material was transferred to the W&StP railhead at Tracy. A proprietary line, the Dakota Central Railway, was created to build the westward extension of the W&StP into South Dakota in early 1879. By September grading and track construction progressed to Aurora; one month later, to Volga, originally described as a winter camp, and finally to the town of DeSmet.[12] Additionally, surveyors had completed their work all the way to the east bank of the Missouri River, approximately 175 miles from the Minnesota border.[13] In November 1879, the C&NW announced plans to push their track through the Black Hills to Deadwood.[14]

In August 1880, *Railway World* reported that the C&NW had completed its intended Black Hills extension as far as Pierre, a distance of 255 miles from Tracy, Minnesota.[15] While immigration to Dakota Territory and the growth of new towns on the nascent rail lines steadily increased, rail construction stalled at the Pierre terminus on the east bank of the Missouri River for twenty-five years. Railroad companies, including the C&NW, were unable to develop their line west of the Missouri River because Federal ruling prohibited any railroad line from crossing the Great Sioux Reservation (located in western Dakota Territory), from eastern Dakota Territory. The Treaty of 1851 had ceded the Black Hills and surrounding land to the Sioux, and as a result of a subsequent Treaty of 1867, the Sioux moved to a Dakota reservation.[16] In spite of the legal obstacle, various attempts to span the distance from the Missouri River through the Black Hills were made by several rail lines during the 1880s, but none were successful. While awaiting a turn of events to allow passage to western Dakota Territory, the C&NW kept increasing its trackage by the construction of several branch lines, tapping into other areas of the northern plains.[17]

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[12] C&NW, *21st Annual Report Ending May 31, 1880* (New York: Henry Bessey, Printer, 1880), 22, 51. Wells and Company laid track.
[13] Mills, "C&NW in the Black Hills Country," 49.
[14] *Railway World*, November 15, 1879, 1093.
[15] *Railway World*, August 21, 1880, 800. Track was laid at the rate of 1 1/2 miles a day. The rails were constructed of steel. Huron became the location of the line's principal shops by the close of 1880, with a ten-stall roundhouse, car and tool shops, baggage and emigrant facilities. Upon the completion of the line to Pierre, the C&NW ran a continuous track of 783 miles between Chicago and the upper Missouri River.
[16] When gold was found in the Black Hills in 1874, an influx of prospectors precipitated Sioux resistance under such chiefs as Sitting Bull, Red Cloud and Crazy Horse. Gen. George Custer was defeated and his troops annihilated at the Battle of the Little Bighorn, 1876. In 1979 the Sioux were awarded $105 million for the taking of their lands, resolving a legal action begun in 1923. Now mostly farmers and ranchers, the Sioux numbered over 100,000 in 1990. Over 40% live in South Dakota.
[17] C&NW *Annual Reports*, 1882-1885. See also Mills, "The C&NW in the Black Hills Country," 53. The C&NW acquired control of the Northwestern Express and Transfer Company in 1881, a state company to the Black Hills via Fort Pierre. Stage and freighting routes were exempt from the Federal ruling.

Ultimately the C&NW gained access to the Black Hills on October 1, 1884, by purchasing the assets of the Fremont, Elkhorn & Missouri Valley Railroad (the Elkhorn), an eastern Nebraska shortline that had built a route in proximity to the Black Hills at the Niobrara River. "This put the Elkhorn in an enviable position of having a clear route to northwest Nebraska, and then taking a northward course to the Hills."[18] Marvin Hughitt, now vice-president of the C&NW, was named president of the Elkhorn. During his tenure with the newly acquired line, Hughitt pushed the Elkhorn from Valentine, Nebraska, 180 miles west and then north into Dakota Territory. In November 1885, the first Elkhorn train steamed into the town of Buffalo Gap, Dakota. Subsequent subsidiary lines stretched the C&NW through Rapid City to Deadwood, west to Wyoming Territory and Iowa.[19]

The event that finally permitted the C&NW to cross the Missouri River into the Black Hills was an 1889 Congressional act that opened a transportation corridor through the Sioux reservation in the newly formed State of South Dakota.[20] Unfortunately Hughitt's dream was again stalled, this time by the nation-wide economic Panic of 1893, but favorable financial and political conditions of the next century cleared the way for direct railroad construction into the Black Hills from the great Missouri River.

Prior to the trans Missouri extension, the C&NW made two important transactions that further bolstered the strengths of the company. In 1900 the W&StP and the Dakota Central were formally absorbed into the C&NW.[21] In addition, on February 28, 1903, The Elkhorn was officially purchased thus giving the C&NW possession of over 1,300 miles of track in the western South Dakota, Nebraska and central Wyoming.

In September 1905, the C&NW announced its plan to build the line from Pierre west to Rapid City and to erect an imposing span across the Missouri River. In order to implement these activities, the C&NW created two new proprietary lines, the Pierre and Ft. Pierre Bridge Railway and the Pierre,

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[18] Mills, "The C&NW," 54.
[19] *Ibid.*, 54-59.
[20] An act by the U.S. Congress in March 1889 split the Great Sioux Reservation into six smaller reservations, thereby opening up the land between the White and Cheyenne Rivers. The only act or treaty recognized by the Sioux is the Fort Laramie Treaty of 1868 which established the Great Sioux Reservation; with this Treaty, the U.S. government pledged to keep whites out of the Reservation.
[21] As a result the line west of Tracy was renamed the Dakota Division; headquarters were moved to Huron.

Rapid City and Northwestern Railway. The C&NW's *47th Annual Report* (June 30, 1906), described the two paper lines as follows:

The Pierre and Ft. Pierre Bridge Railway will extend from an intersection with the Dakota Division of the Chicago and Northwestern Railway in the city of Pierre, to an intersection with the Pierre Rapid City and Northwestern Railway, hereafter referred to, 0.2 miles north of Ft. Pierre in Stanley County, a distance of 1.79 miles. The crossing of the Missouri River will be effected by the construction of a bridge between Ft. Pierre and Pierre...The Pierre, Rapid City & Northwestern Railway begins at an intersection with the Pierre and Ft. Pierre Bridge Railway, 0.2 miles north of Ft. Pierre and extends in a general westerly direction, traversing portions of Stanley, Lyman, Pennington Counties in South Dakota and terminates at an intersection with the Nebraska and Wyoming Division of the Chicago and North Western Railway at Rapid City, a distance of 165.47 miles.[22]

The Pierre & Fort Pierre Bridge Railway Company was created to assume construction of the Missouri River Bridge and late in 1905, the newly formed subsidiary built a temporary pile trestle river crossing which served as an invaluable feature for the rail line. "Throughout the winter, the C&NW delivered massive shipments of construction material to the location, to be used both for the bridge and for the line extension to Rapid City."[23]

Even before pier construction on the permanent Missouri River Bridge began, the Pierre, Rapid City and Northwestern Railway Company was well underway with its Black Hills extension. Sections of the trans Missouri line from Ft. Pierre to Capa were opened on November 26, 1906, from Capa to Midland on December 19th, and from Midland to Philip on June 30, 1907. The westernmost section from Rapid City forty-five miles east to Wasta was completed on November 26, 1906. The remaining forty-five mile gap, Philip to Wasta, was finished by July 1907. As a result of the completion of the western line, sixteen new stations were established at intervals of

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[22]C&NW, *47th Annual Report, June 30, 1906*, 21. See also *the Seventeenth Annual Report of the Board of Railroad Commissioners of the State of South Dakota for the Year Ending June 30, 1906* (Huron: Huronite Printing Company, 1906), 12.

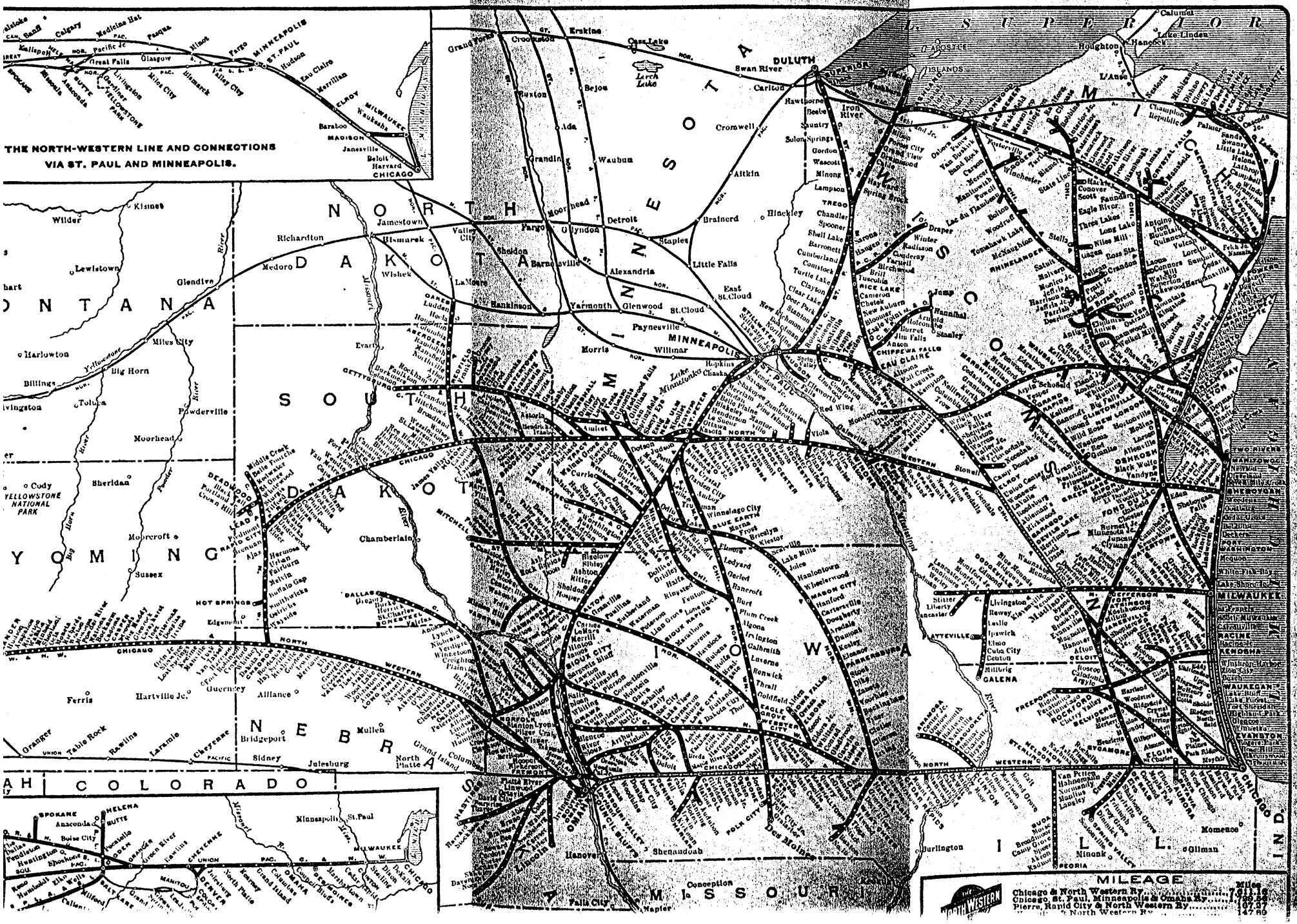
[23]Mark Hufstetler, "Chicago and Northwestern Railroad Bridge." National Register of Historic Places Nomination. March 1, 1998, section 8, page 5. This NR nomination includes a brief discussion of the construction of the Missouri River Bridge. For a comprehensive description, see "The Missouri River Bridge of the Chicago & Northwestern Railway at Pierre, South Dakota," *The Engineering Record* 57 (May 30, 1908): 687-89; "Bridge of Chicago & Northwestern, Pierre, S.D," *The Railway Age* 44 (November 1, 1907): 613-614.

approximately ten miles including those at Ft. Pierre, Teton, Wendte, Van Metre, Capa, Midland, Nowlin, Wokama, Philip, Cottonwood, Quinn, Wall and Wasta.[24]

At the completion of trackage in the summer of 1907, the Pierre & Fort Pierre Bridge Railway Company felt an urgency to finish the superstructure of the Missouri River Bridge. Only two months after

[24] *Eighteenth Annual Report of the Board of Railroad Commissioners of the State of South Dakota for the Year Ending June 30, 1907* (Pierre: Hipple Printing Company, 1907), 26-29; *Nineteenth Annual Report of the Board of Railroad Commissioners...for the Year Ending June 30, 1908* (Huron: Huronite Printing Company, 1908), 6.

MAP OF THE CHICAGO & NORTH WESTERN SYSTEM—1908.



the Pierre to Rapid City connection opened, the 2200-foot, five-span (four fixed and one draw span), pin-connected steel Pennsylvania through truss was completed in September 1907. This momentous feat, celebrated by the commercial clubs of the twin cities, subsequently linked the C&NW with the Pierre Rapid City & Northwestern and ultimately opened train service between Chicago and the Black Hills, via Pierre. The new single-track structure was opened to passenger traffic in October 1907, after a construction period of over two years.[25]

7.2. The Chicago and Northwestern from 1907.

During the ensuing years through WWI, despite a period of financial difficulty in South Dakota, the C&NW saw substantial growth with steady increases in freight and passenger traffic. Even with the outbreak of WWI, the C&NW, like the rest of the railroad industry,
" 'turned consistent profits based on the enormous demand of a wartime economy.' "[26] From 1918 to March 1920, operations of the rail line and related property were under control and direction of the United States Railroad Administration, as a result of a lease agreement between the Federal government and the C&NW for the war effort.[27] Shortly after they regained jurisdiction of their line, the C&NW acquired the Pierre, Rapid City and North Western Railway and the Pierre and Fort Pierre Bridge Railway, one of the last major purchases by the railroad in the twentieth century.

Following WWI into the 1920s, the C&NW promoted the Black Hills as a vacation getaway with their North Western Tours which combined rail and sightseeing excursions. However these passenger runs began to decline due to the increasing popularity of the automobile beginning in the 1920s. The increase in auto traffic, coupled with the stock market crash of 1929, a decrease in South Dakota's general population, a severe drought in 1934 and

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[25]Although sources differ with regard to the "official" date of passenger service, it appears that the first train to operate over the Pierre, Rapid City and Northwestern line was on July 11, while service for the general public between Pierre, Rapid City and Deadwood began on July 14, 1907. See "Northwestern Bridge Near Pierre, S.D. Opened," *The Railway Age* 44 (October 18, 1907): 548.
[26]As quoted in Hufstetler and Bedeau, "Historic Railroads of South Dakota," Section E, Page 20. A prominent source of "carloadings" occurred during WWI as Cavalry troops and their mounts arrived and departed from Fort Robinson, Nebraska and Fort Meade, South Dakota. Rapid City became the region's railroad jumping off point. See Mills, "The C&NW in the Black Hills Country," 79.
[27]*The Fifty-ninth Annual Report of the C&NW Railway Company, Year Ending December 31, 1918*, 6; *The Sixtieth Annual Report of the C&NW Railway Company, Year Ending December 31, 1919*, 5. *The Sixty-first Annual Report...Ending December 31, 1920*, 5.

drastic loss of farm production caused the C&NW to enter into bankruptcy in 1935. After this collapse, the company "never regained their high position."[28]

The C&NW emerged from bankruptcy on June 1, 1944 following the termination of war-time government possession of the railroads, and for a period of time, business improved. Revenues had been steady during the war years because of the heavy movement of troops and furloughed servicemen and an increase in civilian travel due to nationwide gas rationing. In addition, certain tonnage records were set on some of C&NW's lines. In the Black Hills area, for example, in the week of October 15, 1946, a new stock loading record with 1,106 cars of range cattle shipped from the Black Hills Division points, breaking a record that had stood since 1919. Over the next decade, a great deal of rock aggregate moved east from Rapid City to Pierre for the construction of the Missouri River Dam system.[29]

Despite the increased volume of traffic, the C&NW was in serious trouble by the mid-1950s. The company, left with post-war shortages of labor and supplies, was forced to shut down over 2300 facilities, including small town depots, shop buildings and minor structures. From mid-1949 to 1955 an average of 450,000 annual passenger train miles were trimmed and from 1956 and 1963, long distance passenger service, as well as passenger service from Mankato, Minnesota west to Huron, was greatly down-sized. According to C&NW historian H. Roger Grant, "the railroad began to look like a transportation slum: bridges and buildings had gone for years without maintenance or paint."[30]

7.3. The C&NW's Abandonment in South Dakota

Beginning in the decade of the 1960s, the C&NW began its abandonment campaign and through the 1970s, the C&NW continued to shut-down lines

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[28]Grant, *The North Western*, 151. Grant states that in 1931 the C&NW "drastically reduced tariffs in South Dakota for carload lots of hay, straw and feed grains and even transported some cattle free of charge to save their owner's investments."

[29]Rick Mills, "The North Western in the Black Hills Country, Part II-1927-1995," *North Western Lines* 24 (Spring 1997): 43, 45. In the article, Mills states that by the 1940s, bentonite (a highly absorbent porous rock composed essentially of clayey materials) "had eclipsed the cattle traffic."

[30]Grant, *The North Western*, 190. Grant asserts that on November 5, 1957, the C&NW filed a petition with the South Dakota Public Utilities Commission to create a central agency system, thus eliminating unneeded stations. There were sixty-one, one-person stations in South Dakota in which duties of the agent did not require more than two hours per day. The company averaged about two closings a year.

across the state.[31] In 1983 officials of the C&NW announced their plan to abandon the Pierre to Rapid City line, but local protestors helped to preserve service temporarily.[32] The passing of an extraordinary era in South Dakota's and the nation's railroad history began in 1986 when the Dakota Minnesota & Eastern Railroad Corporation, Brookings, South Dakota, purchased the C&NW's Rapid City to Winona, Minnesota trackage.[33]

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[31]According to Grant, "the railroad quickly compiled a hit list of unneeded trackage." C&NW's President Provo told grain dealers in 1974 that. . ."these lines have long since passed any kind of economic justification for keeping them in service. They are an enormous drain on the railroad. Just to operate over these lines is a big cash drain. But the damage goes far beyond that. These lines waste freight cars and locomotives like nothing else can. An they waste precious fuel."

[32]Mills, "The North Western in the Black Hills Country, Part II," 49. By 1980 60% of South Dakota's rails had been shut-down.

[33]*Ibid.*, 244. The DM&E eventually purchased 965 miles of secondary and branch lines in the Dakota's, Iowa and Minnesota. These were just part of the C&NW's major route sales. After several bids to take over the C&NW materialized, the remaining common shares of the historic line were sold to the Union Pacific Railroad in 1995.

8. Description of Property Types: Bridges

8.1. Open Deck Pile Trestles (see Appendix B)

By far the majority of bridges serving the rail line are simple timber stringer spans with timber pile bents and open deck. This design is used alone (dates range from 1915-1972), or as approaches to longer steel or iron spans. A total of 148 bridges contain only timber stringer spans, while thirty-nine bridges have timber-stinger approach spans. Bridges and approaches range from one to sixty-nine spans (this includes the total number of approaches, i.e., east and west); spans measure between twelve and thirteen feet in length. The general design and specifications for the open deck pile trestle were adopted from contemporary publications such as the *Manual for the American Railway Engineering Association*. An example of the specifications for the year 1921 by the American Railway Engineering Association for wooden trestles, including wood type and grade for piles and flooring, pile driving, and metal details can be found in Appendix J.

Decks are open, consisting of timber ties supporting one or more sets of steel rails. Three or four square-section stringers are aligned below each rail. On earlier structures, three stringers are separated by about four inches, with the separation maintained by iron spacers situated at regular intervals. The stringers in this configuration are referred to as "open." Later, to increase the carrying capacity of the spans, stringers were placed immediately adjacent to each other, an arrangement known as "compressed." Initially, three stringers were grouped together; later, this was increased to four. In both the open and compressed configurations, the three or four stringers beneath one rail typically extend for two "spans," with the center of the stringers supported by a bent midway. The sets of stringers are staggered: a bent supports the ends of the stringers beneath one rail, and the center of the stringers beneath the other rail. Each set of stringers is connected by metal tie rods.[34]
Bents are nearly always comprised of five cylindrical timber piles, although a sixth pile is occasionally present. Piles are spaced not closer than 2 1/2 feet between centers. Piles are driven in accordance with formulas for bearing power. The center piles are known as plumb piles, while the outermost piles are termed batter piles. Acting as a support, the exposed pile can sustain

[34]For information on the construction and maintenance of DM&E bridges, the authors are indebted to DM&E employees Tim Paluch and Cody Schonbaum who drove the high rail for the South Dakota segment of the survey. Both men have been involved with repairing and reconstructing bridges along the route.

loads from 15 tons to 20 tons each. If over five feet of the piles in a bent are exposed, the bent is braced with timber planks (called the sway brace) in an "X" configuration. At deeper ravines, timber planks extend longitudinally between the outside piles of adjacent bents to bolster the substructure.

Timber piles also are used for abutments. Back walls are virtually always timber planks. Angled wing walls sometimes extend behind the back walls, but usually appear to be later additions.

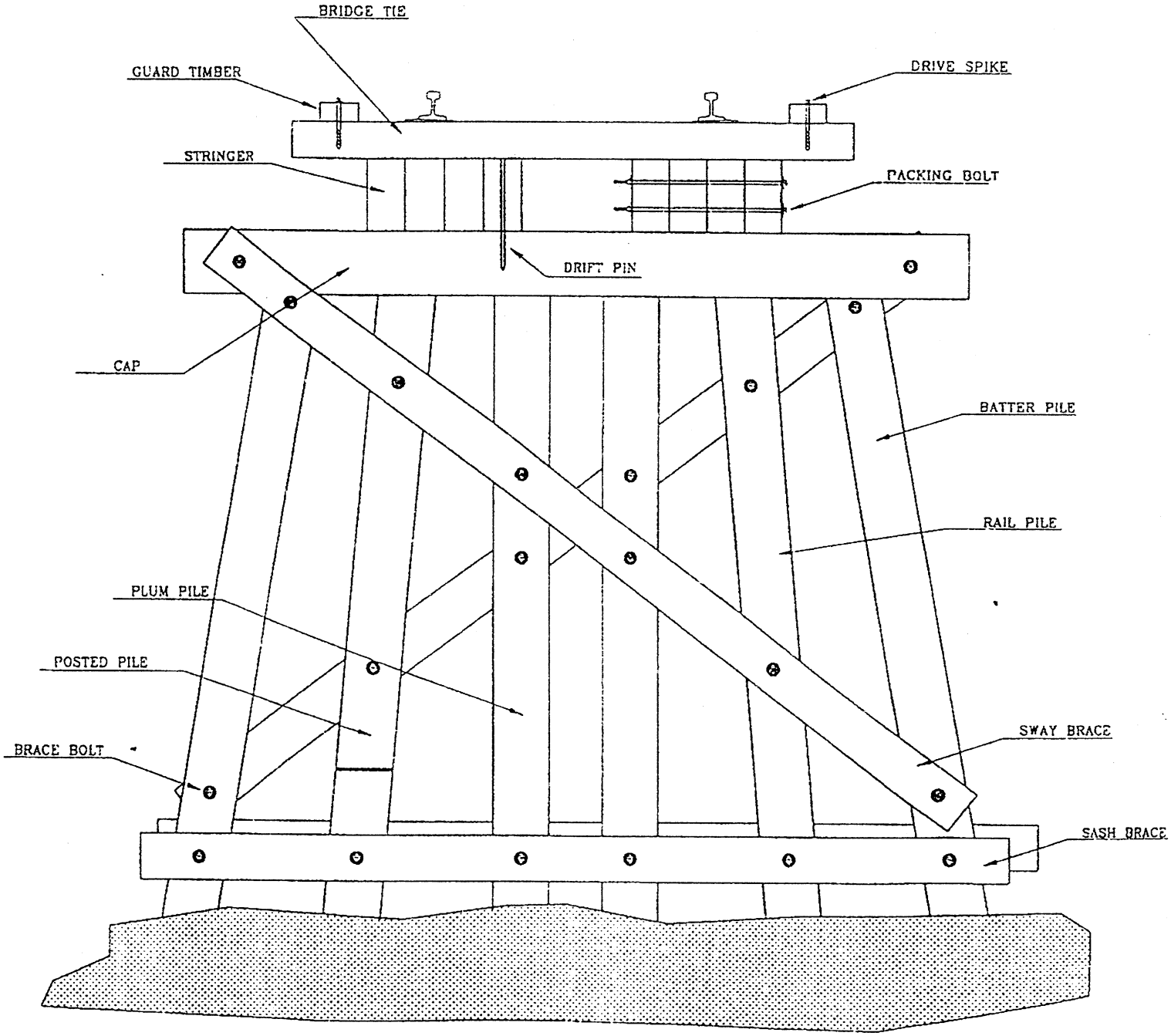
Nearly all of the timber is treated with creosote. Occasionally an earlier untreated ("white") timber appears, apparently salvaged during a reconstruction project.

A number of the open deck pile trestles have been modified over the years. Evidence of substantial reconstruction includes decayed piles near existing bents; old ties and stringers alongside bridges; and anecdotal information from men who have worked on railroad crews. A common alteration is full or partial stringer replacement. Partial replacement is apparent, for example, when three open stringers are beneath one rail and three compressed stringers beneath the other. In some cases, existing stringers have been fortified with "helpers," an additional stringer attached to the outside of a set of stringers. To raise the track level when bents have settled, blocks of wood ("false caps") are inserted between the stringers and the horizontal caps over the bent piles. Metal caps were installed on the top of some piles to slow deterioration, a technique that was subsequently found to be counterproductive.

It is important to note that due to their physical makeup, timber trestles have been in constant need of maintenance. Timber piles,

BRIDGE DIAGRAM

OPEN DECK PILE TRESTLE BENT



for example, are often renewed, strengthened or replaced. Because of the general characteristics of this bridge type and the somewhat limited life span of its materials, changes are anticipated and warranted. In most cases the alterations/additions to this property type have not impacted the overall integrity of materials and design (see Section 10: "Comments Concerning National Register of Historic Places Evaluation" below).

8.2. I-Beams (see Appendix C)

I-beam bridges are a simple bridge type used to span distances that timber trestles cannot reach or to provide a more permanent crossing. On the C&NW line in South Dakota, two of the four surviving I-beam bridges are only 13 1/2 feet long, just six inches longer than many of the timber trestles on the line. This indicates that the railroad may have been initiating a push in 1909--the construction date for all four I-beam bridges in South Dakota--to replace trestles with more permanent bridge types. The bridges are all single-span, steel structures with two sets of three rolled I-beams supporting the timber ties that comprise the deck. Each set of I-beams is centered beneath a rail on top of the deck. The bridges also have coursed ashlar limestone abutments. Three bridges have straight abutments and the fourth, the longest I-beam span at 24 1/2 feet, has a U-abutment with stepped wingwalls.

8.3. Plate Girders (see Appendixes D and E)

On the C&NW line in South Dakota, twenty-four bridges have through plate girder spans and seventeen have deck plate girder spans. Dates for these spans range from 1893 through 1937. Like I-beam bridges, they are used for crossings requiring longer clear spans than timber trestles could provide. Girder spans were also seen as an alternative to trusses in some situations, enabling the railroad to simplify bridge design and eliminate overhead obstructions associated with through trusses.

Girder spans removed from a bridge undergoing reconstruction or expansion were sometimes recycled and used for another crossing. At least three girder bridges in South Dakota had previously been used at other locations, including one that was fabricated in 1893. Its early fabrication date indicates that it is likely an iron girder, rather than steel.

About half the girder bridges on the C&NW line have timber trestle approach spans; a few have I-beam approaches. The substructure for the bridges varies from timber pile piers (generally in association with timber approach spans) to stone, concrete, or steel pile piers. Abutments similarly vary. The girders are characterized by their curved or straight ends. Some spans display both curved and straight ends, indicating that alterations were done at some point, perhaps to repair damage resulting from derailment. Decks are open and follow the same design as those on the Open Deck Pile Trestle bridge type.

8.4. Trusses (see Appendix F)

Trusses, commonly used to provide large clear-span crossings, are relatively rare on South Dakota railroads.[35] Still, truss spans are found on twenty bridges in the South Dakota portion of the C&NW line. Four truss styles are present: triangular lattice, Pratt, Pennsylvania, and Warren. All are through trusses, with the single exception of one Pratt pony truss. The majority of trusses are of the relatively uncommon triangular lattice type: there are twenty-two lattice spans on seventeen bridges.

The dates of fabrication for the trusses range from 1885 to 1925. Several, however, were put in place as late as 1930, for they were removed from other crossing and installed along this section of the line. Up to a dozen of the lattice trusses may have been recycled spans from the Mississippi River crossing at Winona, Minnesota. Those trusses were fabricated in 1885 and 1886 and are iron rather than steel (see individual bridge forms for more information).

Regardless of type, all the truss spans on the C&NW line in South Dakota have timber trestle approach spans and open decks. The decks follow the same configuration found on the Open Deck Pile Trestle type. Abutments, like the approaches, are timber pile with back walls of timber; some have angled wingwalls that appear to have been added later. The trusses themselves rest either on concrete-filled steel cylinder piers, concrete piers, or timber pile piers.

8.5. Stone Box Culverts (see Appendix G)

[35] Hufstetler and Bedeau, "Historic Railroads of South Dakota," F66.

In several locations where the flow of water was too slight to warrant the erection of a bridge, a variety of culverts were constructed instead. A total of twenty-six stone box culverts, laid in cement mortar, carry the line over drainages between Pierre, South Dakota east to the state line. No stone box culverts were found west of the Missouri River. The culverts, constructed between 1900-1911, feature essentially the same design, differing primarily in scale and the size of opening. Large blocks of buff ashlar limestone, many displaying quarry drill marks, are laid in regular courses. On the culvert's face, the coping course projects slightly. Surveyors' marks are sometimes installed on top of this course. One course separates the coping from the culvert opening. Openings are typically three or four feet wide and three to six feet high. The size of the opening was determined by using standard drainage tables.[36] Some of the openings have straight walls, perpendicular to the lintel. On other culverts, the top two courses edging the opening are slightly corbeled, suggesting a false arch. Two double culverts were identified; one located in the rail yard in Pierre had been repointed with concrete, causing the stone to split. Otherwise, the integrity of the culverts was generally good, despite some spalling and corrosion due to the elements. The dimensions of the original openings are sometimes difficult to determine or may not be apparent due to environmental changes, i.e., where ground height has shifted due to erosion or water flow.

[36] For example, see "Approximate Areas of Waterways for Drainage Areas of 0.1 to 6,000 square miles, computed by Chief Engineer, James Dun, M. Am. Soc. C. E., as reprinted in *Transactions, A. S. C. E.* 51 (December 1903), 441. Curiously, the Bridge Record files indicated that some of the stone culverts with larger openings were used for cattle passes as well. Their use for a cattle pass, of course, would be highly impractical, if not impossible. Nonetheless, the culverts that were indicated in the Bridge Records as cattle passes were noted as such on the respective inventory forms.

9. Description of Property Types: Railway Service and Operations Buildings (see Appendix H)

9.1. Depots

According to the property type description developed in "Historic Railroads of South Dakota" National Register of Historic Places Multiple Property Documentation Form (1998), "The railway companies themselves . . . took an interest in the appearance of their depots, since each depot was a local symbol of corporate identity. The uniform color schemes found on most wooden depots served as one reflection of this image, as did the standardized designs of many of the depots themselves."[37]

The C&NW, like other rail lines in South Dakota, constructed their depots in various locations before settlement and town development. Generally speaking, designs were based on standardized plans. Throughout the early decades of the twentieth century before modern conveniences prevailed, the C&NW depot remained the connecting link for commerce, communication and travel with the outside world. Although the C&NW constructed depots at points approximately ten miles apart throughout the main line in South Dakota, only a few of these historic facilities have survived.

9.1.1. Combination Depots

This sub-type includes those depots designed to accommodate freight and passenger facilities. "Since few South Dakota towns generated enough business to justify separate freight and passenger facilities, placing a waiting room, freight house, and office under one roof made sense."[38] Most depots were modest in design and featured wood exterior siding with and a minimum of embellishment. Combination stations generally contained a waiting room or rooms and a freight room flanking a central ticket office. The ticket office often featured a projecting bay window at improved the agent's view along the tracks.[39]

Applying a simple numerical system based on the building's size, the C&NW developed and relied on four standard combination depot plans and called them "Number One," "Number Two," "Number Three," and "Standard Combination Station with Living Quarters." Measuring 16 x 40,

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[37] Hufstetler and Bedeau, "Historic Railroads of South Dakota," F47.

[38] Charles W. Bohi and H. Roger Grant. "Country Railroad Stations of the Milwaukee Road and the Chicago & North Western in South Dakota," *South Dakota History* 9 (Winter 1978), 3.

[39] H. Roger Grant and Charles W. Bohi, *The Country Railroad Station in America* (Sioux Falls, South Dakota: The Center for Western Studies, Augustana College, 1988), 22.

Number Three was the smallest, simplest depot consisting of a single waiting room, a ticket office, and a freight room. The plan called for a side-gable roof, drop siding, cedar roof shingles, and doors in the gable ends. Number Two was a larger, more architecturally embellished depot, with a hipped roof, half-timbered gable bay, larger rooms, and ample fenestration. The plan also included a "register room," a place for conductors to record their arrival times. An example of a depot based on the standardized Number Two design survives intact in De Smet. The design for the largest of the standardized depots, Number One was very similar to Number Two and is mainly distinguished by the addition of an additional room (in the center), thus allowing separate waiting areas for both men and women. In most cases, Number One replaced an older, smaller facility. The fourth standard plan, as indicated by its name, included second-floor living quarters for the railroad agent. This plan was relatively unusual in the C&NW system, but a somewhat heavy concentration of them appeared in South Dakota. At least eleven of these depots were erected between Pierre and Rapid City, but none appear to have survived in their original location.[40]

Unfortunately, most of the C&NW's combination depots became obsolete due to the extensive abandonment program that began in the 1970s. Subsequently, most were razed or sold to individuals who moved them from their original sites.[41] Along the historic C&NW line, all of the four extant depots are combination depots.

9.2. Roundhouses

For a discussion of roundhouses it is useful to refer, again, to the property type section of "Historic Railroads of South Dakota." Roundhouses, as described in the document, are arc-shaped facilities typically located in more prominent railway terminals and in division points. The service tracks in each turntable bay most often led to a turntable located at the center of the arc. Designed to station railroad locomotives and to house activities related to their maintenance, roundhouses were the focal point of activity for the railroad. These structures were almost always constructed of brick and a

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[40] Bohi and Grant, "Country Railroad Stations of the Milwaukee Road and the C&NW in South Dakota," 12-20; Grant and Bohi, *The Country Railroad Station in America*, 94-97. Walter Gilman Berg, chief engineer of the Lehigh Valley Railroad and an internationally recognized authority on railway buildings, wrote about the combination station in 1893 stating "[They should be] used on railroads at [locations] of minor importance where the amount of freight or the volume of the passenger business does not warrant the construction of a separate freight-house or separate passenger depot." See Walter Berg. *Buildings and Structures of American Railroads: A Reference Book for Railroad Managers, Superintendents, Master Mechanics, Engineers, Architects and Students*. New York: John Wiley and Sons, 1893.

[41] Hufstetler and Bedeau, "Historic Railroads of South Dakota," F53.

variety of roof shapes were applied. Other features of the roundhouse often included heavy wood-post interior supports throughout the broad open spaces, large smokestacks with moveable hoods to remove engine emissions, varied flooring materials (i.e., packed earth, wood planks, asphalt, concrete, etc.), and prominent fenestration that frequently included clerestory units. Access to the individual roundhouse stalls was achieved by the use of a turntable that aligned track with the desired stall through the use of a large platform mounted on a rotating pivot. At least one engine pit was located adjacent to the roundhouse, in order to facilitate maintenance and repair work on a locomotive's undercarriage.[42]

In South Dakota, on the historic C&NW rail line, the roundhouse located in Huron is the sole surviving example of that property subtype and quite possibly the state's best remaining example. According to "Historic Railroads of South Dakota," there are few roundhouses that have survived in the state.[43]

9.3. Miscellaneous Property Types

Sited adjacent to a secondary track of the main line were company stockpens constructed of wood and designed according to standard plans. Modest in overall plan, these structures typically featured six to eight pens, a single platform, stock loading gang planks, troughs for cattle and hogs, loading chutes, and a scale. The stockpen located at Quinn is the sole surviving property type of its kind along the C&NW rail line.

[42] Hufstetler and Bedeau, "Historic Railroads of South Dakota," F55-57.
[43] Ibid., F57.

10. Comments Concerning National Register of Historic Places Evaluation

In evaluating the historic importance of a property or resource, the National Register of Historic Places is the mechanism by which properties are determined to be significant enough to warrant protection under the National Historic Preservation Act of 1966. Determinations of eligibility are based on criteria as set forth in 36 CFR Part 60.4 (70) and are delineated in *National Register Bulletin 15 How to Apply the National Register Criteria for Evaluation*. Furthermore, as stated in *Bulletin 15* "To be listed in the National Register of Historic Places a property must not only be shown to be significant under the National Register criteria but it must also have integrity."[44] The Bulletin also states that integrity is the ability of the property to convey its significance. This may be expressed through the following aspects of integrity: location, design, setting, materials, workmanship, feeling and association.[45] To retain historic integrity a property must always possess several, and usually most, of the seven aspects.

