3.22 Wildlife

3.22.1 Affected Environment

More than 175 species of mammals, birds, and amphibians live in, seasonally use, or visit the Kenai River basin (USFWS 2014). The sections below summarize the bird, mammal, and amphibian species known or likely to occur in the project area including population information, agency status, habitats, selected life histories, mortality factors, and current conditions related to the project area. Non-native and invasive species are also discussed. Mammals are discussed in Section 3.22.1.1, birds in Section 3.22.1.2, and amphibians in Section 3.22.1.3.

In accordance with Section 7(a)(2) of the Endangered Species Act of 1973 (87 Stat. 884, as amended, 16 USC § 1531 *et seq.*), FHWA received concurrence from both the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) that no species listed as Federally threatened or endangered under the Endangered Species Act (ESA) occur in the project area (Balogh 2006, Mecum 2006). Review of the USFWS and National Oceanic and Atmospheric Administration (NOAA) websites verified that no ESA-listed or ESA-proposed or candidate species are present in the project area (NOAA 2013, USFWS No date).

There are no animals classified as Forest Service, U.S. Department of Agriculture (Forest Service) Sensitive Species in the project area (Goldstein, Martin and Stensvold 2009).

No State-listed endangered species are known to occur in the project area (ADF&G 2011b).

3.22.1.1 Mammals

Species Occurrence and Agency Status

There are 26 species of mammals that are known or likely to occur in the project area, including bears, ungulates (moose, sheep, and goats), canids (wolves, coyotes, and foxes), lynx, weasels, rodents, hares, shrews, and bats (Table 3.22-1). All of these are known to occur on the Kenai National Wildlife Refuge (KNWR (USFWS 2010a)). No wild non-native or invasive mammal species have been documented on the Kenai Peninsula as of 2008 (McClory and Gotthard 2008), or on the KNWR as of 2010 (USFWS 2010a).

Although there are no threatened, endangered, or Forest Service sensitive mammal species in the project area, 14 mammal species occurring or likely to occur in the area have special agency designations by the Alaska Department of Fish & Game (ADF&G), the KNWR, and/or the Chugach National Forest (CNF; see Table 3.22-1). Only brown bear and wolverine have special designations by all three agencies.

Nineteen of the project area mammal species are classified as game species by the ADF&G and regulated for hunting and trapping (ADF&G 2013a). The ADF&G's Comprehensive Wildlife Conservation Strategy includes a list of "species of greatest conservation need" (ADF&G 2006a). Eight mammal species known or likely to occur in the project area are included on that list, including three game species (Table 3.22-1).

Table 3.22-1. Mammals known or likely to occur in the project area, with agency status*

		Agency Status		
Common Name	**Scientific Name**	**Forest Service[a]**	**USFWS[b]**	**ADF&G[c]**
Brown bear[d]	*Ursus arctos*	MIS	continued interest	SGCN, G
American black bear[d]	*Ursus americanus*	none	none	G
Moose[d]	*Alces alces*	MIS	none	G
Dall sheep[d]	*Ovis dalli kenaiensis*	none	none	G
Mountain goat[d]	*Oreamnos americanus*	MIS	none	G
Gray wolf[d]	*Canis lupus*	SSI	none	G
Coyote	*Canis latrans*	none	none	G
Red fox	*Vulpes vulpes kenaiensis*	none	special interest	G
Canadian lynx[d]	*Lynx canadensis*	SSI	none	G
Wolverine[d,e]	*Gulo gulo luscus*	SSI	special interest	SGCN, G
River otter[d]	*Lontra canadensis*	SSI	none	G
American marten	*Martes americana kenaiensis*	none	none	SGCN, G
Least weasel	*Mustela nivalis*	none	none	G
Ermine	*Mustela erminea*	none	none	G
American mink	*Neovison vison*	none	none	G
Beaver	*Castor canadensis*	none	none	G
Muskrat	*Ondatra zibethicus*	none	none	G
Porcupine	*Erethizon dorsatum*	none	none	G
Root vole	*Microtus oeconomus*	none	none	SGCN, UG
Northern red-backed vole	*Myodes rutilus*	none	none	SGCN, UG
Northern bog lemming	*Synaptomys borealis*	none	none	SGCN, UG
Cinereus shrew	*Sorex cinereus*	none	none	UG
Pygmy shrew	*Sorex hoyi*	none	none	SGCN, UG
Dusky shrew	*Sorex monticolus*	none	none	SGCN, UG
Snowshoe hare	*Lepus americanus*	none	none	G
Little brown bat	*Myotis lucifugus*	none	none	NG

* Based on MacDonald and Cook (2005) unless noted.

[a] MIS = management indicator species; SSI = species of special interest (Forest Service 2002a, 2009)

[b] Special interest = USFWS KNWR Species of Special or Continued Interest (2010a)

[c] ADF&G = Alaska Department of Fish and Game; SGCN = species of the greatest conservation need (ADF&G 2006a); UG = unclassified game, no closed season or bag limits; NG = nongame, no harvest permitted; G = game species (ADF&G 2013a)

[d] Selected as management/indicator species or as species for evaluation of impacts from this project by interagency group (HDR 2004a).

[e] "The Kenai Peninsula population may harbor a disproportionate amount of the North American mitochondrial diversity and, as such, warrants special conservation" (USFWS 2010a).

As of 2010, USFWS recognized some species on the KNWR with "special" or "continued" interest (USFWS 2010a). Three of the mammal species identified are known or likely to occur in the project area (Table 3.22-1).

