4.3 Groundwater

This section describes potential impacts to groundwater from the proposed Port MacKenzie Rail Extension. Section 4.3.1 defines the groundwater study area, Section 4.3.2 describes the methods employed to analyze impacts to groundwater, Section 4.3.3 describes the affected environment (existing conditions), Section 4.3.4 describes potential environmental consequences (impacts) to groundwater, and Section 4.3.5 describes unavoidable environmental consequences of the proposed action to groundwater.

4.3.1 Study Area

The proposed rail line would be northwest of Anchorage on the west side of the Knik Arm (ARRC, 2008). The study area is within the Susitna River valley and bounded by the Susitna River on the west, the Knik Arm of Cook Inlet on the south and east, and Parks Highway and the existing ARRC main line on the north. Groundwater in the Susitna River basin is recharged mainly by snowmelt and precipitation infiltrating into the foothill slopes of the Talkeetna Mountains, and by direct snowmelt and precipitation throughout the area (ADEC, 2006).

4.3.2 Analysis Methodology

To identify potential impacts to groundwater from the proposed rail line construction and operation, the analysis incorporated review of existing ARRC project descriptions and groundwater and well data the USEPA, U.S. Geological Survey, and ADEC collected.

4.3.3 Affected Environment

Groundwater is the subsurface water that saturates the pores and cracks in soil and rock. Groundwater discharges replenish streams, rivers, and wetlands with fresh water. An aquifer is a geologic layer that transmits groundwater. There are different types of aquifers, which are characterized based on aquifer composition. Most groundwater is more protected from quick contamination than surface water, depending on a contaminant's ability to permeate the overlying soils or rock.

Groundwater is a source of drinking water for approximately 50 percent of Alaska's total population and 90 percent of the state's rural residents. Alaska has 1,602 public drinking water systems; 83 percent of those use a groundwater source. In areas with a greater population, such as Anchorage, Juneau, and Ketchikan, the amount of groundwater use in the public water system represents 37 percent of the total fresh water use, with the majority of water drawn from surface water. Conversely, 90 percent of private drinking water supplies are from groundwater sources.

Of the estimated 63 million gallons of fresh groundwater used in Alaska each day, more than 50 percent is used for public water supplies and roughly 10 percent is used for domestic water. Southcentral and Interior Alaska have the greatest dependence on groundwater, with the largest groundwater withdrawals occurring in Anchorage, the Fairbanks, MSB, and the Kenai Peninsula Borough. Most of Alaska's aquifers consist of unconsolidated materials derived from glaciers, rivers, and streams.

In the MSB, approximately 60 percent of Houston residents, 50 percent of Willow residents, and 85 percent of Big Lake residents have individual wells; the remainder of residents haul water. Sixty-two percent of homes in the Wasilla area have individual water wells, and the city operates a piped water system to supply water to the remainder of residents. The city's drinking water system consists of 3 primary groundwater wells and 4 one-million-gallon above-ground steel reservoirs. Therefore, drinking water in the MSB is primarily from groundwater sources (ADNR, 2009; City of Wasilla, 2008).

In the study area, groundwater is fed by direct infiltration of precipitation and snowmelt and by streams infiltrating into foothills slopes. The surface of the water table is a subdued expression of the area's topography. Regionally, groundwater flows southerly from the Talkeetna Mountain foothills to the Cook Inlet coast (USGS, 2006). There are no USEPA-designated sole-source aquifers in the study area (USEPA, 2009).

All Alaska land use actions require maintenance of Federal and state water quality standards. Alaska Admin. Code 18 § 70, Water Quality Standards, and the USEPA Quality Criteria for Water, 1986, describe standards for drinking water quality.