For purposes of evaluating aspects of integrity of the historic bridges inventoried as part of this Section 106 documentation (many of the structures have been modified to a greater or lesser degree), it is very beneficial to refer to the 1983 Transportation Research Board publication *Historic Bridges-Criteria For Decision Making*, chapter four, "Evaluation of Relative Importance":

10.1. Integrity of location deals simply with whether the property is at its original site or has been moved. For many properties, including many bridges (i.e., stone masonry and concrete arches, long suspension bridges, etc.) the issue is moot because they are for practical purposes immovable. However, for others, such as some of the metal truss bridges, exceptions are usually made particularly if there is no strong association with other cultural features. The very nature of early truss fabrication and erection enabled them to be conveniently removed to other sites as crossings were upgraded.

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[44]U.S. Department of the Interior, *National Register Bulletin 15 How to Apply the National Register Criteria for Evaluation* (Washington, D.C.: U.S. Department of the Interior, 1991), 44.
[45] *Ibid*., 44-45.

10.2. Integrity of design relates to whether the property retains the features of its class; that is, the essential elements of what it is intended to represent. Where paving over a timber deck in a truss bridge to better serve modern traffic may not be perceived as a serious compromise of design integrity, the addition of stiffening cables to the truss might, because the principal focus of interest is usually the truss itself. Likewise, replacement of deteriorated parapets on a concrete arch bridge or grouting of the facia of an unmortared stone arch would likely be seen as altering an essential design element.

10.3. Integrity of setting addresses changes that have occurred to the immediate surroundings and how these changes (buildings, land use, foliage, topography, etc.) have affected the relationship of the property to its setting. Truss bridges for instance, built over railroads or canals may have distinctive features in some regions. Removal of the trackage or filling of the canal in such instances would probably be interpreted as compromising the integrity of their setting.

10.4. Integrity of materials has to do with whether original materials of historic importance associated with the property have been substantially altered by deterioration or replacement and, if replaced, whether the new materials are equivalent to or compatible with the original. A bridge that has had its original random unmortared stone abutments replaced with reinforced concrete might suffer from a loss of materials integrity.

10.5. Integrity of workmanship deals with the relationship between the specific form of different materials and the way they are combined, and the technology of producing these forms and combinations. This attribute is more subtle and difficult to define for bridges, but may be illustrated by a covered timber bridge in which some hand-hewn members with mortised and tenoned joints have been replaced by machine-sawn timbers using modern connectors. In this instance, integrity of materials has been maintained but integrity of workmanship compromised. Similarly, replacement of a damaged truss member consisting of a riveted built-up section with one that was welded would entail a loss of integrity of workmanship.

Most of these attributes are interrelated (for instance, design and materials or location and setting), and it is hard to lose a total of one without some of

another as well. The last two attributes are more interpretive than the first five and are typically considered together.

10.6. Integrity of feeling and association is considered to be present if the property communicates to an informed observer a sense of what it was like in its historic period. This generally occurs if the other five attributes are present to a high degree. However, for older highway bridges one could argue that only those on unpaved roads in rural areas could truly communicate such a sense.

In applying the criteria, it is obvious that each integrity attribute may vary in degree from property to property. However, in order to be judged significant, it has usually been assumed that a candidate property must not be totally lacking in any of the seven categories. It is also true in practice that the more important a property is, the greater the propensity to compromise on integrity.[46] In determining eligibility, two of the four National Register criteria apply:

Criterion A is assigned to those properties "that are associated with events that have made significant contributions to the broad patterns of history."

Criterion C is assigned to those properties "that embody the distinctive characteristics of a type, period, or method of construction or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction."

[46] Transportation Research Board, "Evaluation of Relative Importance," *Historic Bridges-Criteria for Decision Making* (Washington, D.C.: TRB, October 1983): 16.

11. Recommendations

The following comprehensive list of historic resources along the C&NW line in South Dakota (found in Appendix I) includes comments regarding integrity, National Register of Historic Places eligibility, NRHP criteria and period of significance. Although the accompanying list cites NR eligibility of resources on an individual basis, it is recommended that the entire C&NW line, stretching from Elkton west to Wasta, South Dakota, be listed as a linear district. National Register Bulletin states that "a district possess a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development." This district definition certainly applies to the rail corridor of the C&NW, which features intact and significant historic bridges and buildings built by the railroad company. With regard to the C&NW resources that no longer retain their integrity, they should be included in the district as non-contributing elements.

At the time of this writing the period of significance begins with the date of construction of the rail line in each state and ends in 1949, the fifty-year arbitrary cut-off for National Register listing. Coincidentally, it should be noted that the Chicago and North Western line was still very active through the late 1940s, when company records continued to be set in certain tonnages, including car loads of cattle, machinery, and cement shipped to the west.[47] However, the period of significance more than likely will be extended with the anticipated continuation of the Section 106 compliance project. For example, if the project ends in 2001, the end date for the period of significance would be 1951.

[47] Heavy loads of construction materials were delivered to Oral, South Dakota for construction of the Angustora Dam and irrigation project in 1947. In 1949, a $1.5 million expansion of the South Dakota Cement Plant in Rapid City increased car loadings.

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Track Charts: Rapid City, South Dakota, to Winona, Minnesota. DM&E Engineering Department, Brookings, South Dakota.

Appendix A:

The Chicago and North Western Railroad:
An Historic Chronology of the Development of the Line in Minnesota and South Dakota

The Chicago & North Western Railroad:
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Records indicate that the Chicago and North Western Railroad (C&NW) in Minnesota and most of the line in South Dakota was originally built as the Winona & St. Peter Railroad. The W&StP was constructed for the "stated purpose of benefiting the people of Minnesota by providing a means for the farmers who settled in Minnesota Territory to get their produce to a profitable market." The line also made it possible "for settlers to move to the vast prairies of South Dakota and the line across Minnesota became primarily a funnel to deliver immigrants to the Dakotas."[48]

1851 The Treaty Traverse des Sioux was signed near St. Peter, Minnesota, which opened up settlement of the area.

The Treaty of 1851 ceded the Black Hills and surrounding land to the Sioux.

1855 The Territory of Minnesota chartered The Transit Railroad Company (TRC) to build from Winona through St. Peter, Minnesota, to a point on the Big Sioux River on March 3.

The U.S. Government undertook the first official reconnaissance of the Black Hills region in Dakota Territory.

1857 March 3, Congress enacted a Federal Land Grant to the Territory of Minnesota to finance railroad construction of specific companies.

Mapmaker G.K. Warren explored the Black Hills region that resulted in the first "routes" map to the area.

1858 Grading of the TRC began; financial crisis halts construction one year later.

Minnesota granted Statehood.

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[48]Joe Follmar, "The C&NW Across Minnesota," *North Western Lines* 23 (Winter 1996): 23.

1859 June 2, court-appointed receivers sold the Chicago, St. Paul and Fond du Lac Rail-Road Company (established in 1855) to a group of affiliated investors. The successor firm, The Chicago & North Western Railway Company, chartered by the State of Illinois on June 7, acquired the assets of the bankrupt line.

1860 The TRC sold under foreclosure to the State of Minnesota on June 23. The State then owned a fifty-mile, raised earthen pathway between Winona and Rochester.

1861 The State's interest in the TRC was purchased by the Winona, St. Peter & Missouri River Railroad Company, but the line was never built. Hardships as the result of the Civil War discouraged efforts to attract interested investors.

Dakota Territory established.

1862 On March 10, the legislature of Minnesota transferred the charter of the Winona, St. Peter & Missouri River Railroad Company to the Winona & St. Peter Railroad.

The W&StP was incorporated on June 10. The new charter required that 10 miles of track had to be completed by the new line by January 1, 1863.

On December 6, the W&StP track was completed to Stockton, approximately 11 miles west of Winona.

1863 443,314.7 acres of Federal land in Minnesota and [South] Dakota were granted to finance the construction of the W&StP line.

By an act of the Legislature of the State of Illinois, the Chicago and North Western Railway Company (C&NW) was recognized as an existing corporation.

1864 The W&StP constructed its first brick shop buildings in Winona, Minnesota.

The Chicago & North Western merged with the Galena and Chicago Union Railroad on June 2. Known as "The Great Consolidation."

The W&StP reached Rochester, Minnesota.

1865 The Chicago and North Western's route included 860 miles of line. The company claimed to be the "longest carrier in America."

The Civil War ended.

1866 On July 13, 640 acres (within 20 miles of completed right-of-way) were awarded to the W&StP by the State of Minnesota by Congressional approval. This was the final land grant to a state for railroad construction in the United States.

The W&StP line reached Owatonna, where it connected with the Minnesota Central Railroad.

1867 The W&StP, in addition to the La Cross, Trempealeau & Prescott Railroad, was sold to the Chicago & North Western on October 1. The development of the W&StP trackage continued under its own corporate name and operated as a proprietary road. The Winona, Mankato & Northern RR, as a subsidiary line, was created to construct the line into Mankato.

The W&StP reached Waseca.

1870 The W&StP reached Mankato.

1871 The W&StP reached St. Peter.

On October 8 the Chicago fire destroyed C&NW's property causing disruption of business and loss of income.

Congress granted an extension of the previous March 3 deadline (which stipulated as a part of the land grant that the W&StP had to complete the line to the Big Sioux River), to September 3, 1873.

1872	The W&StP reached New Ulm.
	The W&StP reached Dakota Territory at Gary.
1873	The W&StP was completed to Lake Kempeska, Dakota Territory, on August 18. Even though the land grant extended only to the Big Sioux River, the W&StP built its line to the west of its banks.
	The Panic of 1873, a four-year nationwide economic depression, began.
1874	W&StP trains stopped operations west of New Ulm due to extensive work load.
	Gold discovered in the Black Hills of Dakota Territory; prospectors poured into the area.
1876	Marvin Hughitt became general manager of the C&NW.
	Battle of Little Big Horn.
	A grasshopper plague and a severe drought temporarily halted settlement in the fertile prairies of Minnesota and Dakota.
1877	Hughitt made a personal exploration of the [South] Dakota Territory and initiated a plan to extend the C&NW railroad from Tracy, Minnesota, to the Black Hills. Surrender of the majority of Sioux and Cheyenne in the Black Hills region.
	Black Hills made a part of Dakota Territory.
1877-78	Several branch lines of the W&StP were constructed in Minnesota.
1878	Due to poor economic conditions Minnesota settlers had removed ties along the W&StP for firewood. Prairie fires had destroyed bridges along the line in Minnesota.

The W&StP was forced to pull back its tracks to the east of the Big Sioux River. As a result, Watertown was established as a county seat and the former town of Kampeska was abandoned.

1879 The Chicago & Dakota Railway Company was established by the C&NW to build a line from Tracy, Minnesota, east to the [South] Dakota border on May 6.

The Dakota Central Railway Company was established by the C&NW to build a line from the [South] Dakota border west to the Missouri River at Pierre. Unlike the W&StP, the Dakota Central did not receive public lands to help off-set the cost of construction. The C&NW financed the new mileage through bond and stock issues. Its Western Town Lot Company developed properties, often profitably.

As a result of the new railroad development, the original main line of the W&StP to Watertown became a branch line and Tracy, Minnesota, became an important Division terminal.

Grading and track construction progressed to Aurora, [South] Dakota Territory and pushed west through to the new communities of Brookings and on to a winter camp located at Volga.

Surveyors completed field work 175 miles west of the Missouri River by fall.

1880 The Great Dakota Land Boom began, with the C&NW as a major catalyst.

Would-be farmers and families flocked west as the Dakota Central constructed new line.

Arlington, Lake Preston, and DeSmet, [South] Dakota Territory, were platted by C&NW's Western Town Lot Company.

June 25, the first train crossed the James River Bridge at the site of "Ragtown", later renamed Huron by C&NW's president Hughitt.

C&NW surveyors plated the Missouri River terminus at Pierre. (Pierre was planned as a transfer point with riverboats on the Missouri and as the point from which goods could be freighted across western Dakota to the Black Hills until the line extended west). Trackage reached Pierre.

1880-81 Record snowstorms buried the Dakotas. The C&NW had to make cuts in the deep snow; they helped to save the immigrant population by delivering corn and fuel oil during the months of October through May.

1882 The commencement of a bridge program to replace numerous deteriorated trestle spans in the area of Stockton Hill quarry in Minnesota.

1883 Winona, Minnesota, machine shops and engine house destroyed by fire on April 11.

1884 Federal ruling prohibited any railroad lines from crossing the Sioux Reservation from Eastern Dakota Territory to get to the Black Hills.

The C&NW assumed the assets of the Fremont, Elkhorn & Missouri Valley ("Elkhorn") Railroad, an eastern Nebraska shortline, which gave the company direct access to western Dakota.

1886 Winona building campaign, including a roundhouse and associated buildings, completed.

1889 A Congressional act opened a transportation corridor through the Sioux reservation, setting the stage to link eastern South Dakota and the Black Hills by rail.

South Dakota granted Statehood.

1893	Wall Street Panic, a devastating financial three-year period of economic depression, began in May.
1895	One-quarter of the nation's railroads were in bankruptcy.
1900	Construction of a new main line from Mankato to New Ulm, called the Mankato and New Ulm Railway (M&NU), was completed on May 29.
	The W&StP, along with the M&NU, merged into the Chicago & North Western Railroad. The line west of Tracy, Minnesota, was renamed the Dakota Division with headquarters at Huron, South Dakota.
1903	On February 28, the C&NW officially took control of the "Elkhorn" Railroad.
1904	Pierre, instead of Mitchell, declared the official State Capitol of South Dakota.
1905	A temporary wood trestle was constructed across the Missouri River between Ft. Pierre and Pierre.
1906	Construction of the C&NW from Pierre to Rapid City began on the Pierre, Rapid City and North Western Railway (PRC), a subsidiary line.
1907	The Missouri River drawbridge linking Pierre to Ft. Pierre was completed. This project was undertaken by the Pierre & Ft. Pierre Bridge Railway, a subsidiary of the C&NW.
	The 44.8 mile segment of line from Wasta to Philip was completed.
	The first train operated on the Pierre, Rapid City and Northwestern Railway over the newly completed Missouri River bridge on July 11.
	Panic of 1907.

Public service on the C&NW commenced between Pierre to Rapid City and on to Deadwood, South Dakota, on July 14.

1910 Marvin Hughitt resigned the presidency of the C&NW.

1917 World War I began.

1919 World War I ends.

Operations of the nation's rail lines were under control and direction of the United States Railroad Administration.

On April 30, the C&NW acquired the railway and property of the following proprietary companies: Pierre, Rapid City and North Western Railway Company, and the Pierre and Fort Pierre Bridge Railway Company.

1920 The C&NW regains jurisdiction of their rail line.

1920s An increase in automobile traffic on a new highway system took a toll on passenger train business. During a 12 year period (1920-1932), passenger revenues declined by a total of 73%.

1922 Shopmen's Strike occurred on July 1. Nearly all of the shop crafts employees and foremen stopped work (similar strikes occurred on all rail lines across the U.S.). Over 12,000 employees of the C&NW participated for nearly 2 1/2 months. Work resumed on September 17, 1922.

1924 After struggling with the South Dakota Railroad Commission, the C&NW won the right to discontinue two Sunday trains that operated between Huron and Pierre.

To cut expenses, the C&NW began operating mixed trains (freight and passenger).

1929 Stock Market Crash.

1931	The C&NW drastically reduced tariffs in South Dakota for carload lots of hay, straw and feed grains; cattle were often transported free of charge to save their owner's investments.
1934	Severe drought in Minnesota and South Dakota.
1935	The C&NW sought protection from creditors in bankruptcy court.
1939	Reorganization of the C&NW on December 15.
1943	On December 27, the President of the U.S., acting through the Secretary of War, took possession and control of the railroads in order to avoid a threatened interruption of vital transportation service.
1944	Government control of the railroads ended on January 18.
	The C&NW emerged from bankruptcy on June 1 and reincorporated under the laws of Wisconsin.
	During and after the war years, the C&NW retired 137 coal and water facilities, 249 small town depots, 659 shop buildings and 1,344 "minor structures".
1947	The Interstate Commerce Commission approved the C&NW application for authority to construct an 18-mile extension in South Dakota across the state line into Wyoming to serve "extensive deposits of bentonite and processing plants now being erected or to be erected, at the site."
1949	Beginning in 1949, an average of 450,000 annual passenger train miles were cut from operation on the C&NW line.
1950s	The C&NW was in serious financial trouble.
1956	Permanent retirement of steam and the adoption of dieselization on May 11.

Beginning in 1956, the C&NW greatly reduced its long-distance passenger service, including trains between Mankato, Minnesota, and Huron, South Dakota.

1957 On November 5, the C&NW filed a petition with the South Dakota Public Utilities Commission to create a "central agency" system to eliminate unneeded stations throughout the state.

1970 On October 5, a leveraged buyout of the C&NW by its employees occurred. Northwest Industries (a holding company) entered into an agreement with the North Western Employees Transportation Company (NETCO) to sell all assets of the C&NW ($19 million and assumption of $340 million in company debt).

1972 NETCO renamed the Chicago and North Western Transportation Company.

1973 The C&NW begins the Coal Line Project in the Powder River Basin in southeastern Wyoming, for the lucrative trade in low-sulphur, subbituminous coal.

1981 The C&NW begins negotiations to reduce its amount of trackage. The deteriorated tracks between Pierre and Rapid City were put up for abandonment; the State of South Dakota objected to plan.

The ICC gave approval to the Coal Line Project on July 24.

1983 The C&NW notifies the ICC that the PRC line could be subject to abandonment.

Construction of the Coal Line Project in Wyoming began on June 27.

1984 A prairie fire touched off by a welder's torch destroyed seven bridges near Wall forcing diversion of eastbound trains from the Black Hills. The line reopened later that year.

1985 South Dakota Sen. Larry Pressler spearheaded negotiations between the C&NW and L. B. Foster Inc., a Pittsburgh-based railway equipment and shortline concern. The company, affiliated with the Dakota, Minnesota and Eastern Railroad, agreed to a $26 million purchase price for the track and other assets.

1986 The Rapid City, South Dakota, to Winona, Minnesota, trackage was officially sold to the Dakota, Minnesota and Eastern Railroad (DM&E), Brookings, South Dakota, on September 4.

On September 5, the DM&E operated its first train out of Huron. The former C&NW roundhouse and shops in Huron become the line's maintenance base.

South Dakota Open Deck Pile Trestles

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
526.53	1617	SD	Open Deck Pile Trestle	1915	Yes	Yes	A	1915-1949
540.35	1655	SD	Open Deck Pile Trestle	1918	Yes	Yes	A	1918-1949
532.20	1632	SD	Open Deck Pile Trestle	1920	No	No	N/A	N/A
559.52	1695	SD	Open Deck Pile Trestle	1920	Yes	Yes	A	1920-1949
548.60	1676	SD	Open Deck Pile Trestle	1920	Yes	Yes	A	1920-1949
552.50	1682	SD	Open Deck Pile Trestle	1921	Yes	Yes	A	1921-1949
583.12	1749	SD	Open Deck Pile Trestle	1921	Yes	Yes	A	1921-1949
526.12	1615	SD	Open Deck Pile Trestle	1921	Yes	Yes	A	1921-1949
576.81	1738	SD	Open Deck Pile Trestle	1922	Yes	Yes	A	1922-1949
550.30	1678.5	SD	Open Deck Pile Trestle	1922	Yes	Yes	A	1922-1949
597.40	1799	SD	Open Deck Pile Trestle	1922	Yes	Yes	A	1922-1949
546.63	1672	SD	Open Deck Pile Trestle	1922	Yes	Yes	A	1922-1949
502.76	1548	SD	Open Deck Pile Trestle	1922	Yes	Yes	A	1922-1949
542.94	1661	SD	Open Deck Pile Trestle	1922	Yes	Yes	A	1922-1949
551.63	1681	SD	Open Deck Pile Trestle	1922	Yes	Yes	A	1922-1949

South Dakota Open Deck Pile Trestles

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
550.37	1679	SD	Open Deck Pile Trestle	1923	Yes	Yes	A	1931-1949
501.55	1545	SD	Open Deck Pile Trestle	1923	Yes	Yes	A	1923-1949
556.63	1691	SD	Open Deck Pile Trestle	1923	Yes	Yes	A	1923-1949
569.25	1719	SD	Open Deck Pile Trestle	1923	Yes	Yes	A	1923-1949
544.64	1666	SD	Open Deck Pile Trestle	1923	Yes	Yes	A	1923-1949
511.70	1571	SD	Open Deck Pile Trestle	1923	Yes	Yes	A	1923-1949
597.70	1800	SD	Open Deck Pile Trestle	1923	Yes	Yes	A	1923-1949
603.93	1817	SD	Open Deck Pile Trestle	1923	Yes	Yes	A	1923-1949
541.32	1657	SD	Open Deck Pile Trestle	1924	Yes	Yes	A	1924-1949
587.96	1760	SD	Open Deck Pile Trestle	1924	Yes	Yes	A	1924-1949
588.44	1762	SD	Open Deck Pile Trestle	1924	Yes	Yes	A	1924-1949
530.16	1628	SD	Open Deck Pile Trestle	1924	Yes	Yes	A	1924-1949
496.97	1533	SD	Open Deck Pile Trestle	1924	No	No	n/a	n/a
549.50	1677	SD	Open Deck Pile Trestle	1924	No	No	n/a	n/a

South Dakota Open Deck Pile Trestles

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
593.14	1776	SD	Open Deck Pile Trestle	1925	Yes	Yes	A	1925-1949
490.05	1514	SD	Open Deck Pile Trestle	1925	Yes	Yes	A	1925-1949
545.86	1670	SD	Open Deck Pile Trestle	1925	Yes	Yes	A	1925-1949
544.21	1665	SD	Open Deck Pile Trestle	1926	Yes	Yes	A	1926-1949
557.23	1692	SD	Open Deck Pile Trestle	1926	Yes	Yes	A	1926-1949
357.28	138	SD	Open Deck Pile Trestle	1927	Yes	Yes	A	1927-1949
519.59	1597	SD	Open Deck Pile Trestle	1927	Yes	Yes	A	1927-1949
489.48	1513	SD	Open Deck Pile Trestle	1927	Yes	Yes	A	1927-1949
358.70	140	SD	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1949
605.42	1823	SD	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1949
531.50	1631	SD	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1949
600.17	1809	SD	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1949
499.38	1538	SD	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1949
598.51	1802	SD	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1949

South Dakota Open Deck Pile Trestles

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
555.94	1689	SD	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1949
497.23	1534	SD	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1949
589.05	1764	SD	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1949
580.80	1746	SD	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1949
492.94	1523	SD	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1949
487.22	1510	SD	Open Deck Pile Trestle	1929	Yes	Yes	A	1929-1949
419.94	1600	SD	Open Deck Pile Trestle	1929	Yes	Yes	A	1929-1949
283.44	8	SD	Open Deck Pile Trestle	1929	Yes	Yes	A	1929-1949
606.70	1828	SD	Open Deck Pile Trestle	1929	Yes	Yes	A	1929-1949
542.63	1660	SD	Open Deck Pile Trestle	1929	Yes	Yes	A	1929-1949
553.17	1684	SD	Open Deck Pile Trestle	1929	Yes	Yes	A	1929-1949
335.79	105	SD	Open Deck Pile Trestle	1930	No	No	n/a	n/a
605.81	1824	SD	Open Deck Pile Trestle	1930	Yes	Yes	A	1930-1949
603.75	1816	SD	Open Deck Pile Trestle	1930	Yes	Yes	A	1930-1949

South Dakota Open Deck Pile Trestles

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
603.39	1815	SD	Open Deck Pile Trestle	1930	Yes	Yes	A	1930-1949
593.43	1778	SD	Open Deck Pile Trestle	1930	Yes	Yes	A	1930-1949
413.18	194	SD	Open Deck Pile Trestle	1931	Yes	Yes	A	1931-1949
501.75	1546	SD	Open Deck Pile Trestle	1931	Yes	Yes	A	1931-1949
570.47	1725	SD	Open Deck Pile Trestle	1932	Yes	Yes	A	1932-1949
609.50	1843.5	SD	Open Deck Pile Trestle	1932	Yes	Yes	A	1932-1949
537.63	1645	SD	Open Deck Pile Trestle	1932	Yes	Yes	A	1932-1949
315.24	61	SD	Open Deck Pile Trestle	1933	Yes	Yes	A	1933-1949
573.98	1734	SD	Open Deck Pile Trestle	1934	Yes	Yes	A	1934-1949
478.25	293	SD	Open Deck Pile Trestle	1934	Yes	Yes	A	1934-1949
598.96	1804	SD	Open Deck Pile Trestle	1934	Yes	Yes	A	1934-1949
455.07	232	SD	Open Deck Pile Trestle	1934	Yes	Yes	A	1934-1949
398.74	177	SD	Open Deck Pile Trestle	1935	Yes	Yes	A	1935-1949
304.13	46	SD	Open Deck Pile Trestle	1935	Yes	Yes	A	1935-1949

South Dakota Open Deck Pile Trestles

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
455.38	233	SD	Open Deck Pile Trestle	1935	Yes	Yes	A	1935-1949
301.87	38	SD	Open Deck Pile Trestle	1936	Yes	Yes	A	1936-1949
538.81	1648	SD	Open Deck Pile Trestle	1937	Yes	Yes	A	1937-1949
463.41	254	SD	Open Deck Pile Trestle	1937	Yes	Yes	A	1937-1949
356.64	137	SD	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
344.63	112	SD	Open Deck Pile Trestle	1939	Yes	Yes	A	1939-1949
550.11	1678	SD	Open Deck Pile Trestle	1939	Yes	Yes	A	1939-1949
466.62	263	SD	Open Deck Pile Trestle	1939	Yes	Yes	A	1939-1949
577.52	1739	SD	Open Deck Pile Trestle	1939	Yes	Yes	A	1939-1949
458.65	240	SD	Open Deck Pile Trestle	1939	Yes	Yes	A	1939-1949
460.88	248	SD	Open Deck Pile Trestle	1939	Yes	Yes	A	1939-1949
340.60	109	SD	Open Deck Pile Trestle	1940	Yes	Yes	A	1940-1949
302.86	43	SD	Open Deck Pile Trestle	1940	Yes	Yes	A	1940-1949
312.84	58	SD	Open Deck Pile Trestle	1940	Yes	Yes	A	1940-1949

South Dakota Open Deck Pile Trestles

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
578.57	1741	SD	Open Deck Pile Trestle	1940	No	No	n/a	n/a
575.96	1736	SD	Open Deck Pile Trestle	1940	Yes	Yes	A	1940-1949
604.32	1821	SD	Open Deck Pile Trestle	1940	Yes	Yes	A	1940-1949
403.41	186	SD	Open Deck Pile Trestle	1941	Yes	Yes	A	1941-1949
474.54	275	SD	Open Deck Pile Trestle	1941	Yes	Yes	A	1941-1949
580.36	1745	SD	Open Deck Pile Trestle	1942	Yes	Yes	A	1942-1949
496.81	1532.5	SD	Open Deck Pile Trestle	1942	No	No	n/a	n/a
500.37	1539	SD	Open Deck Pile Trestle	1943	Yes	Yes	A	1943-1949
342.11	110	SD	Open Deck Pile Trestle	1945	Yes	Yes	A	1945-1949
537.28	1644	SD	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
535.00	1639	SD	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
481.32	300	SD	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
390.98	168	SD	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
327.39	90	SD	Open Deck Pile Trestle	1947	Yes	Yes	A	1947-1949

South Dakota Open Deck Pile Trestles

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
479.50	297	SD	Open Deck Pile Trestle	1947	Yes	Yes	A	1947-1949
479.50	297A	SD	Open Deck Pile Trestle	1947	Yes	Yes	A	1947-1949
456.45	236	SD	Open Deck Pile Trestle	1947	Yes	Yes	A	1947-1949
477.31	289	SD	Open Deck Pile Trestle	1948	Yes	Yes	A	1948-1949
280.31	5	SD	Open Deck Pile Trestle	1948	Yes	Yes	A	1948-1949
472.65	271.25	SD	Open Deck Pile Trestle	1948	Yes	Yes	A	1948-1949
525.91	1612	SD	Open Deck Pile Trestle	1948	Yes	Yes	A	1948-1949
479.20	295	SD	Open Deck Pile Trestle	1948	Yes	Yes	A	1948-1949
609.76	1844	SD	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
462.32	251	SD	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
473.43	272	SD	Open Deck Pile Trestle	1949	No	No	n/a	n/a
369.70	145	SD	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
453.46	230	SD	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
406.10	188	SD	Open Deck Pile Trestle	1952	n/a	n/a	n/a	n/a

South Dakota Open Deck Pile Trestles

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
353.34	129	SD	Open Deck Pile Trestle	1952	n/a	n/a	n/a	n/a
347.00	118	SD	Open Deck Pile Trestle	1952	n/a	n/a	n/a	n/a
452.15	228	SD	Open Deck Pile Trestle	1953	n/a	n/a	n/a	n/a
305.32	47	SD	Open Deck Pile Trestle	1953	n/a	n/a	n/a	n/a
283.66	9	SD	Open Deck Pile Trestle	1954	n/a	n/a	n/a	n/a
283.60	8.5	SD	Open Deck Pile Trestle	1956	n/a	n/a	n/a	n/a
293.45	23	SD	Open Deck Pile Trestle	1956	n/a	n/a	n/a	n/a
302.29	40	SD	Open Deck Pile Trestle	1956	n/a	n/a	n/a	n/a
294.90	27	SD	Open Deck Pile Trestle	1959	n/a	n/a	n/a	n/a
285.52	10	SD	Open Deck Pile Trestle	1959	n/a	n/a	n/a	n/a
287.29	12	SD	Open Deck Pile Trestle	1959	n/a	n/a	n/a	n/a
288.11	14	SD	Open Deck Pile Trestle	1959	n/a	n/a	n/a	n/a
293.20	21	SD	Open Deck Pile Trestle	1959	n/a	n/a	n/a	n/a
293.98	24	SD	Open Deck Pile Trestle	1959	n/a	n/a	n/a	n/a

South Dakota Open Deck Pile Trestles

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Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
302.45	41	SD	Open Deck Pile Trestle	1959	n/a	n/a	n/a	n/a
303.30	45	SD	Open Deck Pile Trestle	1959	n/a	n/a	n/a	n/a
295.90	30	SD	Open Deck Pile Trestle	1959	n/a	n/a	n/a	n/a
291.88	18	SD	Open Deck Pile Trestle	1960	n/a	n/a	n/a	n/a
295.10	28	SD	Open Deck Pile Trestle	1960	n/a	n/a	n/a	n/a
278.18	2	SD	Open Deck Pile Trestle	1961	n/a	n/a	n/a	n/a
349.82	124	SD	Open Deck Pile Trestle	1962	n/a	n/a	n/a	n/a
351.00	126	SD	Open Deck Pile Trestle	1962	n/a	n/a	n/a	n/a
352.41	127	SD	Open Deck Pile Trestle	1963	n/a	n/a	n/a	n/a
292.30	19	SD	Open Deck Pile Trestle	1965	n/a	n/a	n/a	n/a
473.70	272.5	SD	Open Deck Pile Trestle	1966	n/a	n/a	n/a	n/a
474.00	274	SD	Open Deck Pile Trestle	1966	n/a	n/a	n/a	n/a
379.80	153	SD	Open Deck Pile Trestle	1967	n/a	n/a	n/a	n/a
287.05	11	SD	Open Deck Pile Trestle	1968	n/a	n/a	n/a	n/a

South Dakota Open Deck Pile Trestles

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
328.14	91	SD	Open Deck Pile Trestle	1968	n/a	n/a	n/a	n/a
292.60	20	SD	Open Deck Pile Trestle	1968	n/a	n/a	n/a	n/a
547.12	1673	SD	Open Deck Pile Trestle	1968	n/a	n/a	n/a	n/a
276.53	1	SD	Open Deck Pile Trestle	1968	n/a	n/a	n/a	n/a
452.70	229	SD	Open Deck Pile Trestle	1969	n/a	n/a	n/a	n/a
458.03	239	SD	Open Deck Pile Trestle	1970	n/a	n/a	n/a	n/a
294.30	24.5	SD	Open Deck Pile Trestle	1972	n/a	n/a	n/a	n/a

Appendix C:

South Dakota I-Beam Bridges

South Dakota I-Beam Bridges

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
414.17	195	SD	I-Beam	1909	Yes	Yes	A,C	1909-1949
407.60	189	SD	I-Beam	1909	Yes	Yes	A,C	1909-1949
318.74	72	SD	I-Beam	1909	Yes	Yes	A,C	1908-1949
308.88	52	SD	I-Beam	1909	Yes	Yes	A,C	1909-1949

Appendix D:

South Dakota Through Plate Girders

South Dakota Through Plate Girders

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
492.43	1522	SD	Through Plate Girder	1905	Yes	Yes	A,C	1911-1949
481.87	391.25	SD	Through Plate Girder	1907	Yes	Yes	A,C	1907-1949
462.57	252	SD	Through Plate Girder	1908	Yes	Yes	A,C	1908-1949
464.30	256	SD	Through Plate Girder	1909	Yes	Yes	A,C	1909-1949
465.61	259	SD	Through Plate Girder	1909	Yes	Yes	A,C	1909-1949
467.48	265	SD	Through Plate Girder	1909	No	No	n/a	n/a
459.60	243	SD	Through Plate Girder	1910	Yes	Yes	A,C	1910-1949
455.82	234	SD	Through Plate Girder	1911	Yes	Yes	A,C	1911-1949
456.16	235	SD	Through Plate Girder	1911	Yes	Yes	A,C	1911-1949
464.04	255	SD	Through Plate Girder	1912	Yes	Yes	A,C	1912-1949
450.93	226	SD	Through Plate Girder	1912	Yes	Yes	A,C	1912-1949
466.30	261	SD	Through Plate Girder	1913	Yes	Yes	A,C	1913-1949
448.49	222	SD	Through Plate Girder	1914	Yes	Yes	A,C	1914-1949
488.64	1512	SD	Through Plate Girder	1920	No	No	n/a	n/a
562.84	1703	SD	Through Plate Girder	1921	Yes	Yes	C	1921-1949

South Dakota Through Plate Girders

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
485.02	1507	SD	Triangular Lattice Through Truss, Through Plate	1921	Yes	Yes	C	1921-1949
521.48	1603	SD	Through Plate Girder	1922	Yes	Yes	A,C	1922-1949
599.80	1807	SD	Through Plate Girder	1922	Yes	Yes	A,C	1922-1949
507.41	1563	SD	Through Plate Girder	1924	Yes	Yes	C	1924-1949
600.46	1810	SD	Through Plate Girder	1925	Yes	Yes	A,C	1925-1949
503.65	1552	SD	Through Plate Girder	1926	No	No	n/a	n/a
610.20	1845	SD	Through Plate Girder	1927	Yes	Yes	A,C	1927-1949
532.90	1634	SD	Through Plate Girder	1930	Yes	Yes	A,C	1930-1949
290.70	17.5	SD	Through Plate Girder	1937	Yes	Yes	A,C	1937-1949

Appendix E:

South Dakota Deck Plate Girders

South Dakota Deck Plate Girders

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
567.30	1715	SD	Deck Plate Girder	1893	Yes	Yes	A,C(b)	1893-1949
362.04	142	SD	Deck Plate Girder	1904	Yes	Yes	A,C	1904-1949
347.66	120	SD	Deck Plate Girder	1909	Yes	Yes	A,C	1909-1949
388.00	163	SD	Deck Plate Girder	1909	Yes	Yes	A,C	1909-1949
337.76	107	SD	Deck Plate Girder	1909	Yes	Yes	A,C	1909-1949
459.18	242	SD	Deck Plate Girder	1910	Yes	Yes	A,C	1910-1949
400.20	180	SD	Deck Plate Girder	1910	Yes	Yes	A,C	1910-1949
397.10	173	SD	Deck Plate Girder	1912	Yes	Yes	A,C(b)	1912-1949
565.70	1712	SD	Deck Plate Girder	1922	Yes	Yes	A,C	1922-1949
596.97	1797	SD	Deck Plate Girder	1924	Yes	Yes	C	1929-1949
596.48	1794	SD	Deck Plate Girder	1924	Yes	Yes	C	1924-1949
595.06	1787	SD	Deck Plate Girder	1925	Yes	Yes	A,C	1930-1949
502.28	1547	SD	Deck Plate Girder	1826	Yes	Yes	A,C	1926-1949
491.50	1519	SD	Deck Plate Girder	1928	Yes	Yes	C	1928-1949
594.92	1786	SD	Deck Plate Girder	1928	Yes	Yes	A,C	1928-1949

South Dakota Deck Plate Girders

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
607.60	1831	SD	Deck Plate Girder	1929	Yes	Yes	C	1929-1949
476.80	288	SD	Deck Plate Girder	unknown	Yes	Yes	A,C(b)	(1940)-1949

Appendix F:

South Dakota Truss Bridges

South Dakota Truss Bridges

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
510.31	1569	SD	Triangular Lattice Through Truss	[1885]	Yes	Yes	C(b)	[1885]-1949
565.17	1711	SD	Triangular Lattice Through Truss	[1885]	Yes	Yes	A, C(b)	[1885]-1949
485.74	1508	SD	Triangular Lattice Through Truss	[1885]	Yes	Yes	A, C(b)	[1885]-1949
486.48	1509	SD	Triangular Lattice Through Truss	[1885]	Yes	Yes	A, C(b)	[1885]-1949
542.14	1659	SD	Triangular Lattice Through Truss	[1885]	Yes	Yes	A, C(b)	[1885]-1949
602.27	1813	SD	Triangular Lattice Through Truss (spans 1&4); Warren Through Truss (spans 2&3)	[1885]	Yes	Yes	A, C(b)	[1885]-1949
508.97	1567	SD	Triangular Lattice Through Truss	[1886]	No	No	n/a	n/a
520.44	1602	SD	Triangular Lattice Through Truss	1885	Yes	Yes	C(b)	1885-1949
535.66	1640	SD	Triangular Lattice Through Truss	1886	Yes	Yes	A, C(b)	1886-1949
536.49	1642	SD	Triangular Lattice Through Truss	1886	Yes	Yes	A, C(b)	1886-1949
539.85	1652	SD	Triangular Lattice Through Truss	1886	Yes	Yes	A, C(b)	1886-1949
547.71	1674	SD	Triangular Lattice Through Truss	1886	Yes	Yes	C(b)	1886-1949
484.64	1506	SD	Triangular Lattice Through Truss	1906	Yes	Yes	A, C	1906-1949

South Dakota Truss Bridges

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
482.88	1500	SD	Pennsylvania Through Truss	1907	Yes	Listed	A, C	1907-1949
295.50	29	SD	Riveted Pratt Through Truss	1910	Yes	Yes	A, C(b)	1910-1949
485.02	1507	SD	Triangular Lattice Through Truss, Through Plate Girder	1921	Yes	Yes	C	1921-1949
494.12	1527	SD	Triangular Lattice Through Truss	1924	Yes	Yes	A, C	1924-1949
518.41	1593	SD	Triangular Lattice Through Truss	1924	Yes	Yes	C	1924-1949
495.67	1531	SD	Triangular Lattice Through Truss	1925	Yes	Yes	C	1925-1949
560.33	1697	SD	Riveted Pratt Through Truss	unknown	Yes	Yes	A, C(b)	[1928]-1949

South Dakota Stone Box Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
330.60	95	SD	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
333.10	100	SD	Single Stone Box Culvert	1903	Yes	Yes	A	1903-1949
282.60	7	SD	Single Stone Box Culvert	1903	Yes	Yes	A	1903-1949
327.25	89	SD	Single Stone Box Culvert	1904	Yes	Yes	A	1904-1949
280.92	6	SD	Single Stone Box Culvert	1904	Yes	Yes	A	1904-1949
372.60	148	SD	Single Stone Box Culvert	1905	Yes	Yes	A	1905-1949
307.10	49	SD	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
306.76	48	SD	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
314.50	60	SD	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
480.10	298	SD	Double Stone Box Culvert	1907	No	No	n/a	n/a
320.45	73.5	SD	Single Stone Box Culvert	1907	Yes	Yes	A	1907-1949
389.25	166	SD	Single Stone Box Culvert	1907	Yes	Yes	A	1907-1949
319.95	73	SD	Single Stone Box Culvert	1907	Yes	Yes	A	1907-1949
449.90	223	SD	Single Stone Box Culvert	1907	Yes	Yes	A	1907-1949
371.25	147	SD	Single Stone Box Culvert	1907	Yes	Yes	A	1907-1949

South Dakota Stone Box Culverts

listed by year built

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
450.10	224	SD	Single Stone Box Culvert	1907	Yes	Yes	A	1907-1949
459.95	244	SD	Double Stone Box Culvert	1908	Yes	Yes	A	1908-1949
410.70	192	SD	Single Stone Box Culvert	1909	Yes	Yes	A	1909-1949
410.1	191	SD	Single Stone Box Culvert	1909	Yes	Yes	A	1909-1949
381.85	156	SD	Single Stone Box Culvert	1909	Yes	Yes	A	1909-1949
348.65	121	SD	Single Stone Box Culvert	1909	Yes	Yes	A	1909-1949
307.90	51	SD	Single Stone Box Culvert	1909	Yes	Yes	A	1909-1949
325.10	83	SD	Single Stone Box Culvert	1909	Yes	Yes	A	1909-1949
365.55	144	SD	Single Stone Box Culvert	1909	Yes	Yes	A	1909-1949
418.15	200	SD	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949
326.70	88	SD	Single Stone Box Culvert	1911	Yes	Yes	A	1911-1949

Appendix H:

South Dakota Buildings

South Dakota Buildings

listed by year built

Mile Post	Name	State	Historic Use	Current use	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
291.00	Chicago & North Western Depot Brookings (DM&E Building 916	SD	depot	KQ102 Radio Station	1904	Yes	Yes	A	1904-1949
329.50	Chicago & North Western Depot, De Smet	SD	combination depc	De Smet City Museum	1906	Yes	Yes	A,C	1906-1949
384.70	Quinn Stockyards	SD	stock yards	none	1907	Yes	Yes	A	1907-1949
362.60	Huron Roundhouse (DM&E Building 921	SD	roundhouse	roundhouse	1907	Yes	Listed	A,C	1907-1949
362.60	Huron Roundhouse Office Building	SD	office/storage	mechanical department main office	ca. 1907	Yes	Listed	A,C	1907-1949
321.00	Lake Preston Freight House	SD	storage	not in use	ca. 1910	Yes	Yes	A	ca. 1910-1949
402.80	Miller Freight House	SD	freight house	station house	ca. 1915	Yes	Yes	A	ca. 1915-1949

Appendix I:

South Dakota Bridges: Eligibility Summary

South Dakota Bridges: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
276.53	1	SD	Open Deck Pile Trestle	1968	n/a	n/a	n/a	n/a
278.18	2	SD	Open Deck Pile Trestle	1961	n/a	n/a	n/a	n/a
280.31	5	SD	Open Deck Pile Trestle	1948	Yes	Yes	A	1948-1949
280.92	6	SD	Single Stone Box Culvert	1904	Yes	Yes	A	1904-1949
282.60	7	SD	Single Stone Box Culvert	1903	Yes	Yes	A	1903-1949
283.44	8	SD	Open Deck Pile Trestle	1929	Yes	Yes	A	1929-1949
283.60	8.5	SD	Open Deck Pile Trestle	1956	n/a	n/a	n/a	n/a
283.66	9	SD	Open Deck Pile Trestle	1954	n/a	n/a	n/a	n/a
285.52	10	SD	Open Deck Pile Trestle	1959	n/a	n/a	n/a	n/a
287.05	11	SD	Open Deck Pile Trestle	1968	n/a	n/a	n/a	n/a
287.29	12	SD	Open Deck Pile Trestle	1959	n/a	n/a	n/a	n/a
288.11	14	SD	Open Deck Pile Trestle	1959	n/a	n/a	n/a	n/a
290.70	17.5	SD	Through Plate Girder	1937	Yes	Yes	A, C	1937-1949
291.88	18	SD	Open Deck Pile Trestle	1960	n/a	n/a	n/a	n/a

South Dakota Bridges: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
292.30	19	SD	Open Deck Pile Trestle	1965	n/a	n/a	n/a	n/a
292.60	20	SD	Open Deck Pile Trestle	1968	n/a	n/a	n/a	n/a
293.20	21	SD	Open Deck Pile Trestle	1959	n/a	n/a	n/a	n/a
293.45	23	SD	Open Deck Pile Trestle	1956	n/a	n/a	n/a	n/a
293.98	24	SD	Open Deck Pile Trestle	1959	n/a	n/a	n/a	n/a
294.30	24.5	SD	Open Deck Pile Trestle	1972	n/a	n/a	n/a	n/a
294.90	27	SD	Open Deck Pile Trestle	1959	n/a	n/a	n/a	n/a
295.10	28	SD	Open Deck Pile Trestle	1960	n/a	n/a	n/a	n/a
295.50	29	SD	Riveted Pratt Through Truss	1910	Yes	Yes	A, C	1910-1949
295.90	30	SD	Open Deck Pile Trestle	1959	n/a	n/a	n/a	n/a
301.87	38	SD	Open Deck Pile Trestle	1936	Yes	Yes	A	1936-1949
302.29	40	SD	Open Deck Pile Trestle	1956	n/a	n/a	n/a	n/a
302.45	41	SD	Open Deck Pile Trestle	1959	n/a	n/a	n/a	n/a
302.86	43	SD	Open Deck Pile Trestle	1940	Yes	Yes	A	1940-1949

South Dakota Bridges: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
303.30	45	SD	Open Deck Pile Trestle	1959	n/a	n/a	n/a	n/a
304.13	46	SD	Open Deck Pile Trestle	1935	Yes	Yes	A	1935-1949
305.32	47	SD	Open Deck Pile Trestle	1953	n/a	n/a	n/a	n/a
306.76	48	SD	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
307.10	49	SD	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
307.90	51	SD	Single Stone Box Culvert	1909	Yes	Yes	A	1909-1949
308.88	52	SD	I-Beam	1909	Yes	Yes	A, C	1909-1949
312.84	58	SD	Open Deck Pile Trestle	1940	Yes	Yes	A	1940-1949
314.50	60	SD	Single Stone Box Culvert	1906	Yes	Yes	A	1906-1949
315.24	61	SD	Open Deck Pile Trestle	1933	Yes	Yes	A	1933-1949
318.74	72	SD	I-Beam	1909	Yes	Yes	A, C	1908-1949
319.95	73	SD	Single Stone Box Culvert	1907	Yes	Yes	A	1907-1949
320.45	73.5	SD	Single Stone Box Culvert	1907	Yes	Yes	A	1907-1949
325.10	83	SD	Single Stone Box Culvert	1909	Yes	Yes	A	1909-1949

South Dakota Bridges: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
326.70	88	SD	Single Stone Box Culvert	1911	Yes	Yes	A	1911-1949
327.25	89	SD	Single Stone Box Culvert	1904	Yes	Yes	A	1904-1949
327.39	90	SD	Open Deck Pile Trestle	1947	Yes	Yes	A	1947-1949
328.14	91	SD	Open Deck Pile Trestle	1968	n/a	n/a	n/a	n/a
330.60	95	SD	Single Stone Box Culvert	1900	Yes	Yes	A	1900-1949
333.10	100	SD	Single Stone Box Culvert	1903	Yes	Yes	A	1903-1949
335.79	105	SD	Open Deck Pile Trestle	1930	No	No	n/a	n/a
337.76	107	SD	Deck Plate Girder	1909	Yes	Yes	A, C	1909-1949
340.60	109	SD	Open Deck Pile Trestle	1940	Yes	Yes	A	1940-1949
342.11	110	SD	Open Deck Pile Trestle	1945	Yes	Yes	A	1945-1949
344.63	112	SD	Open Deck Pile Trestle	1939	Yes	Yes	A	1939-1949
347.00	118	SD	Open Deck Pile Trestle	1952	n/a	n/a	n/a	n/a
347.66	120	SD	Deck Plate Girder	1909	Yes	Yes	A, C	1909-1949
348.65	121	SD	Single Stone Box Culvert	1909	Yes	Yes	A	1909-1949

South Dakota Bridges: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
349.82	124	SD	Open Deck Pile Trestle	1962	n/a	n/a	n/a	n/a
351.00	126	SD	Open Deck Pile Trestle	1962	n/a	n/a	n/a	n/a
352.41	127	SD	Open Deck Pile Trestle	1963	n/a	n/a	n/a	n/a
353.34	129	SD	Open Deck Pile Trestle	1952	n/a	n/a	n/a	n/a
356.64	137	SD	Open Deck Pile Trestle	1938	Yes	Yes	A	1938-1949
357.28	138	SD	Open Deck Pile Trestle	1927	Yes	Yes	A	1927-1949
358.70	140	SD	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1949
362.04	142	SD	Deck Plate Girder	1904	Yes	Yes	A, C	1904-1949
365.55	144	SD	Single Stone Box Culvert	1909	Yes	Yes	A	1909-1949
369.70	145	SD	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
371.25	147	SD	Single Stone Box Culvert	1907	Yes	Yes	A	1907-1949
372.60	148	SD	Single Stone Box Culvert	1905	Yes	Yes	A	1905-1949
375.20	WRONG	SD	Precast Concrete Slab	1996	No	No	n/a	n/a
379.80	153	SD	Open Deck Pile Trestle	1967	n/a	n/a	n/a	n/a

South Dakota Bridges: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
381.85	156	SD	Single Stone Box Culvert	1909	Yes	Yes	A	1909-1949
388.00	163	SD	Deck Plate Girder	1909	Yes	Yes	A, C	1909-1949
389.25	166	SD	Single Stone Box Culvert	1907	Yes	Yes	A	1907-1949
390.98	168	SD	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
397.10	173	SD	Deck Plate Girder	1912	Yes	Yes	A, C(b)	1912-1949
398.74	177	SD	Open Deck Pile Trestle	1935	Yes	Yes	A	1935-1949
400.20	180	SD	Deck Plate Girder	1910	Yes	Yes	A, C	1910-1949
403.41	186	SD	Open Deck Pile Trestle	1941	Yes	Yes	A	1941-1949
406.10	188	SD	Open Deck Pile Trestle	1952	n/a	n/a	n/a	n/a
407.60	189	SD	I-Beam	1909	Yes	Yes	A, C	1909-1949
410.10	191	SD	Single Stone Box Culvert	1909	Yes	Yes	A	1909-1949
410.70	192	SD	Single Stone Box Culvert	1909	Yes	Yes	A	1909-1949
413.18	194	SD	Open Deck Pile Trestle	1931	Yes	Yes	A	1931-1949
414.17	195	SD	I-Beam	1909	Yes	Yes	A, C	1909-1949

South Dakota Bridges: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
418.15	200	SD	Single Stone Box Culvert	1910	Yes	Yes	A	1910-1949
448.49	222	SD	Through Plate Girder	1914	Yes	Yes	A, C	1914-1949
449.90	223	SD	Single Stone Box Culvert	1907	Yes	Yes	A	1907-1949
450.10	224	SD	Single Stone Box Culvert	1907	Yes	Yes	A	1907-1949
450.93	226	SD	Through Plate Girder	1912	Yes	Yes	A, C	1912-1949
452.15	228	SD	Open Deck Pile Trestle	1953	n/a	n/a	n/a	n/a
452.70	229	SD	Open Deck Pile Trestle	1969	n/a	n/a	n/a	n/a
453.46	230	SD	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
455.07	232	SD	Open Deck Pile Trestle	1934	Yes	Yes	A	1934-1949
455.38	233	SD	Open Deck Pile Trestle	1935	Yes	Yes	A	1935-1949
455.82	234	SD	Through Plate Girder	1911	Yes	Yes	A, C	1911-1949
456.16	235	SD	Through Plate Girder	1911	Yes	Yes	A, C	1911-1949
456.45	236	SD	Open Deck Pile Trestle	1947	Yes	Yes	A	1947-1949
458.03	239	SD	Open Deck Pile Trestle	1970	n/a	n/a	n/a	n/a

South Dakota Bridges: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
458.65	240	SD	Open Deck Pile Trestle	1939	Yes	Yes	A	1930-1949
459.18	242	SD	Deck Plate Girder	1910	Yes	Yes	A, C	1910-1949
459.60	243	SD	Through Plate Girder	1910	Yes	Yes	A, C	1910-1949
459.95	244	SD	Double Stone Box Culvert	1908	Yes	Yes	A	1908-1949
460.88	248	SD	Open Deck Pile Trestle	1939	Yes	Yes	A	1939-1949
462.32	251	SD	Open Deck Pile Trestle	1949	Yes	Yes	A	1949
462.57	252	SD	Through Plate Girder	1908	Yes	Yes	A, C	1908-1949
463.41	254	SD	Open Deck Pile Trestle	1937	Yes	Yes	A	1937-1949
464.04	255	SD	Through Plate Girder	1912	Yes	Yes	A, C	1912-1949
464.30	256	SD	Through Plate Girder	1909	Yes	Yes	A, C	1909-1949
465.61	259	SD	Through Plate Girder	1909	Yes	Yes	A, C	1909-1949
466.30	261	SD	Through Plate Girder	1913	Yes	Yes	A, C	1913-1949
466.62	263	SD	Open Deck Pile Trestle	1939	Yes	Yes	A	1939-1949
467.48	265	SD	Through Plate Girder	1909	No	No	n/a	n/a

South Dakota Bridges: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
472.65	271.25	SD	Open Deck Pile Trestle	1948	Yes	Yes	A	1948-1949
473.43	272	SD	Open Deck Pile Trestle	1949	No	No	n/a	n/a
473.70	272.5	SD	Open Deck Pile Trestle	1966	n/a	n/a	n/a	n/a
474.00	274	SD	Open Deck Pile Trestle	1966	n/a	n/a	n/a	n/a
474.54	275	SD	Open Deck Pile Trestle	1941	Yes	Yes	A	1941-1949
476.80	288	SD	Deck Plate Girder	unknown	Yes	Yes	A, C(b)	[1940]-1949
477.31	289	SD	Open Deck Pile Trestle	1948	Yes	Yes	A	1948-1949
478.25	293	SD	Open Deck Pile Trestle	1934	Yes	Yes	A	1934-1949
479.20	295	SD	Open Deck Pile Trestle	1948	Yes	Yes	A	1948-1949
479.50	297	SD	Open Deck Pile Trestle	1947	Yes	Yes	A	1947-1949
479.50	297A	SD	Open Deck Pile Trestle	1947	Yes	Yes	A	1947-1949
480.10	298	SD	Double Stone Box Culvert	1907	No	No	n/a	n/a
481.32	300	SD	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
481.87	301.25	SD	Through Plate Girder	1907	Yes	Yes	A, C	1907-1949

South Dakota Bridges: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
482.88	1500	SD	Pennsylvania Through Truss	1907	Yes	Listed	A, C	1907-1949
484.64	1506	SD	Triangular Lattice Through Truss	1906	Yes	Yes	A, C	1906-1949
485.02	1507	SD	Triangular Lattice Through Truss, Through Plate Girder	1921	Yes	Yes	C	1921-1949
485.74	1508	SD	Triangular Lattice Through Truss	[1885]	Yes	Yes	A, C(b)	[1885]-1949
486.48	1509	SD	Triangular Lattice Through Truss	[1885]	Yes	Yes	A, C(b)	[1885]-1949
487.22	1510	SD	Open Deck Pile Trestle	1929	Yes	Yes	A	1929-1949
488.64	1512	SD	Through Plate Girder	1920	No	No	n/a	n/a
489.48	1513	SD	Open Deck Pile Trestle	1927	Yes	Yes	A	1927-1949
490.05	1514	SD	Open Deck Pile Trestle	1925	Yes	Yes	A	1925-1949
491.50	1519	SD	Deck Plate Girder	1928	Yes	Yes	C	1928-1949
492.43	1522	SD	Through Plate Girder	1905	Yes	Yes	A, C	1911-1949
492.94	1523	SD	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1949
494.12	1527	SD	Triangular Lattice Through Truss	1924	Yes	Yes	A, C	1924-1949
495.67	1531	SD	Triangular Lattice Through Truss	1925	Yes	Yes	C	1925-1949

South Dakota Bridges: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
496.81	1532.5	SD	Open Deck Pile Trestle	1942	No	No	n/a	n/a
496.97	1533	SD	Open Deck Pile Trestle	1924	No	No	n/a	n/a
497.23	1534	SD	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1949
499.38	1538	SD	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1949
500.37	1539	SD	Open Deck Pile Trestle	1943	Yes	Yes	A	1943-1949
501.55	1545	SD	Open Deck Pile Trestle	1923	Yes	Yes	A	1923-1949
501.75	1546	SD	Open Deck Pile Trestle	1931	Yes	Yes	A	1931-1949
502.28	1547	SD	Deck Plate Girder	1926	Yes	Yes	A, C	1926-1949
502.76	1548	SD	Open Deck Pile Trestle	1922	Yes	Yes	A	1922-1949
503.65	1552	SD	Through Plate Girder	1926	No	No	n/a	n/a
507.41	1563	SD	Through Plate Girder	1924	Yes	Yes	C	1924-1949
508.97	1567	SD	Triangular Lattice Through Truss	[1886]	No	No	n/a	n/a
510.31	1569	SD	Triangular Lattice Through Truss	[1885]	Yes	Yes	C(b)	[1885]-1949
511.70	1571	SD	Open Deck Pile Trestle	1923	Yes	Yes	A	1923-1949

South Dakota Bridges: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
518.41	1593	SD	Triangular Lattice Through Truss	1924	Yes	Yes	C	1924-1949
519.59	1597	SD	Open Deck Pile Trestle	1927	Yes	Yes	A	1927-1949
519.94	1600	SD	Open Deck Pile Trestle	1929	Yes	Yes	A	1929-1949
520.44	1602	SD	Triangular Lattice Through Truss	1885	Yes	Yes	C(b)	1885-1949
521.48	1603	SD	Through Plate Girder	1922	Yes	Yes	A, C	1922-1949
525.91	1612	SD	Open Deck Pile Trestle	1948	Yes	Yes	A	1948-1949
526.12	1615	SD	Open Deck Pile Trestle	1921	Yes	Yes	A	1921-1949
526.53	1617	SD	Open Deck Pile Trestle	1915	Yes	Yes	A	1915-1949
530.16	1628	SD	Open Deck Pile Trestle	1924	Yes	Yes	A	1924-1949
531.50	1631	SD	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1949
532.20	1632	SD	Open Deck Pile Trestle	1920	No	No	n/a	n/a
532.90	1634	SD	Through Plate Girder	1930	Yes	Yes	A, C	1930-1949
535.00	1639	SD	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
535.66	1640	SD	Triangular Lattice Through Truss	1886	Yes	Yes	A, C(b)	1886-1949

South Dakota Bridges: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
536.49	1642	SD	Triangular Lattice Through Truss	1886	Yes	Yes	A, C(b)	1886-1949
537.28	1644	SD	Open Deck Pile Trestle	1946	Yes	Yes	A	1946-1949
537.63	1645	SD	Open Deck Pile Trestle	1932	Yes	Yes	A	1932-1949
538.81	1648	SD	Open Deck Pile Trestle	1937	Yes	Yes	A	1937-1949
539.85	1652	SD	Triangular Lattice Through Truss	1886	Yes	Yes	A, C(b)	1886-1949
540.35	1655	SD	Open Deck Pile Trestle	1918	Yes	Yes	A	1918-1949
541.32	1657	SD	Open Deck Pile Trestle	1924	Yes	Yes	A	1924-1949
542.14	1659	SD	Triangular Lattice Through Truss	[1885]	Yes	Yes	A, C(b)	[1885]-1949
542.63	1660	SD	Open Deck Pile Trestle	1929	Yes	Yes	A	1929-1949
542.94	1661	SD	Open Deck Pile Trestle	1922	Yes	Yes	A	1922-1949
544.21	1665	SD	Open Deck Pile Trestle	1926	Yes	Yes	A	1926-1949
544.64	1666	SD	Open Deck Pile Trestle	1923	Yes	Yes	A	1923-1949
545.86	1670	SD	Open Deck Pile Trestle	1925	Yes	Yes	A	1925-1949
546.63	1672	SD	Open Deck Pile Trestle	1922	Yes	Yes	A	1922-1949

South Dakota Bridges: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
547.12	1673	SD	Open Deck Pile Trestle	1968	n/a	n/a	n/a	n/a
547.71	1674	SD	Triangular Lattice Through Truss	1886	Yes	Yes	C(b)	1886-1949
548.60	1676	SD	Open Deck Pile Trestle	1920	Yes	Yes	A	1920-1949
549.50	1677	SD	Open Deck Pile Trestle	1924	No	No	n/a	n/a
550.11	1678	SD	Open Deck Pile Trestle	1939	Yes	Yes	A	1939-1949
550.30	1678.5	SD	Open Deck Pile Trestle	1922	Yes	Yes	A	1922-1949
550.37	1679	SD	Open Deck Pile Trestle	1923	Yes	Yes	A	1923-1949
551.63	1681	SD	Open Deck Pile Trestle	1922	Yes	Yes	A	1922-1949
552.50	1682	SD	Open Deck Pile Trestle	1921	Yes	Yes	A	1921-1949
553.17	1684	SD	Open Deck Pile Trestle	1929	Yes	Yes	A	1929-1949
555.94	1689	SD	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1949
556.63	1691	SD	Open Deck Pile Trestle	1923	Yes	Yes	A	1923-1949
557.23	1692	SD	Open Deck Pile Trestle	1926	Yes	Yes	A	1926-1949
559.52	1695	SD	Open Deck Pile Trestle	1920	Yes	Yes	A	1920-1949

South Dakota Bridges: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
560.33	1697	SD	Riveted Pratt Pony Truss	unknown	Yes	Yes	A, C(b)	[1928]-1949
562.84	1703	SD	Through Plate Girder	1921	Yes	Yes	C	1921-1949
565.17	1711	SD	Triangular Lattice Through Truss	[1885]	Yes	Yes	A, C(b)	[1885]-1949
565.70	1712	SD	Deck Plate Girder	1922	Yes	Yes	A, C	1922-1949
567.37	1715	SD	Deck Plate Girder	1893	Yes	Yes	A, C(b)	1893-1949
569.25	1719	SD	Open Deck Pile Trestle	1923	Yes	Yes	A	1923-1949
570.47	1725	SD	Open Deck Pile Trestle	1932	Yes	Yes	A	1932-1949
573.98	1734	SD	Open Deck Pile Trestle	1934	Yes	Yes	A	1934-1949
575.96	1736	SD	Open Deck Pile Trestle	1940	Yes	Yes	A	1940-1949
576.81	1738	SD	Open Deck Pile Trestle	1922	Yes	Yes	A	1922-1949
577.52	1739	SD	Open Deck Pile Trestle	1939	Yes	Yes	A	1939-1949
578.57	1741	SD	Open Deck Pile Trestle	1940	No	No	n/a	n/a
580.36	1745	SD	Open Deck Pile Trestle	1942	Yes	Yes	A	1942-1949
58.80	1746	SD	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1949

South Dakota Bridges: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
583.12	1749	SD	Open Deck Pile Trestle	1921	Yes	Yes	A	1921-1949
587.96	1760	SD	Open Deck Pile Trestle	1924	Yes	Yes	A	1924-1949
588.44	1762	SD	Open Deck Pile Trestle	1924	Yes	Yes	A	1924-1949
589.05	1764	SD	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1949
593.14	1776	SD	Open Deck Pile Trestle	1925	Yes	Yes	A	1925-1949
593.43	1778	SD	Open Deck Pile Trestle	1930	Yes	Yes	A	1930-1949
594.92	1786	SD	Deck Plate Girder	1928	Yes	Yes	A, C	1928-1949
595.06	1787	SD	Deck Plate Girder	1925	Yes	Yes	A, C	1930-1949
596.48	1794	SD	Deck Plate Girder	1924	Yes	Yes	C	1924-1949
596.97	1797	SD	Deck Plate Girder	1924	Yes	Yes	C	1929-1949
597.40	1799	SD	Open Deck Pile Trestle	1922	Yes	Yes	A	1922-1949
597.70	1800	SD	Open Deck Pile Trestle	1923	Yes	Yes	A	1923-1949
598.51	1802	SD	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1949
598.96	1804	SD	Open Deck Pile Trestle	1934	Yes	Yes	A	1934-1949

South Dakota Bridges: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
599.80	1807	SD	Through Plate Girder	1922	Yes	Yes	A, C	1922-1949
600.17	1809	SD	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1949
600.46	1810	SD	Through Plate Girder	1925	Yes	Yes	A, C	1925-1949
602.27	1813	SD	Triangular Lattice Through Truss (spans 1&4); Warren Through Truss (spans 2&3)	[1885]	Yes	Yes	A, C(b)	[1885]-1949
603.39	1815	SD	Open Deck Pile Trestle	1930	Yes	Yes	A	1930-1949
603.75	1816	SD	Open Deck Pile Trestle	1930	Yes	Yes	A	1930-1949
603.93	1817	SD	Open Deck Pile Trestle	1923	Yes	Yes	A	1923-1949
604.32	1821	SD	Open Deck Pile Trestle	1940	Yes	Yes	A	1949-1949
605.42	1823	SD	Open Deck Pile Trestle	1928	Yes	Yes	A	1928-1949
605.81	1824	SD	Open Deck Pile Trestle	1930	Yes	Yes	A	1930-1949
606.70	1828	SD	Open Deck Pile Trestle	1929	Yes	Yes	A	1929-1949
607.60	1831	SD	Deck Plate Girder	1929	Yes	Yes	C	1929-1949
609.50	1843.5	SD	Open Deck Pile Trestle	1932	Yes	Yes	A	1932-1949
609.76	1844	SD	Open Deck Pile Trestle	1949	Yes	Yes	A	1949

South Dakota Bridges: Eligibility Summary

Mile Post	Bridge Number	State	Main Span Type	Year Built	Retains Integrity	NRHP Eligible	NRHP Criteria	Period of Significance
610.20	1845	SD	Through Plate Girder	1927	Yes	Yes	A, C	1927-1949

MANUAL

OF THE

American Railway Engineering Association

Definitions, Specifications
and Principles of Practice

FOR

RAILWAY ENGINEERING

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WOODEN BRIDGES AND TRESTLES.

[1] DEFINITIONS.

General

Wooden Trestle.—A wooden structure composed of upright members supporting simple horizontal members or beams, the whole forming a support for loads applied to the horizontal members.

Frame Trestle.—A structure in which the upright members or supports are framed timbers.

Pile Trestle.—A structure in which the upright members or supports are piles.

Bent.—The group of members forming a single vertical support of a trestle, designated as pile bent where the principal members are piles, and as framed bent where of framed timbers.

Post.—One of the vertical or battered members of the bent of a framed trestle.

Pile.—(See definition under subject of Piles and Pile Driving.)

Batter.—A deviation from the vertical in upright members of a bent.

Cap.—A horizontal member upon the top of piles or posts, connecting them in the form of a bent.

Sill.—The lowest horizontal member of a framed bent.

Mud-Sill or Sub-Sill.—A timber bedded in the ground to support a framed bent.

Intermediate Sill.—A horizontal member in the plane of the bent forming the cap of a lower section and the sill of an upper section.

Sway Brace.—A member bolted or spiked to the bent and extending diagonally across its face.

Longitudinal Strut or Girt.—A stiffening member running horizontally, or nearly so, from bent to bent.

Longitudinal X Brace.—A member extending diagonally from bent to bent in a vertical or battered plane.

Sash Brace.—A horizontal member secured to the posts or piles of a bent.

[1] Adopted, Vol. 6, 1905, pp. 35, 36, 42, 55-67; Vol. 7, 1906, pp. 683, 684; Vol. 11, Part 1, 1910, pp. 178, 228; Vol. 16, 1915, pp. 894, 1179; Vol. 21, 1920, pp. 1281, 1434.

STRINGER.—A longitudinal member extending from bent to bent and supporting the track.

JACK STRINGER.—A stringer placed outside of the line of main stringers.

BRIDGE TIE.—A transverse timber resting on the stringers and supporting the rails.

INNER GUARD RAIL.—A longitudinal member, usually a metal rail, secured on top of the ties inside of the track rail, to guide derailed car wheels.

GUARD TIMBER.—A longitudinal timber placed outside of the track rail, to maintain the spacing of the ties.

PACKING BLOCK.—A small member, usually wood, used to secure the parts of a composite member in their proper relative positions.

PACKING SPOOL OR SEPARATOR.—A small casting used in connection with packing bolts to secure the several parts of a composite member in their proper relative positions.

DRIFT BOLT.—A piece of round or square iron of specified length, with or without head or point, driven as a spike.

DOWEL.—An iron or wooden pin, extending into, but not through, two members of the structure to connect them.

SHIM.—A small piece of wood or metal placed between two members of a structure to bring them to a desired relative elevation.

FISH-PLATE.—A short piece lapping a joint, secured to the side of two members, to connect them end to end.

BULKHEAD.—Timbers placed against the embankment side of an end bent to retain the embankment.

[2]PILES AND PILE DRIVING.

PILE.—A member usually driven or jetted into the ground and deriving its support from the underlying strata, and by the friction of the ground on its surface.

The usual functions of a pile are: (*a*) To carry a superimposed load; (*b*) To compact the surrounding ground; (*c*) To form a wall to exclude water and soft material, or to resist the lateral pressure of adjacent ground.

HEAD OF PILE.—The upper end of a pile.

FOOT OF PILE.—The lower end of a pile.

BUTT OF PILE.—The larger end of a pile.

TIP OF PILE.—The smaller end of a pile.

BEARING PILE.—One used to carry a superimposed load.

[2]Adopted, Vol. 10, 1909, p. 565; Vol. 16, 1915, pp. 894, 1179; Vol. 21, 1920, pp. 1282, 1434.

SCREW PILE.—One having a broad-bladed screw attached to its foot to provide a larger bearing area.

DISC PILE.—One having a disc attached to its foot to provide a larger bearing area.

BATTER PILE.—One driven at an inclination to resist forces which are not vertical.

SHEET PILES.—Piles driven in close contact in order to provide a tight wall, to prevent leakage of water and soft materials; or driven to resist the lateral pressure of adjacent ground.

PILE DRIVER.—A machine for driving piles.

HAMMER.—A weight used to drive piles.

DROP HAMMER.—One which is raised by means of a rope and then allowed to drop.

STEAM HAMMER.—One which is automatically operated by the action of a steam cylinder and piston supported in a frame which rests on the pile.

LEADS.—The upright parallel members of a pile driver which support the sheaves used to hoist the hammer and piles, and which guide the hammer in its movement.

PILE CAP, HOOD OR BONNET.—A block used to protect the head of a pile and to hold it in the leads during driving.

RING.—A metal hoop used to bind the head of a pile during driving.

SHOE.—A metal protection for the point or foot of a pile.

FOLLOWER.—A member interposed between the hammer and pile to transmit blows to the latter when below the foot of the leads.

[2]SPECIFICATIONS FOR TIMBER PILES.

RAILROAD HEART GRADE.

1. This grade includes white, burr, and post oak; dense pine, Douglas fir, tamarack, Eastern white and red cedar, chestnut, Western cedar, redwood and cypress.

2. Piles shall be cut from sound trees; shall be close grained and solid, free from defects, such as injurious ring shakes, large and unsound or loose knots, decay or other defects, which may materially impair their strength or durability. In Eastern red or white cedar a small amount of heart rot at the butt, which does not materially injure the strength of the pile, will be allowed.

3. Piles must be butt cut above the ground swell and have a uniform taper from butt to tip. Short bends will not be allowed. A line drawn

[2]Adopted, Vol. 10, 1909, pp. 537, 541, 542, 603-611.

from the center of the butt to the center of the tip shall lie within the body of the pile.

4. Unless otherwise allowed, piles must be cut when sap is down. Piles must be peeled soon after cutting. All knots shall be trimmed close to the body of the pile.

5. The minimum diameter at the tips of round piles shall be 9 inches for lengths not exceeding 30 feet; 8 inches for lengths over 30 feet but not exceeding 50 feet, and 7 inches for lengths over 50 feet. The minimum diameter at one-quarter of the length from the butt shall be 12 inches and the maximum diameter at the butt 20 inches.

6. The minimum width of any side of the tip of a square pile shall be 9 inches for lengths not exceeding 30 feet; 8 inches for lengths over 30 feet but not exceeding 50 feet, and 7 inches for lengths over 50 feet. The minimum width of any side at one-quarter of the length from the butt shall be 12 inches.

7. Square piles shall show at least 80 per cent. heart on each side at any cross-section of the stick, and all round piles shall show at least 10½ inches diameter of heart at the butt.

Railroad Falsework Grade.

8. This grade includes red and all other oaks not included in Railroad Heart grade, sycamore, sweet, black and tupelo gum, maple, elm, hickory, Norway pine or any sound timber that will stand driving.

9. The requirements for size of tip and butt taper and lateral curvature are the same as for Railroad Heart grade.

10. Unless otherwise specified piles need not be peeled.

11. No limits are specified as to the diameter or proportion of heart.

12. Piles which meet the requirements of Railroad Heart grade except the proportion of heart specified will be classed as Railroad Falsework grade.

[1]PILE DRIVING—PRINCIPLES OF PRACTICE.

(1) A thorough exploration of the soil by borings, or preliminary test piles, is the most important prerequisite to the design and construction of pile foundations.

[1]Adopted Vol. 12, 1911, Part 1, pp. 279, 307; Vol. 16, 1915, pp. 894, 1181.

(2) Soil consisting wholly or chiefly of sand is most favorable to the use of the water jet.

(3) In harder soils containing gravel the use of the jet may be advantageous, if sufficient volume and pressure be provided.

(4) In clay it may be economical to bore several holes in the soil with the aid of the jet before driving the pile, thus securing the accurate location of the pile, and its lubrication while being driven.

(5) In general, the water jet should not be attached to the pile, but handled separately.