The Forest Service selects management indicator species because "their population changes are believed to indicate the effects of management activities" (from CFR 219.19 [a][1]). All three of the CNF's mammal management indicator species and four of the six mammal "species of special interest" in the CNF (Forest Service 2002a) are likely to occur in or near the project area (Table 3.22-1).

During consultations for this project, a 2004 interagency working group comprised of representatives from DOT&PF, FHWA, ADF&G, the Forest Service, USFWS, and the National Park Service (NPS) identified nine mammal species that could be affected the most by the proposed project and/or that the interagency working group considered to be key indicators of potential effects to terrestrial wildlife in general (HDR 2004a). These species were primarily selected from species identified in the Forest Service CNF Plan (Forest Service 2002a). Selected species include moose, brown and black bear, river otter, Dall sheep, mountain goat, Canadian lynx, wolf, and wolverine (HDR 2004a).

The following sections discuss the affected environment for the nine selected mammal species. Brown bear and moose are highlighted because agencies identified these species as ones of particular importance for evaluation of potential impacts from the project (Ruediger 2004).[1]

Brown Bear

There is no estimate for the number of brown bears using the project area, although at least 11 individual brown bears have been known to use lower Juneau Creek (USFWS and Forest Service 2010), and at least 12 individuals have been known to use the Russian River area (Benoit 2011).

Empirical evidence from ADF&G tagging data and a 2010 population study (i.e., 11,175 black and brown bear hair samples captured from grid-located traps on the KNWR and CNF) indicate that at least 211 brown bears were alive on the Kenai Peninsula in 2010. These data were used to generate a population estimate for a study area consisting of the KNWR and CNF of 428 bears (353 to 539) with a density of 42 bears per 1,000 square kilometers (386 square miles, mi^2) of habitat. These data were further extrapolated to generate a 2010 brown bear population estimate for the entire Kenai Peninsula (3,938 mi^2) of 582 bears. According to these studies, the Kenai Peninsula population is likely to have equal numbers of males and females, estimated at 188 adult males, 188 adult females, and 206 dependent young (103 male, 103 female). Between 2012 and 2014, high brown bear harvest (n=184) reduced the Kenai brown bear population by 18 percent to about 478 bears in 2014 (Morton et al. 2016).

The recent population estimates of brown bears for the Kenai Peninsula are greater than the 1993 population estimate of 277 brown bears. The 1993 estimate was based on an assumed density of 20 bears per 386 mi^2 of an estimated 5,347 mi^2 of brown bear habitat on the Kenai Peninsula (Del Frate 1993). The 2010 estimate is consistent with ADF&G opinion in 2005 that the Kenai Peninsula brown bear population likely increased between 1995 and 2005 (Selinger 2005).

[1] Caribou were generally considered to occur outside the project area (HDR 2007a) because they inhabit the Chickaloon River, Big Indian Creek, and Resurrection Creek areas (McDonough 2011b), although there are instances of occasional strays in the project area (HDR 2007a). Caribou were ranked as a lower priority for impact analysis and were not selected as a species of special consideration for this analysis (HDR 2007a).

Despite the large runs of salmon in the Kenai River and other streams and the updated population estimate, the Kenai Peninsula brown bear population density is closer to the lower densities of Interior Alaska bears (non-salmon-dependent populations) than higher densities associated with salmon-dependent coastal brown bear populations elsewhere in Alaska (Morton et al. 2016). Human disturbance and development, including forest clearing in areas with high-quality habitat on the Kenai Peninsula, may help explain this lower density (Suring, Barber, et al. 1998). In addition, the Kenai Peninsula brown bear population has been considered isolated because the narrow isthmus of the Kenai Peninsula could affect immigration and viability (Graves et al. 2006, Suring et al. 2006). However, scientists have not found strong enough genetic evidence of isolation to cause concern (Jackson et al. 2008).

Habitat-use studies and management objectives generally focus on reproductive-age adult female brown bears because they are most important to the viability of the Kenai Peninsula population (Selinger 2009, Graves et al. 2006). Brown bears on the Kenai Peninsula use a wide variety of habitats, including rivers and streams, forests, and subalpine and alpine areas (Goldstein et al. 2010), generally avoiding areas in proximity to roads during spring and summer (Suring, Farley, et al. 2006). Locations of radio-tracked female Kenai Peninsula brown bears (male bears were not studied) clearly show extensive use of salmon streams for feeding during the summer (Farley et al. 2001). From July to October, female Kenai Peninsula brown bears were an average of 6,560 feet (approximately 2,000 meters) from a salmon stream. Related data show that female bears extensively use riparian areas up to 6,560 feet or more from a stream. The average daily movement of female brown bears slowly decreased in distance from May through October, presumably as bears spent more time near salmon streams. Kenai Peninsula dens used by female brown bears are typically in mountainous, remote sites (average 2,210 feet elevation and 8 miles from roads) on steep slopes (Goldstein, Poe, et al. 2010). Seasonal brown bear habitat use is summarized in Table 3.22-2.

The area surrounding Cooper Landing (approximately between Mileposts [MP] 45 and 55) has been generally identified as Kenai Peninsula brown bear habitat. Furthermore, the area just west of Cooper Landing near Juneau Creek was identified as a "linkage zone" (i.e., primary brown bear habitat (T. A. Graves, S. Farley, et al. 2007)). The general area between MP 45 and 60 is in a class of habitat with medium to high probability of use by both lone adult females and females with cubs during spring and summer (Farley et al. 2001).

