5.3 Wildlife

This section describes wildlife resources (primarily game and nongame mammals, marine mammals, and birds) regularly present in the proposed Port MacKenzie Rail Extension study area and potential impacts to those resources from the proposed rail line. Section 5.1 describes the regulatory setting for wildlife, Section 5.3.1 defines the study area, Section 5.3.2 describes the analysis methodology, Section 5.3.3 describes the affected environment (existing conditions), Section 5.3.4 describes potential environmental consequences (impacts) to wildlife resources from the proposed rail line, and Section 5.3.5 describes unavoidable environmental consequences of the proposed action to wildlife resources.

5.3.1 Study Area

The study area is 5 miles on each side of the centerline (a 10-mile-wide corridor) along the proposed rail line segments. The study area provides context for the evaluation of potential impacts to wildlife from the proposed rail line. Population estimates and harvest and management of game mammals are based on ADF&G Game Management Unit 14 data. The proposed rail line alternatives would cross Subunits 14A and 14B. Construction activities would occur within the 200-foot ROW of the rail line; activities such as grading for the rail line, the access road, and associated facilities would generally only permanently disturb areas within the rail line footprint, which includes the rail bed, terminal reserve area, access road, and associated facilities.

5.3.2 Analysis Methodology

OEA evaluated potential impacts to wildlife based on habitat use, habitat requirements, and seasonal movements of animals in the study area. OEA based the wildlife habitat analysis on the vegetation types and results of the vegetation analysis described in Section 5.2 and Appendix D using the reported density and habitat use of animals present in the study area; based the analysis of impacts to eagle, raptor, large owl, loon, and swan habitats on raptor survey data for the proposed rail line (Shook and Ritchie, 2008) and waterbird data from the USFWS (Conant *et al.*, 2007; Platte *et al.*, 2008); and based the analysis of habitat loss for small owls, shorebirds, seabirds, and landbirds on density data for breeding bird survey routes in or near the study area (Sauer *et al.*, 2008; Benson, 2001).

OEA evaluated potential fragmentation of large contiguous habitat areas, referred to as core areas or habitats, by visual comparison and consideration of spatial statistics generated using the Patch Analyst (Centre for Northern Forest Ecosystem Research, Thunder Bay, Ontario, Canada) extension for ArcGIS® (ESRI, Redlands, California), as follows:

- Aggregated habitat polygons for the existing raster image landcover map (Homer *et al.*, 2004) by landcover class within the study area.
- Constructed core habitat areas using a 100-foot buffer, based on the 30-meter pixel size for the landcover map.
- Identified and computed spatial statistics for core habitats larger than 100 acres that the segments would cross.

OEA estimated rail collision mortality for moose based on the reported annual mortality for moose from segments of the existing rail line operating in Game Management Subunits 14A and 14B. OEA evaluated the timing and severity of disturbance and collision mortality along specific segments and alternatives based on fall moose distribution data (ADF&G, 2008), moose habitat mapping, and patterns of historical moose-train and moose-vehicle collision mortalities.

5.3.3 Affected Environment

The proposed rail line would be within ADF&G Game Management Unit 14 (6,625 square miles) and would cross Subunits 14A (2,561 square miles) and 14B (2,152 square miles). Moose and black bears are the primary big game mammals in the study area. Trappers harvest marten, beaver, red fox, lynx, mink, and wolves in the area. Appendix E provides additional descriptions of mammals and birds in the study area. Wildlife habitats in the study area are dominated by forested habitats (50 percent), followed by wetland habitats (32 percent), open water habitats (11 percent), developed or barren areas (4 percent), and agricultural habitats (3 percent) (Homer *et al.*, 2004).

5.3.3.1 Mammals

Bears

Black and brown (grizzly) bears are common in Game Management Unit 14. During spring, black bears use moist lowlands where early growing vegetation, especially horsetail (*Equisetum* spp.), comprises the bulk of their diet. Black bears also eat carrion, moose calves, and salmon when available. During fall, black bears primarily feed on berries, especially blueberries, in open meadows or alpine areas. Brown bears feed on a variety of plants and animals, using their long claws to expose ground squirrels in burrows and to dig roots. Brown bears feed on berries, grasses, sedges, horsetails, cow parsnips, salmon, roots, and various mammals, including ground squirrels and moose. As food becomes scarce and temperatures drop in fall, both black and brown bears go into hibernation in dens generally excavated into small mounds, hillsides, or river terraces. Bears may remain dormant in winter dens as long as 7 to 8 months. Sows give birth to their young while in their winter dens and emerge with their young in May.

Black bear and brown bear populations in Subunits 14A and 14B are managed to provide the greatest opportunity for hunters (Kavalok, 2005, 2007). Hunters harvested an average of 76 black bears per year in Subunits 14A and 14B from 1996 through 2003 (Kavalok, 2005). Many black bears are harvested by resident hunters during May at bait stations as bears emerge from their dens and during late September, when moose and other big game are also harvested (Kavalok, 2005). Hunters harvested an average of 15 brown bears annually in Game Management Unit 14 from 1996 through 2005 (Kavalok, 2007). Most brown bears are harvested during fall, although about 25 percent of the harvest occurs during spring (Kavalok, 2007). Bear population trends in Subunits 14A and 14B are suspected to be stable or increasing (Kavalok, 2005, 2007).

Moose

Moose in the study area include both locally migrant and resident populations (Masteller, undated; Modafferi, 1988). Estimated annual home ranges for moose in Southcentral Alaska average 112 square miles for nonmigratory cows and 195 square miles for migratory cows; cow summer ranges vary from 4 square miles to 100 square miles (Hundertmark, 1997). Moose ranges are influenced by the sex and age of individuals, the range characteristics of the cow, and habitat conditions (Hundertmark, 1997). Moose tend to use traditional migratory routes and calves learn migratory behavior as they follow their mothers on annual migrations (Hundertmark, 1997). Fall movements to winter habitats occur post-rut and are generally initiated by snow depths of more than 15 inches (Peek, 1997). Moose are well adapted to traveling across snow, but depths of more than 28 inches can affect moose movements and habitat use (Peek, 1997). Moose might use closed canopy needleleaf forests, which generally have lower snow depths, as snowpack reaches more than 38 inches (Peek, 1997).

During calving in mid May to mid June (Modafferi, 1988), cow moose generally select habitats with heavy cover, such as dense tall shrub or closed canopy needleleaf forests, often returning to areas used for calving in previous years (Masteller, undated; Tremblay *et al.*, 2007). Moose forage on sedges, horsetail, pondweeds, and grasses during spring and vegetation in shallow ponds and forbs and the leaves of birch, willow, and aspen during summer. Aquatic habitats provide aquatic and emergent vegetation, relief from insects, drinking water, and water for cooling to assist with thermoregulation. Moose mate from mid September through October (Modafferi, 1988), selecting more open habitats during the rut. During fall, moose transition from a leafy to a woody diet and feed on willow, birch, and aspen twigs during winter. Moose generally use open areas with abundant shrub forage during winter.

Moose populations in Subunits 14A and 14B are managed to provide for high levels of human consumptive use, and to provide a maximum opportunity for hunters (Peltier, 2006a, 2006b). Most moose are harvested by hunters using off-road vehicles or highway vehicles for access during the general hunting season in fall, with an average annual harvest of 468 moose in Subunit 14A and 62 moose in Subunit 14B (Peltier, 2006a, 2006b). The moose population in Subunit 14A has remained relatively stable at about 5,500 to 6,500, and the moose population in Subunit 14B has remained relatively stable at around 1,500 (Peltier, 2006a, 2006b).

Wolves

Wolves are common throughout the study area. Wolves are social animals that live in packs of 2 to 12 animals, usually including parents and pups; larger packs contain multiple females and can include 2 or 3 litters of pups. Wolves breed in February and March, and litters are born in May or early June, averaging 4 to 7 pups. Pups are born in a den excavated in well-drained soil. Wolves center their activities near their den sites, traveling as far as 20 miles in search of food to bring back to the den. Pups are weaned during mid summer, and pups are usually moved away from the den in mid to late summer.

Wolf populations in Subunits 14A and 14B are managed to provide for optimum harvest of wolves (Peltier, 2006c). Most harvested wolves are taken by trappers using snares and traps during mid winter, although hunters shoot some, with an average annual harvest of 14 wolves

per year in Subunit 14A and 7 wolves per year in Subunit 14B (Peltier, 2006c). Abundant moose, beaver, and salmon have allowed wolf numbers to increase in Game Management Unit 14 over the last 30 years (Peltier, 2006c). During winter, a pack might kill a moose every few days. Wolf and prey populations can be affected by a number of factors, including weather and food availability.

Furbearers

Furbearers are quite varied in ecology and habitat use. Beaver, mink, muskrat, and river otter all depend on aquatic habitats, but only beaver and muskrat forage on vegetation. Ermine and mink prefer riparian woodlands and feed on small mammals, but will eat birds, eggs, frogs, fish, and insects. Martens depend on small mammals, but also subsist on berries, bird eggs, and vegetation, preferring forested areas with black spruce and bogs. Wolverines (a weasel relative) are solitary animals that are primarily scavengers, although they will also prey on small mammals. These animals are habitat generalists that use all available forested and riparian habitats in the study area. All furbearers use some type of nest, den, or burrow for reproduction and some species use these structures year round.

The canids – red fox, coyote, and wolf – range widely and use many habitat types, with home range size increasing with the increasing size of the species. These 3 species compete for smaller prey and will exclude the smaller canids from their range, such that foxes are less abundant where coyote are common and coyote are absent or scarce where wolves are abundant.

Lynx have a wide range; the size of their range is dependent on prey availability. Lynx populations are particularly influenced by hare populations, which, in turn, are regulated through vegetation following an 8- to 10-year cycle.

Furbearers targeted by trappers in this area are marten, river otter, wolf, wolverine, beaver, fox, and lynx, although the reported harvest indicates that muskrat, red fox, and mink were most often reported as harvested (Blejwas, 2006). Wolverine and lynx are considered scarce in Game Management Unit 14, while red squirrels, mice, and rodents are considered abundant (Blejwas, 2006). Most trappers in Game Management Unit 14 use traps or snares to harvest furbearers and access trapping areas from established roads and trails using snowmachines (Peltier, 2007).

Other Mammals

Other mammals in the study area include bats, flying squirrels, porcupines, shrews, voles, and lemmings. Bats, flying squirrels, and porcupines depend on forested habitats. Shrews, voles, and lemmings are important forage for raptors, owls, and many furbearers.

Marine Mammals

Beluga whales, harbor porpoises, and harbor seals might be present in the Knik Arm near Port MacKenzie near the southern terminus of the proposed rail line. All 3 of these marine mammals likely travel upriver in the Susitna and Little Susitna rivers in pursuit of prey species.