(6) Two jets will often succeed where one fails. In special cases a third jet extending a part of the depth aids materially in keeping loose the material around the pile.

(7) Where the material is of such a porous character that the water from the jets may be dissipated and fail to come up in the immediate vicinity of the pile, the utility of the jet is uncertain, except for a part of the penetration.

(8) A steam or drop hammer should be used in connection with the water jet, and used to test the final rate of penetration.

(9) The use of the water jet is one of the most effective means of avoiding injury to piles by overdriving.

(10) There is danger from overdriving when the hammer begins to bounce. Overdriving is also indicated by the bending, kicking or staggering of the pile.

(11) The brooming of the head of the pile dissipates a part, and in some cases all, of the energy due to the fall of the hammer.

(12) The steam hammer is usually more effective than the drop hammer in securing the penetration of a wooden pile without injury, because of the shorter interval between blows.

(13) Where shock to surrounding material is apt to prove detrimental to the structure, the steam hammer should always be used instead of the drop hammer. This is especially true in the case of sheet piling which is intended to prevent the passage of water. In some cases also the jet should not be used.

(14) In general, the resistance of piles, penetrating soft material, depending solely upon skin friction, is materially increased after a period

of rest. This period may be as short as fifteen minutes, and rarely exceeds twelve hours.

(15) Where a pile penetrates a soft yielding material and bears upon hard stratum at its foot, its strength should be determined as a column; omitting the resistance, if any, due to skin friction.

(16) Unless the record of previous experience at the same site is available, the approximate bearing power may be obtained by loading test piles. The results of loading test piles should be used with caution, unless their condition is fairly comparable with that of the piles in the proposed foundation.

(17) In case the piles in a foundation are expected to act as columns, the results of loading test piles should not be depended upon unless they are sufficient in number to insure their action in a similar manner; and unless they are stayed against lateral motion.

(18) Before testing the penetration of a pile in soft material where its bearing power depends principally, or wholly, upon skin friction, the pile should be allowed to rest for 24 hours after driving.

(19) Where the resistance of piles depends mainly upon skin friction it is possible to diminish the combined strength, or bearing capacity, of a group of piles by driving additional piles within the same area.

(20) Where piles will foot in a hard stratum, investigation should be made to determine that this stratum is of sufficient depth and strength to carry the load.

(21) Timber piles may be advantageously pointed, in some cases to a 4-inch or 6-inch square at the end.

(22) Piles should not be pointed when driven into soft material.

(23) Shoes should be provided for piles when the driving is very hard, especially in riprap or shale. These shoes should be so constructed as to form an integral part of the pile.

(24) The use of a cap is advantageous in distributing the impact of the hammer more uniformly over the head of the pile, as well as in holding it in position during driving.

*PILE RECORD FORM.

Size 8½x11 or 8x10½ Inches. Form M. W. 701.

North and South Railroad.

Pile Record of Bridge..

LOCATION..

Weight and Kind of Hammer..........................**Date**..............**19**....

Bents Numbered from North or East End Piles numbered from Left to Right

Date	Bent No.	No. of Pile	Size of Pile			Kind of Wood	Cut-off	Base of rail to Ground	Total Penetrat.	Av. Last Five Blows		Kind of Soil	Remarks
			Tip End	Butt End	Length					Drop of Ham'r	Penetrat.		

*Adopted, Vol. 12, Part 1, 1911, pp. 278, 307.

*SPECIFICATIONS FOR WORKMANSHIP FOR PILE AND FRAME TRESTLES OF UNTREATED MATERIAL TO BE BUILT UNDER CONTRACT.

Site.

1. The trestle to be built under these specifications is located on the line of ..... Railway at ..... County of .....State of .....

General Description.

2. The work to be done under these specifications covers the construction of a ..... track wooden trestle about ..... feet long and an average of ..... feet high.

General Clauses.

3. The contractor shall furnish all necessary labor, tools, machinery, supplies, temporary staging and outfit required. He shall build the complete trestle ready for the track rails, in a workmanlike manner, in strict accordance with the plans and the true intent of these specifications, to the satisfaction and acceptance of the Engineer of the Railway Company.

4. The workmanship shall be of the best quality in each class of work. Details, fastenings and connections shall be of the best method of construction in general use on first-class work.

5. Holes shall be bored for all bolts. The depth of the hole and the diameter of the augur shall be as specified by the Engineer.

6. Framing shall be accurately fitted. No blocking or shimming will be allowed in making joints. Timbers shall be cut off with the saw; no axe to be used.

7. Joints and points of bearing, for which no fastening is shown on the plans, shall be fastened as specified by the Engineer.

8. The Engineer or his authorized agents shall have full power to cause any inferior work to be condemned, and taken down or altered, at the expense of the contractor. Any material destroyed by the contractor on account of inferior workmanship or carelessness of his men must be replaced by the contractor at his own expense.

9. Figures shown on the plans shall govern in preference to scale measurements. If any discrepancies should arise or irregularities be discovered in the plans, the contractor shall call on the Engineer for instructions. These specifications and the plans are intended to coincide, and if any question arises as to the proper interpretation of the plans or specifications, it shall be referred to the Engineer for a ruling.

*Adopted, Vol. 8, 1907, pp. 397-400, 442-450.

10. The contractor shall, when required by the Engineer, furnish a satisfactory watchman to guard the work.

11. On the completion of the work, all refuse material and rubbish that may have accumulated on top and under and near the trestle, by reason of its construction, shall be removed by the contractor.

Detail Specifications.

12. Piles shall be carefully selected to suit the place and ground where they are to be driven. When required by the Engineer, pile butts shall be banded with iron or steel for driving, and the tips shod with suitable iron or steel shoes. Such shoes will be furnished by the Railway Company.

13. Piles shall be driven to firm bearing, satisfactory to the Engineer; or until five blows of a hammer weighing 3000 lb., falling 15 feet (or a hammer and fall producing the same mechanical effect), are required to cause an average penetration of ½ inch per blow, except in soft bottom, where special instructions will be given.

14. Batter piles shall be driven to the inclination shown by the plans, and shall require but slight bending before framing.

15. Butts of all piles in a bent shall be sawed off to one plane and trimmed so as not to leave any horizontal projection outside of the cap.

16. Piles injured in driving, or driven out of place, shall either be pulled out or cut off, and replaced by new piles.

Caps.

17. Caps shall be sized and brought to a uniform thickness and even bearing on piles or posts. The side with most sap shall be placed downward.

Posts.

18. Posts shall be sawed to proper length for their position (vertical or batter), and to even bearing on cap and sill.

Sills.

19. Sills shall be sized at the bearing of posts to one plane.

Sash and Sway Braces.

20. Sash and sway bracing shall be properly framed and securely fastened to piles or posts. When necessary, filling pieces shall be used between the braces and the piles of a bent on account of the variation in size of piles, and securely fastened and faced to obtain a bearing against all piles.

Longitudinal Braces.

21. Longitudinal X braces shall be properly framed and securely fastened to piles or posts.

Girts.

22. Girts shall be properly framed and securely fastened to caps, sub-sills, intermediate sills, posts or piles, as the plans may require.

Stringers.

23. Stringers shall be sized to a uniform depth at supports. The edges with most sap shall be placed downward.

Jack Stringers.

24. Jack stringers, if required on the plans, shall be neatly framed on caps, and their tops shall be in the same plane as the track stringers.

Ties.

25. Ties shall be sized to a uniform thickness and shall be placed with the rough side upward. They shall be spaced regularly and cut to even length and line, as called for on the plans.

Guard Timbers.

26. Guard timbers shall be framed as called for on the plans, laid to line and to a uniform top surface. They shall be firmly fastened to the ties as required.

Bulkheads.

27. Bulkheads shall be of sufficient dimensions to keep the embankment clear of the caps, stringers and ties, at the end bents of the trestle. There shall be a space of not less than 2 inches between the back of the end bent and the face of the bulkhead. The projecting ends of the bulkhead shall be sawed off to conform to the slope of the embankment, unless otherwise specified.

Time of Completion.

28. The work shall be completed in all its parts on or before ..... 19....

Payments.

29. Payments will be made under the usual regulations of the Railway Company.

[1]USE OF GUARD RAILS AND GUARD TIMBERS FOR WOODEN BRIDGES AND TRESTLES.

(1) It is recommended as good practice to use guard timbers on all open-floor bridges, and same should be so constructed as to properly space the ties and hold them securely in their places.

(2) It is recommended that the guard timber and the inner guard rail, when used, shall be so spaced in reference to the track rail that a derailed truck will strike the inner guard rail without striking the guard timber. The inner guard rail should not be higher nor more than one inch lower than the running rail.

(3) It is recommended as good practice in the installation of inner guard rails to extend them beyond the ends of the bridges for such distance as is required by local conditions, but that this distance, in any case, be not less than 50 feet; that inner guard rails be fully spiked to every tie, and spliced at every joint; that the inner guard rails be some form of metal section; and that the ends be beveled, bent down, or otherwise protected against direct impact with moving parts of equipment.

(4) It is recommended as good practice to use inner guard rails on all open-floor and on the outside tracks of all solid-floor bridges and similar structures longer than 20 feet in main-line tracks, and on similar bridges and structures in branch-line tracks on which the speed of trains is 20 miles per hour or more.

[1]USE OF LAG SCREWS IN TRESTLE CONSTRUCTION.

(1) Lag screws require greater care than ordinary bolts and nuts to properly install, but are cheaper on account of ease of general maintenance.

(2) Lag screws, where properly applied, hold ties from bunching equally as well as bolts and nuts, and better than daps, in guard timbers.

(3) If the lag screws are tightened after timber has shrunk, there is less cost of maintenance than with bolts and nuts.

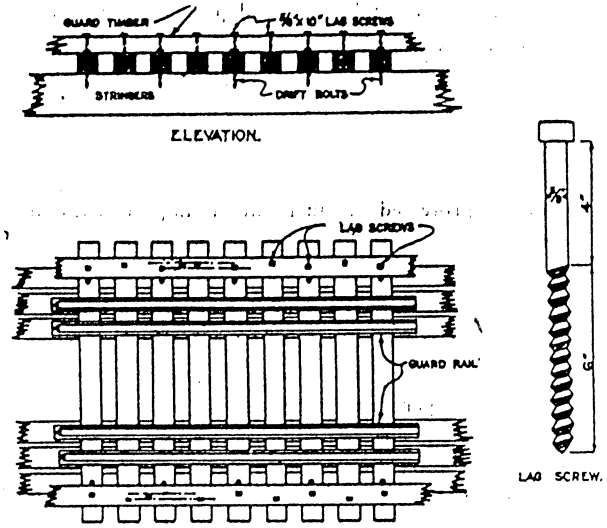
(4) Use of lag screws renders unnecessary the dapping of guard timbers, and, therefore, decreases cost of trestles without impairing quality.

[1] Adopted, Vol. 14, 1913, pp. 652, 653, 1136-1143; Vol. 15, 1914, pp. 403, 1036-1044; Vol. 21, 1920, pp. 1285, 1434.

(5) Surfacing (sizing) ties and guard timbers is better construction than dapping.

(6) For proper application of lag screws, holes in guard timbers should be bored with auger bits 1/16 in. less in diameter and holes in ties 1/4 in. less in diameter than the nominal size of lag screws used.

(7) Lag screws must be screwed in, not driven.



NOTE.—Ties and guard timbers to be sized one dimension. Omit dapping of guard timbers and ties. Use lag screws in every tie. Holes to be bored for lag screws one inch deeper than penetration of lag screw. Holes to be bored 1/16 in. smaller than diameter of lag in guard timber, and 1/4 in. smaller than diameter of lag in ties. Lag screws must not be driven but screwed to position. Fasten alternate ties to stringers. Lag

SPECIFICATIONS FOR METAL DETAILS USED IN WOODEN BRIDGES AND TRESTLES.

Wrought-Iron.

1. Wrought-iron shall be double-rolled, tough, fibrous and uniform in character. It shall be thoroughly welded in rolling and be free from surface defects. When tested in specimens of the form of Fig. 1 or in full-sized pieces of the same length, it shall show an ultimate strength of at least 50,000 lbs. per square inch, an elongation of 18 per cent. in 8 in., with fracture wholly fibrous. Specimens shall bend cold, with the fiber, through 135 degrees, without sign of fracture, around a pin the diameter of which is not over twice the thickness of the piece tested. When nicked and bent, the fracture shall show at least 90 per cent. fibrous.

Steel.

2. Steel shall be made by the open-hearth process and shall be of uniform quality. It shall contain not more than 0.05 per cent. sulphur. If made by the acid process it shall contain not more than 0.06 per cent. phosphorus; and if made by the basic process, not more than 0.04 per cent. phosphorus. When tested in specimens of the form of Fig. 1, or full-

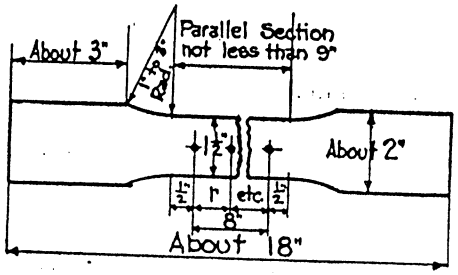


FIG. 1.

sized pieces of the same length, it shall have a desired ultimate tensile strength of 60,000 lbs. per square inch. If the ultimate strength varies more than 4000 lbs. from that desired, a retest shall be made on the same gage, which, to be acceptable, shall be within 5000 lbs. of the desired ultimate. It shall have a minimum percentage of elongation in 8 inches of $\frac{1{,}500{,}000}{\text{ultimate tensile strength}}$; and shall bend cold without fracture 180 degrees flat. The fracture for tensile tests shall be silky.

Cast-Iron.

3. Except where chilled iron is specified, castings shall be made of tough gray iron, with sulphur not over 0.10 per cent. They shall be true to pattern, out of wind and free from flaws and excessive shrinkage. If

tests are demanded, they shall be made on the "Arbitration Bar" of the American Society for Testing Materials, which is a round bar 1¼ inches in diameter and 15 inches long. The transverse test shall be made on a supported length of 12 inches, with load at middle. The minimum breaking load so applied shall be 2900 lbs., with a deflection of at least 1/10 inch before rupture.

Bolts.

4. Bolts shall be of wrought-iron or steel, made with square heads, standard size, the length of thread to be 2½ times the diameter of bolt. The nuts shall be made square, standard size, with thread fitting closely the thread of bolt. Threads shall be cut according to U. S. standards.

Drift Bolts.

5. Drift bolts shall be of wrought-iron or steel, with or without square head, pointed or without point, as may be called for on plans.

Spikes.

6. Spikes shall be of wrought-iron or steel, square or round, as called for on the plans. Steel wire spikes, when used for spiking planking, shall not be used in lengths more than 6 inches; if greater lengths are required, wrought or steel spikes shall be used.

Packing Spools or Separators.

7. Packing spools or separators shall be of cast-iron, made to size and shape called for on plans. The diameter of hole shall be ⅛ inch larger than diameter of packing bolts.

Cast Washers.

8. Cast washers shall be of cast-iron. The diameter shall be not less than 3½ times the diameter of bolt for which it is used, and its thickness equal to the diameter of bolt. The diameter of hole shall be ⅛ inch larger than the diameter of the bolt.

Wrought Washers.

9. Wrought washers shall be of wrought-iron or steel, the diameter shall be not less than 3½ times the diameter of bolt for which it is used, and not less than ¼ inch thick. The hole shall be ⅛ inch larger than the diameter of the bolt.

Special Castings.

10. Special castings shall be made true to pattern, without wind, free from flaws and excessive shrinkage; size and shape to be as called for by the plans.

"RELATIVE ECONOMY OF REPAIRS AND RENEWALS OF WOODEN BRIDGES AND TRESTLES.

It is good practice to repair wooden bridges and trestles by parts until such time as the general condition of the structure requires entire renewal.

"COMPARATIVE MERITS OF BALLAST DECK AND REINFORCED CONCRETE TRESTLES.

(1) While in certain locations there is little probability of fire loss in creosoted ballast deck timber trestles, yet due to the very nature of the material used the reinforced concrete trestle has a decided advantage.

(2) The concrete structure is slightly superior to the timber structure for bridging waterways subject to flood currents, or wide fluctuations in elevation of water surface.

(3) Although the concrete trestle may possibly afford better service qualities than the wooden trestle, the matter is so intangible in character as to preclude a definite statement of relative merit.

(4) Where selection of type of trestle is optional and not influenced by other considerations, neither type of trestle has the advantage of the other in the matter of appearance.

(5) Notwithstanding the fact that the two materials are, with certain limitations, equally suitable for the construction of trestles, the use of concrete is more in accord with the theory of conservation of natural resources and industrial economy.

(6) Adoption of either type should be the result of carefully weighing, for each individual bridge, the greater economy of the timber trestle against the several advantages of the concrete not susceptible of mathematical demonstration.

(7) Creosoted timber trestles are more economical than concrete, except when the cost of the concrete structure is less than one and one-half times the cost of the wooden structure.

"Adopted, Vol. 16, 1915, pp. 891, 1179.
"Adopted, Vol. 19, 1918, [illegible]

"WORKING STRESSES PERMISSIBLE FOR STRUCTURAL TIMBERS (Pounds per Square Inch)

Species	Bending. Allowable stress in extreme fiber. Damp or wet location (docks, piling, and sills)	Outside, not in contact with soil (bridges and open sheds)	Under shelter in a dry location (factories and warehouses)	Allowable horizontal shear stress. All locations	Compression. Allowable stress parallel to grain "Short Columns." Wet location	Outside location	Dry location	Allowable stress perpendicular to grain. Wet location	Outside location	Inside location
Cedar, western red	750	800	900	80	650	700	700	125	150	200
Cedar, northern white	600	650	750	70	450	500	550	100	140	175
Chestnut	700	850	950	90	600	700	800	150	200	300
Cypress	900	1100	1300	100	800	1100	1100	225	250	350
Douglas fir—										
No. 1 structural	1100	1400	1600	100	900	1100	1200	225	250	350
No. 2 structural	900	1100	1300	90	800	900	1000	200	225	300
Rocky Mountain region	700	900	1100	85	700	800	800	200	225	275
Fir, balsam	600	750	900	70	500	600	700	100	125	150
Gum, red	800	900	1100	100	650	750	800	150	200	300
Hemlock, western	900	1100	1300	75	800	900	900	200	225	300
Hemlock, eastern	800	900	1000	70	600	700	700	200	225	300
Hickory	1200	1500	1900	140	1000	1200	1500	350	400	600
Larch, western	900	1100	1200	100	800	1000	1100	200	225	325
Maple, sugar or hard	1000	1300	1500	150	900	1100	1200	300	375	500
Maple, silver or soft	700	900	1000	100	600	700	800	200	250	350
Oak, white or red	1000	1200	1400	125	800	900	1000	300	375	500
Pine—										
Southern yellow (dense)	1100	1400	1600	125	900	1100	1200	225	250	350
Southern yellow (sound)	900	1100	1300	105	800	900	1000	200	225	300
Eastern white	750	800	900	85	650	750	750	125	150	250
Western white	750	800	900	85	650	750	750	125	150	250
Norway	800	1000	1100	85	700	800	800	150	175	300
Redwood	800	1000	1200	70	750	900	1000	125	150	250
Spruce, red, white and Sitka	800	900	1100	85	650	750	800	125	150	250
Spruce, Engelmann	500	650	750	70	450	550	600	100	140	175
Tamarack, eastern	900	1100	1200	95	800	900	1000	200	225	300

[12]Adopted, Vol. 21, 1920, pp. 1337, 1434.

"SPECIFICATIONS AND CLASSIFICATION AND GRADING RULES FOR LUMBER AND TIMBER TO BE USED IN THE CONSTRUCTION AND MAINTENANCE OF WAY DEPARTMENTS OF RAILROADS.

Structural Timber.

Definitions.

Axis.—The line connecting the centers of successive cross-sections of a stick.

Corner.—The line of intersection of the planes of two adjacent longitudinal surfaces.

Cross-Section.—A section of a stick at right angles to the axis.

Edge.—Either of the two narrower longitudinal surfaces of a stick.

Face.—The surface of a stick which is exposed to view in the finished structure.

Full Length.—Long enough to "square" up to the length specified in the order.

Girth.—The perimeter of a cross-section.

Heartwood.—The older and central part of a log, usually darker in color than sapwood. It appears in strong contrast to the sapwood in some species, while in others it is but slightly different in color.

Out of Wind.—Having the longitudinal surfaces plane.

Side.—Either of the two wider longitudinal surfaces of a stick.

Solid.—Without cavities; free from loose heart, wind shakes, bad checks, splits or breaks, loose slivers and worm or insect holes.

Sound.—Free from decay.

Springwood.—The inner part of the annual ring formed in the earlier part of the season, not necessarily in the spring, and often containing vessels or pores.

Square-Cornered.—Free from wane.

Straight.—Having a straight line of an axis.

Summerwood.—The outer part of the annual ring formed later in the season, not necessarily in the summer, being usually dense in structure and without conspicuous pores.

True.—Of uniform cross-section. Defects are caused by wavy or jagged sawing or consist of trapezoidal instead of rectangular cross-sections.

Names for Varieties of Structural Timber.

Cedar covers White Cedars: Thuya occidentalis, Maine to Minnesota and northward; Chamæcyparis thyoides, Atlantic Coast from Maine to Mississippi; Chamæcyparis lawsoniana, along the coast line of Oregon; Libocedrus decurrens, Cascades and Sierra Nevada of Oregon and California. Red Cedars: Thuya gigantea, Washington to North-

[12]Adopted, Vol. 22, 1921, pp. 494, 1072.

ern California and eastward to Montana; Juniperus virginiana, throughout United States. Western Red Cedar; Thuja plicata.

CYPRESS (Taxodium distichum) covers bald cypress, black, white and red cypress, from swamp and overflow land along the coast and rivers of the Southern States.

DOUGLAS FIR.—The term "Douglas Fir" covers the timber known as yellow fir, red fir, Western fir, Washington fir, Oregon or Puget Sound fir or pine, Northwest and West Coast fir.

HEMLOCK covers Southern or Eastern hemlock; that is, hemlock from all states east of and including Minnesota.

IDAHO WHITE PINE covers the variety of white pine from Western Montana, Northern Idaho and Eastern Washington.

NORWAY PINE covers what is known also as "Red Pine" and Banksian (Pinus Banksiana).

OAK.—Under this heading three classes of timber are used: (a) White Oak, to include White Oak, Burr Oak and Post Oak; (b) Red Oak, to include Red Oak, Scarlet Oak, Black Oak and all bastard oaks; (c) Chestnut Oak, to include only Chestnut Oak.

REDWOOD includes the California wood usually known by that name.

SOUTHERN YELLOW PINE.—This term includes the species of yellow pine growing in the Southern States from Virginia to Texas, that is, the pines hitherto known as longleaf pine (Pinus palustris), shortleaf pine (Pinus echinata), loblolly pine (Pinus taeda), Cuban pine (Pinus heterophylla) and pond pine (Pinus serotina).

SPRUCE covers Eastern spruce; that is, the spruce timber coming from points east of and including Minnesota.

TAMARACK covers the timber known as "Tamarack," or "Eastern Tamarack," from states east of and including Minnesota.

WESTERN HEMLOCK covers hemlock from the Pacific Coast.

WESTERN LARCH covers the species of Larch or Tamarack from the Rocky Mountains and Pacific Coast regions.

WESTERN PINE covers the timber sold as white pine coming from Arizona, California, New Mexico, Colorado, Oregon and Washington. This is the timber sometimes known as "Western Yellow Pine," or "Ponderosa Pine," or "California White Pine," or "Western White Pine."

WESTERN OR SITKA SPRUCE covers spruce timber from the Pacific Coast.

WHITE PINE covers the timber which has hitherto been known as white pine, from Maine, Michigan, Wisconsin and Minnesota.

Classification Terms.

LUMBER is the product of the saw and planing mill not further advanced in manufacture than by sawing, resawing and passing lengthwise through a standard planing machine, crosscutting to length, and end matching.

Lumber is classified as yard lumber, shop or factory lumber and structural timber. Different grading rules apply to each class of lumber.

YARD LUMBER is lumber that is less than six inches in thickness and is intended for general building and construction purposes. The grading of yard lumber is based upon the use of the entire piece, except when a stated amount of waste to remove defects is provided in the classification of the material under consideration.

SHOP OR FACTORY lumber is intended to be cut up for use in further manufacture and is graded on the basis of the percentage of the area which will produce a limited number of cuttings of a given minimum size and quality.

STRUCTURAL TIMBER is lumber that is six inches or over in thickness and width. The grading of structural timber is based upon the strength of the piece and the use of the entire piece.

Yard lumber is classified roughly as finishing and construction lumber. There is no sharp line between finishing and construction lumber. The medium grades may be used for either purpose.

FINISHING is yard lumber of the higher grades in which appearance, perfection of the surface and finishing qualities are primarily the basis on which the grade is determined. The higher finishing grades are more suitable for "natural" or transparent finishes while the lower finishing grades are smooth and free from serious defects and are particularly adapted to the use of paint.

CONSTRUCTION LUMBER is yard lumber which is graded primarily upon the basis of its strength as affected by defects, and its fitness for general construction purposes.

STRIPS are yard lumber less than two inches thick and under eight inches wide. Strips are usually manufactured into matched and patterned lumber.

BOARDS are yard lumber less than two inches thick and eight inches or over wide.

PLANKS are yard lumber two inches and under four inches thick and eight inches and over in width.

SCANTLINGS are yard lumber two inches and under six inches thick and under eight inches wide.

HEAVY JOISTS are yard lumber that is four inches and under six inches thick and eight inches and over wide.

DIMENSION includes all yard lumber except boards and strips; that is, yard lumber two inches and under six inches thick and of any width.

MANUFACTURED lumber is classified as rough, surfaced and worked.

ROUGH lumber is undressed lumber left as it comes from the saw.

SURFACED lumber is lumber that is dressed by running through a planer. It may be surfaced on one side (S1S), two sides (S2S), one edge (S1E), two edges (S2E), or a combination of sides and edges (as S1S1E, S2S1E, or S1S2E).

WORKED lumber is lumber which has been run through a matching machine, sticker or moulder. Worked lumber may be matched, shiplapped or patterned. Patterned lumber is usually matched or shiplapped.

MATCHED lumber is lumber that is edge dressed and shaped to make a close tongue and groove joint at the edges or ends when laid edge to edge or end to end.

SHIPLAPPED lumber is lumber that is edge dressed to make a close rabbeted or lap joint when laid edge to edge.

PATTERNED lumber is worked lumber that is shaped to a patterned or moulded form.

Definitions of Defects and Blemishes.

The terms "Defect" and "Blemish" as applied to wood usually imply the idea of imperfections. These are not always detrimental.

DEFECT.—Any irregularity or want occurring in or on wood that may lower some of its strength value.

BLEMISH.—Any mark or formation of wood structure marring the appearance.

The presence of a defect or blemish may or may not be detrimental to the value of the material, depending upon the character of the defect or blemish and the use of the material.

Knots.

KNOT.—The hard mass of wood formed in a trunk of a tree at a branch with the grain distinct and separate from the grain of the trunk.

KNOTS shall be classified according to size, form and quality.

The average of the maximum and minimum diameters shall be used in measuring the size of knots unless otherwise stated.

In all grades of material all knots should be sound and tight unless otherwise specified.

PIN KNOT.—One not over ⅜ of an inch in diameter.

SMALL KNOT.—One between ⅜ and ¾ of an inch in diameter.

STANDARD KNOT.—One between ¾ and 1½ inches in diameter.

LARGE KNOT.—One over 1½ inches in diameter.

ROUND KNOT.—One whose maximum diameter is not over one and one-half times as great as its minimum diameter.

OVAL KNOT.—One having its maximum diameter one and one-half to three times as great as its minimum diameter.

SPIKE KNOT.—One sawed in a lengthwise direction whose maximum diameter is over three times as great as its minimum diameter.

SOUND KNOT.—One which is solid across its face, and is as hard as the wood surrounding it and shows no indications of decay.

UNSOUND OR ROTTEN KNOT.—One not as hard as the wood surrounding it or one in which decay has started.

TIGHT KNOT.—One so fixed by growth or position that it will firmly retain its place in the piece.

LOOSE KNOT.—One not held firmly in place by growth or position.

LIVE KNOT.—One whose growth rings are completely intergrown with those of the surrounding wood.

ENCASED KNOTS.—One whose growth rings are not intergrown and homogeneous with the growth rings of the surrounding wood. The encasement may be partial or complete.

WATERTIGHT KNOT.—One whose growth rings are completely intergrown with those of the surrounding wood on one face of the piece, and which is sound on that face.

PITH KNOT.—Sound knot except that it has a pith hole in the central growth ring. The hole rarely exceeds ¼ of an inch in diameter.

Holes.

HOLES in wood may extend partially or entirely through the piece. They are enumerated as knot, dog, picaroon, bird, insect (including pin, shot, spot, grub worms, etc.) metal and wooden rafting pin holes, through pitch pockets and the like.

When holes are permitted, the average of the maximum and minimum diameters at right angles to the direction of the hole shall be used in measuring the size, unless otherwise stated.

WOODEN RAFTING PINHOLES sometimes appear on river timber which has been rafted when holes have been bored in the solid wood for securing the timber, and a solid plug or pin driven in the hole, completely filling it. These defects must be treated and considered the same as Knot Defects. Ordinary Metal Rafting Pin, Cant Hook or Chain Dog-hole is not considered a defect.

GRUB WORM HOLES are usually from about ⅛-inch to $\frac{3}{16}$-inch in width, and vary in length from about 1 inch to 1½ inches and are caused by grubs working in the wood.

PIN WORM HOLES are very small holes caused by minute insects or worms. These holes are usually not over $\frac{1}{16}$-inch in diameter, the wood surrounding them is sound and does not show any evidence of the worm hole having any effect on the wood other than the opening.

SPOT WORM DEFECTS (also known as Flagworm Defects) are caused, like pin worm holes, by minute insects or worms working on the timber during the growth. The size of the hole is about the same as Pin-worm holes, but the surrounding wood shows a colored spot as evidence of the blemish. This spot is usually sound and does not affect the strength of the piece.

Checks.

CHECK is a separation of the wood cells along a radial plane of the tree

SURFACE CHECK is a shallow check occurring on the surface of a piece.

END CHECK is one occurring on an end of a piece.

THROUGH CHECK is one extending from one surface through the piece to the opposite surface or to an adjoining surface.

HEART CHECK is one starting at the pith and extending towards but not to the surface of a log and is not necessarily due to seasoning.

STAR CHECK is the combination of several heart checks occurring together.

HONEYCOMBING is checking occurring in the interior of a piece; often the checks are not visible on the surface. On a cross-section they usually appear as slits, or as open pockets whose width may appear very large in proportion to the radial length.

ORDINARY season checks such as occur in lumber properly covered in yard, or season checks of equal size in kiln-dried lumber shall not be considered defects.

Shakes and Splits.

SHAKE is a cylindrical separation of the wood following in general the annual layers (rings) of growth. Thus any shake is a ring shake.

ROUND SHAKE is one completely encircling the pith.

CUP SHAKE is one that does not completely encircle the pith.

THROUGH SHAKE is one extending from one surface through the piece to the opposite surface or to an adjoining surface.

PITCH SHAKE.—A clearly defined seam or opening between the grain of the wood and may be either filled or not with granulated pitch.

SPLIT is a lengthwise separation of the wood due to tearing apart of the wood cells in rough handling, felling the tree or similar causes. It may run in any direction across the end of a piece.

PITH is the small soft core occurring in the center growth ring of a log. In some woods it is large enough to mar the surface of the piece on which it appears. The wood immediately surrounding the pith often contains small checks, shakes or numerous pin knots and is often discolored; any such combination of defects and blemishes is known as Heart Center.

Pockets.

PITCH POCKET.—A well defined opening between the annual layers of growth usually containing more or less pitch, either solid or liquid. Bark may also be present in the pocket. On an edge-grain surface they appear as narrow open seams, and on flat grain surface they vary in appearance from narrow open seams to oval cavities sometimes called "Scab Pitch Pockets." On either surface they are known as very small, small, medium or large, depending upon their size.

VERY SMALL PITCH POCKET.—One not over ⅛ of an inch in width and not over 2 inches in length.

SMALL PITCH POCKET.—One whose maximum width may vary from ⅛ of an inch to ¼ of an inch provided a maximum limit of length of four inches decreases to two inches proportionately as the width increases.

MEDIUM PITCH POCKET.—One whose maximum width may vary from ⅛ of an inch to ⅜ of an inch provided a maximum limit of length of nine inches decreases to three inches proportionately as the width increases.

LARGE PITCH POCKET.—One whose width or length exceeds the sizes stated as permissible for a medium pitch pocket.

BARK POCKET is a patch of bark partially or wholly enclosed in the wood. It may result from wood and bark forming over a place where the tree has been injured. As a defect it is measured in the same manner as a Pitch Pocket.

Streaks and Discolorations.

PITCH STREAK.—A well defined and conspicuous accumulation of pitch in the wood cells. It is usually not considered an important blemish unless both springwood and summerwood appear saturated. They are known as small, medium or large depending upon their size with respect to the piece they are in.

SMALL PITCH STREAK.—One whose area does not exceed the product of one-twelfth the width by one-sixth the length of the face on which it occurs.

MEDIUM PITCH STREAK.—One whose area does not exceed the product of one-sixth the width by one-third the length of the face on which it occurs.

LARGE PITCH STREAK.—One whose area exceeds the product of one-sixth the width by one-third the length of the face on which it occurs.

PITH FLECK is a narrow streak, usually brownish, up to several inches in length on the face of a piece resulting from the larvæ of an insect having burrowed in the growing tissue or cells of the tree.

BIRD PECK is a small hole or patch of distorted grain resulting from birds pecking through the growing cells in the tree. It usually resembles a carpet tack in shape with the point towards the bark and it is usually accompanied by a discoloration extending along the grain and usually to a smaller extent around the layers of growth. A section through the discoloration produced by the bird peck produces what is commonly known as "Mineral Streak."

GUM SPOT OR STREAK is an accumulation of gum-like substance occurring as a small patch or streak in the piece. It may occur in conjunction with a bird peck or other injuries to the growing wood.

DISCOLORATIONS on or in lumber are enumerated as weather, sticker, water or fungus (such as blue stain, etc.) stain, brown stain, kiln burn and similar color changes due to a combination of temperature, moisture, chemicals, etc. Discoloration may follow insect attack, bird peck, etc.

LIGHT DISCOLORATION is paler than the medium discoloration and occurs in approximately one-fourth of the stained stock.

MEDIUM DISCOLORATION is a shade most commonly found and which occurs in approximately one-half of the stained stock.

HEAVY DISCOLORATION is darker than the medium discoloration and occurs in approximately one-fourth of the stained stock.

DECAY is disintegration of the wood substance due to the action of certain kinds of fungi. A few of the rot-producing fungi which start in the standing tree do not seem to seriously develop after the tree is cut into lumber.

RED HEART of the pines, spruces, Douglas fir and some other conifers, and peck of cypress and incense cedar are produced by fungi of this type. Decay may be classified as incipient and advanced decay.

INCIPIENT DECAY is the early stages of decay, usually detected by a discoloration of the wood which seems to be firm and solid.

ADVANCED DECAY or rot is noticeable as a decided softening or breaking down of the wood.

WATER STAIN, or what are sometimes called scalded or burnt spots, usually caused by timber lying in the water under certain conditions before it is sawed, and burnt spots where timber is improperly piled while green, are not considered defects, as they do not affect the strength of the piece.

"SAP"—SAPWOOD is the alburnum of the tree—the exterior part of the wood next to the bark. Sapwood is not considered a defect except as provided herein.

SOUND HEART.—The term "Sound Heart" is used whenever that part of the piece which was originally the central part or core of the tree is sound and solid, not decayed.

CROSS GRAINED WOOD is that in which the wood cells or fibers do not run parallel with the axis or sides of a piece. It may be classified as spiral, diagonal, wavy, dip, curly and interlocked grain. The slope of the grain can be determined by observing the direction of surface checks, resin ducts, pores of the wood, annual layers of growth, etc. A drop of stained liquid such as ink tends to elongate in the direction of the grain when placed on a smooth surface of the piece.

SPIRAL GRAINED WOOD is that in which the fibers take a more or less winding or spiral course, such as occurs in a twisted tree. It may be detected on the flat grain (plain sawed or tangential) surface.

DIAGONAL GRAINED WOOD is that in which the fibers extend at an angle (i. e., diagonally) across a piece as a result of sawing at an angle across the annual layers of growth. It may appear on either the radial or tangential surface.

WAVY GRAINED WOOD is that in which the fibers take the form of waves or undulations as indicated by the wavy surface of the split piece. It may appear on either the radial or tangential surface.

DIP GRAINED WOOD is that which has one wave or undulation of the fibers such as occurs around knots, pitch pockets, etc.

CURLY GRAINED WOOD is that in which the fibers are distorted so that they take a curled direction as in "Birdseye Wood." These patches may vary up to several inches in diameter.

INTERLOCKED GRAIN is wood that shows spiral grain in one direction for a number of years and then the slope of the grain in the succeeding annual layers of growth turns in a reverse direction around the tree, then later reverses back, etc.