The 2004 interagency working group for this project identified areas considered important habitat for brown bears that intersected the proposed alignments (Map 3.22-1; (HDR 2004a)). The interagency working group also noted other bear/human conflict areas, such as the refuse transfer station near MP 45 (Map 3.22-1, Area 1) and the Sportsman's Landing recreation area at MP 55 (Area 17; see Map 3.22-1; (HDR 2004a)). The agencies identified Areas 4 and 11 (Map 3.22-1) as areas of particular note for brown bears for high-value habitat or high-value feeding and movement areas, including a large area of lower Juneau Creek and bench areas to the west (Ruediger 2004). Areas 8, 9, and 11 (Map 3.22-1) near Juneau Creek were also noted as feeding and movement areas. Areas 11 and 16 (Map 3.22-1), which include the area at and west of Juneau Creek and a large area north of the Russian River confluence and well west of Juneau Creek, were noted as brown bear movement areas.

The *Chugach National Forest Land and Resources Management Plan* includes Bear Habitat Management *standards* and *guidelines* and has indicated that these apply to the areas mapped for this project and described in the previous paragraph. Refer to Section 3.2.3.2 for information on

the management plan requirements and subsections that follow in Section 3.2, Land Use, that describe the impacts of the project by alternative on these bear habitat areas.

A 2010 study by USFWS and the Forest Service identifying potential wildlife movement corridors indicated that brown bears likely move back and forth in a northwest-southeast direction over the Kenai Mountains and across the Kenai River within the project area. Based on GPS locations of collared bears, north-south landscape linkages for bears have been identified in the Juneau-Cooper creeks area (2,431 acres) and the Round Mountain (Juneau Creek-Russian River) area (part of 670 acres; (USFWS and Forest Service 2010, Benoit 2011)). East-west landscape linkages for bears were identified along Bean Creek (884 acres; (USFWS and Forest Service 2010)).

No brown bear dens were known in the project area as of 2010 (USFWS and Forest Service 2010).

Table 3.22-2. Seasonal activities and associated habitat use for brown bears

Activity	Season	Seasonal Habitats in Project Area	Selected Project Areas (see Map 3.22-1)
Feeding	July through September	Salmon streams; forest; subalpine	Areas 8, 9 (Juneau Creek) Area 11 (Juneau Creek to highlands)
Movement	Unspecified	Unspecified	Area 1 Area 4 (Slaughter Gulch ridge and valley – "high value bear habitat") Area 9 (Juneau Creek) Area 11 (Juneau Creek to highlands) Area 16 (north-south movement)
Denning	October through April or May	Females den in mountainous, remote sites (average 2,210 feet elevation; 8 miles from roads) on steep slopes [a]	None

[a] Goldstein, Poe et al. (2010)

The persistence of brown bears is affected by three factors: 1) the quality of available habitat, 2) the number of humans within that habitat, and 3) the relationship of those humans to brown bears (Mattson et al. 1996, McLellan 1998, Apps et al. 2004). Natural or human-induced landscape-scale changes influence brown bear populations through habitat loss, changes in habitat suitability, changes in habitat use (e.g., displacement from habitat or disruption of movement patterns), or reduced survival (Goldstein, Suring and Preston 2004). These changes may result in fragmentation of brown bear habitat, modifications of brown bear habitat use, and decreased population sustainability (Goldstein, Suring and Preston 2004). Human actions also result in direct bear mortality through hunting, vehicle collisions, and bear kills in Defense of Life and Property (DLP). The approximate numbers and types of human-caused brown bear deaths are described below to provide a context for evaluating the changes in bear mortality that could result from project alternatives.

In 2000, a sustainable human-caused mortality rate for the Kenai Peninsula brown bear population was thought to be 15 bears per year, including no more than 6 females (Farley et al. 2001). In 2006, the ADF&G management objective changed to allow no more than 10 reproductive-age females (5 to 6 years old) to be killed per year by any human cause. However, from fall 1999 to spring 2009, the number of females killed exceeded ADF&G levels for at least 5 of those years (although the ages were not reported; see Table 3.22-3).

From 1999 to 2009, DLP kills were the highest type of recorded brown bear mortality in Game Management Units[2] (GMU) 7 and 15 (65 percent), followed by "other mortality" (accidental deaths from research, public safety actions, poaching, etc.; 16 percent), hunting (13 percent), and vehicle collisions (6 percent; see Table 3.22-3; McDonough, personal communication (2011a)). ADF&G management objectives continue to focus on reducing the non-hunting mortality and conservation of reproductive-age adult female brown bears because they are most important to the viability of the Kenai Peninsula population (Selinger 2009, Graves et al. 2006).

The number of brown bear DLP kills on the Kenai Peninsula has increased from less than 1 bear annually in the 1960s, to an average of 5 bears annually in the 1990s, and to an average of 17 bears annually between 2001 and 2009 (Table 3.22-3; Figure 3.22-1 (Suring and Del Frate 2002)). An increase in human population is one factor associated with the increase of DLP kills since the 1960s. The human population of the Kenai Peninsula Borough (Borough) increased from approximately 9,000 people in 1960, to 40,802 people in 1990, to 49,691 people in 2000, and to 55,400 people in 2010 (Figure 3.22-1 (ADOLWD 2010); see Section 3.3.1). Other factors include an increasing brown bear population on the Kenai Peninsula and brown bear use of salmon streams in roaded areas of Southcentral Alaska, resulting in more frequent human-bear encounters and bear mortality (Titus and Beier 1991, Schoen et al. 1994). A Forest Service study prepared for this project also indicated that an increase in road density (the ratio of length of road network to land area) is associated with an increased likelihood of Kenai Peninsula brown bear DLP kills (Suring and Del Frate 2002, Goldstein, Suring and Preston 2004). Of note, most of the DLP kills analyzed from 1961 to 1999 were associated with hunting or took place near residences (Suring and Del Frate 2002).