5.3.3.2 Birds

Waterbirds

Waterbirds, including waterfowl, loons, grebes, gulls, and shorebirds, are considered migratory. The most abundant waterfowl in the study area are mallard, green-winged teal, scaup, American wigeon, goldeneye, northern pintail, and scoters. All the waterbirds generally nest near aquatic habitats (Mallek and Groves, 2008). Many geese, ducks, swans, sandhill cranes, and shorebirds stage in and migrate through the Cook Inlet basin during spring and fall. Trumpeter swans, common loons, Pacific loons, and red-necked grebes nest in the study area on the numerous lakes and ponds (Conant *et al.*, 2007; Platte *et al.*, 2008). Shorebirds and cranes generally nest in wetland habitats, although some shorebirds nest in upland habitats. Shorebirds in the study area include common snipe, greater and lesser yellowlegs, spotted sandpipers, solitary sandpipers, and red-necked phalaropes (URS, 2006; Sauer *et al.*, 2008). Seabirds in the area include herring gulls, mew gulls, glaucous-winged gulls, Bonaparte's gulls, and Arctic terns (URS, 2006; Sauer *et al.*, 2008). Hunters harvest ducks, geese, snipe, and sandhill cranes from ponds, lakes, wetlands, agricultural fields, and rivers during fall migrations.

Raptors

Raptors in or near the study area include bald eagles, red-tailed hawks, sharp-shinned hawks, osprey, great horned owls, great gray owls, northern saw-whet owls, and boreal owls (Sauer *et al.*, 2008; Shook and Ritchie, 2008; Benson, 2001). Bald eagles are the most abundant large raptor nesting in the study area, followed by red-tailed hawks (Shook and Ritchie, 2008). During stick-nest surveys, balsam poplar was found to be the most commonly used nest tree for large stick nests along the proposed rail line alternatives, followed by aspen, spruce, and birch (Shook and Ritchie, 2008). Smaller raptors and owls are not effectively surveyed during normal breeding-bird and stick-nest surveys. Owl surveys in the Chugach National Forest approximately 30 miles south-southeast of the study area indicate that boreal and northern saw-whet owls are also likely abundant in the area (Benson, 2001).

Landbirds

Landbirds belong to many diverse groups and include both migrant and resident birds. Resident birds remain active during winter. Resident woodpeckers, chickadees, crossbills, and redpolls rely primarily on fruit and seed crops. Resident ravens, magpies, and gray jays scavenge on winter or predator-killed carrion. However, many birds feed primarily on insects that are not available during winter, and these birds remain in Southcentral Alaska only during the summer breeding season when insects are abundant.

Birds of Conservation Concern

Forty-two birds featured in the ADF&G Comprehensive Wildlife Conservation Plan (ADF&G, 2006) have been documented to occur in the study area during the breeding season, including 5 waterbirds, 3 waterfowl, 2 seabirds, 2 shorebirds, 6 raptors, 2 owls, and 22 landbirds. The 22 landbirds include 7 resident birds, 7 short-distance migrants, and 8 long-distance migrants. Eight birds in the study area are designated USFWS Birds of Conservation Concern – the Arctic tern, bald eagle, horned grebe, lesser yellowlegs, murrelet species (marbled or Kittliz's murrelets),

olive-sided flycatcher, rusty blackbird, and solitary sandpiper (USFWS, 2008). Three birds in the study area are designated ADF&G Alaska Species of Special Concern – blackpole warbler, olive-sided flycatcher, and Townsend's warbler (ADF&G, 1998).

5.3.4 Environmental Consequences

Potential impacts to wildlife resulting from proposed rail line construction and operation vary based on the animals' dependence on specific habitats, the availability of preferred and used habitats, the amount of preferred habitat the project would affect, ecology and life history, and past and present population trends. Because game mammal populations are managed for sustainable human harvest, project-related effects to population abundance and distribution, available habitat, and predator-prey relationships can also affect management of these game mammals. Appendix E provides supporting descriptions of environmental consequences and the results of qualitative and quantitative analyses.

5.3.4.1 Proposed Action

This section first describes general impacts common to all rail line alternatives, then describes how those general impacts apply to wildlife, and concludes with a description of specific impacts along rail line segments, segment combinations, and alternatives. Many potential impacts to wildlife would be similar regardless of alternative and are, therefore, described as common impacts.

Common Impacts

Construction Impacts

Temporary impacts could occur from construction-related activities such as clearing within the ROW, laying the new rail bed and rail line, installing communications towers and power lines, creating construction staging areas, and excavating borrow sites. In general, construction-related activities would cause temporary (short-term) disturbance and displacement of wildlife, although these activities could also cause mortality. Vegetation clearing and fill placement during construction within the rail line footprint would result in long-term habitat loss and alteration. Potential construction impacts to wildlife would include:

- Short-term habitat loss – The project would require temporary removal of vegetation cover, which provides wildlife habitat, in construction staging areas. These sites would be revegetated after rail line construction activities were completed.
- Short-term disturbances – Disturbances from construction activities would result in temporary displacement of wildlife from the project area, potentially resulting in reduced survival and productivity. Construction noise and human activity could cause denning mammals to flee from hibernation sites or abandon young. Abandoned young would likely perish and the energy expended by these mammals during fleeing could cause reduced survival rates over harsh winter months. Bears and moose could be intentionally harassed (such as by hazing) to protect workers and equipment. Construction activities during breeding seasons could lead to loss of breeding success, especially if animals were differentially displaced because of sex or age. Disturbance-related displacement from

favored breeding habitats could result in energy spent finding suitable replacement habitats, thus limiting survival of offspring or adults.

- Construction mortality – Construction-related traffic along the access road would include gravel haul trucks and other traffic. Wildlife could be hit and killed or fatally injured by construction vehicles, especially within areas or during weather conditions with poor visibility coincident with high traffic levels. Mammals in hibernation, in dens or nests with young, or in middens or nests in trees that are unable to escape during clearing within the ROW and gravel placement or extraction would be destroyed. If birds with eggs or young in nests in trees or on the ground were present at the time of clearing, they would be destroyed.
- Long-term habitat loss – Vegetation clearing, placement of gravel fill, and gravel extraction would result in permanent loss of wildlife habitats and alteration of surrounding habitats. Construction of the 31- to 46-mile rail line would result in a minimum impact of about 600 acres and a maximum area of about 850 acres of primarily forested and wetland wildlife habitats. For all habitat types at the scale of mapping used for assessment (Homer *et al.*, 2004), the maximum area of impact would represent less than 1 percent of habitats available within 5 miles of the proposed rail line alternatives.
- Long-term habitat alteration – Wildlife that reuse den or nest sites in the vicinity of the rail line might abandon them due to habitat changes and disturbance. This displacement from previously used habitats would require extra energy that could reduce survival rates. Alteration of habitats would include reduced or increased forage, vegetation for herbivores, insects for insectivores, small mammals for carnivores, and fish for marine mammals. The rail line could act as a fire break and affect the spread of fires in this region.

Operation Impacts

Rail line operation would include running one round-trip train per day over the rail line and maintenance of the rail line footprint. Rail line operation would result in the following common types of impacts to wildlife:

- Operation mortality – Train traffic on the rail line would result in wildlife fatalities, especially in areas or under weather conditions with poor visibility and in areas with concentrated use by wildlife. Collision-related mortality would be most obvious for large wildlife because collisions with small mammals and birds would generally occur without notice. An unknown number of small mammals and birds would be killed or injured during collisions with trains. Mammals and birds that feed on carrion from previous collisions with trains, and birds attracted to gravel along the road and rail beds, would likely have an increased incidence of collision mortality. Power lines associated with the rail line and three new communications towers could also increase the collision potential for birds (Manville, 2005).
- Habitat fragmentation – Review and analysis of land cover mapping (Homer *et al.*, 2001) indicates that the proposed rail line would contribute to habitat fragmentation of forested and wetland habitats (Appendix E). Issues relevant to wildlife related to habitat fragmentation include barriers to movement, creation of edge effects, reductions in core habitat size, facilitation of predator feeding, intrusion of invasive species, and human disturbance (Jalkotzy *et al.*, 1997). Much of the habitat the proposed rail line would cross is a mosaic of

habitats, has been previously fragmented by improved and unimproved roads, and is crossed by a network of trails.

- Barrier to movements – All large wildlife and most birds would be expected to cross the rail line footprint unimpeded. However, small animals such as lemmings, shrews, voles, and amphibians would likely be unable to cross the rail line and some mammals and resident landbirds might avoid crossing the rail line. Brood-rearing waterfowl and waterbirds would likely be unable to cross the rail line and might avoid crossing along waterways through small-diameter culverts.
- Edge effects and reductions in core habitat size – Fragmentation splits large areas of contiguous habitat of uniform type (patches or core habitats) into smaller pieces; increasing the amount of habitat edge or the area where one habitat is bordered by a differing habitat. In particular, fragmentation of late-succession forest habitats would impact forest-nesting landbirds and old-growth dependent mammals, such as the marten, by fragmenting large patches of forest and creating edge habitat. This could lead to a reduction in core habitat size, which would ultimately result in decreased reproductive potential.
- Facilitation of predator feeding – Any alteration of predator survival, especially for wolves and bears, the primary predators of moose in the region, due to increased nutrition from rail-killed moose or other large game mammals or decreased energy for travel from creation of a travel corridor, would have the potential to disrupt predator-prey relationships in the area.
- Intrusion of invasive species – Invasive plants and animals reduce habitat quality for native wildlife, reduce biodiversity, and threaten ecosystem integrity. Section 5.2 addresses invasive plant species; Section 5.4 addresses invasive fish in the study area, including northern pike.
- Human disturbance –ARRC regulations would prohibit access to the rail line ROW. This could alter or reduce hunter and trapper access in the vicinity of the rail line and could therefore impact mortality of game mammals in the area.

• Reduced survival or productivity – Disturbance from train passage could cause animals nesting or foraging near the rail line footprint to startle and flee, potentially alerting predators to their location and facilitating predation. Periodic disturbances during the breeding season could lead to a loss or reduction in breeding success because adults tending young might be interrupted or displaced from dens or nests.

- Displacement or attraction – Wildlife displaced by the rail line could experience decreased survival or productivity because of increased energy costs expended from using marginal habitats or expended locating new preferred habitats. Predators and scavengers such as wolves, coyotes, foxes, ravens, and magpies might be attracted to the rail line by the increased availability of carcasses from animals colliding with trains, which would benefit predators and scavengers.
- Exposure to spills and leaks of toxic materials – Chapter 11 addresses the potential for spills or releases of toxic materials. Wildlife could be exposed to small leaks of fuels, oils, antifreeze, and other toxic substances used to operate and maintain equipment or exposed to spills caused by derailment or collisions during rail line operation. A spill

also could lead to a reduction in available food because it would kill forage such as insects, small mammals, and fish.

Bears

All proposed rail line alternatives would have similar effects on black and brown (grizzly) bears. Based on the reported densities, there are an estimated 64 to 120 black bears and 24 to 32 brown bears in the study area (Kavalok, 2006, 2007). Habitat loss from the proposed alternatives would result in reduced habitat for less than 1 black bear and less than 1 brown bear and would likely be of no consequence to existing black and brown bear populations.