Distortions and Crooks.

CROSS BREAK is a separation of the wood cells across the grain. It may be due to tension resulting from unequal longitudinal shrinkage or mechanical stresses.

COMPRESSION FAILURE is a wrinkling or buckling of the wood cells extending in a more or less irregular plane across the grain. It is due to longitudinal crushing or compression.

COLLAPSE is a caving in of the surface of a piece. It sometimes occurs in streaks giving the surface a corrugated appearance, and is often due to the flattening of the cells when drying wet wood at high temperatures.

WARPING is any variation from a true or plane surface. It includes crook, bow, twist or any combination of these.

CROOK is a deviation edgewise from a straight line drawn from end to end of a piece and is measured at the point of greatest departure from a straight line. It is known as slight, small, medium and large.

Unless otherwise specified, the different degrees of crook based on a piece four (4) inches wide and 16 feet long shall be as follows:

SLIGHT CROOK, a departure of one (1) inch.

SMALL CROOK, a departure of 1½ inches.

MEDIUM CROOK, a departure of 2 inches.

LARGE CROOK, a departure of over 2 inches.

For wider pieces it shall be ⅛-inch less for each additional 2 inches of width.

Shorter or longer pieces shall have the same limits for curvature.

BOW is a deviation flatwise from a straight line drawn from end to end of a piece, measured at the point of greatest distance from a straight line.

CUPPING is the curvature of a piece across the grain or width of a piece.

TWISTING is the turning or winding of the edges of a piece so that four corners of any face are no longer in the same plane (i. e., it is the twisting of an edge around the axis of the piece).

SPECIFICATIONS.

Defects of Manufacture, Applicable to All Timber and Lumber.

1. Defects in rough stock caused by improper manufacture and drying will reduce grade, unless they can be removed in dressing such stock to standard sizes.

2. In structural timber defects of manufacture have usually been omitted, being of minor significance.

3. Imperfect manufacture in dressed stock, such as torn grain, loosened grain, slight skips in dressing, wane, broken knots, mismatched, insufficient tongue or groove for flooring, ceiling, drop siding, etc., shall be considered defects, and will reduce the grade according as they are slight or serious in their effects on the use of the stock.

4. Torn grain consists of a part of the wood having been torn out in dressing. It occurs around knots and curly places and is of four distinct characters: slight, medium, heavy and deep. Slight torn grain shall not exceed 3/32-inch in depth; medium 1/16 and heavy 1/8-inch. Any torn grain heavier than 1/8-inch shall be termed deep.

5. Loosened grain consists in a point of one grain being torn loose from the next grain. It occurs on the heart side of the piece and is a serious defect, especially in flooring.

6. Chipped grain consists in a part of the surface being chipped or broken out in small particles below the line of cut and, as usually found, should not be classed as torn grain, and shall be considered a defect only when it unfits the piece for use intended.

7. Pieces of Flooring, Drop Siding or Partition with 3/16-inch or more of tongue; and pieces of Ceiling with 1/8-inch or more of tongue; and pieces of Ship Lap with 3/16-inch of lap will be admitted in any grade.

8. Pieces of Flooring, Drop Siding, Ceiling or Partition having not less than 1/16-inch tongue will be admitted in No. 2 Common. Pieces of Ship Lap having less than 3/16-inch and not less than 1/8-inch lap shall be admitted in No. 2 Common.

Standard Sizes.

1. In the absence of a special agreement between buyer and seller for each order, the following sizes shall be standard for all lumber and timber.

2. "Rough timbers sawed to standard size" means that they shall not vary over one-quarter (1/4) inch scant from the nominal size specified. For instance, a 12x12-inch timber shall measure not less than 11¾x11¾ inches.

3. "Standard Dressing" means that not more than 1/4-inch shall be allowed for dressing each surface. For instance, a 12x12-inch timber,

Dimension S1S1E.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
2	1⅝	4	3⅝
2½	2⅛	5	4⅝
3	2⅝	6	5⅝
4	3⅝	7	6⅝
5	4⅝	8	7½
...	...	9	8½
...	...	10	9½
...	...	12	11½
...	...	14	13½
...	...	16	15½

Standard lengths are multiples of two feet, 4 to 24 feet, inclusive, but lengths shorter than 10 feet shall not be included in miscellaneous or mixed shipments except by agreement.

Common Boards and Strips.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
1 R	13/16	4	3⅝
1 S 1 S	⅞	6	5⅝
1 S 2 S	13/16	8	7½
1¼	1 1/16	10	9½
1½	1 5/16	12	11½

Dressed Finishing Lumber S1S

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
⅜	5/16	4	3⅝
½	7/16	5	4⅝
⅝	9/16	6	5⅝
¾	11/16	7	6⅝
1	13/16	8	7½
1¼	1⅛	9	8½
1½	1⅜	10	9½
2	1¾	12	11½
2½	2⅛	14	13½
3	2⅝	16	15½

Flooring.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
3/8	...	...	....
1/2	...	...	....
5/8	...	...	....
			Tongue and Groove
3/4	11/16	3	2 3/8
1	13/16	4	3 1/4
1 1/4	1 1/16	5	4 1/4
1 1/2	1 5/16	6	5 1/4
2	1 5/8	6 Factory	5 1/8
2 1/2	2 1/8	...	....
			Splined
3	2 5/8	6	5 1/2
3 1/2	3 1/8	7	6 1/2
4	3 5/8	8	7 1/2
...	...	9	8 1/2
...	...	10	9 1/2
...	...	12	11 1/2
			Shiplap
...	...	6	5
...	...	7	6
...	...	8	7
...	...	9	8
...	...	10	9
...	...	12	11

Standard lengths are multiples of one foot from 4 to 20 feet. Five per cent. of 8 or 9 foot lengths is allowed in mixed length shipments of "B and Better" and in addition five per cent. of 6 or 7 feet in C, D and No. 1 Common, and in addition five per cent. of four or five feet in No. 2 Common, No. 3 Common, 4 to 20 feet inclusive.

The above percentage of short lengths is customary, and in the interest of conservation will be included, as far as practicable, in all shipments of mixed lengths.

Ceiling.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
3/8	5/16	3	2 3/8
1/2	7/16	4	3 1/4
5/8	9/16	5	4 1/4
...	...	6	5 1/4
1	3/4	7	6 1/8

Standard lengths are multiples of one foot, from 4 to 20 feet.

Five per cent. of 8 or 9 feet is allowed in mixed length shipments of "B and Better" Ceiling and in addition five per cent. of 6 or 7 feet in No. 1 Common, and in addition five per cent. of 4 or 5 feet in No. 2 Common.

The above percentage of short lengths is customary, and in the interest of conservation will be included, as far as practicable, in all shipments of mixed lengths.

Partition.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
3/8	5/16	3	2 3/8
1/2	7/16	4	3 1/4
5/8	9/16	5	4 1/4
3/4	11/16	6	5 1/4
1	3/4	7	6 1/8

Standard lengths are multiples of one foot.

Same percentage of short lengths is allowed as in ceiling.

Grooved Roofing.

Nominal thickness one (1) inch, actual thickness 13/16-inch.

Nominal Width Inches	*Actual Width Inches*
8	7 1/2
10	9 1/2
12	11 1/2

Roofers.

Roofers shall be made of No. 2 boards, 13/16-inch machine run, center matched and of nominal widths 6 or 8 inches as specified.

Fencing.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
1	13/16	3	2 5/8
1 1/4	1 1/16	4	3 5/8
1 1/2	1 5/16	5	4 5/8
...	...	6	5 5/8

Drop Siding, D&M.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
⅝	9/16	3	2¼
¾	11/16	4	3¼
1	¾	5	4¼
1¼	...	6	5¼
1½	...	...	...

Drop Siding, Worked Shiplap and Rustic.

Nominal thickness one (1) inch, actual thickness three-fourths (¾) inch.

Nominal Width Inches	*Actual Width Inches*
6	5⅛
8	7⅛
10	9⅛

Standard Lengths are multiples of 2 feet from 4 to 20 feet.

Five per cent. of 8 or 9 feet is allowed in mixed length shipments of "B and Better Drop Siding," and in addition five per cent. of 6 or 7 feet in "No. 1 Common" and in addition five per cent. of 4 or 5 feet in No. 2 Common.

The above percentage of short lengths is customary and in the interest of conservation will be included, so far as practicable, in all shipments of mixed lengths.

Shiplap.

Nominal thickness one (1) inch, actual thickness three-fourths (¾) inch, ⅜-inch lap.

Nominal Width Inches	*Actual Width Inches*
4	3⅛
6	5⅛
8	7⅛
10	9⅛
12	11⅛

Bevel Siding.

Nominal Thickness Inches	*Actual Thickness Inches*	*Nominal Width Inches*	*Actual Width Inches*
½ ¼ E	7/16 and 9/16	4	3½
.....	.....	5	4½
.....	.....	6	5½
⅝ ¼ E	9/16 and 11/16	...	...
¾ ¼ E	.....	8	7¼
.....	.....	10	9¼
.....	.....	12	11¼

Standard lengths are multiples of one foot, from 4 to 20 feet. Five per cent. of 8 or 9 feet is allowed in mixed shipments of "B and Better," Bevel Siding, and in addition five per cent. of 6 or 7 feet in "No. 1 Common" and in addition, five per cent. of 4 or 5 feet in "No. 2 Common."

The above percentage of short lengths is customary, and in the interest of conservation will be included, so far as practicable, in all shipments of mixed lengths.

General Instructions on Grading Timber and Lumber.

1. No arbitrary rules for the inspection of lumber can be maintained with satisfaction. The combinations and evaluations of defects are numerous and the interpretation of classification in grading lumber must be left to practical common sense. The general features of these classes are given by the following description of grades.

2. All lumber is graded with special reference to its suitability for the use intended.

3. With this in view each piece is considered and its grade determined by its general character, including the sum of all its defects.

4. Inspection of lumber is not an exact science and a reasonable variation of opinion between inspectors should be recognized; therefore, a variation of not more than 5 per cent. upon reinspection should not disturb the original inspection.

5. The enumerated defects herein described in any grade are intended to be descriptive of the coarsest piece such grades may contain.

6. In construing and applying these rules, the defects allowed are understood to be equivalent in damaging effect to those mentioned applying to stock under consideration.

7. In case of a piece of lumber which lies so close to the boundary line between two grades that there is doubt as to which grade it belongs in, it shall be given the lower grade.

8. A shipment of any grade must consist of a fair average of that grade and shall not include an unfair proportion of the better or poorer pieces that would pass in that grade. A shipment of mixed widths shall contain a fair assortment of each width. A shipment of mixed lengths shall contain a fair assortment of each length.

9. Defects in lumber are to be considered in connection with the size of the piece, and for this reason wider and longer pieces will carry more defects than smaller pieces in the same grade. Defects in flooring, ceiling, partition, casing and base, drop siding and rustic are based on a piece 4 inches wide and 12 feet long, except where otherwise specified.

10. Lumber must be accepted on grade in the form in which it was shipped. Any subsequent change in manufacture or condition will prohibit a reinspection for the adjustment of claims, except with the consent of all parties interested.

11. What is known as "Yard Lumber," such as Dimension, Common Boards and Finish, etc., is graded from the face side, which is the best

side, except that lumber which is dressed one side only is graded from the dressed side.

12. Factory lumber, which is used for the manufacture of doors, sash, etc., and must show both sides, is always graded from the poorer side. The grade is determined by the quantity of suitable cuttings obtainable in each piece.

13. All dressed lumber shall be measured and sold at the full size of rough material used in its manufacture.

14. All lumber one inch or less in thickness shall be counted as one inch thick.

15. The term "Vertical Grain" is here used as synonymous with edge grain, rift sawed or quarter sawed. The term "Flat Grain" is synonymous with slash grain or plain sawed.

Structural Grades for Bridge and Trestle Timbers.

Southern Yellow Pine and Douglas Fir Specifications.

Density Requirements.

Shall contain only Southern Yellow Pine or Douglas Fir timbers graded in two grades by the following density rules:

Density Rule for Southern Yellow Pine.

1. Dense Southern Yellow Pine shall show on either one end or the other an average of at least six annual rings per inch or eighteen rings in three inches as measured over the third, fourth and fifth inches of a radial line from the pith, and at least one-third (⅓) summerwood for girders not exceeding 20 inches in height, and for columns 16 inches square or less. For larger timbers the inspection shall be made over the central three inches on the longest radial line from the pith to the corner of the piece. Wide ringed material excluded by the above will be accepted, provided the amount of summerwood, as above measured, shall be at least 50 per cent.

2. The contrast in color between summerwood and springwood shall be sharp, and the summerwood shall be dark in color, except in pieces having considerably above the minimum requirement for summerwood.

3. In cases where timbers do not contain the pith, and it is impossible to locate it with any degree of accuracy, the same inspection shall be made over three inches of an approximate radial line beginning at the edge nearest the pith in timbers over three inches in thickness and on the second inch (on the piece) nearest to the pith in timbers three inches or less in thickness.

4. In dimension material containing the pith but not a five-inch radial line, which is less than two by eight inches in section or less than eight inches in width, that does not show over sixteen square inches on the cross-section, the inspection shall apply to the second inch from the pith. In larger material which does not show a five-inch radial line, the inspection shall apply to the three inches farthest from the pith.

5. The radial line chosen shall be representative. In case of a disagreement between purchaser and seller as to what is a representative radial line, the average summerwood and number of rings shall be the average of the two radial lines chosen.

Density Rule for Douglas Fir.

1. Dense Douglas Fir shall show, on either one end or the other, an average of at least six annual rings per inch and at least one-third summerwood measured over three inches on a line located as described hereinafter. Coarse-grained material excluded by this rule shall be acceptable provided the amount of summerwood measured as described shall be at least one-half. Material in which the proportion of summerwood is not clearly discernible shall not be accepted.

2. Any timber whose least dimension is less than five inches shall not show the pith (heart) on the inspection end; pieces whose least dimension is five inches or more may contain the pith.

3. When the least dimension is five inches or more, the pith being present, the line over which the rate of growth and per cent. of summerwood measurements shall be made shall run from the pith to the corner farthest from the pith. To find the beginning of the three-inch line, measure a distance of one-half the least dimension of the piece, less two inches, from the pith. This distance may be expressed as follows:

$$a = \tfrac{1}{2}\, d - 2,$$

where a = distance in inches from pith to beginning of three-inch line.
d = least dimension of piece in inches.

4. When the rings are very irregular it may be necessary to shift the line somewhat around the piece to get a fair average for inspection, but the distance from the pith to the beginning of the three-inch line must not be changed.

5. For all pieces where the pith is not present the center of the three-inch line shall be at the center of the end of the piece, and the direction of the three-inch line shall be at right angles to the annual rings.

6. If a radial line of 3 inches cannot be obtained, the measurement shall be made over the entire radial line that is available.

General Requirements.

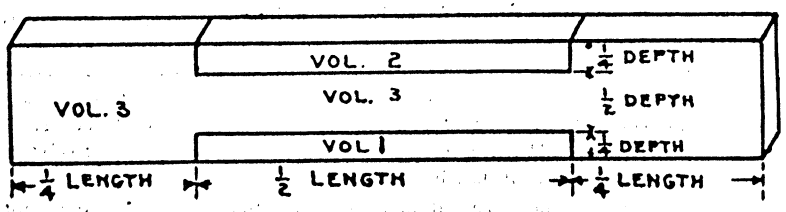
1. Shall consist of lumber well manufactured, square edges and sawed standard size.

2. When the timbers 4x4 inches and larger are ordered sized, they will be ½ inch less than nominal size, either S1S1E or S4S, unless otherwise specified.

3. Structural timbers shall be sound and free from rotten or unsound knots, knots in clusters, decay, round or ring shakes occupying more than one-fourth (¼) the least dimension on either end of a timber (a round or ring shake shall be measured on its vertical projection), injurious diagonal grain or other defects that will materially impair its strength. Shakes shall not show on any face of the timber.

4. Knots limited in size and position as hereinafter provided will be permitted if so fixed by growth or position that they will retain their place in the piece as at time of manufacture.

5. For the limitation of knots in beams in size and location, a beam shall be considered as divided into three volumes as shown below:



Measurement of Knots.

1. In beams, the diameter of a knot on the narrow or horizontal face shall be taken as its projection on a line perpendicular to the edge of the timber. On the wide or vertical face, the smallest dimension of a knot is to be taken as its diameter.

2. In columns, the mean or average dimension of a knot on any face shall be taken as its diameter.

3. Beams shall not have diagonal or spiral grain in Volumes 1 and 2 with slope greater than 1 in 20; in posts the angle shall not be greater than 1 in 15.

4. Posts and beams have different restrictions as to knots and angle of grain and must be listed accordingly in bills of material.

No. 1 Structural.

1. No. 1 Structural timbers shall be of Dense Southern Yellow Pine or Dense Douglas Fir, and shall meet the General Requirements for Structural Grades.

2. This grade shall not have tight pitch pockets over six (6) inches long or over ⅜ inch wide or wane exceeding one (1) inch on one corner or over one-sixth (1/6) the length of the piece.

3. Loose knots larger than one-half (½) inch shall not be permitted.

Beams, Stringers, Girders and Deep Joists.

1. Beams, Stringers, Girders and Deep Joists shall show not less than 85 per cent. of heart on each side of the four sides measured across the sides anywhere in the length of the piece.

2. Beams, Stringers, Girders and Deep Joists shall not have knots in Volumes 1 and 2 larger in diameter than one-fourth (¼) the width of the face of the beam in which they occur, up to and including six (6) inches, nor larger than one and one-half (1½) inches in a face over six (6) inches. Knots within the center half of the length of a beam shall not exceed in the aggregate the width of the surface of the beam in which they occur.

3. Beams shall not have knots in Volume 3 larger in diameter than one-fourth the width of the face in which they occur, with a maximum for any one knot of 3 inches in diameter.

4. When beams are of two spans length and so marked in bill of materials, Volumes 1 and 2 on inspection shall be considered as extending between points located one-eighth (⅛) the length of the beam from each end.

5. The inspector shall place his stamp on the edge of the beam or stringer to be placed up in service.

Caps and Sills.

1. Caps and Sills shall show 85 per cent. of heart on each of the four sides, measured across the surface anywhere in the length of the piece.

2. Caps and Sills shall be free from knots larger than one-fourth (¼) the width of the surface in which they occur with maximum for any one knot of 3 inches in diameter. Knots shall not be in groups.

Posts.

1. Posts shall show not less than 85 per cent. of heart on each of the four sides, measured across the surface anywhere in the length of the piece.

2. Posts shall not have knots larger than one-fourth (¼) the least dimension of the posts nor larger than three inches. Knots shall not be in groups.

Longitudinal Struts or Girts.

1. Longitudinal Struts or Girts shall show all heart on one surface; the other surface and two sides shall show not less than 85 per cent. of heart, measured across the face or side anywhere in the length of the piece.

2. Longitudinal Struts or Girts shall be free from knots over two inches in diameter.

Longitudinal Cross Braces, Sash Braces and Sway Braces.

1. Longitudinal Cross Braces, Sash Braces and Sway Braces shall show not less than 85 per cent. heart on two faces.

2. Longitudinal Cross Braces, Sash Braces and Sway Braces shall be free from knots larger than one-third the width of the face in which they occur, with a maximum of 2 inches in diameter.

Ties and Guard Timbers.

1. Ties and Guard Timbers shall show one side all heart; the other side and two edges shall show not less than 75 per cent. heart, measured across the surface anywhere in the length of the piece.

2. Ties and Guard Timbers shall be free from any large knots or other defects which will materially injure their strength; and where surfaced the remaining rough face shall show all heart.

No. 2 Structural.

1. No. 2 Structural Timbers shall meet the General Requirements for Structural Grades, and shall include timbers not passing the No. 1 Grade because of having less density than is required or greater defects than are permitted.

2. This grade shall not have pitch pockets longer than twelve (12) inches or over ⅜ inch wide or wane exceeding two (2) inches on one corner or the equivalent on two or more corners of 10x10 timbers, with wane in proportion on small or large sizes.

Beams, Stringers, Girders and Deep Joists.

1. Beams, Stringers, Girders and Deep Joists shall not have knots in Volumes 1 and 2 larger than as follows:

2. If of Dense Southern Yellow Pine or Dense Douglas Fir, one-third (⅓) the width of the face of the beam in which they occur, up to and including nine (9) inches, nor larger than three (3) inches in a face over nine (9) inches.

3. If not of Dense Southern Yellow Pine or Dense Douglas Fir, one-fourth (¼) the width of the face of the beam in which they occur, up to and including six (6) inches, nor larger than one and one-half (1½) inches, in a face over six (6) inches.

4. Knots in the center half of the length of a beam shall not exceed in the aggregate twice the width of the surface of the beam in which they occur.

5. Beams shall not have knots in Volume 3 larger in diameter than one-third (⅓) the width of the face in which they occur.

6. Loose knots larger than one-half (½) the size of knots allowed above shall not be permitted; beams shall not have loose knots, in Volume 3, larger than one and one-half (1½) inches.

Caps and Sills.

Caps and Sills shall be free from knots larger than one-half (½) the width of the face in which they occur with a maximum for any one knot of three (3) inches in diameter. Knots shall not be in groups.

Posts.

Posts shall not have knots, if of Dense Southern Yellow Pine or Dense Douglas Fir, larger than one-third (⅓) of the least dimension of the post, nor larger than four inches; if not of Dense Southern Yellow Pine or Dense Douglas Fir, larger than one-fourth (¼) the least dimension of the post, nor larger than three (3) inches.

Longitudinal Struts or Girts.

Longitudinal Struts or Girts shall be free from knots over 2 inches in diameter.

Longitudinal Cross Braces, Sash Braces and Sway Braces.

Longitudinal Cross Braces, Sash Braces and Sway Braces shall be free from knots larger than one-third the width of the face in which they occur, with a maximum of 2 inches in diameter.

Specifications for Timber to be Treated.

1. Specifications for timber to be treated are the same as for untreated timber, except that no restriction is to be placed upon the amount of sap wood allowed in the timber which is to be treated.

2. Many varieties of timber can be used, if treated, that would not be satisfactory to use in the untreated state on account of being subject to rapid decay if they are not treated.

Commercial Timber and Lumber Grades.

TIMBER.

Selected Common.

1. Selected Common shall be sound, strong timber, well manufactured and free from defects that materially impair its strength. Must be suitable for high-class construction purposes, free from shake, splits, loose or rotten knots. Will allow sound and tight knots, if not in clusters and which in no case shall exceed in diameter one-sixth the width of the face in which such knots occur up to and including 12x12-inch; and further providing that such sound and tight knots in 14x14-inch and larger shall in no case exceed 2½ inches in diameter.

2. The select common grade also will allow tight pitch pockets, not over six inches in length, wane not to exceed one inch on one corner and not exceeding one-sixth the length of the piece.

3. White sap or a slight amount of sound stained sap on the back shall not be considered a defect in this grade.

NOTE.—Commercial Timber and Lumber Grades here given apply to Southern Yellow Pine, Douglas Fir, White Pine, Western Pine, Idaho White Pine, Norway Pine, Spruce, Tamarack and Redwood products.

No. 1 Common.

1. No. 1 Common Timber 6x10 inches and larger shall be sound stock well manufactured and free from defects that will materially weaken the piece. Occasional slight variation in sawing allowed, provided such variation will not reduce size of stick below standard for dressed lumber.

2. Ten by ten-inch timbers may have a 2-inch wane on one corner or the equivalent on two or more corners, checks and season checks not extending over one-eighth the length of the piece. Smaller and larger timbers may have wane in proportion. In addition will allow large sound and tight knots, which approximately should not be more than one-fourth the width in diameter of any one side in which they may appear, spike knots, stained sap one-third the width and slight streak of heart stain extending not more than one-fourth the length of the piece.

No. 2 Common.

No. 2 Common Timbers will admit large, loose or rotten knots; a 10x10-inch may have a 3-inch wane on one corner or the equivalent on two or more corners, larger and smaller sizes in proportion; shake or rot that does not impair its utility for temporary work.

Dimension Plank, Joists, Scantling and Small Timbers.

Selected Common.

1. Selected Common shall be sound, strong lumber well manufactured and free from defects that materially impair the strength. Must be suitable for high-class construction purposes and free from shake, loose or rotten knots.

2. Will allow occasional variation in sawing, sound and tight, small and standard knots and tight pitch pockets not over 6 inches in length.

3. Twelve inches and wider may contain, in addition to the above, a couple of large knots not to exceed 2 inches in diameter when well placed, a slight amount of sap admissible.

No. 1 Common.

1. No. 1 Common must be sound stock, well manufactured and suitable for all ordinary construction purposes without waste and must be sound and tight-knotted stock.

2. Will admit knots which in a 2x4 or 3x4 piece may be approximately 1½ inches; in a 2x6-inch or 3x6-inch piece, 2 inches; in a 2x8-inch or 3x8-inch or 2x10-inch or 3x10-inch piece, 2½ inches; and one-fourth the width of the piece in 12 inches and wider; spike knots that do not materially weaken the piece; wane not over one-fourth the thickness of the piece 1 inch wide on face up to 6 inches, and 1½ inches wide on face of 8 inches and wider, extending not more than one-third the length of the piece or a proportionate amount for a shorter distance on both edges; in any case one side and two edges should provide a good nailing surface and in no case shall wane extend over one-half the side of the piece.

3. Pith knots or small defective knots which do not weaken the piece more than the knots above allowed are admitted, solid pitch, pitch pockets, sap stain, a limited number of worm holes well scattered, limited torn grain, seasoning checks, splits in ends, not exceeding in length the width of the piece, firm red heart, heart shakes that do not go through.

4. May contain crook of 1½-inch in 2x4—16 feet, and ⅛ inch less in each additional 2 inches in width up to and including 2x12—16 feet. Length longer or shorter than 16 feet of No. 1 Common Dimension may contain crook in proportion to the above.

No. 2 Common.

1. This grade shall consist of lumber suitable for a cheaper class of construction than No. 1 Common.

2. Will admit large, coarse sound knots, which in a 2x4 and 3x4-inch piece should not be larger than 2½ inches in diameter; in 2x6 or 2x8 or 3x6 or 3x8-inch pieces, 3 inches, and in 2x10 or 3x10 or wider pieces one-third the width of the piece in diameter, spike knots, smaller, loose, hollow or rotten knots that do not weaken the piece more than the knots aforesaid, worm holes well scattered, large pitch pockets, rotten streaks, small amount of fine shake, split not to exceed one-quarter the length of the piece, heart and sap stains in any amount, decayed sap, wane if leaving a fair nailing surface.

3. May contain crook of 2 inches in 2x4—16 feet, and ⅛ inch less in each additional 2 inches in width up to and including 2x12—16 feet. Length shorter or longer than 16 feet may contain crook in proportion to the above.

4. Miscut 2-inch Common which does not fall below 1½ inches in thickness or ⅛ inch scant in width from standard size, shall be admitted in No. 2 Common, provided such pieces are in all other respects as good as No. 1 Common at point of miscut.

5. A very serious combination of above defects must not be permitted in any one piece.

No. 3 Common.

1. No. 3 Common will include all pieces falling below No. 2 Common which are sound enough to use for cheap building material by wasting 25 per cent. of each piece or one-third of number of pieces in any one item of a shipment but it must not be more than ½ inch scant of standard finished width nor ⅜ inch scant of standard finished thickness. This grade will admit a greater degree of all the imperfections allowed in No. 1 and No. 2 Common, but shall not admit useless culls.

Boards, Ship Lap and D & M.

Selected Common.

Selected Common shall be square edged, well manufactured. Will admit sound tight knots not over 1 inch in diameter in 4-inch and 6-inch, not over 1½ inches diameter in 8-inch, medium sized tight pitch pockets not over 6 inches in length, two pith knots, the equivalent of one split not to exceed in length the width of the piece, torn grain, pitch pockets, slight shake, sap stain, seasoning checks, firm red heart, small amount of slightly stained sap. These boards must be of a sound, strong character.

No. 1 Common.

1. No. 1 Common will admit any two of the following or their equivalent of combined defects:

2. Sound and tight knots approximately 1½ inches in diameter in 4 and 6-inch; 2 inches in diameter in 8 and 10-inch; 2½ inches in 12-inch and not over 3 inches in diameter in widths over 12 inches.

3. Pitch pockets, seasoning checks, one straight split not longer than the width of the piece, sap stain, slight streak of heart stain, pith knots, torn grain, slight shake, firm red heart, wane ¼ inch deep on edge not exceed-

ing 1 inch in width on face and extending not over one-third the length of the piece, a limited number of pin worm holes well scattered.

4. These boards must be firm, sound and suitable for use in ordinary construction except finishing purposes without waste.

5. No. 1 Common Ship Lap or D & M or Barn Siding shall be graded by rules governing No. 1 Common Boards except as to wane which shall not be so deep as to extend into the tongue or one-half the thickness of the top lip on the groove in D & M, or over one-half the thickness of the lap in Ship Lap on the face side; pieces of Ship Lap with 1/16 inch of lap will be admitted in any grade.

No. 2 Common.

1. No. 2 Common will admit large coarse knots not necessarily sound, approximately 2 inches in diameter in 4 and 6-inch stock; 2½ inches in 8 and 10-inch and one-third the width of the piece in 12-inch and wider, spike knots, solid heart or sap stain, solid pitch or pitch pockets, a limited number of well scattered worm holes, splits one-fourth the length of the piece. Small amount of fine shake, wane 2 inches wide if it does not extend into the opposite face, or through heart shakes over one-half the piece or through rotten streaks when firm, ½ inch wide over one-fourth the length of the piece or its equivalent of unsound red heart or combination of defects equivalent to the above but a serious combination of above defects in any one piece not permitted.

2. A knot hole 2 inches in diameter will be admitted provided the piece is otherwise as good as No. 1 Common.

3. Miscut 1-inch Common Boards which do not fall below ¾ inch in thickness shall be admitted in No. 2 Common, provided the grade of such thin stock is otherwise as good as No. 1 Common.

No. 3 Common.

No. 3 Common will admit of stock below the grade of No. 2 Common that is suitable for cheap sheathing. The general appearance is coarse. It will admit large coarse knots without restrictions as to size, loose knots, unsound knots, knot holes, pitch pockets, solid pitch, very wormy pieces, shake, heart or sap stain, decayed sap, decayed streaks, well scattered small rotten spots, split, blue sap, wane, but a serious combination of above defects in any one piece not permitted. It should cut 75 per cent. of lumber as sound as No. 2 Common.

No. 4 Common.

1. No. 4 Common shall include all pieces that fall below the grade of No. 3 Common, excluding such pieces as will not be held in place by nailing, after wasting one-fourth the length of the piece by cutting into two or three pieces.

2. The predominating defect characterizing this grade is red rot. Other defects are numerous large worm holes, several knot holes, or pieces that are extremely coarse knotted, wany, shaky or badly split, extremely cross-checked.

No. 5 Common.

No. 5 Common is the lowest grade and admits of all defects known in lumber, provided the piece is strong enough to hold together when carefully handled.

Thick Common Lumber.

Common lumber, 1¼ inches and thicker, shall be graded the same as 1-inch lumber.

Rough Stock for Finish.

1. Finish must be evenly manufactured and shall embrace all sizes from 1 to 2 inches inclusive in thickness by 3 inches and over in width.

2. One, 1¼ and 1½-inch finishing lumber unless otherwise ordered shall measure when dry not more than 1/16 inch scant in thickness and 2-inch not more than ⅛ inch scant in thickness when seasoned.

3. Stock width shipments of "C" and "Better," either rough or dressed on one or two sides, shall be accepted as standard where not more than 20 per cent. of any shipment is ¼ inch scant on 8-inch widths and under; ⅜ inch scant on 9 or 10-inch; and ½ inch scant on 11 and 12-inch and wider when seasoned; pieces narrower than the above and pieces in excess of 20 per cent. of the shipment that are of the minimum measurement given, should be measured as of the next lower standard width and not reduced in grade.

4. Standard lengths are 8 to 20 feet; and in shipments of mixed lengths, 5 per cent. of 8 feet in grade of "C" and "Better," shall be admitted. The above percentage of short lengths is customary and in the interest of conservation will be included as far as practicable in all shipments of mixed lengths.

5. Wane and other defects that will dress out in working standard sizes are admissible.

6. Finishing lumber ordered rough if thicker than count thickness for dry or green stock, may be dressed to such count thickness, and when so dressed, shall be considered as rough.

7. Rough finish shall be graded on the best side, but the reverse side must not be more than one grade lower.

8. Subject to the foregoing provisions, Rough Finishing Lumber shall be graded according to the rules applying to Dressed Finishing Lumber.

9. When like grade on both faces is required, special contract must be made.

Dressed Finishing Lumber.

Selected Flat Grain.

1. Selected Flat Grain shall be finishing lumber free from all sap or defects on face and edges and shall be selected for beauty and character of grain.

2. "A" Finishing, inch, 1¼, 1½ and 2-inch dressed one or two sides up to and including 12 inches in width, must show one face practically clear of all defects, except that it may have such wane as would dress off if surfaced four sides; 13-inch and wider "A" Finishing will admit two small defects or their equivalent. "B" Finishing, inch, 1¼, 1½ and 2-inch dressed one or two sides, up to and including 10 inches in width in addition to the equivalent of one split in end which should not exceed in length the width of the piece, will admit any two of the following or their equivalent of combined defects: slightly torn grain, three pin knots, one standard knot, three small pitch pockets, one standard pitch pocket, one standard pitch streak, 5 per cent. of sap stain or firm red heart; wane not to exceed 1 inch in width, ¼ inch in depth and one-sixth the length of the piece, small seasoning checks.

3. Eleven-inch and wider "B" Finishing will admit three of the above defects or their equivalent, but sap stain or firm red heart shall not exceed 10 per cent.

4. "C" Finishing up to and including 10-inch in width will admit in addition to the equivalent of one split in end which should not exceed in length the width of the piece, any two of the following, or their equivalent of combined defects: 25 per cent. of sap stain, 25 per cent. firm red heart, two standard pitch streaks, medium torn grain in three places, slight shake, seasoning checks that do not show an opening through, two standard pitch pockets, six small pitch pockets, two standard knots, six pin knots, wane 1 inch in width, ½ inch in depth and one-third the length of the piece. Defective dressing or slight skips in dressing will also be allowed that do not prevent its use as finish without waste. Eleven-inch and 12-inch "C" Finishing will admit one additional defect or its equivalent. Pieces wider than 12 inches will admit two additional defects to those admitted in 10-inch or their equivalent, except sap stain which shall not be increased.

Selected Flat Grain.

Pieces otherwise as good as "B" will admit of twenty worm holes.

Special Finish.

In case both sides are desired, "A," "B" or "C" grade, or free from all defects, special contract must be made. Defective dressing or slight skips in dressing on the reverse side of Finishing are admissible.

Moulded Casing, Base, Window and Door Jambs.

1. Moulded Casing and Base shall be worked to ¾ inch thick as per established patterns.

2. Window and Door Jambs are to be dressed, rabbeted and plowed as ordered.

Grades A, B and C.

1. "A" Grade must be practically free from defects on the face side and well manufactured.

2. "B" Grade shall admit the same defects as are admissible in the same widths of "B" Finishing except wane.

3. "C" Grade shall admit the same defects as are admissible in the same widths of "C" Finishing except wane.

Moulding.

1. "B and Better" Moulding. One-third of any item may contain any one of the following defects or its equivalent: One pin knot, small pitch pockets, pitch 1 inch wide, 6 inches long, three pin worm holes, slight defects in dressing.

2. Standard lengths; 8 feet and longer, and in shipments of mixed lengths 5 per cent. of 6 or 7 feet shall be admitted, even though the number of feet of each length be specifically stated.

Drop Siding.

1. Defects named in Drop Siding are based upon a piece manufactured from 1x6—12 feet, and pieces larger or smaller than this will take a greater or lesser number of defects, proportioned to their size on this basis.

2. The amount of crook permissible in No. 1 Common and Better Drop Siding may be as follows:

3. Sixteen-foot lengths as a basis for 4-inch widths, 3-inch crook.

4. Sixteen-foot lengths as a basis for 6-inch widths, 2½-inch crook.

5. Lengths longer or shorter than 16 feet may have a proportional amount of crook.

6. In all grades of Drop Siding wane on the reverse side, not exceeding one-third the width and one-sixth the length of any piece is admissible, providing the wane does not extend into the tongue.

"A" Drop Siding.

1. "A" Drop Siding must be practically free from defects on the face side and well manufactured.

2. Slight roughness in dressing admissible.

3. A piece 14 feet or longer may have one defect located 4 feet or more from the end that can be cut out by wasting not more than 1½ inches of the length, provided balance of piece be practically free from other defects.

"B" Drop Siding.

1. "B" Drop Siding will admit any two of the following defects: Medium torn grain, three pin knots, one standard knot, 15 per cent. sap stain, 15 per cent. firm red heart, small seasoning checks, six pin worm holes or any one of the above defects combined with either three small pitch pockets or one small pitch streak.

2. A piece that is otherwise as good as "B" grade may have a defect that can be cut out by wasting not more than 2½ inches in the length of the piece, providing the defect is 4 feet or more from the end.