The following paragraphs summarize the character of community water in the study area of the MSB (FHWA, 2007):

- Four groundwater wells tapping multiple unconfined aquifers provide community water for Wasilla. The wells range from 146 to 250 feet in depth. Raw water quality is very good, and the system does not require treatment other than routine chlorination.
- Typical domestic supply from the glacial deposits near Houston has met expectations of a range of 10 to 50 gallons per minute, while it is reported that yields as high as 1,000 gallons per minute could be achieved through proper well design at locations near the Little Susitna River. Sandstone and coal layers at depth also supply potable water. Water quality concerns in the Houston area include incidental occurrences of high concentrations of hydrogen sulfide and conductivity, iron, total dissolved solids, and phosphorous.
- In the Big Lake area, higher yields are typical from the confined aquifer – up to 110 gallons per minute compared to approximately 5 to 50 gallons per minute in the shallow deposits. The quality of drinking water near Big Lake is generally good; however, some wells contain constituent concentrations that exceed regulatory standards. These include total dissolved solids (as high as 1,430 milligrams per liter), iron (as high as 7.2 milligrams per liter), chlorides (700 milligrams per liter), sulfates (130 milligrams per liter), and manganese (0.46 milligram per liter).

The ADNR Web-based Well Log Tracking System contains groundwater data for all known water wells in the state. At present, there are more than 30,000 water-well logs in the database. Table 4.3-1 lists all 230 known drinking water supply wells identified in the database for the study area by Township, Range, and Section. Figure 4.3-1 shows the Townships, Ranges, and Sections in the study area, as defined in Section 4.3.1.

The ADEC Drinking Water Program is responsible for requiring that public water systems (a public well is one that provides water for 25 or more people) supply safe drinking water for

Table 4.3-1
Identified Drinking Water Supply Wells in the Study Area[a]

Township – North	Range – West	Sections	Number of Wells within Township/Range/ Section(s) in the Study Area
14	4	4 through 8, 17, 18, 20 through 23, 26, 27	13
14	5	1, 12, 13	4
15	4	4 through 8, 17 through 20, 28, through 33	3
15	5	1 through 3, 10 through 12, 14, 15, 22, 23, 26, 27, 35, 36	19
16	3	2, 3, 9, 10, 16, 20, 21, 29, 30	6
16	4	6, 7, 25 through 27, 31 through 35	3
16	5	1, 4, 5, 9, 10, 12 through 16, 22 through 27, 34 through 36	3
17	2	6	0
17	3	1, 2, 6, 11 through 14, 23, 26, 34, 35	98
17	4	1 through 3, 10, 11, 15 through 17, 19 through 21, 29 through 31	14
17	5	5, 8, 9, 16, 17, 21, 28, 29, 32, 33	0
18	3	20, 21, 27, 28, 31 through 33, 35	50
18	4	2, 3, 10, 11, 13, 14, 23, 24, 26, 35	12
18	5	2 through 4, 9, 10, 16, 17, 20, 21, 29, 32	0
19	5	2, 3, 10, 11, 15, 22, 27, 34	0
20	4	19, 20, 31	5
20	5	35, 36	0
Totals			**230**

[a] Source: ADNR, 2009.

public consumption that meets minimum Federal health-based standards established by the USEPA in the Federal Safe Drinking Water Act, 42 U.S.C. § 300f. Alaska has had primary enforcement responsibility of the public water system supervision program (Safe Drinking Water Program) since 1978. There are approximately 343 public water supply wells that have been identified within the MSB, 230 which have been identified within the study area. All but 6 water supply wells use groundwater as their primary source of water; the remaining 6 water supply wells use surface water (ADEC, 2008b). Two of the 343 well systems (the Willow Trading Post in Willow at Township 19N, Range 4W, Section 8 and the Pioneer Lodge in Willow at Township 19N, Range 4W, Section 6) are near the study area and listed on the USEPA Significant Non-Complier list for violations of the total coliform rule. A significant non-complier is a system whose serious, frequent, or persistent non-compliance of drinking water regulations meets the significant non-complier criteria as defined by the USEPA for a specific rule. The USEPA and ADEC do not have the authority to regulate private drinking water wells (ADEC, 2008c).

Historical (2005) monitoring data from the U.S. Geological Survey at groundwater sites near the proposed rail line were used to describe baseline water quality. The data are derived from