Construction of the proposed rail line across rivers and streams would fragment riparian habitats that bears use for travel and forage. The rail line would cross most major rivers via bridges, which generally would have sufficient height and span to allow bears to cross underneath. The rail line and access road could act as a fire break, leading to decreased incidence of wildland fires spreading across the rail line. Fires can be either beneficial to bears by increasing plant growth and berry crops and leading to increased forage and prey animals or detrimental to bears by clearing large areas of forest, thus reducing black bear numbers, or adversely affecting salmon streams, thus reducing prey. If construction of bridges and bridge approaches for streams with salmon spawning runs occurred coincident with these runs during summer into early winter, bears could be temporarily displaced from these foraging habitats.

The rail line alternatives could coincide with bear den sites. Vegetation clearing and excavation during fall and winter could affect 1 black or brown bear den, based on the estimated density of bears in the study area. While there could be impacts to a few individuals, these impacts are unlikely to have adverse impacts on the bear population. Food-conditioned bears attracted to worksites or construction areas by food and garbage odors might be killed in defense of life or property. Sows that become food-conditioned by access to human food or garbage teach their cubs to also associate humans with food, which can eventually lead to the destruction of entire family groups.

Few bears would be expected to be hit by trains. Bears would generally be expected to avoid the rail line, although some bears might be attracted to the rail line if grains or animal feeds, such as wheat, barley, oats, or dog foods, were spilled and not effectively removed. Bears could also be attracted to the rail line by rail-killed carrion during their active periods – spring through fall. The one round-trip train per day and periodic summer maintenance work could cause displacement of up to 1 bear, but this impact is unlikely to adversely impact the bear population.

Moose

Preferred moose habitats include riparian willow, poorly-drained meadows, and early succession forests. Based on fall moose densities adjusted by the proportion of the study area within each Game Management Unit, there would be an estimated 2,873 moose in the study area (Peltier, 2006a, 2006b). Habitat loss from project alternatives would result in reduced habitat for 5 to 7 moose, which would likely be of no consequence to the existing moose population. The total area of vegetation removed within the rail line footprint might underestimate the total impact to moose habitat if moose avoid it (Laurian *et al.*, 2008; Rolley and Keith, 1980). However, snow

conditions and migratory behaviors can negate avoidance, and because moose use a variety of habitats and readily cross rail lines and roadways during most of the year, habitat loss and fragmentation as a result of the rail line would generally be of minor consequence to moose.

Moose-train collision mortality from operation of the 31- to 46-mile-long rail line would average 3 to 4 moose per year, ranging from 1 to 9 collision mortalities per year, primarily during January, February, November, and December (ADF&G, 2008). Increased train traffic on the main line as a result of rail line construction would result in a combined direct and indirect moose-train collision mortality average of 6 to 7 moose per year, ranging from 3 to 17 moose per year. Brush cutting for vegetation maintenance could concentrate highly palatable forage for moose along the rail line (Rea and Gillingham, 2007; Rea *et al.*, 2007), which could increase the time moose spend near the rail line, thereby increasing the probability that an animal would cross the rail line and be hit by a train. Migratory moose could experience a disproportionate level of mortality compared to resident moose if movements across the proposed rail line were more common for migratory populations than resident populations. An unknown number of moose also would likely be injured during unreported glancing blows; some of these injuries would likely cause reduced survival or reduced mobility, which would facilitate predation.

The proposed rail line may result in indirect effects on moose habitat, movements, survival, and reproduction related to disturbance, as well as direct and indirect loss of moose habitat and moose due to moose-train collision mortality. All moose would be expected to successfully cross the rail line footprint, unless they were hit by a train or work vehicle. The one round-trip train per day and periodic maintenance work could also cause displacement of moose from the ROW.

Wolves

Wolves are habitat generalists, and would not likely be directly affected by habitat loss due to proposed rail line construction, but could be indirectly affected by habitat loss if there were changes in potential prey species. Rail line construction could directly affect wolf den sites. There could be natal and seasonal den sites for the estimated 18 to 21 wolf packs in Game Management Unit 14 along the rail line alternatives. Noise from construction activities would affect a larger area than the immediate rail line footprint and could result in displacement of a few individual wolves from the immediate area. If construction activities occurred in early spring shortly after pups were born, disturbance near an active den site could lead to abandonment of the den and loss of the pups, but could also result in adult wolves moving the pups to a new den site.

Wolves hunt daily, traveling in areas that provide the best passage, such as rivers, ridges, creeks, trails, and infrequently used roads. Wolves residing in the study area would likely be attracted to and travel along the rail line, although few wolves would be expected to be hit by trains. Indirect effects due to disturbance could cause displacement of wolves from the vicinity of the rail line, although wolves would be more likely to be attracted to the rail line by the increased availability of animal carcasses from moose-train collisions and bird collisions with power lines.

Furbearers and Other Mammals

Forested, wetland, and riparian habitats would be the primary habitats used by the diverse assemblage of furbearing animals in the area. Estimated potential impacts to furbearer and other mammals as a result of habitat loss would result in average habitat loss for furbearers that could affect as many as 5 to 10 beavers, 14 to 28 ermine, 11 to 40 least weasels, 4 to 10 female mink, 19 to 37 muskrats, 317 to 634 red squirrels, and 18 to 98 snowshoe hare (see Appendix E, Table E-4). Average habitat loss for other mammals, many of which serve as a forage base for furbearers, raptors, and owls, could affect as many as 513 northern bog lemmings, 4 to 46 northern flying squirrels, 2 to 30 porcupine, 686 to 2,287 shrews, and 686 to 2,744 voles (see Appendix E, Table E-4). Habitat loss in riparian areas would be of disproportionate consequence to river otters, muskrats, or beavers if burrows and den sites were destroyed and suitable substrates and materials for den construction were rare. As these animals are very common in the study area, the effects of habitat loss on furbearer and other mammal populations in the project area is unlikely to adversely impact the species' population.

A few furbearers and other mammals would likely be hit and killed by construction vehicles. Several train-animal collision mortalities could be expected each year due to proposed rail line operation, and porcupines would be especially vulnerable. Small animals such as lemmings, shrews, voles, and amphibians would be physically blocked from crossing the rail line footprint or would likely experience increased predation as they were exposed while attempting to cross it. Bats with young roosting in trees would be destroyed if these trees were removed during clearing activities within the ROW in spring and summer.

Many mammals are curious and could experience fatalities if they ingest toxic substances either directly or indirectly through self cleaning of oiled fur or hair or through consumption of oiled prey. Fur provides insulation that is lost upon contact with petroleum-based products such as diesel fuel and oil, leading to hypothermia, especially for mammals tied to aquatic environments, such as beavers and otters.

Marine Mammals

Habitat impacts at large river crossings would likely be sufficiently far from river deltas that harbor porpoises and beluga whales would be unlikely to come in contact with bridges. Harbor seals might travel as far as bridge locations on the Little Susitna River but would be unlikely to regularly occur this far upstream. Most project construction and operation effects on marine mammals would be caused by impacts to stream habitats and water quality for prey species – anadromous salmonids and other forage fish such as eulachon, smelt, and whitefish – and disturbance from potential increased ship traffic at Port MacKenzie. These indirect impacts would be likely to result in negligible effects to forage species and minor disturbance to a few harbor seals and harbor porpoises. Section 5.5 and Appendix H address potential project impacts to the Cook Inlet beluga whale.

Birds

The primary impacts to birds from proposed rail line construction and operation would be habitat loss, alteration, and fragmentation and mortality from collisions with power lines and

communications towers. All birds would experience a loss of nesting, foraging, and migration staging habitats due to rail line construction along a linear alternative. The loss of forested habitat would be considered a long-term impact, even if a portion of this habitat were subsequently restored, because of the time it takes for forested habitat to regenerate. Loss of forest communities would generally require 5 to 20 years or more to reestablish trees and shrub habitat for cover, perching, and nesting for most raptors and landbirds; 50 to 100 years for trees large enough to support eagle and large owl nests; and more than 50 years to grow the snags to support cavity nesting landbirds. Construction of the rail line and associated facilities would result in short-term disturbance and long-term habitat modification along the approximately 31- to 46-mile-long rail line. Habitat loss could affect as many as 40 waterbirds and waterfowl, 5 raptors and owls, 44 shorebirds, 5 seabirds, and 1,174 landbirds (Sauer *et al.*, 2008; Mallek and Groves, 2008; Benson, 2001; Shook and Ritchie, 2008).

Construction of rail beds and road beds across wetlands would alter the suitability of habitats near these structures for ground-nesting waterbirds and waterfowl due to changes in water abundance and distribution. Reduced habitat suitability would indirectly affect bird survival and reproductive potential. Tree-nesting raptors and cavity-nesting landbirds reuse nest structures and loss of nest trees could lead to reduced or lost reproduction in subsequent years from energy spent establishing new nests and nesting territories. This would have a disproportionate and delayed consequence for long-distance migrant landbirds (Schmiegelow and Hannon, 1999).

Habitat fragmentation caused by loss and changes in vegetation cover within the ROW through large areas of core forest habitats would have the greatest effect on resident and migrant landbirds (Hinkle *et al.*, 2002), although resident birds would likely respond to the rail line and access road corridor as a barrier to movement (Desrochers and Hannon, 1997). Forest-nesting landbird abundance, diversity, and reproduction rates all become depressed as a result of fragmentation associated with linear developments (Jalkotzy *et al.*, 1997). Linear developments can increase landbird nest predation by concentrating predator forage activity, such as gray jays and ravens, along the newly created edge habitats (Ibarzabal and Desrochers, 2004; Marzluff and Restani, 1999).

Rail line operation would result in continued disturbances to birds due to train movement. Disturbance to nesting birds could result in incubating birds flushing from their nests and leaving nests vulnerable to mammalian and avian predators. For ground-nesting birds, flushing might alert nearby mammalian and avian predators to the location of the nest, which could subsequently result in nest depredation and lost reproduction. Many waterfowl and shorebirds stage in the project area during spring and fall migrations, remaining within an area to congregate and feed while on their way to and from breeding and wintering habitats. Many landbirds migrate through Interior Alaska on their way to and from nesting grounds in Western and Arctic Alaska. Disturbance of migrant birds in staging habitats could limit the birds' ability to acquire the fat stores necessary to continue migration, and could reduce reproductive outputs of birds traveling to nesting grounds in spring, or reduce survival of birds traveling to wintering grounds in fall.

Bird nests with eggs or young in trees, shrubs, or on the ground would be destroyed if clearing activities within the ROW occurred during spring and summer. Factors influencing collision risk are related to the type of bird, environmental factors, and the location and configuration of the

power lines and towers. Power-line poles and communications towers would provide perches for raptors and other predatory birds, which would facilitate predation of ground-nesting waterfowl, waterbirds, and landbirds and could lead to reduced productivity of birds nesting close to these structures. Heavy-bodied, less-agile birds and birds in large flocks, such as cranes, swans, and geese, would be more likely to experience fatalities from collisions with power lines and communications towers because they might lack the ability to quickly negotiate obstacles. Power poles associated with the project could result in fatalities from electrocution for opportunistic raptors using them for nesting sites or vantages for territorial defense and hunting. Raptors are particularly susceptible to electrocution by poorly-designed power poles, especially when these are placed near nesting territories or foraging habitats.