No. 1 Drop Siding.

1. No. 1 Common Drop Siding will admit numerous small or several medium or one large pitch pocket, one standard pitch streak and in addition sound knots not over one-half the width of the piece in the rough, a couple of small knot holes, pin worm holes or a few well scattered grub worm holes, sap stain, firm red heart, slight shake, heavy torn grain, seasoning checks that do not show an opening through, defects in manufacturing that will lay without waste. A very serious combination of above defects not permissible in any one piece.

2. Pieces otherwise as good as "B" Drop Siding may have one defect (like a knot hole) that can be cut out by wasting 2½ inches of the length of the piece, provided both pieces are 16 inches or over in length after cutting out such defects.

No. 2 Common Drop Siding.

No. 2 Common Drop Siding admits of all pieces not as good as No. 1 Common that can be used without waste of more than one-fourth the length of any one piece.

Bevel Siding.

Bevel Siding shall be graded according to the rules for Drop Siding and will admit in addition slight imperfections on the thin edge, which will be covered by the lap when laid 2½ and 4½ inches to the weather.

Rustic Siding.

Rustic Siding shall be graded according to the rules for Drop Siding.

FLOORING.

Special.

1. Defects named in Flooring are based upon a piece manufactured from 1x4—12 feet long, and pieces larger or smaller than this will take a greater or lesser number of defects proportioned to their size on this basis, except that standard knots shall not exceed 1¼ inches in diameter in 3-inch flooring.

2. The amount of crook permissible in No. 1 Common and Better Flooring may be as follows:

3. Sixteen-foot lengths as a basis for 3-inch widths, 3½-inch crook.

4. Sixteen-foot lengths as a basis for 4-inch widths, 3 -inch crook.

5. Sixteen-foot lengths as a basis for 6-inch widths, 2½-inch crook.

6. Lengths longer or shorter than 16 feet may have a proportionate amount of crook.

7. Standard Matched Flooring to be surfaced two sides with scored back.

8. Center Matched Flooring (S2S and C. M.) shall be required to come up to grade on one side only, and the defects admissible on the reverse side of standard match shall be allowed.

GRADES A, B, C, D, AND No. 1 COMMON EDGE OR VERTICAL GRAIN.

GRADES A, B, C, D, No. 1 COMMON, No. 2 COMMON, No. 3 COMMON OR No. 3 SHEATING, FLAT GRAIN.

Grade "A" Edge Grain Flooring.

Admits no piece in which angle of the grain exceeds 45 degrees from vertical at any point. This grade shall be well milled on face, must have perfect edges and be practically free from all defects on the face side. Bright sap showing not more than one-third of face half the length of piece will be admitted.

Grade "B" Grain Flooring.

Admits no piece in which angle of the grain exceeds 45 degrees from vertical at any point. This grade will admit any two of the following or their equivalent of combined defects: Five per cent. sap stain, 15 per cent. firm red heart, three pin knots, one standard pitch streak, slight torn grain, small seasoning checks.

Grade "C" Edge or Vertical Grain Flooring.

1. Admits no piece in which angle of the grain exceeds 45 degrees from vertical at any point. This grade will admit any two of the following defects or their equivalent or combined defects. Fifteen per cent. sap stain, 25 per cent. firm red heart, six pin knots, two standard knots, small pitch pockets, two standard pitch pockets, two standard pitch streaks, twelve pin worm holes, slight shake that does not go through, seasoning checks that do not show an opening through, medium torn grain or other machine defects that will lay without waste.

2. A piece 12 feet or longer otherwise as good as "B" may have a defect that can be cut out and the piece laid with a loss of not more than 2½ inches in its length, providing the defect is 4 feet or more from the end of the piece.

Grade "D" Edge or Vertical Grain Flooring.

1. Admits no piece in which angle of the grain exceeds 45 degrees from vertical at any point. This grade will admit the following defects or their equivalent of combined defects: Sap stain, firm red hearts, sound knots not over one-half the cross-section of the piece in the rough and any one point throughout its length, three pith knots, pitch, pitch pockets, a limited number of pin worm holes, well scattered, shake that does not show an opening through, loosened or heavy torn grain or other machine defects that lay without waste.

2. Pieces otherwise as good as "B" Flooring may have one defect (like a knot hole) that can be cut out by wasting 20 inches of the length of the piece, provided both pieces are 16 inches or over in length after cutting out such defects.

3. It is generally understood that this grade will admit such defects or combination of defects as will not impair its utility for cheap floors.

4. No. 1 Common Flooring is the combined grade of C and D Flooring and will admit all pieces that will not grade "B" and are better than No. 2 Common Flat Grain Flooring.

5. Flat Grain Flooring shall take the same inspection as Edge or Vertical Grain, except as to requirement of angle of the grain.

No. 2 Common Flooring.

1. Admits all pieces that will not grade as good as "D" Flooring that can be used for cheap floors without waste of more than one-fourth the length of any one piece.

2. Pieces of flooring having not less than $\frac{1}{8}$ inch tongue will be admitted in No. 2 Common.

No. 3 Common or No. 3 Sheathing.

Admits all pieces that cannot be used as No. 2 Common Flooring but are still available as cheap sheathing or lathing without waste of more than one-fourth the length of any one piece.

Ceiling.

1. Defects in Ceiling are based upon a piece manufactured from 1x4—12 feet long and pieces larger or smaller than this will take a greater or lesser number of defects, proportionate to their size on this basis.

2. The amount of crook permissible in No. 1 Common and Better Ceiling may be as follows:

3. Sixteen-foot lengths as a basis for 3-inch widths, 3½-inch crook.

4. Sixteen-foot lengths as a basis for 4-inch widths, 3 -inch crook.

5. Sixteen-foot lengths as a basis for 6-inch widths, 2½-inch crook.

6. Lengths longer or shorter than 16 feet may have a proportionate amount of crook. In all grades of Ceiling wane on the reverse side, not exceeding one-third the width and one-sixth the length of any piece is admissible providing the wane does not extend into the tongue.

7. Ceiling may be specified either as Edge or Vertical Grain or Flat Grain. The inspection will be the same for either kind.

"A" Ceiling.

"A" Ceiling must be practically free from defects on the face side, well manufactured, will admit of slight roughness in dressing, through close pitch pockets, each not to exceed 2 inches in length, or one sound and tight smooth pin knot, or the equivalent of combined defects.

"B" Ceiling.

1. "B" Ceiling will admit of any two of the following defects or their equivalent of combined defects: Slight torn grain, three pin knots, two small or one standard knot, three small pitch pockets, any two of which may be open, one standard pitch pocket, one small pitch streak, small seasoning checks, 15 per cent. sap stain, 15 per cent. firm red heart, six pin worm holes.

2. A piece otherwise as good as No. 2 may have a defect that can be cut out and the piece laid with a waste of not more than 2½ inches in length, providing the defect is 4 feet or more from the end of the piece.

No. 1 Common Ceiling.

1. No. 1 Common Ceiling will admit the following defects or their equivalent of combined defects: Heavy torn grain, sound knots not over one-half the cross-section of the piece in the rough, pitch, pitch pockets, seasoning checks that do not show an opening through, a sap stain, firm red heart, slight shake, defects in manufacture that will lay without waste, a limited number of pin worm holes well scattered.

2. Pieces otherwise as good as "B" Ceiling may have one defect (like a knot hole) that can be cut by wasting 2½ inches of the length of the piece, providing both pieces are 10 inches or over in length after cutting out such defects.

No. 2 Common Ceiling.

1. No. 2 Common Ceiling admits of all pieces not as good as No. 1 Common that can be used without waste of more than one-fourth the length of any one piece.

2. Pieces of Ceiling having not less than $\frac{1}{8}$ inch tongue, will be admitted in No. 2 Common.

Partition.

Grades "A," "B," No. 1 Common and No. 2 Common. Partition shall be graded according to Ceiling rules and must meet the requirements of the specified grades on the face side only, but the reverse side shall not be more than one grade lower, and shall not cause waste in No. 1 Common and Better.

Specifications for Construction Oak.

General Instructions.

Those who are not familiar with the anatomy of the oak tree should, when reading over these rules, take into consideration that the rule describes the poorest piece that goes into the grade and that a large per cent. is above the grade described.

Definition of Oak for Construction Purposes.

1. The term "Construction Oak" means all such products of oak in which the strength and durability of the timber is the controlling element in its selection and use. The following is a list of products which are recommended for consideration as "Construction Oak."

2. Firsts are to be sound and free from heart shakes and checks, but may have other defects as follows:

Construction Oak.

Trestle and Bridge Timbers.—Mud Sills, Stringers, Caps, Posts, Bracing, Bridge Ties, Struts, Guard Rails, Girts, Sash and Sway Braces.

Docking and Platform Timbers.—Mud Sills, Posts, Bracing Caps, Stringers, Joists, Dock and Platform or Flooring Plank and Wales.

Platform or flooring plank can be either square-edged or matched.

Framing for Building.—Mud Sills, Posts, Girders, Framing Joists, etc.

Bridge and Crossing Plank.—Railroad Crossing Plank, Bridge Floor Planking.

Sheet Piles.—Same as Crossing Plank, except may contain an unlimited amount of heart.

Round Piling.

Stock Guards.

Track or Bumper Posts.

Standard Names for Construction Oak.

Unless specifically mentioned, the terms "White Oak" and "Red Oak" include the following:

"White Oak."	"Red Oak."
White Oak	Red Oak
Chestnut or Tanbark Oak	Pin Oak
Burr or Mossy Cup Oak	Black Oak
Rock Oak	Water Oak
Post or Iron Oak	Willow Oak
Overcup Oak	Spanish Oak
Live Oak	Turkey Oak
Basket or Cow Oak	Black Jack or Barn Oak
Swamp Post Oak	Shingle or Laurel Oak
Yellow or Chinquapin Oak	Scarlet Oak

The term "Mixed Oak" means any kind of oak.

Specifications for Structural Oak Timbers.

General Requirements.

(1) Except as noted, all Structural Timbers shall be White Oak, to be sound timber and sawed specified sizes, free from ring shakes, crooked grain, rotten knots, large knots in groups, rot, dote, wane in amounts greater than allowed in these specifications.

Boxed Hearts.

(2) Boxed Hearts are permitted in pieces of 5 by 5 inches square and larger. The center of the heart should be boxed as near the center of the piece as practical, and not to exceed 30 per cent. of the pieces can have the center of the heart nearer than 1½ inches from any face; 20 per cent. may show one heart face, corner or edge, not to exceed 75 per cent. of the length of the piece.

Wane.

1. The term 20 per cent. of number of pieces or amount shipped refers to each item and size of each car shipped.

2. Pieces 5x5 to 8x8 inches square may show 1 inch wane, side measurement, on any two corners or edges, and this wane not to exceed more than 25 per cent. of the length of the piece singly, or 50 per cent. in aggregate. In the absence of wane on all corners excepting one, the one corner may contain wane 50 per cent. of the length of the piece as above described; not to exceed 20 per cent. of number of pieces may have this defect.

3. Pieces over 8x8, including 12x12 inches square, may show 1½ inch wane, side measurement, edge of any two corners or edges, and this wane not to exceed more than 33⅓ per cent. of the length of the piece singly or 66⅔ per cent. in aggregate. In the absence of wane on all of the length of the piece as above described, not to exceed 20 per cent. of the number of pieces may have this defect.

4. Pieces over 12 by 12 inches square may show 1¾ inch side measurement, any two corners or edges, and this wane not to exceed more than 40 per cent. of the length of the piece singly, or 80 per cent. in aggregate, in the absence of wane on all corners, excepting one, the corner may contain wane 80 per cent. of the length of the piece as above described; not to exceed 20 per cent. of number of pieces may have this defect.

5. In event that pieces have two faces as wide as above described and two faces narrower, the proportion of the amount of wane is admissible.

6. Pieces 1 inch to 5 inches thick, not exceeding 8 inches wide, are governed by defect specifications above mentioned, with the exception that they shall not contain wane, and not to exceed 20 per cent. of pieces 2 inches and thicker may show sound heart on one face; pieces under 2 inches thick must be free of heart. Pieces 8 inches and wider may contain wane as per paragraphs b and d.

7. Rough sizes of Structural Timber shall not vary more than ¼ inch from specified size. Dressed sizes shall be ½ inch less than nominal size after dressing.

Bridge, Dock, Crossing Plank.

1. Lengths, cut to order.
   Widths, cut to order.
   Thickness, cut to order.

2. Sizes cut to order, probably 2 inches, 3 inches and 4 inches thick, 6 inches, 8 inches, 10 inches and 12 inches wide, 12 feet, 14 feet and 16 feet long.

3. This product is intended to work full one good sound face, and this face side must be square edge. Sound knots, small pin and spot worm holes no defect on face side.

4. Must be free from rot and shake; practically square edges, admitting 1 inch of wane on each edge of reverse face, running two-thirds the length. Sound hearts on one side, rafting pin holes, knot holes or grub holes not exceeding 2 inches in diameter admitted.

Sheet Piles.

Same as Ties, except that it may contain sound heart in heart check.

Stock Guards.

To be governed by specifications for Construction Oak.

Track End or Bumping Posts.

To be governed by specifications for Structural Timbers.

Classification and Grading Rules for Cypress Lumber and Shingles.

General Instructions.

Cypress lumber shall be graded according to the following rules and specifications, bearing in mind that as no arbitrary set of rules and specifications can be maintained in every case each must be left to the common sense and best judgment of the inspector.

1. Lumber shall be manufactured and shipped in standard lengths and thickness.

2. Tank, 1st and 2d and worked partition shall be graded from the poorer side.

3. Select lumber, flooring, ceiling, bevel siding and finishing shall be graded from the better or finished side, but the reverse side should in no case be more than one grade lower.

4. All lumber shall be tallied surface or face measure, the tally counted up, and the one-quarter or one-half added to the total where the lumber is one and one-quarter or one and one-half inches thick, and 2 inches and thicker to be multiplied by the thickness.

5. In the measurement of all lumber, fractions exactly on the one-half foot are to be given alternately to the buyer and seller; the fractions below the one-half foot are to be dropped, and all fractions above one-half foot are to be counted to the next higher figure on the board rule.

6. In "line boards," pieces 14 feet and longer shall be given the advantage in grade; pieces 12 feet and shorter shall be reduced in grade.

7. Recognized defects in cypress are knots, knot holes, shakes, splits, wane, wormholes, stained sap and peck.

Standard Lengths.

1. Random standard length stock may be furnished in odd as well as even foot lengths, but there shall not be to exceed 20 per cent. of odd lengths in any one item.

2. Tank stock and No. 1 barn shall be 8 feet and longer.

3. 1st and 2d and select shall be 10 to 20 feet.

4. Finish flooring, ceiling partition, bevel and drop siding shall be 10 to 20 feet.

5. Moldings and battens of all sizes 6 to 20 feet, in both odd and even foot lengths, but not exceeding 10 per cent. of 6, 7, 8 and 9 foot lengths.

6. No. 2 barn, 6 feet and longer.

7. Cull or peck, 4 feet and longer.

Standard Finished Sizes of Cypress.

1. Lumber shipped in the rough (except 8/4 inch No. 1 and No. 2 "Dimension," which grades may be ¼ inch under or ¼ inch over the size specified, both in thickness and width) shall be of sufficient thickness to S2S to standard thickness, as follows:

2. 4/4 Lumber S1S or S2S shall be $\frac{13}{16}$ inch thick.

3. 5/4 Select, 1st and 2d clear, selected common tank and tank lumber S1S or S2S, shall be 1⅛ inches thick.

4. 6/4 Select, 1st and 2d clear, selected common tank and tank lumber S1S or S2S, shall be 1⅜ inches thick.

5. 6/4 Peck, No. 1 and No. 2 barn and finishing lumber S1S or S2S shall be $1\frac{5}{16}$ inches thick.

6. 8/4 Lumber, except No. 1 and No. 2 barn dimension S1S or S2S, shall be 1¾ inches thick.

7. 8/4 No. 1 and No. 2 barn or dimension S1S or S2S, shall be 1⅝ inches thick.

8. 10/4 Lumber S1S or S2S, shall be 2¼ inches thick.

9. 12/4 Lumber S1S or S2S, shall be 2¾ inches thick.

10. All lumber S1E takes off ⅜ inch. S2E, ½ inch.

11. All flooring shall be S2S and CM.

12. 4/4 Flooring shall be $\frac{13}{16}$ inch by 2¼ inch, 3¼ inch, 4¼ inch, 5¼ inch face.

13. 5/4 Flooring shall be $1\frac{1}{16}$, 6/4 shall be $1\frac{5}{16}$, by same widths as 4/4.

14. 3/8 Ceiling shall be worked $\frac{5}{16}$ inch, S1S only.

15. 1/2 Ceiling shall be worked $\frac{7}{16}$ inch, S1S only.

16. 5/8 Ceiling shall be worked $\frac{9}{16}$ inch, S1S only.

17. 3/4 Ceiling shall be worked $\frac{13}{16}$ inch, S1S only.

18. Widths of ceiling to be same as flooring, unless otherwise specified. Ceiling up to ¾ inch face to have one bead on one edge and ceiling wider than 3¼ inch face to be beaded center and edge.

19. Partition to be finished the same as ceiling, but on both faces.

20. Drop siding shall be worked ¾ inch by 3¼ inch, 4½ inch, 5¼ inch, 7¼ inch, 9¼ inch face, S2S and CM or shiplapped.

21. Bevel siding or bevel cribbing shall be worked ½ inch less in width than the rough strip measure.

Tank Stock.

1. Shall be random widths, and will not be furnished in specified widths, and shall be graded from the poorer side.

2. Shall be 5 inches and wider, 1½ inches to 4 inches thick and 8 feet and over in length. Pieces up to 7 inches shall be free from sap. Pieces 7 inches to 13 inches may have one inch of sound sap on one edge, not to exceed half the length and half the thickness of the piece. Pieces 14 inches and wider may have 1 inch of sound sap on both edges not to exceed half the length and half the thickness of the piece. In all widths sound knots that do not impair usefulness for tank purposes may be admitted.

First and Second Clear.

1. Shall be random widths, and will not be furnished in specified widths, and shall be graded from the poorer side.

2. Shall be 8 inches and wider, 1 inch to 4 inches thick and 10 feet and over in length. Pieces 8 to 10 inches may have 1 inch of bright sap on each edge, or its equivalent on one or both edges, otherwise they must be clear. Pieces 10 inches and under 12 inches may have 1½ inches of bright sap on each edge or 3 inches on one edge, and may have one standard knot or its equivalent. Pieces 12 inches wide may have 2 inches of bright sap on each edge, or 4 inches on one edge and may have one standard knot; or, in lieu of sap, may have two standard knots or their equivalent. Pieces wider than 12 inches may admit of defects as specified above in proportion as width increases. Pieces 10 inches and wider may admit of one end split, which shall not exceed in length the width of the piece. Pieces 12 inches and less in width, free from other defects, may have bright sap across one face at one end, but this sap shall not exceed in length one-tenth of the length of the piece. In pieces 13 inches and wider bright sap is not a defect.

Selects.

1. Shall be random widths, and will not be furnished in specified widths, and shall be graded from the better side, but the reverse side shall not be of a lower grade than No. 1 shop or No. 1 barn.

2. Shall be 7 inches and wider, but will not be furnished wider than 12 inches; shall be 1 inch to 4 inches thick, 10 feet and longer. Pieces 10 inches and under in width shall admit two standard knots or their equivalent and an additional standard knot or its equivalent for every two inches in width over 10 inches. Pieces free from other defects, 10 inches and over in width, to admit pin wormholes on one edge one-tenth the width of the piece. Bright sap is not a defect in this grade. Slight wane on pieces 10 inches and over in width is allowed on one edge not over 3 feet in length. When no other defect appears, slight amount of stained sap may be allowed. Pieces 10 inches and wider may admit of one end split, which shall not exceed in length the width of the piece.

Selected Common Tank Stock.

Shall be 4 inches wide, or wider, 1½ inches and 2 inches thick, 8 feet and over in length. Sound sap no defect in this grade, but must be free from unsound knots or other defects that extend through the thickness of the piece, and must be square edged to work the full length of the piece.

No. 1 Barn or Dimension.

Shall be specified widths only, shall be 3 inches and wider, 1 inch and thicker, 8 feet and over in length, admitting sap, bright or stained, shake, season checks, knots, pin wormholes a small amount of peck on one side and one edge, or very slight peck on both sides and both edges of pieces comparatively free from coarse defects; which defects, however, shall not be sufficient to seriously impair the strength, or prevent the use of each piece for "common" purposes in its full length and full width.

No. 2 Barn or Dimension.

Shall be specified widths, 3 inches and wider, 1 inch and thicker, 6 feet and over in length, admitting all the defects allowed in No. 1 barn, but same may be larger and coarser, and in addition will admit peck on both sides; however, the defects shall not be sufficient to prevent the use of each piece in full length and full width for low-grade fencing and other very common purposes.

Cull or Peck.

May be random or specified widths 3 inches and wider, 1 inch to 4 inches thick, 4 feet and over in length. Shall admit all pieces below the grade of No. 2 boxing, and shall also admit the product of that part of the log known as "pecky;" however, each piece shall have sufficient strength and nailing surface to permit its use as a low-grade boxing, crating, sheathing and foundation material.

Finishing.

1. Shall be specified widths 4 inches and wider, 1 inch to 2 inches thick, 10 feet and over in length, and shall be graded from the better side, A, B and C, but the reverse side should not be more than one grade lower. All grades of finish, rough or S1S or S2S may vary ¼ inch from the width specified.

2. "A" Finish.—Pieces 4 inches and 5 inches wide shall be clear of sap, knots and other defects. Pieces 6 inches wide may have 1 inch of bright sap, or, in lieu of sap, one small sound knot. Pieces 7 inches and 8 inches wide may have 2 inches of bright sap, or, in lieu of sap, one small sound knot. Pieces 9 inches and 10 inches wide may have 3 inches of bright sap, or, in lieu of sap, two small

sound knots, or 1½ inches of bright sap and one small sound knot. Pieces 12 inches wide may have 4 inches of bright sap, or, in lieu of sap, one standard knot, or two small sound knots, or two inches of bright sap and one small sound knot. Pieces 14 inches or wider may have more defects in proportion as the width increases.

3. "B" Finish.—Pieces 4 inches, 5 inches and 6 inches wide may have 2 inches of bright sap and one or two small sound knots, or in lieu of knots may have all bright sap. Pieces 7 inches and 8 inches wide may have 3 inches of bright sap and two small sound knots, or in lieu of knots may have all bright sap. Pieces 9 inches and 10 inches wide may have 4 inches of bright sap and one standard knot or three small sound knots, or in lieu of knots may have all bright sap. Pieces 12 inches wide may have 6 inches of bright sap and one standard or four small sound knots, or in lieu of knots may have all bright sap. This grade will not be furnished wider than 12 inches.

4. "C" Finish.—All widths in this grade shall admit small sound knots, stained sap, pin worms and other defects except shake; but none that will prevent the use of same in its full width and length as a paint grade, and will admit pieces containing one coarse defect which can be removed by making two cuts with a waste of not to exceed 5 per cent. in the one piece removed, but which pieces are otherwise "B" grade or better. This grade will not be furnished wider than 12 inches.

5. "D" Finish.—All widths will admit sound knots, stained sap, pin worms, slight shakes and other defects; but none that will prevent the use of same in its full width and length as a common paint grade. This grade will not be furnished wider than 12 inches.

Siding.

1. Siding shall be 4 inches and 6 inches in width, 10 feet to 20 feet in length, and graded from the finished side, A, B, C and D.

2. "A" Siding.—May have one inch of bright sap on thin edge and may contain one small sound knot.

3. "B" Siding.—May have any amount of bright sap, or, if not all bright sap, may have three small sound knots, shake, split or pin worm holes not exceeding in damage the three small knots as above, and may have slight wane on the thin edge. In the absence of other defects a small amount of stained sap will be permitted.

4. "C" Siding.—May have one to 5 knots, the whole not aggregating over 3 inches in diameter, or knots, splits or other defects that can be removed in two cuts with waste not exceeding 10 per cent. of the length, or may have small amount of stained sap and pin worm holes not exceeding in damage the five small knots above described.

5. "D" Siding.—May have stained sap and pin worm holes, or may have other defects that will not cause a waste to exceed one-third the piece.

Flooring and Ceiling.

1. Shall be specified widths, 10 feet to 20 feet in length and graded from the finished side, or, if both sides are finished, it shall be graded from the better side, A, B, C and D.

2. "A"—May have bright sap on one edge one-fourth its width, otherwise must be clear.

3. "B"—May have one-half of its face bright sap if otherwise clear, or, in lieu of sap, may contain two small sound knots, or may have a split not to exceed 9 inches at one end.

4. "C" (10 to 20 feet)—May have all bright sap, or may have one to five knots, the whole not aggregating over 3 inches, or knots or other defects that can be removed in two cuts with waste not exceeding 10 per cent. of the length, or may have three pin worm holes, or may have check or split at one end, not to exceed 10 per cent. of the length.

5. "C" (4 to 9 feet)—May have all bright sap, small sound knots, stained sap, pin worm holes and other defects except shake, but none that will prevent the use of each piece the full length.

6. "D"—May have stained sap and pin worm holes, or may have unsound knots or other defects that will not cause a waste to exceed one-third the piece.

Partition.

Shall be same widths and lengths as floooring and ceiling, but shall be graded from the poorer side, A, B, C and D, same grading to apply as in flooring and ceiling.

Pickets.

1. Shall be graded No. 1 and No. 2.

2. 1 inch by 1 inch shall be Headed and S4S. to $\frac{13}{16}$ inch by $\frac{13}{16}$ inch.

3. 1¼ inches by 1¼ inches shall be Headed and S4S to $1\frac{1}{16}$ inches by $1\frac{1}{16}$ inches.

4. 1½ inches by 1½ inches shall be Headed and S4S to $1\frac{5}{16}$ inches by $1\frac{5}{16}$ inches.

5. 1 inch by 3 inches shall be Headed and S4S to ¾ inch by 2½ inches.

6. No. 1—Shall be well manufactured, bright sap no defect, and may contain one small sound knot.

7. No. 2—Shall admit stained sap, sound knots, pin worm holes, slight shake, and pickets thrown out of the No. 1 grade because of poor manufacture.

Battens.

1. Battens, both flat and OG, are not moldings. Same are invariably used with "common" lumber and shall, therefore, be graded No. 1 barn and better, admitting all defects allowed in No. 1 barn, but none that will prevent the use of each piece in full length for batten-pur-

poses. Three-eighths-inch battens shall be 1 inch strips S2S to 13/16 inch by 2½ inches and resawed, or 1 inch by 2¾ inches to 3 inches S2S and resawed. Unless otherwise specified, ⅜-inch or flat battens shall be S2S only and resawed.

2. OG battens shall be manufactured in the sizes and pattern shown in the Universal Molding Book.

Shingles.

1. **Bests.**—A dimension shingle, 4, 5 and 6 inches in width, 16 inches long, each width packed separately, 5 butts to measure 2 inches, to be all heart and free of shake, knots and other defects.

2. **Primes.**—A dimension shingle, 4, 5 and 6 inches in width, 16 inches long, each width packed separately, 5 butts to measure 2 inches, admitting tight knots and sap, but free of shake and other defects, but with no knots within 8 inches of the butts.

3. This grade may contain shingles clipped two-thirds of the width and one-eighth of the length on the point.

4. **Star-a-Star.**—A random width shingle, 3 inches and wider, 14 inches to 16 inches long, otherwise the same as primes.

5. **Economy.**—Dimensions, 4, 5 and 6 inches, each width separately bunched, admitting sap and sound knots; may have slight peck 5 inches from butts, imperfections on points no objection and admitting 14-inch shingles.

6. **Clippers.**—All shingles below the above grades which are sound for 5 inches from butts, wormholes and slight peck excepted, random widths 2½ inches and wider.

7. The count of manufacture of shingles, of all grades, is based on 4,000 linear inches in width, making 1,000 standard shingles, consequently there would be only 667 6-inch shingles packed and counted as 1,000 standard shingles; 5 inches dimension being counted in like proportion.

8. In making re-inspection of shingles, one bundle out of 20 bundles, taken at random, shall be cut open, the results of this investigation to form the basis of arriving at the grade of the entire shipment.

Classification and Grading Rules for Hemlock Lumber.

Sap.

White or bright sap shall not be considered a defect in any of the grades provided for and described in these rules, except where stipulated.

Water Stain.

In hemlock will often be found streaks or patches of red or brown discolorations, sound and firm, the presence of which does not weaken the wood, nor detract seriously from its utility. Water stain should not be confused with rot, being firm and strong, while rot is soft

Standard Sizes for Hemlock.

Rough Lumber.

Piece Stuff.

Standard lengths for Rough Piece Stuff are 4, 6, 8, 9, 10, 12, 14, 16, 18, 20, 22 and 24 ft. Standard widths are 4, 6, 8, 10 and 12 inches. Standard thickness is 1⅞ inches.

Boards.

Standard lengths for Rough Boards are 4, 6, 8, 10, 12, 14, 16, 18 and 20 ft. Standard widths are 4, 6, 8, 10 and 12 inches. Standard thickness is 13/16 inch.

Dressed Lumber.

Piece Stuff.

Standard sizes for Piece Stuff S1S1E are: 1¾x3¾, 1¾x5¾, 1¾x7¾, 1¾x9¾, 1¾x11¾.

Boards.

The standard thickness for inch lumber S1S is 13/16 inch.

Flooring, Ceiling, Shiplap, Drop Siding.

Standard widths are: 3¼, 5¼, 7¼, 9¼ and 11¼ in. face. Standard thickness is 13/16 in.

Estimated Weights of Hemlock Lumber.

Per M Feet, Shipping Dry

3 in. Plank, Rough	3,000
3 in. Plank and 4x4 to 8x8, S1S1E	2,700
3 in. Plank, S4S or D & M	2,500
4x10 to 12x12, Rough	3,500
4x10 to 12x12, S1S1E	3,200
4x4 to 8x8, Rough	3,000
Thick D & Better, S1S	2,500
Thick D & Better, S1S1	2,200
2 in. Piece Stuff, S1S1E	2,200
2 in. Piece Stuff, Rough or S1E	2,500
2 in. Piece Stuff, S4S or D & M	2,000
1 in. Boards, Rough	2,400
1 in. Boards, S1S or S2S	2,000
1 in. Clear and Select, S1S	2,000
Shiplap, D & M, or Drop Siding	1,800
1x6 Well Tubing, Beveled Edges	1,800
Sheathing Lath	1,500
Lath	500
32 in. Lath	700

Grading Rules.

Thick D and Better.

1. Thick D and Better shall be 4 in. wide and wider, 1¼ in., 1½ in. and dimension thickness.

2. This grade shall have sound, square edges, and be of grade of Inch D Stock and Better on the face side, and not below the grade of Inch No. 1 Common on the back of the piece.

Boards and Strips.

There are six grades made in Boards and Strips:

Inch Clear and Select.	No. 2 Common.
Inch D Stock.	No. 3 Common.
No. 1 Common.	No. 4 Common.

Inch Clear and Select.

1. Inch Clear and Select should be 4 in. and wider, and 8 ft. long and longer, not to exceed 10 per cent. 8 ft. long.

2. This grade is especially adapted for interior finish and only the face, or best side, is expected to show, although some attention should be given to the back of the piece.

3. The face shall show no wane, but the back may show such an amount of wane or other defects as will not interfere with the use of the piece for finishing purposes.

4. No shake or season check shall be allowed on the face side, but a very little tight shake and checks that are not deep may appear on the back of the piece.

5. This grade will admit on the face side several tight pin knots not over ⅜ in. in diameter. In a 4 or 6 in., 12 ft. and longer piece, not more than three knots are admissible, and proportionately more in a wider piece.

6. A 10 or 12 in. piece, 12 ft. and longer, will not admit of more than three sound, firmly set knots, not to exceed ¾ in. in diameter. Narrower and shorter pieces will admit of fewer large knots, but not a combination of large knots and other defects.

7. Pieces 12 ft. and longer are admissible that will, with not more than 10 per cent. of waste, produce two clear cuts, each four feet long or longer.

Inch D Stock.

1. Inch D Stock shall consist of Boards and Strips below the grade of Clear and Select 4 in. and wider, and 8 ft. long and longer, not to exceed 10 per cent. 8 ft. long, and must be of a sound and water-tight character.

2. All knots must be sound and firmly set. Red knots must not exceed 1¼ in. in diameter, and spike knots must not exceed in length one-fourth the width of the piece. Black knots must not exceed ¾ in. in diameter, and must be especially well set.

3. A 6-in. strip 12 ft. long shall not contain more than three defects of the extreme sizes. A wider or longer piece may contain relatively more of these defects, and narrower and shorter pieces relatively less. The general appearance of the piece must be taken into consideration.

4. No shake shall be allowed in this grade, but slight season checks and water stain shall not be considered defects.

5. This grade shall be suitable for sound Drop Siding, Ceiling and Flooring, and shall have a smooth appearance, especially on the edges.

Inch No. 1 Common.

1. The grade of No. 1 Common in Boards or Strips includes stock of a generally sound character.
2. Some shake is admissible.
3. Numerous knots, whether red or black.
4. Some water stain of a firm character.

Inch No. 2 Common.

1. Boards or Strips will admit of considerable shake.
2. Black, unsound knots.
3. Two or three good-sized knot holes, or more of small ones.
4. Streaks, or patches of discoloration, showing partial decay.
5. This grade can be safely recommended for general building purposes.

Inch No. 3 Common.

1. The defects may consist of excessive shake.
2. Very coarse, unsound knots.
3. Some soft rot.
4. Some cross checks.

Inch No. 4 Common.

4 In. and Wider, 4 Feet and Longer.

This grade includes all serviceable lumber below the grade of No. 3.

Piece Stuff or Dimension.

No. 1 Dimension.

1. The grade of No. 1 Dimension will admit of shake that will not materially affect the strength of the piece.

2. Also knots, either black or red, that are well located and fairly sound.

3. Or some slight cross checks or sound water stain.

4. This grade, while admitting the above defects, must at the same time retain the element of strength required for any building purpose.

No. 2 Dimension.

1. The grade of No. 2 Dimension includes stock not good enough to be classed as No. 1, and the defects admissible are of the same gen-

eral character as the defects found in No. 1, except that they are more pronounced.

2. Considerable shake, large unsound knots, loose knots, knot holes and cross checks are all admissible in this grade, but not a serious combination of these defects in any one piece.

Merchantable.

The grade of Merchantable is a combination of No. 1 and No. 2, consisting of approximately 50 per cent of each.

No. 3 Dimension.

1. The defects are excessive shake, numerous knot holes, coarse, rotten knots, or considerable rot.
2. This grade can be recommended for cheap, light construction.

No. 4 Dimension.

2x4 and Wider, 4 Feet and Longer.

This grade includes all serviceable Dimension below the grade of No. 3.

CLASSIFICATION OF THE USES OF LUMBER.

1. Bridge and Construction Timber.

A. Combination and Howe Truss Spans.

1. Compression members.
2. Tension members.
3. Diagonals subject to reversal of stress.
4. Floor beams.
5. Stringers.
6. Ties.
7. Guard timbers.
8. Railing.
9. Stiffeners.
10. Splices.
11. Nailing strips.
12. Grillage.
13. Deck plank.
14. Bridging.

B. Pile and Frame Trestles.

1. Piles.
2. Sills and mud sills.
3. Posts.
4. Caps.
5. Cross bracing.
6. Sash bracing.
7. Longitudinal bracing.
8. Girts.
9. End plank.
10. Stringers.
11. Ties.
12. Guard timbers.
13. Planking for ballasted deck.
14. Railing.

C. Falsework.

1. Piles.
2. Sills and mud sills.
3. Posts.
4. Caps.
5. Stringers.
6. Truss timbers.
7. Centering.
8. Lagging.
9. Bracing.
10. Wedges.
11. Scaffolding.

D. Concrete Forms.

1. Dimension lumber.
2. D. & M. planks.
3. Bracing.

E. Tanks and Supports.

1. Piles.
2. Sills.
3. Posts.
4. Caps.
5. Bracing.
6. Joists.
7. D. & M. flooring.
8. Staves.
9. Rafters.
10. Roof.
11. Ladders, etc.
12. Frost-box material.

F. Docks and Wharves.

1. Piles.
2. Timber sheet piling.
3. Timber in cribs.
4. Caps.
5. Stringers.
6. Bracing.
7. Guard timber.
8. Ties.
9. Plank decking.
10. Mooring posts.
11. Fenders and wales.
12. Warehouse. (See II.)

G. Coaling Stations and Ore Stations.

1. Piles.
2. Sills and mud sills.
3. Posts.
4. Caps.
5. Bracing.
6. Stringers.
7. Joists.
8. Bin lining.
9. Rafters.
10. Flooring.
11. Chutes.
12. Decking.
13. Coal pockets or bins.
14. Roofing.

2. Frame Buildings.

A. Station Buildings, Passenger, Freight, Platform Shelters.

1. Piles.
2. Caps.
3. Sills.
4. Posts.
5. Stringers.
6. Joists.
7. Bridging.
8. Sub-flooring.
9. Finish flooring.
   (a) Pine.
   (b) Fir.
   (c) Maple or oak.
10. Studding and plates.
11. Sheathing.
12. Furring.
13. Siding.