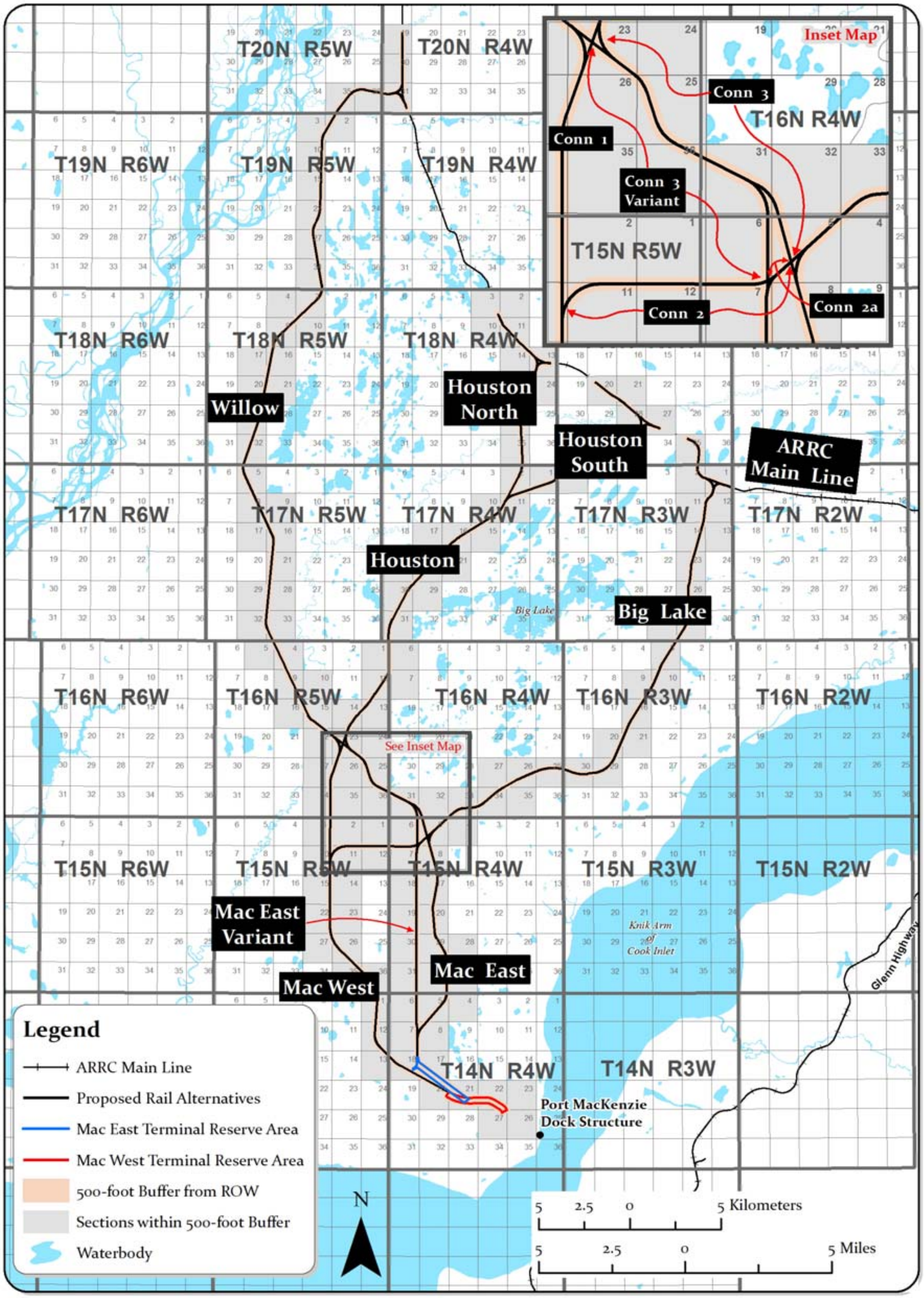

Figure 4.3-1. Proposed Port MacKenzie Rail Extension Township, Range, and Section Map

samples that were not collected at regular intervals and varied from 1 sample per year to 1 sample per month. The parameters collected also varied during the sampling periods, but temperature, conductivity, and pH were measured at most locations.

Table 4.3-2 compares selected water quality parameters to drinking water standards. Figure 4.3-2 shows the sample locations in relation to the build alternatives.