[2] GMUs are geographic subdivisions created by ADF&G to manage hunting in Alaska. Each GMU has regulations that govern hunting in that specific area. The project area includes portions of GMUs 7, 15A, and 15B. GMU boundaries within the project area are depicted on Map 3.22-1.

Table 3.22-3. Reported Kenai Peninsula (Game Management Units 7 and 15) brown bear mortality and related factors for 1999–2009

Year (FY ending June 30)	Vehicle collisions[a]		DLP kills[b]	Hunting harvest[c]		Other mortality[d]	Minimum total killed	Gender of killed bears			Management objectives (max. # adult female bears to be killed)
	Killed	Hit		M	F			M	F	U	
2008–09	1	1(+2)	33	1	5	6	46	21	21	4	10
2007–08	2	2	23	1	0	2	28	17[e]	11[e]	0	10
2006–07	1	3(+3)	23	0	0	7	31	12	15	4	10
2005–06	1	(+4)	12	0	0	6	19	10	7	2	8 (out of 20)
2004–05	1	4	12	3	1	0	17	9	7	1	8 (out of 20)
2003–04	0	0	8	0	0	8	16	5	8	3	8 (out of 20)
2002–03	5	1	18	0	0	0	24	--	--	24	8 (out of 20)
2001–02	2	1	9	1	2	4	18	8	10	0	6 (out of 15)[f]
2000–01	0	0	14	5	1	0	20	8	5	7	6 (out of 15)[f]
1999–2000	0	0	3	5	5	4	17	9	8	0	6 (out of 15)[f]
TOTAL	13 killed +12 hit + (9 hit of unknown bear species)		155	30		37	236	99	92	45	
Portion of total killed	*6%*		*65%*	*13%*		*16%*	*n/a*	*42%*	*39%*	*19%*	

[a] Hit column includes injury and unknown fate. Numbers in parentheses are unknown species of bears. Source: *Road Kill Final Reports* in Morton, personal communication (2011a, 2011b, 2011c). Note: Data are not always consistent with Selinger (2011a).

[b] As reported by McDonough (personal communication 2011b) Note: Data are not always consistent with Selinger (2011a).

[c] For 1999–2007 as reported in ADF&G brown bear management report (Selinger 2011a).

[d] Includes other non-hunting mortality (research or public safety-related, poaching, etc.) as reported in most current ADF&G brown bear management report (Selinger 2011a).

[e] From Selinger (2009) Table 1; however, the source text states 16 females and 11 males.

[f] From Farley et al. (2001).

DLP = defense of life or property kills; M = males; F = females; U= unknown gender

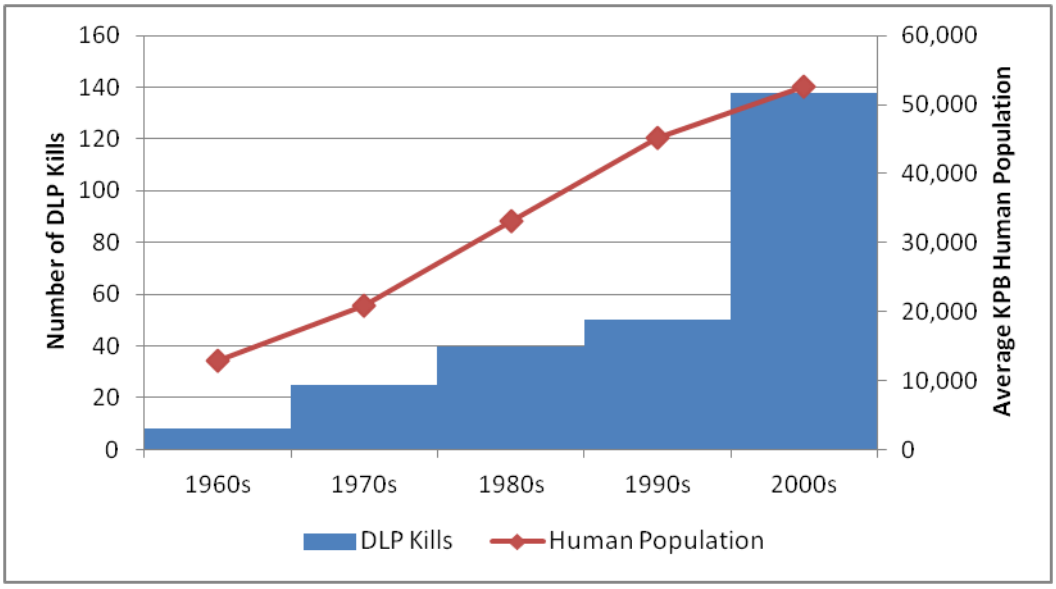


Figure 3.22-1. The human population and number of brown bear DLP kills by decade on the Kenai Peninsula, Alaska

Sources: Suring and Del Frate (2002); ADOLWD (2010).