Birds of Conservation Concern

Forty-two birds featured in the ADF&G Comprehensive Wildlife Conservation Plan have been documented in the study area, and an estimated 229 to 362 birds, depending on alternative, could be affected by reduced habitat availability and suitability due to proposed rail line construction (see Appendix E, Table E-8). Habitat loss could affect a number of USFWS- and ADF&G-designated birds of conservation and special concern, as detailed in Appendix E, Table E-8, which presents the number of nesting birds impacted (Arctic tern; bald eagle – average 4 birds, range 2 to 12 birds; blackpole warbler – average 36 birds, range 30 to 44 birds; horned grebe; lesser yellowlegs – average 10 birds, range 8 to 12 birds; murrelet species; olive-sided flycatcher – average 16 birds, range 13 to 19 birds; rusty blackbird; average 2 birds, solitary sandpiper – average 2 birds, range 1 to 2 birds; and Townsend's warbler). Available data for other bird species that have been documented in the project area are insufficient for making a quantitative estimate of the scale of impact. Other potential impacts to birds of conservation concern are as described for birds above.

Impacts by Segment and Segment Combination

Southern Segments and Segment Combinations

Construction of the southern segments and segment combinations would impact between approximately 350 to 500 acres of wildlife habitat (Table 5.3-1). None of the southern segments and segment combinations would cross moose calving habitat (Table 5.3-1). The southern segments and segment combinations would generally cross more high-density moose habitat (estimated fall 2008) than the northern segments and segment combinations (Figure 5.3-1), although high-density moose areas can vary annually. Habitats supporting between 280 and 460 birds would be lost due to construction of the southern segments and segment combinations (Table 5.3-2). Construction of the southern segments and segment combinations could result in disturbance to nesting trumpeter swans and loons within 0.5 mile of the rail line footprint (Table 5.3-3). Raptor and owl nests within 0.5 mile of the rail line footprint that could be disturbed or destroyed during construction include bald eagle, osprey, and great horned owl nests (Table 5.3-3).

The southern segments and segment combinations would contribute to fragmentation of primarily agricultural and woody wetland core habitats (Figure 5.3-2 and Appendix E). The Mac East Variant Segment would impact approximately 50 acres of the Point MacKenzie Agricultural

Table 5.3-1
Direct Loss of Wildlife Habitat for the Southern Segments and Segment Combinations[a,b] (acres)

Habitat Type	Southern Segments and Segment Combinations					
	Mac West-Conn 1	Mac West-Conn 2	Mac East-Conn 3	Mac East	Mac East Var-Conn 2a	Mac East Var-Conn 3 Var
Agricultural (total)	***26***	***36***	***4***	***3***	***50***	***52***
Closed Evergreen Forest	84	70	63	44	39	58
Open Evergreen Forest	1	<1	0	0	0	0
Woodland Evergreen Forest	1	1	1	1	1	1
Closed Deciduous Forest	25	25	111	104	67	75
Open Deciduous Forest	2	2	9	9	9	9
Woodland Deciduous Forest	5	5	7	8	3	3
Closed Mixed Forest	123	119	183	158	131	160
Open Mixed Forest	2	2	7	7	5	5
Woodland Mixed Forest	3	3	6	6	2	2
Forested Habitats (total)	***245***	***227***	***387***	***336***	***257***	***313***
Emergent Wetlands	26	23	15	12	24	29
Shrub/Scrub [c]	6	6	24	23	25	27
Woody Wetlands	104	95	36	33	30	32
Wetland Habitats (total)	***136***	***124***	***75***	***68***	***79***	***88***
Total Habitat Area	**407**	**387**	**467**	**407**	**386**	**453**
Moose Habitats						
Moose Calving Habitat	0	0	0	0	0	0
Moose Winter Habitat	239	189	40	1	1	40
Moose Foraging Habitat						
Woodland and Open Forests	14	13	30	31	20	20
Emergent Wetlands	26	23	15	12	24	29
Shrub/Scrub	6	6	24	23	25	27
Woody Wetlands	104	95	36	33	30	32
Moose Foraging Habitat (total)	***150***	***137***	***105***	***99***	***99***	***108***

[a] Sources: Homer *et al.,* 2004; ADF&G, 1985. Habitat impacts are for the rail line footprint.
[b] Totals might not equal sums of values due to rounding.
[c] According to Viereck *et al*., 1992, shrub/scrub vegetation in Alaska is mostly wet. As such, this vegetation type has been classified under wetlands for wildlife purposes.

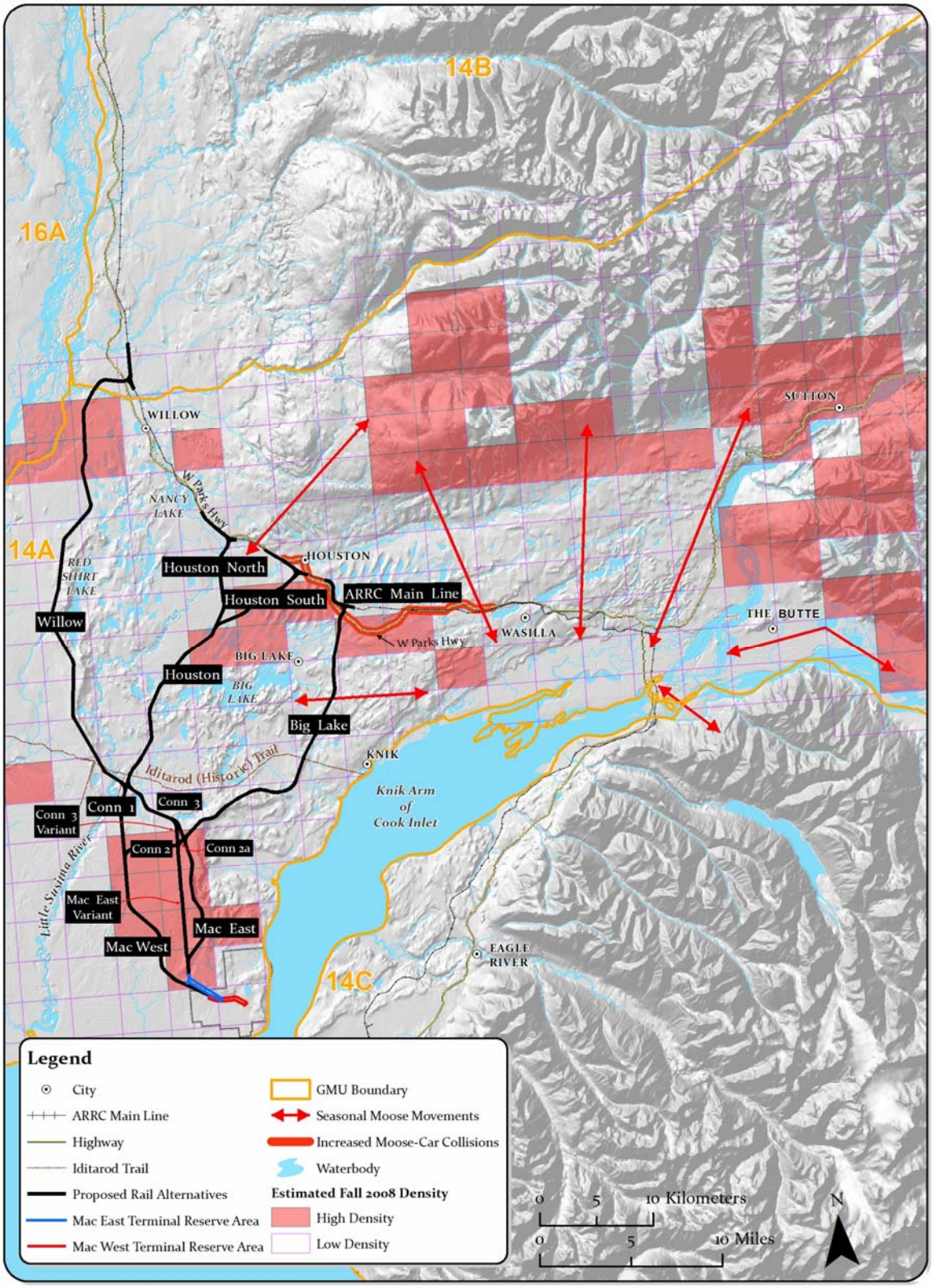

Figure 5.3-1. Estimated Fall 2008 Moose Density and Generalized Movement Patterns (ADF&G, 2008; Masteller, undated; Modafferi, 1988)

Table 5.3-2
Estimated Nesting Habitat Loss Impacts to Birds for the Southern Segments and Segment Combinations (individuals displaced)[a,b]

Bird Type	Mac West-Conn 1	Mac West-Conn 2	Mac East-Conn 3	Mac East	Mac East Var-Conn 2a	Mac East Var-Conn 3 Var
Waterbirds	2	2	2	2	2	2
Geese & Swans	1	1	1	1	1	1
Ducks	*17*	*17*	*20*	*17*	*16*	*19*
Dabbling Ducks	11	10	13	11	10	12
Diving and Sea Ducks	7	7	8	7	7	8
Raptors and Owls	2	2	3	2	2	2
Shorebirds	16	15	16	11	10	15
Seabirds (gulls)	2	2	2	2	2	2
Landbirds	*423*	*395*	*411*	*277*	*256*	*388*
Resident	32	30	31	21	19	29
Short-Distance Migrant	111	104	108	73	67	102
Long-Distance Migrant	281	263	274	184	171	259
Total Individuals[c]	**460**	**431**	**452**	**308**	**286**	**427**

[a] Sources: Shook and Ritchie, 2008; Sauer *et al.,* 2008; Platte *et al.,* 2008; Mallek and Groves, 2008; Benson, 2001.
[b] Estimate based on rail line footprint area multiplied by nesting season density for waterbirds, geese and swans, ducks, small owls (Benson, 2001), shorebirds, seabirds, and landbirds in the study area (Appendix E). Raptors and large owl impacts based on nests identified within the rail line footprint (Shook and Ritchie, 2008).
[c] Total includes waterbirds, geese and swans, ducks, raptors and owls, shorebirds, seabirds, and landbirds. Dabbling ducks and diving and sea ducks are subcategories of ducks. Landbirds categorized by migration are subcategories of landbirds. Totals might not equal sums of values due to rounding.