Table 4.3-2
Historic Water Quality Parameters Compared to Federal and State Standards for Drinking Water Quality[a,b]

Location and Date	Temperature. (°C)	Alkalinity (mg/L CaCO3)	Chloride (mg/L)	pH (s.u.)	Conductivity (µS/cm)
Water Quality Standard					
	≤ 15	30 to 500[c]	250[d]	6.0 to 8.5	< 1500[e]
Big Lake					
8/3/05 – Site B-1	9.1	64	4.54	7.0	141
9/16/05 – Site B-1	9.6			6.9	147
8/1/05 – Site B-2	6.6	101	0.59	8.4	210
9/9/05 – Site B-2	6.0			8.3	215
8/9/05 – Site B-3	4.5	114	2.16	8.5	219
9/12/05 – Site B-3	4.4			8.4	222
Lake Lucille					
8/10/05 – Site L-1	5.9	117	21.50	7.6	319
9/14/05 – Site L-1	6.3			7.8	283
8/15/05 – Site L-2	5.8	192	31.30	7.6	506
9/9/05 – Site L-2	5.6			7.6	503
8/10/05 – Site L-3	5.9	110	2.62	8.4	229
9/13/05 – Site L-3	5.9			8.3	231
Cottonwood Lake					
8/8/05 – Site C-1	4.6	179	3.98	7.8	377
9/14/05 – Site C-1	4.5			7.9	377
8/9/05 – Site C-2	9.6	137	4.41	7.4	297
9/14/05 – Site C-2	9.4			7.6	307
8/8/05 – Site C-3	4.1	191	38.20	7.4	543
Seymour Lake					
8/12/05 – Site S-1	4.8	152	1.53	7.3	301
9/13/05 – Site S-1	4.6			7.3	303
8/12/05 – Site S-2	4.8	148	1.81	7.1	301
9/13/05 – Site S-2	4.6			7.1	304
8/12/05 – Site S-3	4.9	189	2.59	7.2	378
9/13/05 – Site S-3	4.5			7.2	375
Memory Lake					
8/5/05 – Site M-1	5.5	191	44.60	6.9	538
9/12/05 – Site M-1	5.1			6.9	547
8/3/05 – Site M-2	8.2	129	1.95	7.2	269
9/9/05 – Site M-2	7.5			7.1	277
8/5/05 – Site M-3	5.5	114	1.40	6.9	222
9/12/05 – Site M-3	5.4			6.9	225

[a] Sources: USGS, 2006; ADEC, 2008d; USEPA, 1986.
[b] C = degrees Celsius; mg/L = milligrams per liter; $CaCO_3$ = calcium carbonate; pH = measure of the acidity or the alkalinity of a solution; s.u. = standard units; µS/cm = micro-siemens per centimeter; ≤ = less than or equal to; < = less than.
[c] The USEPA limits alkalinity in terms of total dissolved solids (limit 500 parts per million) and to some extent by the limit on pH. The aesthetic objective is generally 30 to 500 mg/L $CaCO_3$.
[d] Neither chlorides nor sulfates may exceed 250 mg/L as part of the total dissolved solids standard.
[e] Conductivity is not a water quality standard, but has an acceptable range for drinking water. Total dissolved solids levels can be inferred from conductivity.