Between 1999 and 2009, hunting harvest represented 13 percent of known brown bear mortalities on the Kenai Peninsula. For example, during the 2009 to 2010 hunting season, there were 5 bears taken by hunters compared to 25 other non-hunting mortalities on the Kenai Peninsula (Selinger 2011a). Hunting mortality has increased both in numbers and relative to other non-hunting mortalities since 2012, when State hunting regulations changed from using State-drawn permit hunts to one using a State registration hunt (RB300) with increased harvest limits and bag limits (ADF&G 2012c, ADF&G 2013a). According to USFWS in its role as a cooperating agency for this Environmental Impact Statement (EIS), a take of 176 brown bears occurred from 2012 through 2014, mostly from hunting. In an emergency notice in October 2013, USFWS closed KNWR to sport hunting of brown bears as a resource protection measure. The action was taken because human-caused mortality of brown bears, including mortality of adult female brown bears, on the KNWR and on the Kenai Peninsula as a whole during 2013 exceeded sustainable levels (USFWS 2013a). This emergency closure remained in effect for 30 days. Brown bears on the KNWR were protected from harvest during the 2014–2015 season. Kenai Peninsula brown bear sows with cubs have been protected from hunting since the 1970s (Goldstein, Suring and Preston 2004, Selinger 2009).

Vehicle-bear collisions comprised 6 percent of brown bear mortalities between 1999 and 2009 (Table 3.22-3; McDonough, personal communication (2011b)). There were at least 13 brown bear mortalities from collisions during 1999 to 2009, and at least 12 more hit with unknown consequences (Table 3.22-3; Morton, personal communications (2011a, 2011b, 2011c)). From 2003 to 2010, at least 3 brown bears were killed by vehicle collisions in the project area (Morton, personal communication 2011a). The number of reproductive-age adult female bears killed by collisions is not identified separately in ADF&G management reports.

Moose

Moose population information for the greater project area is summarized in Table 3.22-4. There are no moose population surveys for GMU 7 due to heavy forest cover (McDonough 2010a). Other information indicates that the population is stable with a "chronically low" density that supports less than 10 percent of the entire Kenai Peninsula moose harvest (Table 3.22-4). ADF&G believes that in GMU 15A (north of MP 55–60, and mostly north and west of the project area on the KNWR), the moose population is in a slow but steady decline (Table 3.22-4 (2010a)). The factors most greatly affecting the moose population on the Kenai Peninsula are considered to be declining habitat quality, predation, and mortality caused by vehicle collisions. Weather is also considered a factor in GMU 7, where a high mortality rate for moose has been linked to consistent severe winters with heavy snowfall (McDonough 2010a).

Table 3.22-4. ADF&G moose population estimates and status in the greater project area

GMU[a]	Related MP	Year	Population Estimate	Basis of estimate	Status	Moose per square mile[b]
7	45–55 (north and south)	2006	1,000–2,000	Based on habitat	Stable with a "chronically low" density	0.3–0.6
15A	55–60 (north)	2012	1,600	Aerial census	Continued decline from 3,400 in 1991; 2,097 in 2001; 2,070 in 2006; 1,670 in 2008	1.2
15B	55–60 (south)	2006	960	Aerial census	Stable since 1999	0.9

[a] GMU boundaries within the project area are depicted on Map 3.22-1.

[b] Calculated from total area of GMU or subunit, not just areas considered as moose habitat.

Source: McDonough (2010a), ADN (2013).

The approximate numbers and types of human-caused moose deaths described below provide context for evaluating the changes in moose mortality that could result from the project alternatives. From MP 45 to 60, there were at least 60 vehicle-moose collisions from 2001 to 2010 (Burch, personal communication 2011). Areas 15 (just east of MP 53) and 19 (near MP 57.5; see Map 3.22-1 and Map 3.22-2) were highlighted by the interagency working group as high moose collision areas (HDR 2004a). Moose killed by vehicles within GMU 7 as a whole (which includes MP 45–55) have ranged from 16 to 30 per year from 2002 to 2009 (averaging 24 per year; Morton, personal communications (2011a, 2011b, 2011c)).

DOT&PF crash data document that, on two-lane rural highways in low-elevation habitats around the state, there is a correlation between traffic volumes and moose collisions. Specifically, from 2001 to 2005, moose collisions increased at a rate of about 0.8 collision per mile per year as traffic volumes increased (Thomas, personal communication 2011). Primary factors in moose-vehicle collisions on the Sterling Highway have been attributed to increasing traffic volume as well as increasing traffic speeds (Del Frate and Spraker 1991). Vehicle collisions tend to increase

during severe winters (e.g., deep snow) and when road conditions favor higher speeds (Del Frate and Spraker 1991).

Moose are an important subsistence and sport hunting resource in the greater project area [see Section 3.10, Subsistence, and Section 3.8, Park and Recreation Resources]. During 2007 to 2011, the average annual harvest in GMU 7 was 34 moose (range 18 to 38), in GMU 15A it was 93 moose (range 4 to 119), and in GMU 15B it was 37 (range 10 to 55; ADF&G (2012b)). In 2011 and 2012, the hunting regulations became more restrictive, substantially reducing moose harvest levels (Selinger, personal communication 2013). These harvest numbers and collision numbers indicate the importance of vehicle collisions in the project area as a mortality factor for moose.