14. Ceiling.
15. Lath.
16. Truss timbers.
17. Purlins.
18. Rafters.
19. Roof boards.
20. Shingles.
21. Door and window frames.
22. Outside finish lumber.
23. Inside finish lumber.
24. Millwork.
    (a) Mouldings.
    (b) Stairs.
    (c) Doors.
    (d) Windows.
25. Partitions.
26. Shelving.

B. Engine House.

1. Piling.
2. Caps.
3. Sills.
4. Posts.
5. Stringers.
6. Joists.
7. Bridging.
8. Flooring.
9. Pit timbers.
10. Studding.
11. Sheathing.
12. Furring.
13. Siding.
14. Ceiling.
15. Lath.
16. Truss timbers.
17. Purlins.
18. Rafters.
19. Roof boards.
20. Shingles.
21. Door and window frames.
22. Outside finish lumber.
23. Inside finish lumber.
24. Millwork.
25. Sleepers.

C. Machine Shops.

1. Piling.
2. Caps.
3. Sills.
4. Posts.
5. Stringers.
6. Joists.
7. Bridging.
8. Flooring.
9. Studding.
10. Sheathing.
11. Furring.
12. Siding.
13. Ceiling.
14. Lath.
15. Truss timbers.
16. Purlins.
17. Rafters.
18. Roof boards.
19. Shingles.
20. Door and window frames
21. Outside finish lumber.
22. Inside finish lumber.
23. Millwork.
24. Sleepers.

D. Section Houses.

1. Posts.
2. Sills.
3. Caps.
4. Stringers.
5. Joists.
6. Bridging.
7. Sub-flooring.
8. Finish flooring.
9. Studding and plates.
10. Sheathing.
11. Furring.
12. Siding.
13. Ceiling.
14. Lath.

15. Rafters.
16. Roof boards.
17. Shingles.
18. Door and window frames.
19. Outside finish lumber.
20. Inside finish lumber.
21. Millwork.

E. Miscellaneous Small Buildings.

1. Posts.
2. Sills.
3. Caps.
4. Stringers.
5. Joists.
6. Bridging.
7. Sub-flooring.
8. Finish flooring.
9. Studding and plates.
10. Sheathing.
11. Furring.
12. Siding.
13. Ceiling.
14. Lath.
15. Rafters.
16. Roof boards.
17. Shingles.
18. Door and window frames.
19. Outside finish lumber.
20. Inside finish lumber.
21. Millwork.

F. Warehouses.

1. Piling.
2. Caps.
3. Sills.
4. Posts.
5. Stringers.
6. Joists.
7. Bridging.
8. Sub-flooring.
9. Finish flooring.
10. Studding and plates.
11. Sheathing.
12. Furring.
13. Siding.
14. Ceiling.
15. Lath.
16. Truss timbers.
17. Purlins.
18. Rafters.
19. Roof boards.
20. Shingles.
21. Door and window frames.
22. Outside finish lumber.
23. Inside finish lumber.
24. Millwork.
25. Sleepers.

G. Ice Houses.

1. Piling.
2. Sills.
3. Caps.
4. Posts.
5. Stringers.
6. Joists.
7. Bridging.
8. Sleepers.
9. Sub-flooring.
10. Finish flooring.
11. Studding.
12. Sheathing.
13. Furring.
14. Siding.
15. Ceiling.
16. Lath.
17. Truss timbers.
18. Purlins.
19. Rafters.
20. Roof boards.
21. Shingles.
22. Door and window frames.
23. Outside finish lumber.
24. Inside finish lumber.
25. Millwork.

3. **Ties.**

A. Cross-Ties.

B. Switch Ties.

4. Miscellaneous Roadway Material.

A. Crossing Plank.

B. Platforms.

1. Posts.
2. Caps.
3. Sills.
4. Stringers.
5. Joists.
6. Bridging.
7. Planking.
8. Railing.
9. Steps.
10. Skids.

C. Stock Guards.

1. Posts.
2. Ties.
3. Wing fences and aprons.
4. Slats.
5. Fillers.

D Signs and Posts.

1 Posts.
2. Bracing.
3. Sign boards.
4. Moulding.

E. Fencing, Including Snow Fence.

1. Posts.
2. Bracing.
3. Stringers.
4. Fence boards.
5. Gate material.
6. Stakes.

F. Culverts and Drains.

1. Sills.
2. Bracing.
3. Timbers.
4. Planking.
5. Grillage.

G. Stock Pens.

1. Posts.
2. Sills.
3. Fencing.
4. Studding.
5. Sheathing.
6. Rafters.
7. Roof boards.
8. Shingles.
9. Outside finish lumber.

H. Poles.

I. Conduits.

J. Bumping Blocks.

K. Cross-arms.

COMMITTEE VIII.

MASONRY.

[1] DEFINITIONS.

ABUTMENT.—A supporting wall carrying the end of a bridge or span and generally sustaining the pressure of the abutting earth.

ARCH MASONRY.—That portion of the masonry in the arch ring only, or between the intrados and the extrados.

ARRIS.—The external edge formed by two surfaces, whether plain or curved, meeting each other.

BATTER.—The slope or inclination of the face or back of a wall from a vertical plane.

BENCH WALL.—The abutment from which an arch springs.

CEMENT.—A material of one of the two classes, Portland and natural, possessing the property of hardening into a solid mass when mixed with water.

CEMENT, NATURAL.—Natural cement is the finely pulverized product resulting from the calcination of an argillaceous limestone at a temperature only sufficient to drive off the carbonic acid gas.

CEMENT, PORTLAND.—Portland cement is the product obtained by finely pulverizing clinker produced by calcining to incipient fusion an intimate and properly proportioned mixture of argillaceous and calcareous materials, with no additions subsequent to calcination excepting water and calcined or uncalcined gypsum.

CENTERING.—A temporary support used in arch construction. (Also called centers.)

COPING.—A top course of stone or concrete, generally slightly projecting, to shelter the masonry from the weather, or to distribute the pressure from exterior loading.

CULVERT.—A covered passage for water under a roadway or embankment.

DOWELS.—Metal bars used to connect two sections of masonry. (See definition of "Dowel" under "Stone and Brick Masonry.")

EXTRADOS.—The outer or convex surface of an arch.

FINAL SET.—A stage of the process of setting marked by certain hardness. (See Cement Specifications.)

[1] Adopted, Vol. 7, 1906, pp. 596-601, 619; Vol. 12, Part 1, 1911, pp. 478, 579; Vol. 16, 1915, pp. 794, 1175; Vol. 19, 1918, pp. 721, 1227; Vol. 21, 1920, pp. 84, 1354.

Inspection.

19. The work of erection shall at all times be subject to the inspection and acceptance of the Engineer.

Engineer.

20. The term "Engineer," as used herein, shall be understood to mean the Chief Engineer of the Railway Company, or his accredited representative.

[11] GENERAL SPECIFICATIONS FOR STEEL RAILWAY BRIDGES

For Fixed Spans Less Than 300 Feet in Length

1920

NOTE.—The purpose of the Committee which wrote these specifications was to formulate specific and detailed rules for the design and manufacture of bridges, as a guide to both the designer and the shop, rather than to confine the specifications to a statement of principles or to limit them to rules defining the duties of the contractor. The intention was to describe the best general practice for standard American and Canadian railways, and to advance somewhat the causes of good design and workmanship. The requirements of light and branch railways and foreign practice have not been considered.

The Clearance Diagram in these specifications is intended to be applied to New Construction Work only. It provides for the future development of motive power to a width of eleven feet.

Information to Be Given Bidders.

		Article
1.	What is the live load to be used?	20
2.	Is the bridge on a tangent or curve?	13
	If on a curve, what is the superelevation of the outer rail and what is the degree of the curve?	
3.	What is the rate and the direction of grade on the bridge?	93
4.	What are the conditions at the site?	2
	Furnish plans showing the general dimensions necessary for designing the structure:	
	Length of spans	
	Types of spans	
	Number and spacing of tracks	
	Angle of skew	
	Type of floor	
	Limiting under-clearance	
5.	Shall the work be "Punched Work" or "Reamed Work?"	206
6.	What size of rivets shall be used?	59
7.	What kind of shop paint will be approved?	269
8.	Will other than two pilot nuts and two driving nuts be required for each size of pin?	256

[11] Adopted, Vol. 21, 1920, pp. 491, 1414.

(1) Proposals and Drawings.

Definitions of Terms.

1. The term "Engineer" refers to the Chief Engineer of the Company or his subordinates in authority. The term "Inspector" refers to the inspector or inspectors representing the Company. The term "Company" refers to the Railway Company or Railroad Company party to the contract. The term "Contractor" refers to the manufacturing or fabricating contractor party to the contract.

Proposals.

2. Bidders shall submit proposals to conform with the terms in the letter of invitation. The proposals preferably shall be based upon plans and specifications furnished by the Company showing the general dimensions necessary for designing the structure, the stresses and the general or typical details. Invitations covering work to be designed or erected by the Contractor shall state the general conditions at the site, such as track spacing, character of foundations, old structures, traffic conditions, etc.

Drawings to Govern.

3. Where the drawings and the specifications differ, the drawings shall govern.

Patented Devices.

4. The Contractor shall protect the Company against claims on account of patented devices or parts proposed by him.

Drawings.

5. After the contract has been awarded and before any work is commenced, the Contractor shall submit to the Engineer for approval duplicate prints of stress sheets and shop drawings, unless such drawings shall have been prepared by the Company. The tracings of these drawings shall be the property of and be delivered to the Company after the completion of the contract. Shop drawings shall be made on the dull side of the tracing cloth, 24 by 36 inches in size, including margins. The margin at the left end shall be 1½ inches wide, and the others ½-inch. The title shall be in the lower right-hand corner. No changes shall be made on any approved drawing without the consent, in writing, of the Engineer.

6. The Contractor shall be responsible for the correctness of his drawings, and for shop fits and field connections, although the drawings may have been approved by the Engineer.

7. Any material ordered by the Contractor prior to the approval of the drawings shall be at his risk.

(2) General Features of Design.

Materials Used.

8. Structures shall be made wholly of structural steel except where otherwise specified. Cast steel preferably shall be used for

shoes and bearings. Cast iron may be used only where specifically authorized by the Engineer.

Types of Bridges.

9. The different types of bridges may be used as follows:

Rolled beams for spans up to 35 feet.
Plate girders for spans from 30 feet to 125 feet.
Riveted trusses for spans from 100 feet to 300 feet.
Pin-connected trusses for spans from 150 feet to 300 feet.

Number of Trusses.

10. Unless otherwise specified, double-track through bridges shall have only two trusses or girders, and four-track bridges three.

Dimensions for Calculation.

11. The dimensions for the calculation of stresses shall be as follows:

SPAN LENGTH.

For trusses and girders, the distance center to center of end bearings.

For floor beams, the distance center to center of trusses or girders.

For stringers, the distance center to center of floor beams.

DEPTH.

For riveted trusses, the distance between centers of gravity of chord sections.

For pin-connected trusses, the distance center to center of chord pins.

For plate girders, floor beams and stringers, the distance between centers of gravity of flanges, but not to exceed the distance back to back of the flange angles.

Spacing of Trusses, Girders and Floorbeams.

12. The width center to center of girders or trusses shall be not less than one-fifteenth of the effective span, and not less than is necessary to prevent overturning under the assumed lateral loading. Panel lengths shall not exceed 1½ times the width c. to c. of trusses or girders.

Clearances.

13. If the alinement is straight, clearances shall be not less than shown on the diagram, Fig. 1. If the alinement is curved, the width of the diagram shall be increased so as to provide the same minimum clearances for a car 80 feet long, 14 feet high and 60 feet center to center of trucks, allowance being made for curvature and superelevation of rails. The height of rail shall be assumed as 6 inches.

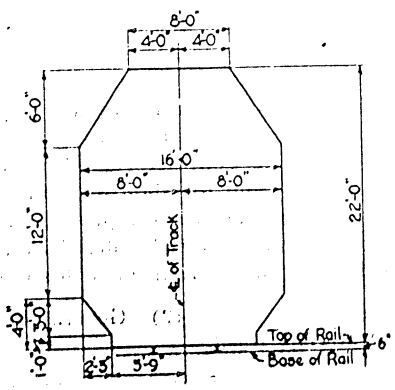


FIG. 1.

Deck Spans on Curves.

14. Deck spans on curves shall have the center line of the span placed, usually, so as to bisect the middle ordinate of and be parallel with the chord of the curve.

Skew Bridges.

15. In skew bridges without ballasted floors, the ends of stringers or girders for each track shall be square with the track.

Ambiguity of Stress.

16. Structures shall be designed so as to avoid, as far as practicable, ambiguity in the determination of the stresses.

(3) Loads

Loads.

17. The structures shall be proportioned for the following loads:

a. The dead load.
b. The live load.
c. The impact or dynamic effect of the live load.
d. The lateral loads and forces.
e. The centrifugal force, including impact.
f. The longitudinal force.

Stresses due to these loads and forces shall be shown separately on the stress sheets.

18. Members shall be proportioned for that combination of stresses which gives the maximum total stress, except as otherwise provided.

Dead Load.

19. The dead load shall consist of the estimated weight of the entire suspended structure. Timber shall be assumed to weigh 4½ pounds per foot B. M., ballast 120 pounds per cubic foot, reinforced concrete 150 pounds per cubic foot, waterproofing 150 pounds per cubic foot, and rails and fastenings 150 pounds per linear foot of track. If ballast is used, it shall be assumed level with the base of rail and the weight of the ties shall be neglected. Ballasted floors shall have at least 6 inches of ballast under the ties.

Live Load.

20. The minimum live load for each track shall be as shown in Figs. 2 and 3, except as modified in Article 21.

The loading that gives the larger stresses shall be used.

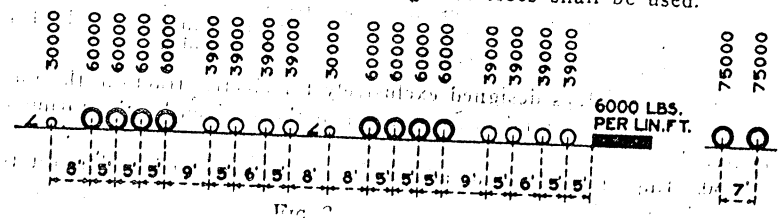


FIG. 2

21. In special locations, where the conditions limit the loading to light engines, a lighter loading, as stipulated by the Engineer, may be used, but not in any case lighter than three-fourths of that specified in Article 20.

22. Other live loadings shall be proportional to the loading specified in Article 20 with the same wheel spacing.

Multiple Tracks.

23. In calculating the maximum stresses due to live load and centrifugal force when two, three or four tracks are simultaneously loaded, use the following percentages of the specified live load:

For two tracks, loaded, 90 per cent.
For three tracks, loaded, 80 per cent.
For four tracks, loaded, 75 per cent.

Floors.

24. Wooden ties shall be designed for the maximum wheel load specified distributed over three ties and with 100 per cent. impact added. The fiber stress shall not exceed 2,000 pounds per square inch. The ties shall be not less than 10 feet in length. They shall be placed with openings not to exceed 4 inches in width and shall be secured against bunching. The maximum dap of ties shall be 1¼ inches.

25. Floors consisting of beams transverse to the axis of the structure shall be designed for a uniform live load of 15,000 pounds per linear foot for each track, when the minimum live load specified in Article 20 is used. When heavier loadings are used, this uniform load shall be increased proportionately.

26. Floors consisting of longitudinal beams shall be designed for the wheel loads specified.

27. In ballasted floor bridges, the live load shall be considered as uniformly distributed laterally over a width of 10 feet.

Impact.

28. The dynamic increment of the live load shall be added to the maximum computed live load stresses and shall be determined by the formula,

$$I = S\,\frac{300}{300 + \dfrac{L^2}{100}}, \text{ in which}$$

I = impact or dynamic increment to be added to the live-load stress.
S = computed maximum live-load stress.
L = the length in feet of the portion of the span which is loaded to produce the maximum stress in the member.

29. For bridges designed exclusively for electric traction, the impact stresses shall be taken as one-half of those given by the formula in Article 28.

30. Impact shall not be added to stresses produced by longitudinal or lateral forces.

Eccentricity of Load on Curves.

31. For bridges on curves, provision shall be made for the increased load carried by any truss, girder or stringer due to the eccentricity of the load.

Lateral Forces.

32. The lateral (or wind) force shall consist of a moving load equal to 30 pounds per square foot on 1½ times the vertical projection of the structure on a plane parallel with its axis (but never less than 200 pounds per linear foot at the loaded chord, and 150 pounds per linear foot at the unloaded chord), and a moving load of 700 pounds per linear foot applied 8 feet above the base of rail.

33. If a moving load of 50 pounds per square foot on 1½ times the vertical projection of the unloaded structure on a plane parallel with its axis produces greater stresses than the lateral force defined in Article 32, it shall be provided for.

34. In calculating the stresses in viaduct towers due to lateral force, the viaduct shall be considered as loaded on either one or both tracks, with empty cars weighing 1,200 pounds per linear foot.

35. The lateral bracing between compression chords or flanges shall be capable of resisting a transverse shear in any panel equal to 2½ per cent. of the total axial stress in the chords in that panel.

Centrifugal Force.

36. On curves, the centrifugal force (assumed to act 6 feet above the rail) shall be taken equal to a percentage of the live load including impact according to the following table:

Degree of Curve	0° 20′	0° 40′	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°
Percentage	2½	5	7½	10	10	10	10	10	10	10	10	10	10	10
Speed in miles per hour	80	80	80	65	53	46	41	38	35	33	31	29	28	27

Longitudinal Force.

37. Provision shall be made in the design for the effect of a longitudinal force of 20 per cent. of the live load on one track only, applied 6 feet above the top of the rail. In structures (such as ballasted deck bridges of only three or four spans) where, by reason of continuity of members or frictional resistance, the longitudinal force will be largely directed to the abutments, its effect on the superstructure shall be taken as one-half that specified above.

(4) Unit Stresses and Proportioning of Parts.

38. The several parts of structures shall be so proportioned that the unit stresses will not exceed the following, except as modified in Articles 46 and 47:

	Pounds per sq. inch
Axial tension, net section	16,000
Axial compression, gross section	$15{,}000 - 50\frac{l}{r}$
but not to exceed	12,500

l = the length of the member in inches.
r = the least radius of gyration of the member in inches.

Tension in extreme fibers of rolled shapes, built sections and girders, net section	16,000
Tension in extreme fibers of pins	24,000
Shear in plate girder, webs, gross section	10,000
Horizontal shear in flange angles of girders	4,000
Shear in power-driven rivets and pins	12,000
Bearing on power-driven rivets, pins, outstanding legs of stiffener angles, and other steel parts in contact	24,000

The above mentioned values for shear and bearing shall be reduced 25 per cent. for countersunk rivets, hand-driven rivets, floor-connection rivets, and turned bolts.

Bearing on expansion rollers, per linear inch ..... $600d$
d = the diameter of rollers in inches.

	Pounds per sq. inch
Bearing on granite masonry	800
Bearing on sandstone and limestone masonry	400
Bearing on concrete masonry	600

39. For cast steel in shoes and bearings, the above mentioned unit stresses shall apply.

40. The diagonal tension in webs of girders and rolled beams at sections where maximum shear and bending occur simultaneously, shall not exceed 16,000 pounds per square inch.

Effective Bearing Area.

41. The effective bearing area of a pin, a bolt or a rivet shall be its diameter multiplied by the thickness of the piece, except that for countersunk rivets, half the depth of the countersink shall be omitted.

Effective Diameter of Rivets.

42. In proportioning rivets, the nominal diameter of the rivet shall be used.

Proportioning Web Members.

43. In proportioning web members of trusses, use two-thirds of the dead load stress plus one and one-sixth times the live load stress, including impact, where this sum is greater than the sum of the dead load stress and the live load stress, including impact.

Reversal of Stress.

44. Members subject to reversal of stress under the passage of the live load shall be proportioned as follows:

Determine the resultant tensile stress and the resultant compressive stress and increase each by 50 per cent. of the smaller; then proportion the member so that it will be capable of resisting either increased resultant stress. The connections shall be proportioned for the sum of the resultant stresses.

Combined Stresses.

45. Members subject to both axial and bending stresses (including bending due to floor beam deflection) shall be proportioned so that the combined fiber stresses will not exceed the allowed axial stress. In members continuous over panel points, only three-fourths of the bending stress computed as for simple beams shall be added to the axial stress.

46. Members subject to stresses produced by a combination of dead load, live load, impact and centrifugal force, with either lateral or longitudinal forces, or bending due to lateral action, may be proportioned for unit stresses 25 per cent. greater than those specified in Article 38; but the section shall not be less than that required for dead load, live load, impact and centrifugal force.

Secondary Stresses.

47. Designing and detailing shall be done so as to avoid secondary stresses as far as possible. In ordinary trusses without subpanelling, no account usually need be taken of the secondary stresses in any member whose width measured in the plane of the truss is less than one-tenth of its length. Where this ratio is exceeded, or where subpanelling is used, secondary stresses due to deflection of the truss shall be computed. The unit stresses specified in Article 38 may be increased one-third for a combination of the secondary stresses with the other stresses, but the section shall not be less than that required when secondary stresses are not considered.

Compression Flanges.

48. The gross area of the compression flanges of plate girders and rolled beams shall not be less than the gross area of the tension flanges, but the stress per square inch shall not exceed

$$14{,}000 - 200\frac{l}{b}, \text{ in which}$$

l = the length of the unsupported flange, between lateral connections or knee braces.
b = the flange width.

(5) Details of Design.

Limiting Lengths of Members.

49. The ratio of length to least radius of gyration shall not exceed 100 for main compression members nor 120 for wind and sway bracing.

50. The lengths of riveted tension members shall not exceed 200 times their least radius of gyration.

Depth Ratios.

51. The depth of trusses preferably shall be not less than one-tenth of the span. The depth of plate girders preferably shall be not less than one-twelfth of the span. The depth of rolled beams used as girders and the depth of solid floors preferably shall be not less than one-fifteenth of the span. If less depths than these are used, the section must be increased so that the maximum deflection will not be greater than if these limiting ratios had not been exceeded.

Parts Accessible.

52. Details shall be designed so that all parts will be accessible for inspection, cleaning and painting. Closed sections shall be avoided wherever possible.

Pockets.

53. Pockets or depressions which would hold water shall have efficient drain holes, or shall be filled with concrete.

Eccentric Connections.

54. Members shall be connected so that their gravity axes will intersect in a point. Eccentric connections shall be avoided if practicable, but, if unavoidable, the members shall be proportioned so that the combined fiber stress will not exceed the allowed axial stress.

Effective Area of Angles.

55. The effective area of single angles in tension shall be assumed as the net area of the connected leg plus 50 per cent. of the area of the unconnected leg. Single angles connected by lug angles shall be considered as connected by one leg.

Counters.

56. If web members are subject to reversal of stress, their end connections preferably shall be riveted. Adjustable counters shall have open turnbuckles.

Strength of Connections.

57. Connections shall have a strength at least equal to that of the members connected, regardless of the computed stress. Connections shall be made, as nearly as practicable, symmetrical about the axis of the members.

Limiting Thickness of Metal.

58. Metal shall not be less than ⅜-inch thick, except for fillers. Metal subject to marked corrosive influences shall be increased in thickness or protected against such influences.

Sizes of Rivets.

59. Rivets shall be ¾ inch, ⅞ inch or 1 inch in diameter, as specified.

Pitch of Rivets.

60. The minimum distance between centers of rivet holes shall be three diameters of the rivet, but the distance preferably shall be not less than 3½ inches for 1 inch rivets, 3 inches for ⅞-inch rivets and 2½ inches for ¾-inch rivets. The maximum pitch in the line of stress for members composed of plates and shapes shall be 7 inches for 1 inch rivets, 6 inches for ⅞-inch rivets and 5 inches for ¾-inch rivets. For angles with two gage lines and rivets staggered, the maximum pitch in each line shall be twice the amounts given above. If two or more web plates are used in contact, stitch rivets shall be provided to make them act in unison. In compression members, the stitch rivets shall be spaced not more than 24 times the thickness of the thinnest plate in the direction perpendicular to the line of stress, and not more than 12 times the thickness of the thinnest plate in the line of stress. In tension members, the stitch rivets shall be not more than 24 times the thickness of the thinnest outer plate in either direction. In tension members composed of two angles in contact, a pitch of 12 inches may be used for riveting the angles together.

Edge Distance.

61. The minimum distance from the center of any rivet hole to a sheared edge shall be: 1¾ inches for 1 inch rivets, 1½ inches for ⅞-inch rivets and 1¼ inches for ¾-inch rivets; to a rolled edge 1½ inches, 1¼ inches and 1⅛ inches, respectively. The maximum distance from any edge shall be eight times the thickness of the plate, but shall not exceed 6 inches.

Size of Rivets in Angles.

62. The diameter of the rivets in any angle whose size is determined by calculated stress shall not exceed one-fourth of the width of the leg in which they are driven. In angles whose size is not so determined 1 inch rivets may be used in 3½ inch legs, ⅞-inch rivets in 3 inch legs, and ¾-inch rivets in 2½ inch legs.

Long Rivets.

63. Rivets which carry calculated stress and whose grip exceeds four and one-half diameters shall be increased in number at least one per cent. for each additional 1/16-inch of grip. If the grip exceeds six times the diameter of the rivet, specially designed rivets shall be used.

Pitch of Rivets at Ends.

64. The pitch of rivets at the ends of built compression members shall not exceed four diameters of the rivet for a distance equal to one and one-half times the maximum width of the member.

Compression Members.

65. In built compression members, the metal shall be concentrated in the webs and flanges. The thickness of each web shall be not less than one-thirtieth of the distance between

connecting it to the flanges. The thickness of cover plates shall be not less than one-fortieth of the distance between the nearest rivet lines.

Outstanding Legs of Angles.

66. The width of the outstanding legs of angles in compression (except when reinforced by plates) shall not exceed the following:

a. For stringer flange angles, ten times the thickness.

b. For main members carrying axial stress, twelve times the thickness.

c. For bracing and other secondary members, fourteen times the thickness.

Stay Plates.

67. The open sides of compression members shall be provided with lacing bars and shall have stay plates as near each end as practicable. Stay plates shall be provided at intermediate points where the lacing is interrupted. In main members, the length of the stay plates shall be not less than 1¼ times the distance between the lines of rivets connecting them to the outer flanges, and the length of intermediate stay plates shall be not less than three-quarters of that distance. Their thickness shall be not less than one-fiftieth of the same distance.

68. Tension members composed of shapes shall have their separate segments stayed together. The stay plates shall have a length not less than two-thirds of the lengths specified for stay plates on compression members.

Lacing.

69. The lacing of compression members shall be proportioned to resist a shearing stress of 2½ per cent. of the direct stress. The minimum width of lacing bars shall be 3 inches for 1 inch rivets, 2¾ inches for ⅞-inch rivets, 2½ inches for ¾-inch rivets, and 2 inches for ⅝-inch rivets. The thickness shall be made as required by Article 38, in which "l" shall be taken as the distance between connections to the main sections.

70. In members composed of side segments and a cover plate, with the open side laced, one-half the shear shall be considered as taken by the lacing. Where double lacing is used, the shear in the plane of the lacing shall be equally distributed between the two systems.

71. Lacing bars of compression members shall be so spaced that the $\frac{l}{r}$ of the portion of the flange included between their connections will be not greater than 40, and not greater than two-thirds of the $\frac{l}{r}$ of the member.

72. In connecting lacing bars to flanges, ⅝-inch rivets shall be used for flanges less than 2½ inches wide, ¾-inch rivets for flanges

from 2½ to 3½ inches wide, and ⅞-inch rivets for flanges 3½ or more inches wide. Lacing bars with at least two rivets in each end shall be used for flanges over 5 inches wide.

73. The angle of lacing bars with the axis of the member shall be not less than 45 degrees for double lacing, and 60 degrees for single lacing. If the distance between rivet lines in the flanges is more than 15 inches and a single-rivet bar is used, the lacing shall be double and riveted at the intersections.

Splices.

74. Abutting joints in compression members faced for bearing shall be spliced on four sides. The gross area of the splice material shall be not less than 50 per cent. of the gross area of the smaller member.

75. Joints in riveted work not faced for bearing, whether in tension or compression, shall be fully spliced.

Net Section at Pins.

76. In pin connected riveted tension members, the net section across the pin hole shall be not less than 140 per cent. and the net section back of the pin hole not less than 100 per cent. of the net section of the body of the member, and there shall be sufficient rivets to make the material effective.

Net Section Defined.

77. The net section of riveted members shall be the least area which can be obtained by deducting from the gross sectional area the areas of holes cut by any plane perpendicular to the axis of the member and parts of the areas of other holes on one side of the plane within a distance of four inches, which are on gage lines one inch or more from those of the holes cut by the plane, the parts being determined by the formula:

$$A\left(1-\frac{P}{4}\right), \text{ in which}$$

A = the area of the hole.
P = the distance in inches of the center of the hole from the plane.

78. In determining the net section, the diameter of the rivet hole shall be taken one-eighth-inch larger than the nominal diameter of the rivet.

Pin Plates.

79. Where necessary to give the required section or bearing area, pin holes shall be reinforced on each segment by plates, one of which on each side must be as wide as the outstanding flanges will permit. These plates shall contain enough rivets and be so connected as to transmit and distribute the bearing pressure uniformly over the full cross-section and to reduce the eccentricity of the segment to a minimum. At least one full-width plate on each segment shall

the far edge of the stay plate and the others not less than 6 inches beyond the near edge.

Indirect Splices.

80. If splice plates are not in direct contact with the parts which they connect, rivets shall be used on each side of the joint in excess of the number required in the case of direct contact to the extent of two extra lines for each intervening plate.

Fillers.

81. Where rivets carrying stress pass through fillers, the fillers shall be extended beyond the connected member and the extension sesured by additional rivets sufficient to develop the value of the filler.

Forked Ends.

82. Forked ends on compression members will be permitted only where unavoidable. Where forked ends are used, a sufficient number of pin plates shall be provided to make the jaws of twice the sectional area of the member and they shall be extended as far as necessary in order to carry the stress of the main member into the jaws, but shall not be shorter than required by Article 79.

Pins.

83. Pins shall be long enough to secure a full bearing of all parts connected upon the turned body of the pin. They shall be secured by chambered nuts or by solid nuts with washers. Where the pins are bored, through rods with cap washers may be used. The screw ends shall be long enough to admit of burring the threads.

84. Pin connected members shall be held against lateral movement on the pins.

Bolts.

85. Where members are connected by bolts, the turned bodies of the bolts shall be long enough to extend through the metal. A washer at least ¼-inch thick shall be used under the nut. Bolts shall not be used except by special permission.

Upset Ends.

86. Bars with screw ends shall be upset so that the area at the root of the thread will be at least 15 per cent. larger than in the body of the bar.

Sleeve Nuts.

87. Sleeve nuts shall not be used.

Expansion.

88. Provision shall be made for expansion and contraction at the rate of one inch for every 100 feet in length. The expansion ends shall be secured against lateral movement. In spans more than 250 feet in length, provision shall be made for expansion in the floor.

Expansion Bearings.

89. Spans more than 70 feet in length shall have rollers at one end. Spans of less length shall be arranged to slide on smooth surfaces.

Fixed Bearings.

90. Bearings and ends of spans shall be secured against lateral motion.

Rollers.

91. Expansion rollers shall be not less than 6 inches in diameter. They shall be coupled together with substantial side bars, which shall be so arranged that the rollers can be cleaned readily. Rollers shall be geared to the upper and lower plates.

Pedestals and Shoes.

92. Pedestals and shoes preferably shall be made of cast steel. The difference between the top and bottom bearing widths shall not exceed twice the depth. For hinged bearings, the depth shall be measured from the center of the pin. Where built pedestals and shoes are used, the web plates and the angles connecting them to the base plate shall be not less than ¾-inch thick. If the size of the pedestal permits, the webs shall be rigidly connected transversely. The minimum thickness of the metal in cast steel pedestals shall be one inch. Pedestals and shoes shall be so constructed that the load will be distributed uniformly over the entire bearing. Spans more than 70 feet in length shall have hinged bearings at each end.

Inclined Bearings.

93. For spans on an inclined grade and without hinged bearings, the sole or masonry plates shall be beveled so that the masonry surfaces will be level.

Name Plates.

94. There shall be a name plate, showing in raised letters and figures the name of the manufacturer and the year of construction, bolted to the bridge near each end at a point convenient for inspection.

(6) Floors.

Types of Floors.

95. Floors may consist of steel floor-beams and stringers, with timber cross-ties supporting the rails, or of one of the solid floor types.

Floor Members.

96. Floor members shall be designed with special reference to stiffness.

97. Specifications for plate girders shall apply to floor-beams and stringers.

Spacing of Stringers.

98. Stringers usually shall be spaced 6 feet 6 inches center to

center. If four stringers are used under one track, each pair shall be spaced symmetrically about the rail.

I-Beam Girders.

99. Rolled beams supporting timber decks shall be arranged with not more than four, and preferably not less than two beams under each rail. The beams in each group shall be placed symmetrically about the rail, and shall be spaced sufficiently far apart to permit cleaning and painting. They shall be connected by solid web diaphragms near the ends and at intermediate points, spaced not over twelve times the flange width. Bearing plates shall be continuous under each group of beams. End stiffeners shall be used if required by the provisions of Article 38.

Floor-Beam Connections.

100. Floor-beams preferably shall be square to the girders or trusses. They shall be riveted directly to the girders or between the posts of through and deck truss spans.

End Connection Angles.

101. The legs of stringer connection angles shall be not less than 4 inches in width, and not less than ⅝-inch in thickness before facing. Shelf angles shall be provided to support the stringers during erection, but the connection angles shall be sufficient to carry the whole load. Stringers in through spans shall be riveted between the floor-beams.

Stringer Frames.

102. Where two lines of stringers are used under each track in panels more than 20 feet in length, they shall be connected by cross frames.

Solid Floor Connections.

103. Solid floors shall be connected to the girders or trusses by angles not less than ⅝-inch thick if to be faced, or ½-inch thick if not to be faced; one angle on each side of the web of I-beams and one on each of the vertical members of troughs. (223)

Proportioning Solid Floors.

104. Solid floors shall be proportioned by the moments of inertia of the sections, using the net sections including the compression side.

(7) Bracing.

Design of Bracing.

105. Lateral, longitudinal and transverse bracing shall be composed of shapes with riveted connections. Lateral bracing shall have concentric connections to chords at end joints, and preferably throughout. The connections between the lateral bracing and the chords shall be designed to avoid, as far as practicable, any bending stress in the truss members.

106. When a double system of bracing is used, both systems may be considered simultaneously effective if the members meet the requirements, both as tension and compression members.

Lateral Bracing.

107. Bottom lateral bracing shall be provided in all bridges except deck plate girder spans less than 50 feet long, from which it may be omitted. Continuous steel or concrete floors will be considered lateral bracing.

108. Top lateral bracing shall be provided in deck spans and in through spans having sufficient head room.

Portal and Sway Bracing.

109. Deck truss spans shall have vertical sway bracing at each panel point. They shall also have bracing in the planes of the end posts. The end reaction of the top lateral system shall be carried through the vertical end bent to the masonry.

110. Through truss spans shall have portal bracing, with knee braces, as deep as the specified clearance will allow.

111. Through truss spans shall have sway bracing at each intermediate panel point if the height of the trusses is such as to permit of a depth of 6 feet or more for the bracing. When the height of the trusses will not permit of such depth, the top lateral struts shall be of the same depth as the chord and shall have knee braces.

Cross-Frames.

112. Deck plate girder spans shall be provided with cross-frames at each end proportioned to resist centrifugal and lateral forces, and shall have intermediate cross-frames at intervals not exceeding 18 feet.

Laterals.

113. The smallest angle to be used in lateral bracing shall be 3½ by 3 by ⅜ inches. There shall be not less than three rivets at each end connection of the angles. Angles shall be connected at their intersections by plates.

Clearance.

114. Lateral bracing beneath the track shall be low enough to clear the ties.

(8) Plate Girders.

Spacing of Girders.

115. The girders of deck bridges usually shall be spaced 6 feet 6 inches between centers, except that:

a. In single-track deck spans 75 or more feet in length, the girders shall be spaced in accordance with paragraph 12, but not less than 7 feet 6 inches between centers.

b. In bridges on curves, the girders shall be spaced as shown on the plans.

Design of Plate Girders.

116. Plate girders shall be proportioned either by the moment of inertia of their net section including compression side; or by assuming that the flanges are concentrated at their centers of gravity. In the latter case, one-eighth of the gross section of the web, if properly spliced, may be used as flange section. For girders having unusual sections, the moment of inertia method shall be used.

Flange Sections.

117. The flange angles shall form as large a part of the area of the flange as practicable. Side plates shall not be used except when flange angles exceeding one inch in thickness otherwise would be required.

118. Flange plates shall be equal in thickness, or shall diminish in thickness from the flange angles outward. No plate shall have a thickness greater than that of the flange angles.