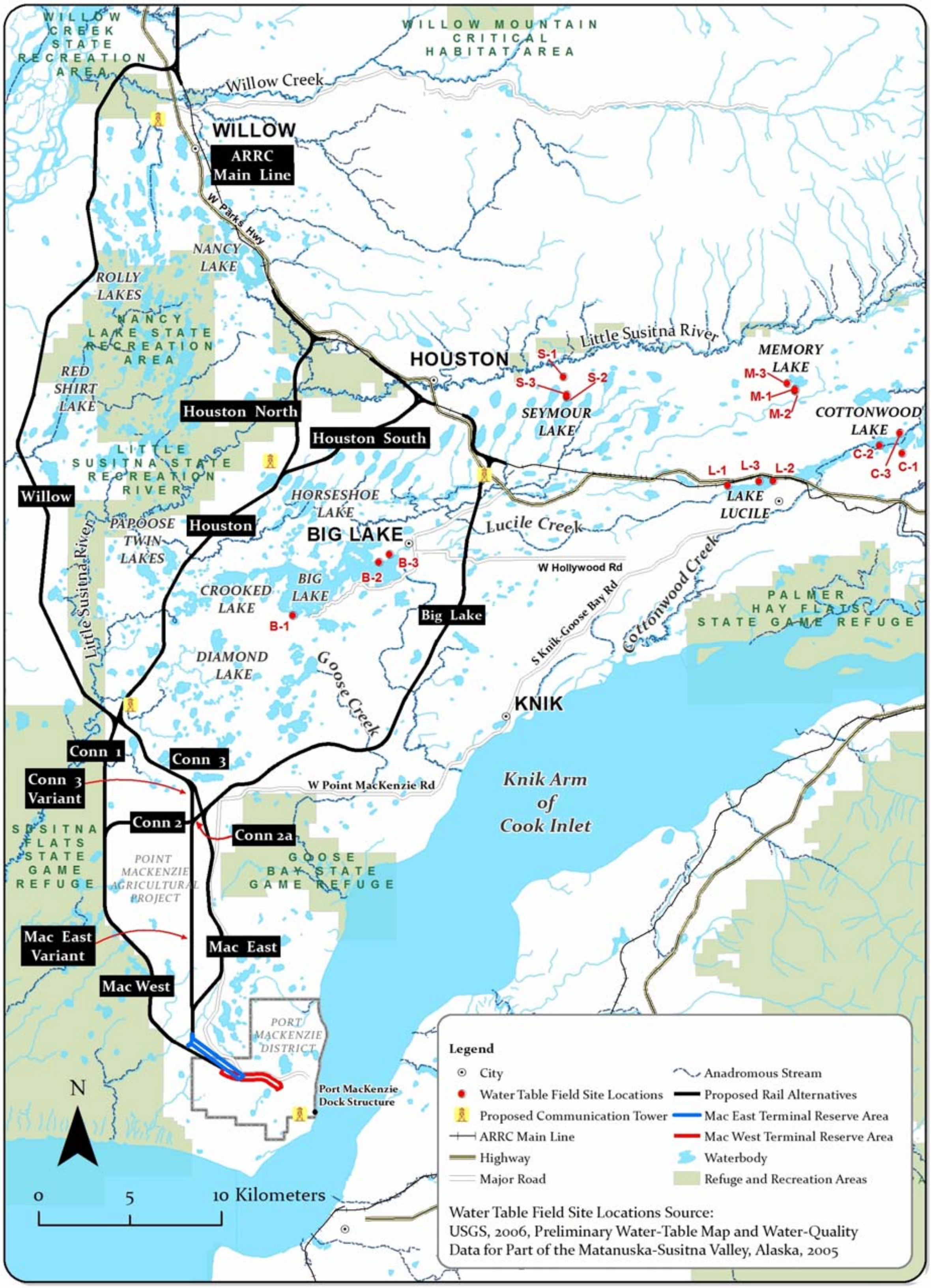

Figure 4.3-2. U.S. Geological Survey Groundwater Sampling Locations

As shown, the available U.S. Geological Survey data for areas in and around the study area (Big Lake, Seymour Lake, Memory Lake, Lake Lucille, and Cottonwood Lake) indicate that groundwater quality meets drinking water standards in those areas. However, there might still be localized water quality impairment in other parts of the study area. Research has shown the following potential areas of concern:

- Arsenic – Conditions favorable to the occurrence of arsenic in groundwater are found throughout the study area. These include the presence of iron oxide and sulfide minerals in the aquifer materials, and phosphates and organic carbon in alkaline (high pH) groundwater. According to the ADEC, 7 public water systems in the MSB are out of compliance with the Federal standard for arsenic, which limits levels to no more than 10 micrograms per liter. The wells identified had concentrations of arsenic between 25 micrograms per liter and 400 micrograms per liter (White, 2009).
- Contaminated sites – OEA searched the ADEC on-line databases for incidents of "open" leaking underground storage tank sites and "active" contaminated sites. The search resulted in the identification of 5 sites within 1 mile of the study area with potential risk for contamination. See Section 13.4 for a detailed summary.
- Groundwater recharge areas – There has been no regional hydrogeologic mapping for the MSB. Based on general geological conditions in the study area, groundwater recharge occurs through multiple pathways, increasing potential for contamination. Recharge to unconfined aquifers occurs through downward percolation of precipitation. Recharge to deeper aquifers is by infiltration of groundwater through aquitards and "leaky" confining layers, by lateral migration from other aquifers, and/or by direct infiltration of precipitation where the till or other confining layers are absent. Groundwater recharge occurs over most of the study area, with local discharge to low-lying areas such as lakes, streams, and wetlands.