The 2004 interagency working group identified areas considered important habitat for moose that intersected the proposed alignments (see Table 3.22-5 and Map 3.22-1 and Map 3.22-2; (HDR 2004a)). Of particular note is Area 13 (Map 3.22-1), a large area spanning the north side of the Kenai River from the western edge of the Juneau Creek drainage westward to the Russian River confluence area (MP 55.5 on the existing highway). This area was identified as an important feeding area that has been partially enhanced through Forest Service vegetation management specifically for moose. Landscape-scale linkages have since been defined by the USFWS and the Forest Service, particularly related to the remaining north-south movement corridors for wildlife on the Kenai Peninsula (Round Mountain and Juneau Creek-Cooper Creek linkages; USFWS and the Forest Service (2010); Benoit (2011)).

Table 3.22-5. Seasonal activities and associated habitat use for moose

Activity	Season	Seasonal Habitats in Project Area	Identified Use Areas[a] (see Map 3.22-1 and Map 3.22-2)
Breeding/ rutting	September through October	Open habitats with shrubs[b]	Area 1 – rutting Area 4 – rutting
Feeding	May through September	Forest, shrub, wetland habitats particularly with willow; ponds with aquatic vegetation[b]	Area 13 (habitat enhanced for moose)
	October through April	Lower elevation vegetation along rivers, forest edges, and forest regrowth[b]	Area 4 – wintering Area 13 (habitat enhanced for moose)
Calving	May to early June	Wetlands adjacent to rivers[c]	None

[a] HDR (2004a).
[b] Franzmann and Schwartz (1998).
[c] Bailey (1984).

Other Mammals

Life history and habitats in the project area for the seven additional mammal species identified as part of the 2004 interagency consultation (HDR 2004a) are summarized below. Seasonal habitats and use areas in the project area identified by agencies in 2004 are summarized in Table 3.22-6 and Map 3.22-1 (HDR 2004a). As discussed above, landscape-scale linkages have since been defined by the USFWS and the Forest Service, particularly related to the remaining north-south

movement corridors for wildlife on the Kenai Peninsula (Round Mountain, and Juneau Creek-Cooper Creek linkages; USFWS and the Forest Service (2010); Benoit (2011)).

Table 3.22-6. Seasonal activities and associated habitat use for other mammals

Common Name	Activity	Season	Seasonal Habitats in Project Area	Selected Project Areas (see Map 3.22-1)
American black bear	Feeding	May through September	Avalanche chutes	Area 1 (east end of Kenai Lake)
	Movement	Unspecified	Unspecified	Area 10 (Cooper Creek) Area 16 (north-south)
	Denning	October through May	Unspecified	None
Dall sheep	Movement	Unspecified	Subalpine slopes	Area 12
Mountain goat	Movement	Unspecified	Alpine/subalpine slopes	Area 12
Canadian lynx	General	Year-round	Mixed deciduous-spruce forest; north side of Kenai River[a]	None
Gray wolf	Movement	Unspecified	All	Area 18
Wolverine	All	Winter	Lower elevations of Kenai Mountains	None
		Winter/Spring	Avalanche chutes	See Map 3.22-1
River otter	All	Year-round	Freshwater habitats; streams (ice-free)	Areas 5, 6, 7

[a] Bailey (1984).

American Black Bear. The Kenai River watershed is considered excellent black bear habitat. Black bears are widely distributed on the Kenai Peninsula in most forest habitats, but typically prefer rugged terrain or dense cover (Bailey 1984). Black bears frequent the open avalanche chutes around Kenai Lake during spring through fall (Area 1, as shown on Map 3.22-1).

There are no specific black bear population estimates in the project area, but in 2010, the population on the entire Kenai Peninsula was estimated at more than 4,000 and was considered stable (Selinger 2011b). The Forest Service considers black bears very common in the Juneau Creek drainage, which provides moderate- to high-quality black bear habitat. The distribution and movements of black bears have been linked to the distribution and abundance of devil's club shrubbery (Schwartz and Franzmann 1991).

Seasonal habitats and use areas in the project area identified through interagency consultation in 2004 are summarized in Table 3.22-6 and Map 3.22-1 (HDR 2004a). Landscape-scale linkages have been defined by the USFWS and the Forest Service, particularly related to the remaining north-south movement corridors for wildlife on the Kenai Peninsula (Round Mountain and Juneau Creek-Cooper Creek linkages; USFWS and the Forest Service (2010); Benoit (2011)).

Primary human-caused mortality factors for black bears are harvests by hunters and collisions with vehicles on highways. From 2005 through 2011, the average annual hunter harvest in GMUs 7, 15A, and 15B was 296 black bears (Selinger 2011b, ADF&G 2012b). At least 35 black

bears have been killed by vehicle collisions on the Kenai Peninsula between 2001 and 2009, and at least 9 more were hit with unknown consequences (Morton, personal communication (2011a, 2011b, 2011c)).

Dall Sheep. Dall sheep occur both north and south of the existing highway in the project area (see Map 3.22-3) (McDonough 2011a). The Broadview subherd of Dall sheep winters on the south-facing cliffs and slopes of the Slaughter and Langille mountains (in the project area north of Cooper Landing and Kenai Lake) and scatters to the north in the summer. The Round Mountain subherd of Dall sheep occupies Round Mountain (in the project area east of Fuller Creek and north of Sportsman's Landing) year-round (McDonough, personal communication 2011b). Within the project area, sheep are known to travel between mountains and across the Sterling Highway. However, the Juneau Creek valley is not a regularly used travel corridor by sheep (Spraker, personal communication 2001).