Table 5.3-3
Estimated Nesting Habitat Disturbance to Swans, Loons, Raptors, and Owls along the Southern Segments and Segment Combinations (nests or nesting lakes disturbed)[a,b]

Bird Type	Mac West-Conn 1	Mac West-Conn 2	Mac East-Conn 3	Mac East	Mac East Var-Conn 2a	Mac East Var-Conn 3 Var
Trumpeter Swans	0	0	2	0	0	2
Common Loons (No. of young)[d]	8 (1)	7 (1)	5	0	0	4
Common Loon Lakes (No. with broods)	6 (2)	5 (2)	4	0	0	4
Pacific Loons	0	0	1	0	0	1
Total Waterbirds	**8**	**7**	**8**	**0**	**0**	**7**
Bald Eagle	1	0	0	0	0	0
Osprey	1	1	0	0	0	0
Red-tailed Hawk	0	0	0	0	0	0
Great Horned Owl	0	0	1	0	0	1
Great Gray Owl	0	0	0	0	0	0
Northern Saw-whet Owl[c]	1	1	1	1	1	1
Boreal Owl[c]	1	1	1	1	1	1
Total Raptors and Owls	**4**	**3**	**3**	**2**	**2**	**3**

[a] Sources: Conant *et al.,* 2007; Platte *et al.,* 2008; Shook and Ritchie, 2008; Benson, 2001.
[b] Estimate based on nest or nesting lake observations within 0.5 mile of proposed rail line footprint. Data for waterbirds are a sample of segment areas and actual impacts might be higher; surveys for raptors and large owls covered the entire segment.
[c] Estimate for small owls based on nesting densities near the study area multiplied by the rail line footprint area, including stream relocation and road relocation areas (Benson, 2001).
[d] No. = Number.

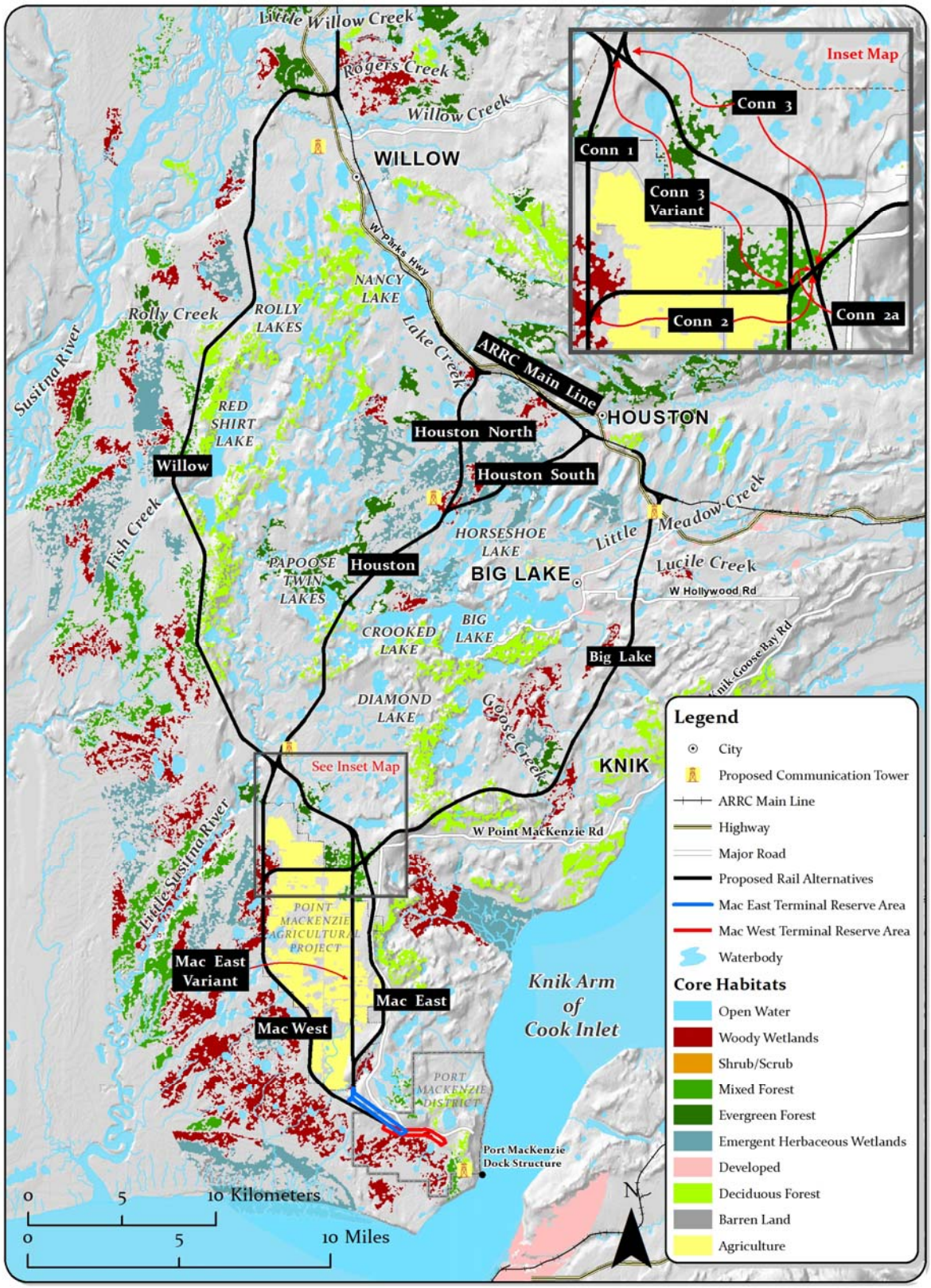

Figure 5.3-2. Core Habitat Areas in the Study Area (Homer *et al.*, 2004)

Project. Both the Mac West-Connector 1 Segment Combination and the Mac East-Connector 3 Segment Combination would skirt the edges of the Point MacKenzie Agricultural Project and would cross agricultural core habitats. In all instances, most of the agricultural area would remain intact, but the edge would be encroached upon at several locations, primarily because the agricultural edge is uneven (Figure 5.3-2). The Mac West-Connector 1 and Mac West-Connector 2 segment combinations would cross a large area of woody wetland core habitat and would contribute to fragmentation of this habitat. The Mac West-Connector 2 and Mac East-Connector 3 segment combinations would fragment core areas of mixed and evergreen forested habitats near the junction of the Mac East and Connector 3 Segments (Figure 5.3-2).

Northern Segments and Segment Combinations

Construction of the northern segments would result in the direct loss of approximately 200 to 400 acres of wildlife habitat (Table 5.3-4). The northern segments and segment combinations would generally cross through less high-density moose habitat (estimated fall 2008) than the southern segments and segment combinations, although high-density moose areas can vary annually (Figure 5.3-1; ADF&G, 2008). All of the northern segments and segment combinations, except the Big Lake Segment, would cross moose calving habitat (Table 5.3-4). Habitats supporting between 500 and 800 birds would be lost due to construction of the northern segments and segment combinations (Table 5.3-5).

Construction of the northern segments and segment combinations could result in disturbance to nesting trumpeter swans and loons within 0.5 mile of the rail line footprint (Table 5.3-6). Raptor and owl nests within 0.5 mile of the rail line footprint that could be disturbed or destroyed during construction include bald eagle, red-tailed hawk, great horned owl, and great gray owl nests (Table 5.3-6).

The northern segments and segment combinations would contribute to fragmentation of primarily forested and emergent wetland habitats (Figure 5.3-2; Appendix E). The Willow Segment and the Houston-Houston North Segment Combination would cross the largest area of core evergreen forest. The Willow Segment also crosses the largest amount of closed deciduous and mixed forest (Table 5.3-4). The Houston-Houston South Segment Combination would cross the largest area of core emergent wetland habitat (Figure 5.3-2).

Summary of Potential Impacts by Rail Line Alternative

The primary potential impacts to wildlife from the proposed rail line would be habitat loss and alteration during construction, moose-train collision mortality, bird-power line and communications tower collision mortality, and potential changes in human disturbance and harvest patterns.

Rail line construction would result in direct loss of an average of approximately 700 acres (ranging from 608 to 822 acres depending on alternative selected) of wildlife habitat (Table 5.3-7), which is less than 1 percent of the 435,895 acres of available habitat in the study area. By comparing the total forested habitat averaged across all alternatives (501 acres) to the total wildlife habitat loss averaged across all alternatives (714 acres), OEA's analysis indicates that, on average, 70 percent of wildlife habitat loss would be from forested habitats (Table 5.3-7).

Table 5.3-4
Direct Loss of Wildlife Habitat for the Northern Segments and Segment Combinations (acres)[a,b]

Habitat Type	Willow	Big Lake	Houston-Houston North	Houston-Houston South
Agricultural (total)	***1***	***<1***	***0***	***0***
Closed Evergreen Forest	46	32	46	31
Open Evergreen Forest	<1	1	1	1
Woodland Evergreen Forest	<1	<1	1	1
Closed Deciduous Forest	138	84	59	35
Open Deciduous Forest	12	11	9	1
Woodland Deciduous Forest	3	2	4	1
Closed Mixed Forest	147	79	42	24
Open Mixed Forest	4	3	4	2
Woodland Mixed Forest	3	2	1	<1
Forested Habitats (total)	***352***	***214***	***167***	***96***
Emergent Wetlands	13	40	41	63
Shrub/Scrub [c]	3	25	<1	14
Woody Wetlands	11	50	57	36
Wetland Habitats (total)	***27***	***115***	***98***	***113***
Total Habitat Area	**380**	**329**	**265**	**210**
Moose Habitats				
Moose Calving Habitat	156	0	202	135
Moose Winter Habitat	354	0	265	198
Moose Foraging Habitat				
Woodland and Open Forests	21	19	20	6
Emergent Wetlands	13	40	41	63
Shrub/Scrub	3	25	<1	14
Woody Wetlands	11	50	57	36
Moose Foraging Habitat (Total)	***48***	***134***	***118***	***120***

[a] Source: Homer *et al.* 2004; ADF&G, 1985. Includes rail line footprint, including stream and road relocation areas along the Big Lake Segment.
[b] Totals might not equal sums of values due to rounding.
[c] According to Viereck *et al.,* 1992, shrub/scrub vegetation in Alaska is mostly wet. As such, this vegetation type has been classified under wetlands for wildlife purposes.

Table 5.3-5
Estimated Nesting Habitat Loss to Birds for the Northern Segments and Segment Combinations (individuals displaced)[a,b]

Bird Type	Willow	Big Lake	Houston-Houston North	Houston-Houston South
Waterbirds	2	2	1	1
Geese & Swans	1	1	1	1
Ducks	*17*	*15*	*12*	*10*
Dabbling Ducks	11	10	7	6
Diving & Sea Ducks	7	6	5	4
Raptors and Owls	2	2	2	1
Shorebirds	28	20	18	19
Seabirds (gulls)	3	3	2	2
Landbirds	*752*	*533*	*479*	*501*
Resident	56	40	36	37
Short-Distance Migrant	197	140	125	131
Long-Distance Migrant	500	355	319	333
Total Individuals[c]	**802**	**574**	**513**	**532**

[a] Sources: Shook and Ritchie, 2008; Sauer *et al.,* 2008; Platte *et al.,* 2008; Mallek and Groves, 2008; Benson, 2001.
[b] Estimate based on rail line footprint, including stream and road relocation footprint areas multiplied by nesting season density for waterbirds, geese and swans, ducks, small owls (Benson, 2001), shorebirds, seabirds, and landbirds in the study area (Appendix E). Raptors and large owl impacts based on nests identified within the rail line footprint (Shook and Ritchie, 2008).
[c] Total includes waterbirds, geese and swans, ducks, raptors and owls, shorebirds, seabirds, and landbirds. Dabbling ducks and diving and sea ducks are subcategories of ducks. Landbirds categorized by migration are subcategories of landbirds. Totals might not equal sums of values due to rounding.