4.3.4 Environmental Consequences

4.3.4.1 Proposed Action

The analysis of potential impacts to groundwater from proposed rail line construction and operation is not specific to rail line segments or alternatives because there would be no impacts to groundwater that distinguish segments, such as the presence of protected groundwater aquifers or groundwater wells within the rail line footprint or the 200-foot ROW. Rather, this section describes common impacts that could occur throughout the study area during proposed rail line construction and operation, and provides a general guideline for understanding the effects of the proposed project. These common impacts vary only by location, but the level of impact would be the same. Because the location and/or design characteristics of some temporary construction facilities and rail line structures would be determined only during the final design and permitting process, the impact determinations for facilities and structures represent conservative best estimates of potential impacts from rail line facilities and structures in the study area.

Construction Impacts

Construction of the rail line, sidings, power lines, communications cables, access road, and other facilities could affect groundwater movement and quality. Groundwater movement could be altered by changes in infiltration and recharge rates due to compaction of the overlying soil. Groundwater quality could be altered if project components and operation provide additional sources or pathways for pollutants to infiltrate groundwater. The following paragraphs describe potential construction-related impacts common to all build alternatives.

Construction of Rail Line, Associated Facilities, Unpaved Access Roads, and Staging Areas

Construction of the rail line, associated facilities, unpaved access roads, and staging areas could alter infiltration and recharge characteristics and could permanently reduce or impede infiltration due to surface soil compaction. These effects would be limited to the footprint of the rail line, including associated facilities and access road, and staging areas, which represent a small fraction of the total recharge area. Any contaminants released to the ground during construction could be introduced to groundwater through infiltration, thus effecting groundwater quality.

Excavation of Borrow Areas

Extraction of material from borrow areas could affect the local hydrogeologic regime (and water balance) by the removal of saturated materials. Depending on the hydraulic transmissivity of the soils in the borrow areas, they would likely fill with groundwater over time. Water levels in the water-filled borrow area would fluctuate with the water table, and would be a source of groundwater discharge through evaporation during summer and a source of groundwater recharge during ice break-up and major rainstorms. Dewatering of aquifers or reservoirs of local, shallow, thawed, water-bearing zones could occur during construction and operation of any borrow area. These activities could result in hydrological and water quality impacts to groundwater.

Operation Impacts

Rail line operation could affect groundwater through the same mechanisms described above for construction impacts. The presence of culverts, bridge pilings, or other permanent maintenance structures would result in negligible impacts to groundwater infiltration because these facilities would not affect infiltration processes. However, the presence of the rail line close to any shallow groundwater wells could reduce or impede infiltration due to surface soil compaction. Given the limited surface area of the rail line, it would be expected that these impacts would be negligible. In addition, the presence of bridges or culverts near or over springs and seeps could disrupt groundwater discharge processes and create instability concerns that would need to be addressed in structure design. Furthermore, any contaminants released to the ground during operation could be introduced to groundwater through infiltration, thus effecting groundwater quality.

4.3.4.2 No-Action Alternative

Under the No-Action Alternative, ARRC would not construct and operate the proposed Port MacKenzie Rail Extension, and there would be no groundwater impacts from the project.

4.3.5 Unavoidable Environmental Consequences of the Proposed Action

To avoid or minimize the potential environmental impacts to groundwater from the proposed rail line as described above in Section 4.3.4.1, OEA is recommending that the Board impose 10 mitigation measures, including 4 measures volunteered by the Applicant (see Section (19.2). These measures include requiring: acquisition of appropriate Federal and state permits; maintenance of natural water flow and drainage; utilization of best management practices imposed by the USACE; construction of project-related winter roads to avoid water quality degradation; abandonment of project-related geotechnical boreholes in compliance with appropriate regulations; and compliance with appropriate regulations governing hazardous substances and potential contamination.

Notwithstanding the recommended mitigation measures, there still would be potential unavoidable impacts to groundwater from the proposed rail line. Potential impacts would include: changes to recharge potential and aquifer dewatering due to increased ground compaction within the rail line footprint and an increased risk of groundwater contamination from the rail line providing additional sources or pathways for pollutants. OEA concluded such mitigated impacts from construction and operation of the proposed rail line would be negligible.