Dall sheep population numbers near the project area and Kenai Peninsula-wide have varied since counts began in 1949, with an overall decline starting in the 1970s (McDonough 2011a). Aerial survey reports of the Round Mountain subherd from July 2002 and July 2004 recorded 69 and 58 sheep, respectively, with 49 sheep recorded in July 2006 (Selinger, personal communication 2006). Sheep populations may have been on the decline in 2006, but more sheep than usual were observed in the Mystery Creek area, which may suggest a change in distribution to the west (Selinger, personal communication 2006). Surveys in the Slaughter and Langille mountains (north of the project area) in summer 2007 recorded 57 sheep (McDonough, personal communication 2011b) and in summer 2015 recorded 39 sheep (Herreman, personal communication 2015).

The Sterling Highway from MP 45 west to the Kenai River crossing, and then west along the river to the confluence of Juneau Creek, forms the southern boundary of ADF&G's "Cooper Landing Closed Area," which is closed to Dall sheep and mountain goat hunting (ADF&G 2013b) and is managed as a viewing area. The closed area is bounded on the west by Juneau Creek.

No sheep-vehicle collisions were reported in the project area from 1999 to 2009 (Morton, personal communication 2011a, 2011b, 2011c). Draw hunt permits are issued based on sheep population levels. Four sheep were harvested from Round Mountain during 2005 to 2012 (ADF&G 2014a). There is a general hunting season in GMUs 7 and 15, but there is very little sheep hunting opportunity in the rest of the project vicinity (ADF&G 2013a).

Mountain Goat. The Kenai Peninsula population of mountain goats has decreased more than 30 percent from the early 1990s to 2009 (McDonough 2010c). Eight mountain goats were recorded during surveys in the summer of 2007 in the Cooper Landing Closed Area north of the project area (including the Slaughter and Langille mountains) (McDonough, personal communication 2011b). In 2015, a count in the closed area resulted in 23 goats (Herreman, personal communication 2015). Aerial counts from 2004 to 2008 on Cecil Rhodes Mountain (south of the project area) ranged from 32 to 60 goats (McDonough 2008, 2010c).

Natural mortality occurs due to predation and avalanches (ADF&G 2008f). During 2004 to 2007, there were three goats killed by hunters on Cecil Rhodes Mountain in GMU 7 (McDonough 2008). The Cooper Landing Closed Area (see above) is closed to Dall sheep and mountain goat hunting (ADF&G 2013b) and is managed as a viewing area. Animals have been known to cross the highway between mountains in the project vicinity (Herreman, personal communication

2015). No goats had been recorded as hit or killed in vehicle collisions during 2002 to 2009 on the Kenai Peninsula (Morton, personal communication 2011a, 2011b, 2011c).

Canadian Lynx. There have not been any population surveys for lynx in the project area. Lynx are cyclically abundant depending on snowshoe hare populations, their primary prey. The last documented population peak on the Kenai Peninsula was around 2009 (McDonough 2010b). The mixed deciduous and spruce forests in GMUs 15A and 15B appear to have a higher abundance of hares and lynx than the spruce forests of GMU 7 (McDonough 2010b). Radio-collared lynx have been monitored in the project area, and appear to travel through the forested area on the north side of the Kenai River between the western lowlands and the eastern mountains (Bailey, personal communication 2000). This travel pattern can be attributed to the north side being more densely forested, wider, and less steep than the south side.

Four radio-collared lynx and at least 2 non-collared lynx were killed while attempting to cross the Sterling Highway as of 2001 (Bailey, personal communication 2001). Between 2002 and 2009, 1 lynx was killed by a vehicle collision in the project area at MP 58.5 in 2007 (Morton, personal communication 2011a, 2011b, 2011c). Lynx harvest seasons (trapping and hunting) are opened or closed based on lynx population levels. Trapping in GMUs 7 and 15 was closed from 2002 to 2007. When trapping resumed in 2008–2009, 8 lynx were taken from GMU 7, and 68 were taken from GMUs 15A and 15B (McDonough 2010b).

Gray Wolf. In 1984, the wolf population on the Kenai Peninsula was estimated as 186 (Peterson, Woolington and Bailey 1984). Wolf surveys have not been conducted recently in the project area or on the entire Kenai Peninsula. A count in GMU 15A (see Map 3.22-1) recorded 40 to 45 wolves in early 2010 (Selinger, personal communication 2011).

In general, wolves avoid areas of human activity on the Kenai Peninsula, including along the Sterling Highway corridor (Jozwiak 1997). However, the project area is an important movement corridor for wolves and other carnivores because it provides relatively easy east-west movement through the mountainous area (Jozwiak 1997). Two packs (the Mountain and the Quartz Creek packs) have used the project area (Jozwiak 1997), with five radio-collared wolves located in the Juneau Creek watershed from 1983 to 1992 (USFWS and Forest Service 2010).

Vehicle collisions are not an important mortality factor for wolves compared to hunting and trapping. From 1999 to 2009, two wolves were killed by vehicle collisions in GMU 7 with none reported from GMU 15A or 15B (Morton, personal communication 2011a, 2011b, 2011c). The average harvest from hunting and trapping between 2003 and 2008 on the Kenai Peninsula was 45 wolves per year (McDonough 2009).