Table 5.3-6
Estimated Nesting Habitat Disturbance Impacts to Swans, Loons, Raptors, and Owls along the Northern Segments and Segment Combinations (nests or nesting lakes disturbed)[a,b]

Birds or Lakes	Willow	Big Lake	Houston-Houston North	Houston-Houston South
Trumpeter Swans	2	0	3	1
Common Loons (No. of young)[d]	13	6	17 (4)	16 (6)
Common Loon Lakes (No. with broods)	8 (1)	7	13 (4)	10 (4)
Pacific Loons	10	1	3	3
Total Waterbirds	**25**	**8**	**23**	**20**
Bald Eagle	5	1	1	1
Osprey	0	0	0	0
Red-tailed Hawk	0	0	6	5
Great Horned Owl	0	0	1	0
Great Gray Owl	0	0	1	1
Northern Saw-whet Owl[c]	1	1	1	1
Boreal Owl[c]	1	1	1	1
Total Raptors and Owls	**7**	**3**	**11**	**9**

[a] Source: Conant *et al.,* 2007; Platte *et al.,* 2008 ; Shook and Ritchie, 2008; Benson, 2001.
[b] Estimate based on observations within 0.5 mile of the proposed rail line footprint. Note that data for waterbirds are a sample of segment areas and actual impacts might be higher; surveys for raptors and large owls covered the entire segment.
[c] Estimate for small owls based on nesting densities near the study area multiplied by the rail line footprint, including stream relocation and road relocation areas (Benson, 2001).
[d] No. = Number.

Table 5.3-7
Direct Loss of Wildlife Habitat for the Alternatives (acres)[a,f,g]

	Alternatives												Summary	
Habitat Type	Mac West-Conn 1-Willow	Mac West-Conn 1-Houston-Houston North	Mac West-Conn 1-Houston-Houston South	Mac West-Conn 2-Big Lake	Mac East-Conn 3-Willow	Mac East-Conn 3-Houston-Houston North	Mac East-Conn 3-Houston-Houston South	Mac East- Big Lake	Mac East Var-Conn 2a-Big Lake	Mac East Var-Conn 3 Var-Willow	Mac East Var-Conn 3 Var-Houston-Houston North	Mac East Var-Conn 3 Var-Houston-Houston South	Average Habitat Loss[b]	Available Study Area Habitat
Agricultural (total)	***27***	***26***	***26***	***36***	***5***	***3***	***3***	***2***	***50***	***53***	***52***	***52***	***28***	***12,192***
Forest Type														
Evergreen	129	129	114	105	107	110	94	78	73	102	105	89	103	66,340
Deciduous	184	103	69	128	275	195	160	217	176	238	158	123	169	93,449
Mixed	277	171	150	208	334	227	206	250	221	313	205	184	229	97,324
Forest Structure														
Closed	556	371	314	410	665	482	424	496	432	612	428	371	463	237,204
Open	18	18	8	19	31	29	20	31	29	30	28	18	23	15,155
Woodland	14	14	10	12	20	20	16	18	9	11	12	8	14	4,754
Forested Habitats (total)[c]	***590***	***403***	***332***	***441***	***716***	***531***	***460***	***545***	***470***	***653***	***468***	***397***	***501***	***257,113***
Emergent Herbaceous Wetlands	38	67	89	64	28	57	78	52	64	42	70	92	62	70,426
Shrub/Scrub[h]	9	6	20	31	27	24	39	47	50	29	27	41	29	13,580
Woody Wetlands	116	161	140	145	46	91	70	83	80	43	89	68	94	82,584
Wetland Habitats (total)	***163***	***234***	***250***	***239***	***101***	***172***	***187***	***182***	***194***	***115***	***186***	***201***	***185***	***166,590***
Wildlife Habitat Total[d]	**779**	**663**	**608**	**716**	**822**	**708**	**652**	**731**	**714**	**821**	**707**	**651**	**714**	**435,895**
Moose Habitats														
Calving	156	202	135	0	156	328	135	0	0	156	202	135	134	132,242
Winter	585	496	428	189	386	298	229	1	1	386	298	230	294	241,990
Forage Habitat[e]	194	266	268	270	152	222	223	231	232	156	226	228	222	186,499

[a] Sources: Homer *et al.,* 2004; ADF&G, 1985.

[b] Averaged value by category for the 12 alternatives. Does not represent an alternative. Average of the combined habitats (i.e., forested, wetland, wildlife) are average values for the alternatives and do not represent the sum of categories

[c] The sum of forested habitats is based on the sum of 2 habitat groupings: 1) leaf type (evergreen, deciduous, mixed) or 2) cover type (closed, open, woodland).

[d] Totals do not include developed land other than agricultural land, although most of the developed habitats in the project area likely support some wildlife use.

[e] Moose forage evaluated as the total of open and woodland forests and all wetlands.

[f] Totals might not equal sums of values due to rounding.

[g] Segment-level data does not sum to alternative-level data as a result of the method used to calculate the rail line routes. Connector segment acreages were calculated by summing both possible “arms” of each connector segment (the arms necessary to connect the segment to either the Willow or Houston segments). Alternative acreages were calculated by generating a smooth path from the respective terminal reserve to either the Willow or Houston segment, and thus include only the one, necessary connector “arm” (as the extra "arm" connecting to the other segment would not be necessary if that route was built).

[h] According to Viereck *et al*., 1992, shrub/scrub vegetation in Alaska is mostly wet. As such, this vegetation type has been classified under wetlands for wildlife purposes.

Similarly, by comparing the total wetland habitat averaged across all alternatives (185 acres) to the total wildlife habitat loss averaged across all alternatives (714 acres), OEA calculated that 26 percent of wildlife habitat loss would be from wetland habitats. Across all alternatives, rail line construction would result in the loss of less than 1 percent of the total forested habitat available in the study area, as well as less than 1 percent of the total wetland habitat available in the study area. This habitat loss would contribute to habitat fragmentation of core forested and wetland habitats (Figure 5.3-2). Habitat loss impacts to bears, moose, wolves, furbearers, other mammals, and birds are previously described under the heading Common Impacts.

Habitat fragmentation would detrimentally impact some species, such as small animals and resident landbirds, which are not anticipated to cross the rail line. Other species, such as moose and other large mammals, would be expected to cross the rail line footprint unimpeded, and thus are not expected to be adversely impacted by habitat fragmentation. In general, the landscape in the study area is composed of a mosaic of small habitat patches (Appendix E) averaging less than 4 acres in size. Core habitat areas, the interior areas of habitat patches greater than 100 acres in size, averaged larger for open water and agricultural habitat types than other habitat types (Appendix E). Core areas greater than 100 acres for wildlife habitats crossed by rail line segments averaged 6 to 49 times larger than core wildlife habitats throughout the study area (Appendix E).

Combined direct moose-train collision mortality for the proposed rail line alternatives and indirect moose-train collision mortality from increased train traffic on the existing rail line would average 6 to 7 moose per year, ranging from 3 to 17 moose per year (Appendix E). Power lines on poles and communications towers built to support the rail line would increase collision mortality for all birds, but would have the greatest potential for damage where power lines and towers were near staging habitats, such as wetlands, agricultural fields, and tidal mudflats, which are used by sandhill cranes, geese, swans, ducks, or shorebirds during migration; or when power lines and towers were near raptor nests and foraging habitats.

ARRC regulations prohibit unauthorized access to rail line ROWs and bar public access across the rail line except at authorized crossing locations. Although grade crossings at public and private roads and officially recognized trails would maintain existing access along established routes, user access to other areas across the rail line would be controlled. This could lead to reduced hunter and trapper access to game mammals.

Both increased moose mortality and changes in hunter and trapper access could require changes in the management of game mammals in portions of Game Management Subunits 14A and 14B, which all rail line alternatives cross.

Mac West-Connector 1-Willow Alternative

This alternative would result in the loss of 779 acres of wildlife habitat (Table 5.3-7) and the fragmentation of 2,847 acres of primarily forested and woody wetland core habitats, the highest across all alternatives (Table 5.3-8). Of the 779 acres of wildlife habitat loss under this alternative, 76 percent (590 acres) would comprise of forested habitat and 21 percent (163 acres) would comprise wetland habitat (Table 5.3-7). This alternative would result in the loss of the largest area of moose winter habitat (585 acres) across all the alternatives (Table 5.3-7) and would cross 65 percent low-density and 35 percent high-density moose areas based on estimated

Table 5.3-8
Core Habitats Greater than 100 Acres Fragmented by Alternative[a,b]

	Mac West-Conn 1-Willow		Mac West-Conn 1-Houston-Houston North		Mac West-Conn 1-Houston-Houston South		Mac West-Conn 2-Big Lake		Mac East-Conn 3-Willow		Mac East-Conn 3-Houston-Houston North		Mac East-Conn 3-Houston-Houston South		Mac East-Big Lake		Mac East Var-Conn 2a-Big Lake		Mac East Var-Conn 3 Var-Willow		Mac East Var-Conn 3 Var-Houston-Houston North		Mac East Var-Conn 3 Var-Houston-Houston South	
	No.	Acres	No.	Acres	No.	Acres	No.	Acres	No.	Acres	No.	Acres	No.	Acres	No.	Acres	No.	Acres	No.	Acres	No.	Acres	No.	Acres
Wildlife Habitats																								
Evergreen Forest	10	716	5	256	5	256	6	343	9	824	4	364	4	364	5	225	5	225	9	824	4	364	4	364
Deciduous Forest	30	496	19	113	19	113	12	502	25	493	14	110	14	110	7	499	7	499	25	493	14	110	14	110
Mixed Forest	37	427	2	1	2	1	11	549	39	634	4	208	4	208	9	242	9	453	37	640	2	214	2	214
Emergent Wetland	0	0	10	871	7	1,536	0	0	0	0	10	871	7	1,536	0	0	0	0	0	0	10	871	7	1,536
Shrub/Scrub	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Woody Wetland	12	1,209	21	1,350	20	1,303	10	1,237	2	182	11	323	10	276	2	224	2	224	2	182	11	323	10	276
Agriculture	3	7,060	3	7,060	3	7,060	4	8,321	1	2,785	1	2,785	1	2,785	1	2,785	2	4,046	2	4,046	2	4,046	2	4,046
Forests	77	1,638	26	370	26	370	29	1,393	73	1,951	22	683	22	683	21	966	21	1,178	71	1,957	20	689	20	689
Wetland	12	1,209	31	2,221	27	2,840	10	1,237	2	182	21	1,194	17	1,812	2	224	2	224	2	182	21	1,194	17	1,812
Forest and Wetland	89	2,847	57	2,592	53	3,210	39	2,631	75	2,133	43	1,877	39	2,495	23	1,191	23	1,402	73	2,139	41	1,883	37	2,501

[a] Source: Homer *et al.*, 2004.