119. Where flange cover plates are used, one cover plate of the top flange shall extend the full length of the girder. Other flange plates shall extend at least 18 inches beyond the theoretical end.

Thickness of Web Plates.

120. The thickness of web plates shall be not less than $\frac{1}{20}\sqrt{D}$, where "D" represents the distance between flanges in inches.

Flange Rivets.

121. The flanges of plate girders shall be connected to the web with a sufficient number of rivets to transfer to the flange section the horizontal shear at any point combined with any load that is applied directly on the flange. One wheel load, where ties rest on the flange, shall be assumed to be distributed over 3 feet.

Flange Splices.

122. Splices in flange members shall not be used except by special permission of the Engineer. Two members shall not be spliced at the same cross-section and, if practicable, splices shall be located at points where there is an excess of section. The net section of the splice shall exceed by 10 per cent. the net section of the member spliced. Flange angle splices shall consist of two angles, one on each side.

Web Splices.

123. Web plates shall be symmetrically spliced by plates on each side. The splice plates for shear shall be of the full depth of the girders between flanges. The splice shall be equal to the web in strength in both shear and moment. There shall be not less than two rows of rivets on each side of the joint.

End Stiffeners.

124. Plate girders shall have stiffener angles over end bearings, the outstanding legs of which will extend as nearly as practicable to the outer edge of the flange angles. These end stiffeners shall be proportioned for bearing of the outstanding legs on the flange angles, and shall be arranged to transmit the end reaction to the pedestals or distribute it over the masonry bearings. They shall be connected to the web by enough rivets to transmit the reaction. End stiffeners shall not be crimped.

Intermediate Stiffeners.

125. The webs of plate girders shall be stiffened by angles at intervals not greater than:

(a) Six feet.
(b) The depth of the web.
(c) The distance given by the formula $d = \frac{t}{40}(12{,}000 - S)$

d = the distance between rivet lines of stiffeners in inches.
t = the thickness of the web in inches.
S = web shear in pounds per square inch at the point considered.

126. If the depth of the web between the flange angles or side plates is less than 50 times the thickness of the web, intermediate stiffeners may be omitted.

127. Stiffener angles shall be placed at points of concentrated loading. Such angles shall not be crimped.

128. Intermediate stiffeners shall be riveted in pairs to the web of the girder. The outstanding leg of each angle shall not be less than 2 inches plus one-thirtieth of the depth of the girder, nor more than 16 times its thickness.

Gusset Plates in Through Girders.

129. In through plate girder spans, the top flanges shall be braced by means of gusset plates or knee braces with solid webs connected to the floor-beams and extending usually to the clearance line. If the unsupported length of the inclined edge of the gusset plate exceeds 18 inches, the gusset plate shall have one or two stiffening angles riveted along its edge. The gusset plate shall be riveted to a stiffener angle on the girder. Preferably it shall form no part of the floor-beam web.

130. In through plate girder spans with solid floors, there shall be knee-braces with ⅜-inch webs, extending usually to the clearance line, at intervals of about 12 feet. Each knee-brace shall be well riveted to the floor and the girder, especially at the top, and shall have its edge reinforced by one or two angles.

Ends of Through Girders.

131. If through plate girders project two feet or more above the base of the rail, the upper corners shall be rounded. In multiple span bridges, usually only the extreme ends shall be rounded. Exposed ends of through girders shall be neatly finished with end plates.

Spans Shipped Riveted.

132. Deck plate girder spans less than 50 feet in length shall be shipped riveted complete, unless otherwise specified.

Masonry Bearings.

133. End bearings on masonry preferably shall be raised above the coping by metal pedestals.

134. Sole plates shall be not less than ¾-inch thick and not less in thickness than the flange plus ⅛-inch. Preferably they shall not be longer than 18 inches.

Anchor Bolts.

135. Anchor bolts shall be 1¼ inches in diameter and shall extend 12 inches into the masonry. There shall be washers under the nuts. Anchor bolt holes in pedestals and sole plates shall be 1⅝ inches in diameter, except that at expansion joints the holes in the sole plates shall be slotted.

(9) Trusses.

Type of Truss and Sections of Members.

136. Trusses shall have single intersection web systems and, preferably, inclined end posts. The top chords and end posts shall be made usually of two side segments with one cover plate and with stay plates and lacing on the open side. The bottom chords of riveted trusses shall be symmetrically made, usually of vertical side plates with flange angles. Web members shall be made of symmetrical sections.

Camber.

137. The length of members of truss spans shall be such that the camber will be equal to the deflection produced by the combined dead and live loads without impact.

Riveted Members in Pin-Connected Trusses.

138. In pin-connected trusses, hip verticals (and members performing similar functions) and, in single track spans, the two panels at each end of the bottom chords shall be riveted members.

Eye-Bars.

139. The cross sectional area of the head through the center of the pin hole shall exceed that of the body of the eye-bar by at least 37½ per cent. The thickness of the bar shall be not less than one-eighth of the width nor less than one inch, and not greater than 2 inches. The form of the head shall be submitted to the Engineer for approval before the bars are made. The diameter of the pin shall be not less than seven-eighths of the width of the widest bar attached.

Packing.

140. The eye-bars of a set shall be packed symmetrically about the plane of the truss and as nearly parallel as practicable, but in no case shall the inclination of any bar to the plane of the truss exceed $\frac{1}{16}$-inch per foot. They shall be packed as closely as practicable. They shall be held against lateral movement, and arranged so that adjacent bars in the same panel will not be in contact.

Gusset Plates.

141. The thickness of gusset plates connecting the chords and web members of the truss shall be proportionate to the stress to be transferred, but shall not be less than ½-inch.

Facilities for Lifting Span.

142. Provision shall be made for lifting the span at the ends.

Masonry Plates.

143. Masonry plates shall not be less than one inch thick.

(10) Viaducts.

Type of Viaduct.

144. Viaducts shall consist usually of alternate tower spans and free spans of plate girders or riveted trusses supported on bents. The tower spans usually shall be not less than 30 feet long.

Bents and Towers.

145. Viaduct bents shall be composed preferably of two supporting columns, and the bents usually shall be united in pairs to form towers. Horizontal diagonal bracing shall be placed in all towers having more than two vertical panels at alternate intermediate panel points. In double track towers, provision shall be made for the transmission of the longitudinal force to both sides.

Single Bents.

146. Where long spans are supported on short single bents, such bents shall have hinged ends, or else have their columns and anchorages proportioned to resist the bending stresses produced by changes in temperature.

Bottom Struts.

147. The bottom struts of viaduct towers shall be proportioned for the calculated stresses, but in no case for less than one-fourth of the dead load reaction on one pedestal, considered as compressive stress. Provision shall be made in the column bearings for expansion of the tower bracing.

Batter.

148. The columns usually shall have a batter transversely of one horizontal to six vertical for single track viaducts, or one horizontal to eight vertical for double track viaducts.

Depth of Girders.

149. The depth of girders in viaducts preferably shall be uniform.

Spacing of Girders.

150. In single track viaducts, the girder spacing usually shall be uniform throughout, and shall be determined by the spacing for the longest span in the viaduct, according to the rules specified for deck plate girder spans.

151. In double track viaducts, the girders under each track usually shall be spaced 6 feet 6 inches between centers, and the inner lines

of girders shall be supported by cross-girders framed between and riveted to the posts.

Girder Connections and Bracing.

152. Girders of tower spans shall be fastened at each end to the tops of the posts or cross-girders. Girders between towers shall have one end riveted, and shall be provided with an effective expansion joint at the other end. No bracing or sway frame shall be common to abutting spans.

153. If neither of the girders under a track rests directly over a tower post, bracing shall be provided to carry the longitudinal force into the tower bracing without producing lateral bending stress in the cross-girders or posts.

Sole and Masonry Plates.

154. Sole and masonry plates shall be not less than ¾-inch thick.

Anchorage for Towers.

155. Anchor bolts for viaduct towers and similar structures shall be designed to engage a mass of masonry the weight of which is at least one and one-half times the uplift.

(11) Materials.*

(a) Structural and Rivet Steel.

Process.

156. Structural and rivet steel shall be made by the open-hearth process.

Properties.

157. Test specimens of structural and rivet steel shall (except as modified in Articles 160, 163 and 164) conform to the following requirements as to chemical and physical properties:

	Structural Steel	*Rivet Steel*
Phosphorus, maximum		
Acid	.06 per cent.	.04 per cent.
Basic	.04 per cent.	.04 per cent.
Sulphur, maximum	.05 per cent.	.045 per cent.
Tensile strength, pounds per square inch	55,000 to 65,000	46,000 to 56,000
Yield point, pounds per sq. in., minimum	30,000	25,000
Elongation in 8 in., minimum, per cent	$\frac{1500000}{\text{Tens. Str.}}$	$\frac{1500000}{\text{Tens. Str.}}$
Elongation in 2 in., minimum, per cent	22	

Ladle Analyses.

158. An analysis of each melt of steel shall be made by the manufacturer to determine the percentages of carbon, manganese, phosphorus and sulphur. This analysis shall be made from a test ingot taken during the pouring of the melt. The chemical composition thus determined shall be reported to the Engineer.

*Specifications for materials conform to A. S. T. M. Standards. Serials A-7-16, A-27-16 and A-48-18 except as to the yield point requirements and Articles 178 and 179, and the footnote to Table II.

Check Analyses.

159. Analyses may be made by the Engineer from finished material representing each melt. The phosphorus and sulphur content thus determined shall not exceed that specified in Article 157 by more than 25 per cent.

Specimen Tension Tests of Eye-Bar Material.

160. In order to meet the minimum tensile strength of full size annealed eye-bars required in Article 284, the Contractor may determine the tensile strength to be obtained in specimen tests, the range not to exceed 14,000 lb. per sq. in. and the maximum not to exceed 74,000 lb. per sq. in. The material shall conform to the requirements as to physical properties other than that of tensile strength as specified in Articles 157, 163 and 166.

Yield Point.

161. The yield point shall be determined by the drop of the beam of the testing machine.

Speed of Testing Machine.

162. The cross-head speed of the testing machine shall be such that the beam of the machine can be kept balanced, but in no case shall the values given in the following table be exceeded:

Gage Length of Specimen	*Maximum Cross-head Speed (in. per minute) in Determining:* Yield Point	Tensile Strength
2 in.	0.5	2.0
8 in.	2.0	6.0

Modifications in Elongation.

163. For structural steel over ¾-inch in thickness, a deduction of one from the percentage of elongation in 8 inches specified in Article 157 shall be made for each increase of ⅛-inch in thickness above ¾-inch, to a minimum of 18 per cent.

164. For structural steel under $\frac{5}{16}$-inch in thickness, a deduction of 2.5 from the percentage of elongation in 8 inches specified in Article 157 shall be made for each decrease of $\frac{1}{16}$-inch in thickness below $\frac{5}{16}$-inch.

Bend Tests.

165. The test specimens for plates, shapes, and bars (except as specified in Articles 166, 167 and 168) shall bend cold through 180 degrees without cracking on the outside of the bent portion, as follows:

(a) For material ¾-inch or less in thickness, flat on itself.

(b) For material more than ¾-inch to and including 1¼ inches in thickness, around a pin the diameter of which is equal to the thickness of the specimen.

Surface Defects.

179. Finished rolled material shall be free from cracks, flaws, injurious seams, blisters, ragged and imperfect edges, and other surface defects. It shall have a smooth finish, and shall be straightened in the mill before shipment.

Permissible Variations in Weight and Thickness.

180. The cross-section or weight of each piece of steel shall not vary more than 2.5 per cent. from that specified, except in the case of sheared plates, which shall be covered by the following permissible variations. One cubic inch of rolled steel is assumed to weigh 0.2833 lb.

(a) When ordered to weight per square foot, the weight of each lot in each shipment shall not vary from the weight ordered more than the amount given in Table I. The term "lot" as applied to Table I means all of the plates of each group width and group weight.

(b) When ordered to thickness, the thickness of each plate shall not vary more than 0.01 inch under that ordered. The overweight of each lot in each shipment shall not exceed the amount given in Table II. The term "lot" as applied to Table II means all of the plates of each group width and group thickness.

Marking.

181. The name or brand of the manufacturer and the melt number shall be legibly stamped or rolled on all finished material, except that rivet and lattice bars and other small sections shall, when loaded for shipment, be separated properly and marked for identification. The identification marks shall be stamped legibly on the end of each pin and roller. The melt number shall be marked legibly by stamping if practicable, on each test specimen.

(b) CAST STEEL.

Process.

182. Cast steel shall be made by the open-hearth or the crucible process.

Heat Treatment.

183. Castings shall be annealed.

Chemical and Physical Properties.

184. Test specimens of cast steel shall conform to the following requirements as to chemical composition and tensile properties:

Elements Considered	*Min. Ten. Strength lb. per sq. in.*	*Min. Yield Point lb. per sq. in.*	*Min. Elongation in 2 in.*	*Min. Reduction of Area*
Phosphorus not over 0.05%	60,000	30,000	22%	30%
Sulphur not over 0.05%				

TABLE I.—PERMISSIBLE VARIATIONS OF PLATES ORDERED TO WEIGHT.

ORDERED WEIGHT, Lb. Per Sq. Ft.	PERMISSIBLE VARIATIONS IN AVERAGE WEIGHTS PER SQUARE FOOT OF PLATES FOR WIDTHS GIVEN, EXPRESSED IN PERCENTAGES OF ORDERED WEIGHTS																	
	Under 48 In.		48 to 60 In., Excl.		60 to 72 In., Excl.		72 to 84 In., Excl.		84 to 96 In., Excl.		96 to 108 In., Excl.		108 to 120 In., Excl.		120 to 132 In., Excl.		132 in. or Over.	
	Over.	Under.	Over.	Under.	Over.	Under.	Over.	Under.	Over.	Under.	Over.	Under.	Over.	Under.	Over.	Under.	Over.	Under.
Under 5	5	3	5.5	3	6	3	7	3	....	....	....	....	....	....	....	....	....	....
5 to 7.5, excl.	4.5	3	5	3	5.5	3	6	3	....	....	....	....	....	....	....	....	....	....
7.5 to 10 excl.	4	3	4.5	3	5	3	5.5	3	6	3	7	3	8	3	....	....	....	....
10 to 12.5, excl.	3.5	2.5	4	3	4.5	3	5	3	5.5	3	6	3	7	3	8	3	9	3
12.5 to 15, excl.	3	2.5	3.5	2.5	4	3	4.5	3	5	3	5.5	3	6	3	7	3	8	3
15 to 17.5, excl.	2.5	2.5	3	2.5	3.5	2.5	4	3	4.5	3	5	3	5.5	3	6	3	7	3
17.5 to 20, excl.	2.5	2	2.5	2.5	3	2.5	3.5	2.5	4	3	4.5	3	5	3	5.5	3	6	3
20 to 25, excl.	2	2	2.5	2	2.5	2.5	3	2.5	3.5	2.5	4	3	4.5	3	5	3	5.5	3
25 to 30, excl.	2	2	2	2	2.5	2	2.5	2.5	3	2.5	3.5	3	4	3	4.5	3	5	3
30 to 40, excl.	2	2	2	2	2	2	2.5	2	2.5	2.5	3	2.5	3.5	3	4	3	4.5	3
40 or over	2	2	2	2	2	2	2	2	2.5	2	2.5	2.5	3	2.5	3.5	3	4	3

NOTE.—The weight per square foot of individual plates shall not vary from the ordered weight by more than 1½ times the amount given in this table.

TABLE II.—PERMISSIBLE OVERWEIGHTS OF PLATES ORDERED TO THICKNESS.

ORDERED THICKNESS, Inches.	PERMISSIBLE EXCESS IN AVERAGE WEIGHTS PER SQUARE FOOT OF PLATES FOR WIDTHS GIVEN, EXPRESSED IN PERCENTAGES OF NOMINAL WEIGHTS.								
	Under 48 In.	48 to 60 In., Excl.	60 to 72 In., Excl.	72 to 84 In., Excl.	84 to 96 In., Excl.	96 to 108 In., Excl.	108 to 120 In., Excl.	120 to 132 In., Excl.	132 In. or Over.
Under ⅛	9	10	12	14	....	....	....	....	....
⅛ to 3/16, excl.	8	9	10	12	....	....	....	....	....
3/16 to ¼, excl.	7	8	9	10	12	....	....	....	....
¼ to 5/16, excl.	6	7	8	9	10	12	14	16	19
5/16 to ⅜, excl.	5	6	7	8	9	10	12	14	17
⅜ to 7/16, excl.	4.5	5	6	7	8	9	10	12	15
7/16 to ½, excl.	4	4.5	5	6	7	8	9	10	13
½ to ⅝, excl.	3.5	4	4.5	5	6	7	8	9	11
⅝ to ¾, excl.	3	3.5	4	4.5	5	6	7	8	9
¾ to 1	2.5	3	3.5	4	4.5	5	6	7	8
1 or over	2.5	2.5	3	3.5	4	4.5	5	6	7

NOTE.—The weight of individual plates ordered to thickness shall not exceed the nominal weight by more than 1½ times the amount given in this table.

Ladle Analyses.

185. An analysis of each melt of steel shall be made by the manufacturer to determine the percentages of carbon, manganese, phosphorus and sulphur. This analysis shall be made from drillings taken at least ¼-inch beneath the surface of a test ingot obtained during the pouring of the melt. The chemical composition thus determined shall be reported to the Engineer.

Check Analyses.

186. Check analyses may be made by the Engineer from a broken tension or bend test specimen. The phosphorus and sulphur content thus determined shall not exceed that specified in Article 184 by more than 20 per cent. Drillings for analysis shall be taken not less than ¼-inch beneath the surface.

Yield Point.

187. The yield point shall be determined by the drop of the beam of the testing machine. The speed of the machine shall conform to the requirements of Article 162.

Bend Test.

188. The test specimen shall bend cold through 120 degrees around a one inch pin without cracking on the outside of the bent portion.

Test Specimens.

189. Sufficient test bars from which the test specimens required by Article 192 may be selected, shall be attached to castings weighing 500 lb. or more, when the design of the castings will permit. If the castings weigh less than 500 lb., or are of such a design that test bars cannot be attached, two test bars shall be cast to represent each melt. Test bars shall be annealed with the castings they represent.

190. Tension test specimens shall conform to the dimensions shown in Fig. 6.

191. Bend test specimens shall be machined to 1 inch by ½-inch in section with corners rounded to a radius not over 1/16-inch.

Number of Tests.

192. One tension and one bend test shall be made from each annealing charge. If more than one melt is represented in the annealing charge, one tension and one bend test shall be made from each melt.

193. If the percentage of elongation of any tension test specimen is less than that specified in Article 184 and any part of the fracture is more than ¾-inch from the center of the gage length, as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

194. If the results of the physical tests of any test lot do not conform to the requirements specified, the manufacturer may re-anneal such lot not more than twice and retests shall be made as specified in Article 184.

Workmanship and Finish at Foundry.

195. The castings shall conform substantially to the drawings and shall be made in a workmanlike manner. The castings shall be free from injurious defects.

Inspection at Foundry.

196. Tests and inspection shall be made at the place of manufacture prior to shipment, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

Rejection.

197. Castings which show injurious defects subsequent to their acceptance at the manufacturer's works will be rejected, and the manufacturer shall be notified.

(c) CAST IRON.

Process.

198. Cast iron shall be of tough grey iron, and shall be made by the cupola process.

Finish.

199. Castings shall be true to pattern and free from excessive shrinkage. They shall be free from cracks, cold shuts, blow holes and other flaws.

Chemical Composition.

200. The sulphur content of cast iron shall not exceed the following:

Light castings	0.10 per cent.
Medium castings	0.10 per cent.
Heavy castings	0.12 per cent.

Drillings taken from the fractured ends of the transverse test bars shall be used for the sulphur determinations. One determination shall be made from each set of bars.

Classification.

201. Castings shall be classified as light, medium and heavy.

(a) Light castings are those having any section less than ½-inch thick.

(b) Heavy castings are those having no section less than two inches thick.

(c) Medium castings are those not included in either of the two classes above.

Test Bar.

202. Tests shall be made on the "Arbitration Test Bar" of the American Society for Testing Materials, as shown by Fig. 1, Serial A48-18.

Tension Tests.

203. Tension tests will be made only when specified by the Engineer and at the expe[illegible]

Number of Tests.

204. Two sets of two test bars each shall be cast from each melt in thoroughly dried green sand moulds, one set from the first iron poured and the other set from the last iron poured. Where the melt exceeds 20 tons, an additional set of two bars shall be cast from each additional 20 tons or fraction thereof.

Transverse Tests.

205. A transverse test of each bar cast shall be made. The load shall be applied at the middle, and the supports shall be spaced 12 inches apart. The load on the test bar at rupture shall be not less than the following:

Light castings	2500 pounds
Medium castings	2900 pounds
Heavy castings	3300 pounds

The deflection at rupture shall in no case be less than 0.10-inch. The rate of application of the load shall be such that a central deflection of 0.10-in. is produced in from 20 to 40 seconds.

(12) Workmanship.

Class of Work.

206. The work shall be "Punched Work" or "Reamed Work" as stipulated.

General.

207. The workmanship and finish shall be equal to the best general practice in modern bridge shops. Material at the shops shall be kept clean and protected from the weather as far as practicable.

Straightening Material.

208. Rolled material, before being laid off or worked, must be straight. If straightening or flattening is necessary, it shall be done by methods that will not injure the material. Sharp kinks and bends may be cause for rejection.

Finish.

209. Shearing and chipping shall be neatly and accurately done and all portions of the work exposed to view shall be neatly finished.

Punched Work.

210. In punched work, holes in material whose thickness is not greater than the diameter of the rivets plus ⅛-inch, may be punched full size. Holes in material of greater thickness shall be drilled.

Reamed Work.

211. In reamed work, holes in material ⅞-inch thick and less, used for lateral, longitudinal and sway bracing, lacing, stay plates and diaphragms, may be punched full size.

212. Holes in other material ¾-inch thick and less, shall be sub-punched and reamed.

213. Holes in material more than ¾-inch thick shall be drilled.

Punched Holes.

214. Full size punched holes shall be $\frac{1}{16}$-inch larger than the nominal diameter of the rivets. The diameter of the die shall not exceed the diameter of the punch by more than $\frac{3}{32}$-inch. If any holes must be enlarged to admit the rivets, they shall be reamed. Holes must be clean cut, without torn or ragged edges. Poor matching of holes may be cause for rejection.

Sub-Punched and Reamed Holes.

215. In sub-punched and reamed work, the holes shall be punched $\frac{1}{16}$-inch smaller and, after assembling, reamed $\frac{1}{16}$-inch larger than the nominal diameter of the rivet. The diameter of the punch used shall be $\frac{1}{16}$-inch smaller than the nominal diameter of the rivet and the diameter of the die not more than $\frac{3}{32}$-inch larger than the diameter of the punch. Outside burrs shall be removed with a tool making a $\frac{1}{16}$-inch fillet.

Accuracy of Punching in Reamed Work.

216. In sub-punched and reamed work, the punching shall be so accurately done that, after assembling and before reaming, a cylindrical pin ⅛-inch smaller in diameter than the nominal size of the punched hole may be entered, perpendicular to the face of the member, without drifting, in at least 75 of any group of 100 contiguous holes in the same plane. If this requirement is not fulfilled, the badly punched pieces shall be rejected. If any hole will not pass a pin $\frac{3}{16}$-inch smaller in diameter than the nominal size of the punched hole, this shall be cause for rejection.

Reaming After Assembling.

217. Reaming shall be done after the pieces forming a built member are assembled and so firmly bolted together that the surfaces are in close contact. Before riveting, they shall be taken apart, if necessary, and any shavings removed. When it is necessary to take the members apart for shipping or handling, the respective pieces reamed together shall be so marked that they may be reassembled in the same position in the final setting up. No interchange of reamed parts will be permitted.

Accuracy of Reaming and Drilling.

218. When holes are reamed or drilled, 85 of any group of 100 contiguous holes in the same plane shall, after reaming or drilling, show no offset greater than $\frac{3}{32}$-inch between adjacent thicknesses of metal.

Reamed Holes.

219. Reamed holes shall be cylindrical, perpendicular to the member, and not more than $\frac{3}{32}$-inch larger than the nominal diameter of the rivets. Reamers preferably shall not be directed by hand. Outside burrs shall be removed with a tool making a $\frac{1}{16}$-inch fillet.

Drilled Holes.

220. Drilled holes shall be 1/16-inch larger than the nominal size of the rivet. Burrs on the outside surfaces shall be removed.

Assembling for Drilling.

221. Connecting parts requiring drilled holes shall be assembled and securely held together while being drilled.

Shop Assembling.

222. The parts of riveted members shall be well pinned and firmly drawn together with bolts before riveting is commenced. The drifting done during assembling shall be only such as to bring the parts into position, and not sufficient to enlarge the holes or distort the metal. Surfaces in contact shall be painted. Bolts in field connection holes shall be left in place.

Field Connections.

223. Solid floor sections shall be assembled to the girders or trusses, or to suitable frames, in the shop, and the end connections made to fit. (103)

224. In reamed work, riveted trusses and skew portals shall be assembled in the shop, the parts adjusted to line and fit, and the holes for field connections drilled or reamed while so assembled. Holes for other field connections, except those in lateral, longitudinal and sway bracing, shall be drilled or reamed in the shop with the connecting parts assembled, or else drilled or reamed to a metal template.

225. In punched work, the field connections (except those in lateral, longitudinal and sway bracing) shall be reamed to metal templates.

Match-Marking.

226. Connecting parts assembled in the shop for the purpose of reaming or drilling holes in field connections shall be match-marked, and a diagram showing such marks shall be furnished the Engineer.

Rivets.

227. The size of rivets called for on the plans shall be the size of the rivet before heating.

228. Rivet heads, when not countersunk or flattened, shall be of approved shape and of uniform size for the same diameter of rivet. Rivet heads shall be full, neatly made, concentric with the rivet holes, and in full contact with the surface of the member.

Riveting.

229. Rivets shall be heated uniformly to a light cherry red and driven while hot. Rivets, when heated and ready for driving, shall be free from slag, scale and carbon deposit. When driven, they shall completely fill the holes. Loose, burned or otherwise defective rivets shall be replaced. In removing rivets, care shall be taken not to injure the adjacent metal, and, if necessary, they shall be drilled out. Caulking or re-cupping will not be permitted.

230. Rivets shall be driven by direct-acting riveters where practicable. The riveters shall retain the pressure after the upsetting is completed.

231. When necessary to drive rivets with a pneumatic riveting hammer, a pneumatic bucker shall be used for holding up, when practicable.

Field Rivets.

232. Field rivets shall be furnished in excess of the nominal number required to the amount of 15 per cent. plus ten rivets, for each size and length.

233. Field rivets shall be carefully selected, and shall be free from fins on the under side of the head.

Turned Bolts.

234. Where turned bolts are used to transmit shear, the holes shall be reamed parallel and the bolts shall make a tight fit with the threads entirely outside of the holes. A washer not less than 1/4-inch thick shall be used under each nut.

Planing Sheared Edges.

235. Sheared edges of material more than 5/8-inch in thickness and carrying calculated stress shall be planed to a depth of 1/4-inch. Re-entrant cuts shall be filleted before cutting.

Lacing Bars.

236. The ends of lacing bars shall be neatly rounded, unless otherwise called for.

Fit of Stiffeners.

237. Stiffeners under the top flanges of deck girders and at all bearing points shall be milled or ground to bear against the flange angles. Other stiffeners must fit sufficiently tight against the flange angles to exclude water after being painted. Fillers and splice plates shall fit within 1/4-inch at each end.

Web Plates.

238. Web plates of girders which have no cover plates may be 1/8-inch above or below the backs of the top flange angles. Web plates of girders which have cover plates may be 1/2-inch less in width than the distance back to back of flange angles.

239. When web plates are spliced, not more than 3/8-inch clearance between ends of plates will be allowed.

Facing Floor Beams, Stringers and Girders.

240. Floor beams, stringers and girders having end connection angles shall be made of exact length after the connection angles are riveted. If facing is necessary, the thickness of the angles shall not be reduced more than 1/8-inch at any point.

Finished Members.

241. Finished members shall be true to line and free from twists, bends and open joints.

Abutting Joints.

242. Abutting joints in compression members and girder flanges, and, where so specified on the drawings, in tension members shall be faced and brought to an even bearing. Where joints are not faced, the opening shall not exceed ¼-inch.

Eye-Bars.

243. Eye-bars shall be straight, true to size, and free from twists, folds in the neck or head, and other defects. The heads shall be made by upsetting, rolling or forging. Welding will not be allowed. The form of the heads will be determined by the dies in use at the works where the eye-bars are made, if satisfactory to the Engineer. The thickness of the head and neck shall not overrun more than 1/16-inch for bars 8 inches or less in width, ⅛-inch for bars more than 8 inches and not more than 12 inches in width, and 3/16-inch for bars more than 12 inches wide.

244. Eye-bars which are to be placed side by side in the structure shall be bored so accurately that, upon being placed together, the pins will pass through the holes at both ends at the same time without driving. Eye-bars shall have both ends bored at the same time.

Annealing.

245. Eye-bars shall be annealed by heating uniformly to the proper temperature followed by slow and uniform cooling. Proper instruments shall be provided for determining at all times the temperature of the bars.

246. Other steel which has been partially heated shall be properly annealed except where used in minor parts.

Boring Pin Holes.

247. Pin holes shall be bored true to gage, smooth, straight, at right angles with the axis of the member and parallel with each other, unless otherwise required. The variation from the specified distance from outside to outside of pin holes in tension members, or from inside to inside of pin holes in compression members, shall not exceed 1/32-inch. In built-up members the boring shall be done after the member is riveted.

Boring Pins.

248. Pins larger than 9 inches in diameter shall have a hole bored longitudinally through the center of each not less than 2 inches in diameter.

Pin Clearances.

249. The difference in diameter between the pin and the pin hole shall be 1/50-inch for pins up to 5 inches in diameter, and 1/32-inch for larger pins.

Pins and Rollers.

250. Pins and rollers shall be accurately turned to gage and shall be straight, smooth and free from flaws.

Screw Threads.

251. Screw threads shall make close fits in the nuts and shall be U. S. Standard, except that for pin ends of diameters greater than 1⅜ inches, they shall be made with six threads to an inch.

Welds.

252. Welds in steel will not be allowed, except to remedy minor defects.

Forging Pins.

253. Pins larger than 7 inches in diameter shall be forged and annealed.

Bearing Surfaces Planed.

254. The top and the bottom surfaces of base and cap plates of columns and pedestals, except those in contact with masonry, shall be planed, or hot-straightened, and parts of members in contact with them shall be faced to fit. Connection angles for base plates and cap plates shall be riveted to compression members before the members are faced.

255. Sole plates of plate girders shall have full contact with the girder flanges. Sole plates and masonry plates shall be planed or hot-straightened. Cast pedestals shall be planed on the surfaces in contact with steel and shall have the bottom surfaces resting on masonry rough finished.

Pilot Nuts.

256. Two pilot nuts and two driving nuts shall be furnished for each size of pin, unless otherwise specified.

(13) Weighing and Shipping.

Weight Paid for.

257. The payment for pound price contracts shall be based on the scale weight of the metal in the fabricated structure, including field rivets shipped. The weight of the field paint and cement, if furnished, boxes and barrels used for packing, and material used for staying or supporting members on cars, shall be excluded.

Variation in Weight.

258. If the weight of any member is more than 2½ per cent. less than the computed weight, it may be cause for rejection.

259. The greatest allowable variation of the total scale weight of any structure from the weights computed from the approved shop drawings shall be 1½ per cent. Any weight in excess of 1½ per cent. above the computed weight shall not be paid for by the Company.

Computed Weight.

260. The weight of steel shall be assumed at 0.2833 lb. per cubic inch.

261. The weights of rolled shapes, and of plates, up to and including 36 inches in width, shall be computed on the basis of their nominal weights and dimensions, as shown on the approved shop drawings, deducting for copes, cuts and open holes.

262. The weights of plates wider than 36 inches shall be computed on the basis of their dimensions, as shown on the approved shop drawings, deducting for cuts and open holes. To this shall be added one-half of the allowed percentages of overrun in weight given in Article 180.

263. The weight of heads of shop driven rivets shall be included in the computed weight.

264. The weights of castings shall be computed from the dimensions shown on the approved shop drawings, with an addition of 10 per cent. for fillets and overrun.

Weighing of Members.

265. Finished work shall be weighed in the presence of the Inspector, if practicable. The Contractor shall furnish satisfactory scales and do the handling of the material for weighing.

Marking and Shipping.

266. Members weighing more than 5 tons shall have the weight marked thereon. Bolts and rivets of one length and diameter, and loose nuts or washers of each size, shall be packed separately. Pins, other small parts, and small packages of bolts, rivets, washers and nuts shall be shipped in boxes, crates, kegs or barrels, but the gross weight of any package shall not exceed 300 pounds. A list and description of the contained material shall be plainly marked on the outside of each package, box or crate.

267. Long girders shall be so loaded and marked that they may arrive at the bridge site in position for erection without turning.

268. Anchor bolts, washers and other anchorage or grillage materials shall be shipped in time for them to be built into the masonry.

(14) Shop Painting.

Shop Cleaning and Painting.

269. Unless otherwise specified, steel work, after it has been accepted by the Inspector and before leaving the shop, shall be thoroughly cleaned and given one coat of approved paint, applied in a workmanlike manner and well worked into joints and open spaces. Cleaning shall be done with steel brushes, hammers, scrapers and chisels, or by other equally effective means. Oil, paraffin and grease shall be removed by wiping with benzine or gasoline. Loose dirt shall be brushed off with a dry bristle brush before the paint is applied.

Surfaces in Contact.

270. Surfaces coming in contact shall be cleaned and given one coat of paint on each surface before assembling.

Erection Marks.

271. Erection marks shall be painted on painted surfaces.

Painting in Damp or Freezing Weather.

272. Painting shall not be done in damp or freezing weather except under cover, and the steel must be free from moisture or frost when the paint is applied. Material painted under cover in damp or freezing weather shall be kept under cover until the paint is dry.

Mixing of Paint.

273. Paint shall be thoroughly mixed before applying, and the pigments shall be kept in suspension.

Machine Finished Surfaces.

274. Machine finished surfaces of steel (except abutting joints and base plates) shall be coated with white lead and tallow, applied hot as soon as the surfaces are finished and accepted by the Inspector.

(15) Mill and Shop Inspection.

Facilities for Inspection.

275. Facilities for inspection of material and workmanship in the mill and shop shall be furnished by the Contractor to the Inspectors, and the Inspectors shall be allowed free access to the necessary parts of the premises.

Mill Orders and Shipping Statements.

276. The Contractor shall furnish the Engineer with as many copies of material orders and shipping statements as the Engineer may direct. The weights of the individual members shall be shown.

Notice of Rolling.

277. The Contractor shall give ample notice to the Engineer of the beginning of rolling at the mill, and of work at the shop, so that inspection may be provided. No material shall be rolled nor work done before the Engineer has been notified where the orders have been placed.

Cost of Testing.

278. The Contractor shall furnish, without charge, test specimens, as specified herein, and all labor, testing machines and tools necessary to make the specimen and full size tests.

Inspector's Authority.

279. The Inspector shall have the power to reject materials or workmanship which do not come up to the requirements of these specifications; but in cases of dispute, the Contractor may appeal to the Engineer, whose decision shall be final.

Rejections.

280. The acceptance of any material or finished members by the Inspector shall not be a bar to their subsequent rejection, if found defective.

281. Rejected material and workmanship shall be replaced promptly or made good by the Contractor.

(16) Full-Size Tests.

Full-Size Tests of Eye-Bars.

282. The number and size of the bars to be tested shall be stipulated by the Engineer before the mill order is placed. The number shall not exceed 5 per cent. of the whole number of bars ordered, with a minimum of two bars on small orders.

283. The test bars shall be of the same section as the bars to be used in the structure and of the same length if within the capacity of the testing machine. They shall be selected by the Inspector from the finished bars preferably after annealing. Test bars representing bars too long for the testing machine shall be selected from the full length bar material after the heads on one end have been formed and shall have the second head formed upon them after being cut to the greatest length which can be tested.

284. Full-size tests of eye-bars shall show a yield point of not less than 29,000 pounds per square inch, an ultimate strength of not less than 54,000 pounds per square inch, and an elongation of not less than 10 per cent. in a length of 20 feet measured in the body of the bar. The fracture shall show a silky or finely granular structure throughout.

285. If a bar fails to meet the requirements of Article 284, two additional bars of the same size and from the same mill heat shall be tested. If the failure of the first test bar is on account of the character of the fracture only, the bars represented by the test may be reannealed before the additional bars are tested.

286. If two of the three bars tested fail, the bars of that size and mill heat shall be rejected.

287. A failure in the head of a bar shall not be cause for rejection if the other requirements are fulfilled.

288. A record of the annealing charges shall be furnished the Engineer showing the bars included in each charge and the treatment they receive.

289. Bars thus tested which meet the requirements of the specifications shall be paid for by the Company at the same unit prices as the structures. Bars which fail to meet the requirements of the specifications, and all bars rejected as a result of tests, shall be at the Contractor's expense.

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