[b] No. = number of core habitat polygons greater than 100 acres crossed by alternative. Area = total area of core habitats greater than 100 acres crossed by alternative in acres.

fall 2008 densities (Figure 5.3-1). Wildlife use of this area, especially bears, wolves, furbearers, raptors, owls, and forest-nesting landbirds, would be expected to be high because of the remoteness of the area and proximity to anadromous fish resources on the Susitna River and its tributaries. Nesting habitat loss would affect 1,262 birds (Table 5.3-9). Nesting habitat disturbance would affect 33 swans and loons, the highest across all alternatives, the greatest number of bald eagle nests (6) across all the alternatives, and an estimated 11 raptor and owl nests (Table 5.3-10). Construction of the Mac West-Connector 1-Willow Alternative would open a corridor through primarily closed canopy forested habitats that would contribute to fragmentation.

Mac West-Connector 1-Houston-Houston North Alternative

This alternative would result in the loss of 663 acres of wildlife habitat (Table 5.3-7) and the fragmentation of 2,592 acres of primarily woody wetland and emergent wetland core habitats (Table 5.3-8). Of the 663 acres of wildlife habitat loss under this alternative, 61 percent (403 acres) would comprise of forested habitat and 35 percent (234 acres) would comprise of wetland habitat (Table 5.3-7). This alternative would result in the loss of nearly 496 acres of moose winter habitat and 202 acres of moose calving habitat (Table 5.3-7) and would cross 71 percent low-density and 29 percent high-density moose areas based on estimated fall 2008 densities (Figure 5.3-1). Wildlife use of this area, especially bears, wolves, furbearers, raptors, owls, and forest-nesting landbirds, would be expected to be moderate because of recreational development in the area. Nesting-habitat loss would affect 972 birds (Table 5.3-9). Nesting-habitat disturbance would affect approximately 30 swans and loons, 2 bald eagle nests, and an estimated 15 raptor and owl nests, the highest across all alternatives (Table 5.3-10). Construction of the Mac West-Connector 1-Houston-Houston North Alternative would open a corridor through primarily wetland habitats that would contribute to fragmentation.

Mac West-Connector 1-Houston-Houston South Alternative

This alternative would result in the loss of 608 acres of wildlife habitat (Table 5.3-7) and fragmentation of 3,210 acres of primarily emergent wetland and woody wetland core habitats (Table 5.3-8). Of the 608 acres of wildlife habitat loss under this alternative, 55 percent (332 acres) would comprise of forested habitat and 41 percent (250 acres) would comprise of wetland habitat (Table 5.3-7). This alternative would result in the loss of 428 acres of moose winter habitat and 135 acres of moose calving habitat (Table 5.3-7) and would cross 66 percent low-density and 34 percent high-density moose areas based on estimated fall 2008 densities (Figure 5.3-1).

Wildlife use of this area, especially furbearers, waterbirds, and wetland-nesting landbirds, would be expected to be moderate to high because of habitat characteristics and recreational development in the area. Nesting habitat loss would affect 992 birds (Table 5.3-9). Nesting habitat disturbance would affect 28 swans and loons, 2 bald eagle nests, and an estimated 12 raptor and owl nests (Table 5.3-10). Construction of the Mac West-Connector 1-Houston-Houston South Alternative would open a corridor through primarily wetland habitats that would contribute to fragmentation.

Table 5.3-9
Estimated Nesting Habitat Loss for Birds for the Alternatives[a]

	Individuals Displaced by Alternative[b]												Summary	
Bird Type	Mac West-Conn 1-Willow	Mac West-Conn 1-Houston-Houston North	Mac West-Conn 1-Houston-Houston South	Mac West-Conn2-Big Lake	Mac East-Conn 3-Willow	Mac East-Conn 3-Houston-Houston North	Mac East-Conn 3-Houston-Houston South	Mac East-Big Lake	Mac East Var-Conn 2a-Big Lake	Mac East Variant-Conn 3 Variant-Willow	Mac East Var-Conn 3 Var-Houston-Houston North	Mac East Var-Conn 3 Var-Houston-Houston South	Average Impact[c]	Estimated Project Area Population[d]
Waterbirds	3	3	2	3	3	3	3	3	3	3	3	3	3	1,587
Geese and Swans	1	1	1	1	1	1	1	1	1	1	1	1	1	543
All Ducks	*34*	*28*	*27*	*31*	*36*	*31*	*29*	*32*	*31*	*36*	*30*	*28*	*31*	*21,109*
Dabbling Ducks	21	18	17	20	23	19	18	20	20	22	19	18	20	13,127
Diving and Sea Ducks	13	11	10	12	14	12	11	12	12	14	12	11	12	7,982
Raptors and Owls	4	4	3	4	5	5	4	4	4	4	4	3	4	4,063
Shorebirds	44	34	34	35	43	33	34	30	30	42	32	33	35	Unknown
Seabirds (gulls)	5	4	4	4	5	4	4	4	4	5	4	4	4	Unknown
Landbirds	*1,174*	*901*	*923*	*929*	*1,163*	*889*	*911*	*810*	*790*	*1,140*	*867*	*889*	*949*	*507,422*
Resident	87	67	68	69	86	66	68	60	59	84	64	66	70	24,957
Short-Distance Migrant	307	236	241	243	304	233	238	212	207	298	227	232	248	199,371
Long-Distance Migrant	781	599	614	618	773	592	606	539	525	758	577	591	631	283,094
Total Individuals[e, f]	**1,262**	**972**	**992**	**1,004**	**1,254**	**964**	**984**	**882**	**860**	**1,229**	**939**	**958**	**1,025**	**534,724**

[a] Sources: Rosenberg, 2004; Shook and Ritchie, 2008; Sauer *et al.,* 2008; Platte *et al.,* 2008; Mallek and Groves, 2008; URS, 2006; Benson, 2001.

[b] Estimate based on rail line footprint, including stream relocation and road relocation areas, multiplied by nesting season density for waterbirds, geese and swans, ducks, and raptors and owls in the study area (Appendix E). Estimate based on route mileage multiplied by nesting season linear density for shorebirds, seabirds, and landbirds in the study area.

[c] Averaged value by category for the 12 alternatives. Does not represent an alternative.

[d] Estimate based on regional or average project area densities multiplied by area within 5 miles of all proposed rail line footprints, or on the proportion of the project area and total population estimates for Bird Conservation Region 4 in Alaska.

[e] Total includes waterbirds, geese and swans, ducks, raptors and owls, shorebirds, seabirds, and landbirds. Dabbling ducks and diving and sea ducks are subcategories of ducks. Landbirds categorized by migration are subcategories of landbirds and totals for birds of conservation concern are included within the appropriate category above.

[f] Differences in totals are due to rounding and significant figures.

Table 5.3-10
Estimated Nesting Habitat Disturbance to Swans, Loons, Raptors, and Owls by Alternative[a]

	Individuals Displaced by Alternatives[b]												
Birds	**Mac West-Conn1-Willow**	**Mac West-Conn 1-Houston-Houston North**	**Mac West-Conn 1-Houston-Houston South**	**Mac West-Conn 2-Big Lake**	**Mac East-Conn 3-Willow**	**Mac East-Conn 3-Houston-Houston North**	**Mac East-Conn 3-Houston-Houston South**	**Mac East -Big Lake**	**Mac East Var-Conn 2a-Big Lake**	**Mac East Var-Conn 3 Var-Willow**	**Mac East Var-Conn 3 Var-Houston-Houston North**	**Mac East Var-Conn 3 Var-Houston-Houston South**	**Estimated Study Area Population or Nests[c]**
Trumpeter Swans	2	2	1	0	3	5	3	0	0	4	5	3	224
Common Loons (No. of young)[e]	21	25 (5)	24 (7)	13 (1)	18	22 (4)	21 (6)	6	6	17	21 (4)	20 (6)	657
Common Loon Lakes (No. with broods)	14 (3)	19 (6)	16 (6)	12 (2)	12 (1)	17 (4)	14 (4)	7	7	12 (1)	17 (4)	14 (4)	
Pacific Loons (young)	10	3	3	1	11	4	4	1	1	11	4	4	141
Total Waterbirds	**33**	**30**	**28**	**14**	**32**	**31**	**28**	**7**	**7**	**32**	**30**	**27**	**1,022**
Bald Eagle	6	2	2	1	5	1	1	1	5	1	1	1	30 nests
Osprey	1	1	1	1	0	1	1	1	0	0	0	0	7 nests
Red-tailed Hawk	0	6	5	0	0	6	5	0	0	6	5	0	44 nests
Great Horned Owl	0	1	0	0	1	2	1	0	1	2	1	0	7 nests
Great Gray Owl	0	1	1	0	0	1	1	0	0	1	1	0	7 nests
Northern Saw-whet Owl[d]	2	2	1	2	2	2	2	2	2	2	2	2	1,200
Boreal Owl[d]	2	2	2	2	3	2	2	2	3	2	2	2	1,600
Total Raptors and Owls	**11**	**15**	**12**	**6**	**11**	**15**	**13**	**6**	**11**	**14**	**12**	**5**	**2,895**

[a] Sources: Conant *et al.,* 2007; Platte *et al.,* 2008; Shook and Ritchie, 2008; Benson, 2001.
[b] Estimate based on observations within 0.5 mile of proposed rail line footprint, note that data for waterbirds are a sample of segment areas and actual impacts could be higher, surveys for raptors and large owls covered the entire segment.
[c] Estimate based on densities within the surveyed areas or observed nests.
[d] Estimate for small owls based on nesting densities near the study area multiplied by alternative footprint areas (Benson, 2001).
[e] No. = Number.

Mac West-Connector 2-Big Lake Alternative

This alternative would result in the loss of 716 acres of wildlife habitat (Table 5.3-7) and the fragmentation of 2,631 acres of primarily woody wetland core habitats (Table 5.3-8). Of the 716 acres of wildlife habitat loss under this alternative, 62 percent (441 acres) would comprise of forested habitat and 33 percent (239 acres) would comprise of wetland habitat (Table 5.3-7). This alternative would result in the loss of 189 acres of moose winter habitat (Table 5.3-7) and would cross 51 percent low-density and 49 percent high-density moose areas based on estimated fall 2008 densities (Figure 5.3-1). Wildlife use of this area, especially furbearers, waterbirds, and forest-nesting and wetland-nesting landbirds, would be expected to be moderate because of habitat characteristics and recreational and rural development in the area. Nesting habitat loss would affect 1,004 birds (Table 5.3-9). Nesting habitat disturbance would affect 14 loons, 1 bald eagle nest, and an estimated 6 raptor and owl nests (Table 5.3-10). Construction of the Mac West-Connector 2-Big Lake Alternative would open a corridor through forested and wetland habitats that would contribute to fragmentation.

Mac East-Connector 3-Willow Alternative

This alternative would result in the loss of 822 acres of wildlife habitat, the highest across all alternatives (Table 5.3-7), and the fragmentation of 2,133 acres of primarily forested core habitats (Table 5.3-8). Of the 822 acres of wildlife habitat loss under this alternative, 87 percent (716 acres) would comprise of forested habitat and only 12 percent (101 acres) would comprise of wetland habitat (Table 5.3-7). This alternative would result in the loss of about 386 acres of moose winter habitat and 156 acres of moose calving habitat (Table 5.3-7) and would cross 61 percent low-density and 39 percent high-density moose areas based on estimated fall 2008 densities (Figure 5.3-1). Wildlife use of this area, especially bears, wolves, furbearers, raptors, owls, and forest-nesting landbirds, would be expected to be high because of the remoteness of the area and proximity to anadromous fish resources on the Susitna River and its tributaries. Nesting habitat loss would affect 1,254 birds (Table 5.3-9). Nesting habitat disturbance would affect an estimated 32 swans and loons, 5 bald eagle nests, and an estimated 11 raptor and owl nests (Table 5.3-10). Construction of the Mac East-Connector 3-Willow Alternative would open a corridor through primarily closed forested habitats that would contribute to fragmentation.

Mac East-Connector 3-Houston-Houston North Alternative

This alternative would result in the loss of 708 acres of wildlife habitat (Table 5.3-7) and fragmentation of 1,877 acres of primarily forested core habitats (Table 5.3-8). Of the 708 acres of wildlife habitat loss under this alternative, 75 percent (531 acres) would comprise of forested habitat and 24 percent (172 acres) would comprise of wetland habitat (Table 5.3-7). This alternative would result in the loss of about 298 acres of moose winter habitat and 328 acres of moose calving habitat (Table 5.3-7), the highest across all alternatives, and would cross 66 percent low-density and 34 percent high-density moose areas based on estimated fall 2008 densities (Figure 5.3-1). Wildlife use of this area, especially furbearers, waterbirds, and wetland-nesting landbirds, would be expected to be moderate because of habitat characteristics and recreational and rural development in the area. Nesting habitat loss would affect 964 birds (Table 5.3-9). Nesting habitat disturbance would affect an estimated 31 swans and loons, 1 bald eagle nest, and an estimated 15 raptor and owl nests, the highest across all alternatives (Table

5.3-10). Construction of the Mac East-Connector 3-Houston-Houston North Alternative would open a corridor through primarily wetland habitats that would contribute to fragmentation.

Mac East-Connector 3-Houston-Houston South Alternative

This alternative would result in the loss of 652 acres of wildlife habitat (Table 5.3-7) and fragmentation of 2,495 acres of primarily emergent wetland core habitats (Table 5.3-8). Of the 652 acres of wildlife habitat loss under this alternative, 71 percent (460 acres) would comprise of forested habitat and 29 percent (187 acres) would comprise of wetland habitat (Table 5.3-7). This alternative would result in the loss of 229 acres of moose winter habitat and 135 acres of moose calving habitat (Table 5.3-7) and would cross 61 percent low-density and 39 percent high-density moose areas based on estimated fall 2008 densities (Figure 5.3-1). Wildlife use of this area, especially furbearers, waterbirds, and wetland-nesting landbirds, would be expected to be moderate because of habitat characteristics and recreational development in the area. Nesting habitat loss would affect 984 birds (Table 5.3-9). Nesting habitat disturbance would affect an estimated 28 swans and loons, 1 bald eagle nest, and an estimated 13 raptor and owl nests (Table 5.3-10). Construction of the Mac East-Connector 3-Houston-Houston South Alternative would open a corridor through primarily wetland habitats that would contribute to fragmentation.

Mac East-Big Lake Alternative

This alternative would result in the loss of 731 acres of wildlife habitat (Table 5.3-7) and fragmentation of 1,191 acres of primarily forested core habitats (Table 5.3-8). Of the 731 acres of wildlife habitat loss under this alternative, 75 percent (545 acres) would comprise of forested habitat and only 25 percent (182 acres) would comprise of wetland habitat (Table 5.3-7). This alternative would result in the loss of 1 acre of moose winter habitat (Table 5.3-7) and would cross 58 percent low-density and 42 percent high-density moose areas based on estimated fall 2008 densities (Figure 5.3-1). Wildlife use of this area, especially furbearers, waterbirds and forest-nesting and wetland-nesting landbirds, would be expected to be moderate because of habitat characteristics and recreational and rural development in the area. Nesting habitat loss would affect 882 birds (Table 5.3-9). Nesting habitat disturbance would affect an estimated 7 loons, 1 bald eagle nest, and 6 raptor and owl nests (Table 5.3-10). Construction of the Mac East-Big Lake Alternative would open a corridor through forested and wetland habitats that would contribute to fragmentation.

Mac East Variant-Connector 2a-Big Lake Alternative

This alternative would result in the loss of 714 acres of wildlife habitat (Table 5.3-7) and fragmentation of 1,402 acres of primarily forested core habitats (Table 5.3-8). Of the 714 acres of wildlife habitat loss under this alternative, 66 percent (470 acres) would comprise of forested habitat and 27 percent (194 acres) would comprise of wetland habitat (Table 5.3-7). This alternative would result in the loss of 1 acre of moose winter habitat (Table 5.3-7) and would cross 58 percent low-density and 42 percent high-density moose areas based on estimated fall 2008 densities (Figure 5.3-1). Wildlife use of this area, especially furbearers, waterbirds and forest-nesting and wetland-nesting landbirds, would be expected to be moderate because of habitat characteristics and recreational and rural development in the area. Nesting habitat loss would affect 860 birds (Table 5.3-9). Nesting habitat disturbance would affect an estimated 7

loons, 5 bald eagle nests, and an estimated 11 raptor and owl nests (Table 5.3-10). Construction of the Mac East Variant-Connector 2a-Big Lake Alternative would open a corridor through forested and wetland habitats that would contribute to fragmentation.

Mac East Variant-Connector 3 Variant-Willow Alternative

This alternative would result in the loss of 821 acres of wildlife habitat (Table 5.3-7) and fragmentation of 2,139 acres of primarily forested core habitats (Table 5.3-8). Of the 821 acres of wildlife habitat loss under this alternative, 79 percent (653 acres) would comprise of forested habitat and 14 percent (115 acres) would comprise of wetland habitat (Table 5.3-7). This alternative would result in the loss of 386 acres of moose winter habitat and 156 acres of moose calving habitat (Table 5.3-7) and would cross 61 percent low-density and 39 percent high-density moose areas based on estimated fall 2008 densities (Figure 5.3-1). Wildlife use of this area, especially furbearers, waterbirds, and wetland-nesting landbirds, would be expected to be moderate because of habitat characteristics and recreational development in the area. Nesting habitat loss would affect 1,229 birds (Table 5.3-9). Nesting habitat disturbance would affect an estimated 32 swans and loons, 1 bald eagle nest, and an estimated 14 raptor and owl nests (Table 5.3-10). Construction of the Mac East Variant-Connector 3 Variant-Willow Alternative would open a corridor through primarily closed forested habitats that would contribute to fragmentation.

Mac East Variant-Connector 3 Variant-Houston-Houston North Alternative

This alternative would result in the loss of 707 acres of wildlife habitat (Table 5.3-7) and fragmentation of 1,883 acres of primarily wetland core habitats (Table 5.3-8). Of the 707 acres of wildlife habitat loss under this alternative, 66 percent (468 acres) would comprise of forested habitat and 26 percent (186 acres) would comprise of wetland habitat (Table 5.3-7). This alternative would result in the loss of 298 acres of moose winter habitat and 202 acres of moose calving habitat (Table 5.3-7) and would cross 66 percent low-density and 34 percent high-density moose areas based on estimated fall 2008 densities (Figure 5.3-1). Wildlife use of this area, especially furbearers, waterbirds, and wetland-nesting landbirds, would be expected to be moderate because of habitat characteristics and recreational and rural development in the area. Nesting habitat loss would affect 939 birds (Table 5.3-9). Nesting habitat disturbance would affect an estimated 30 swans and loons, 1 bald eagle nest, and an estimated 12 raptor and owl nests (Table 5.3-10). Construction of the Mac East Variant-Connector 2a-Big Lake Alternative would open a corridor through primarily wetland habitats that would contribute to fragmentation.

Mac East Variant-Connector 3 Variant-Houston-Houston South Alternative

This alternative would result in the loss of 651 acres of wildlife habitat (Table 5.3-7) and fragmentation of 2,501 acres of primarily emergent wetland core habitats (Table 5.3-8). Of the 651 acres of wildlife habitat loss under this alternative, 61 percent (397 acres) would comprise of forested habitat and 31 percent (201 acres) would comprise of wetland habitat (Table 5.3-7). This alternative would result in the loss of 230 acres of moose winter habitat and 135 acres of moose calving habitat (Table 5.3-7) and would cross 61 percent low-density and 39 percent high-density moose areas based on estimated fall 2008 densities (Figure 5.3-1). Wildlife use of this area, especially furbearers, waterbirds, and wetland-nesting landbirds, would be expected to be

moderate because of habitat characteristics and recreational development in the area. Nesting habitat loss would affect 958 birds (Table 5.3-9). Nesting habitat disturbance would affect an estimated 27 swans and loons, 1 bald eagle nest, and an estimated 5 raptor and owl nests (Table 5.3-10). Construction of the Mac East Variant-Connector 3a-Houston-Houston South Alternative would open a corridor through primarily wetland habitats that would contribute to fragmentation.

5.3.4.2 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 impacts to wildlife.

5.3.5 Unavoidable Environmental Consequences of the Proposed Action

To avoid or minimize the potential environmental impacts to wildlife from the proposed rail line, OEA is recommending that the Board impose 12 mitigation measures including 6 measures volunteered by the Applicant. The measures include requiring restriction of worker harassment of wildlife; acquisition of appropriate state permits and authorizations; minimization of disturbance to migratory bird and bald eagle nests during construction; development of preferred habitat away from the proposed rail line; proper handling, storage, and disposal of food waste during construction; minimization of impacts to habitat areas; reduction of potential collision and electrocution impacts to birds; a strategy to reduce the moose-train collision mortality rate; a bear-human interaction plan; and minimization of disturbance to bear dens.

Notwithstanding the recommended mitigation measures, there still would be potential unavoidable impacts to wildlife from the proposed rail line. Potential impacts include habitat loss and altered suitability within and near the rail line footprint; wildlife mortality; habitat fragmentation and reductions in core area size; increased barriers to movement for some species.