Wolverine. Wolverines require expansive tracts of undisturbed land. On the Kenai Peninsula, some of the primary wolverine habitat is located in the Kenai Mountains (McDonough 2010b), and wolverines use habitat within the project area (McDonough 2010b). Wolverines prefer higher elevations during the summer (including natal denning in the mountains such as those north and south of the project alternatives), and lower elevations during the winter (ADF&G 2008d). Wolverines travel extensively searching for food. Male territories range from 200 to 260 mi^2, and female territories range up to 115 mi^2 (ADF&G 2008d). They primarily scavenge for food and feed on carcasses left behind by bears, wolves, and avalanches (see Map 3.22-1), but they also prey on smaller animals (ADF&G 2008d, USFWS 2006).

There have not been any population surveys for wolverines on the Kenai Peninsula. Wolverines typically occur in low densities; the estimated wolverine density for all primary Kenai Peninsula habitat was 3.0 per 386 mi^2 (Golden, et al. 2007). Kenai Peninsula wolverines are a KNWR "species of special interest" due to low population estimates and declining harvests (USFWS 2010a). From 2004 to 2009, harvests in GMU 7 have ranged between 17 (2004–2005) and 9 (2008–2009), harvests in GMU 15A have been 0 or 1, and harvests in GMU 15B have ranged between 0 and 3 (McDonough 2010b). Much of their range is essentially protected from trapping due to very difficult access or trapping closures (Golden, et al. 2007). No vehicle collisions with wolverines have been recorded in the project area from 1999 to 2009 (Morton, personal communication 2011a, 2011b, 2011c).

River Otter. River otters use primarily freshwater habitats, including streams. During the winter, they dig tunnels and feeding dens within the snow on frozen lakes. River otters have also been known to travel several miles on land between water bodies (ADF&G 2008h).

No population surveys have been conducted in the project area, but river otters or their signs have been observed in Juneau Creek and along the Fuller Lakes Trail by hunters and trappers (Selinger, personal communication 2006). From 2004 to 2009, the trapping harvest averaged about seven otters per year in GMU 7 and about 27 per year in GMUs 15A and 15B (McDonough 2010b). No vehicle mortalities have been recorded in the project area from 2002 to 2009 (Morton, personal communication 2011a, 2011b, 2011c).

3.22.1.2 Birds

Species Occurrence and Agency Status

A variety of waterbirds, raptors, landbirds, and upland game birds occur at least seasonally within the project area. There are no studies that comprehensively document bird species presence and abundance in the project area. However, the KNWR lists 150 bird species that have been documented within or adjacent to the KNWR, and 113 species are known to breed in the KNWR (USFWS 2010a). These species use a range of habitats within the KNWR, some of which are not found in the project area (e.g., subalpine, alpine, coastal). Most bird species occurring within the project area are migratory, arriving or passing through in the spring, beginning with raptors and waterfowl in March and April, continuing with the arrival of songbirds through May, and ending with these species migrating south in late summer or fall to wintering grounds in North or Central America. Approximately 39 species, including several species of waterfowl, raptor, woodpecker, and songbird, are present in the project area year-round (Table 3.22-7). The project area provides important nesting, brood rearing, wintering, and migratory habitat for many of these birds.

All migratory birds are protected by the Migratory Bird Treaty Act (MBTA); eagles are also protected by the Bald and Golden Eagle Protection Act (see below and Section 3.24, Permits). No Federally listed threatened, endangered, proposed, or candidate species or Forest Service Sensitive Species occur in the project area; however, numerous species that have been identified by resource agencies as birds of conservation concern may occur in the project area (USFWS 2013, Goldstein, Martin and Stensvold 2009). Table 3.22-8 identifies birds that are listed as species of conservation concern in the project area. The list includes USFWS Birds of Conservation Concern (BCC), KNWR "species of special interest," and ADF&G "species of the greatest conservation need" (USFWS 2010a, USFWS 2008, ADF&G 2006a).

Table 3.22-7. Year-round resident bird species in the project area

Species Name	Scientific Name	Abundance	Species Name	Scientific Name	Abundance
Trumpeter swan	*Cygnus buccinator*	C	Downy woodpecker	*Picoides pubescens*	C
Mallard	*Anas platyrhynchos*	C	Black-backed woodpecker	*Picoides arcticus*	R
Common goldeneye	*Bucephala clangula*	C	Three-toed woodpecker	*Picoides dorsalis*	C
Barrow's goldeneye	*Bucephala islandica*	C	Gray jay	*Perisoreus canadensis*	C
Common merganser	*Mergus merganser*	C	Steller's jay	*Cyanocitta stelleri*	U
Spruce grouse	*Falcipennis canadensis*	C	Black-billed magpie	*Pica hudsonia*	C
Willow ptarmigan	*Lagopus lagopus*	U	Common raven	*Corvus corax*	C
Rock ptarmigan	*Lagopus muta*	U	Black-capped chickadee	*Poecile atricapillus*	C
Northern goshawk	*Accipiter gentilis*	U	Boreal chickadee	*Poecile hudsonicus*	C
Bald eagle	*Haliaeetus leucocephalus*	C	Red-breasted nuthatch	*Sitta canadensis*	U
Gyrfalcon	*Falco rusticolus*	R	Brown creeper	*Certhia americana*	U
Merlin	*Falco columbarius*	U	American dipper	*Cinclus mexicanus*	U
Glaucous-winged gull	*Larus glaucescens*	C	Golden-crowned kinglet	*Regulus satrapa*	U
Great horned owl	*Bubo virginianus*	U	Bohemian waxwing	*Bombycilla garrulus*	U
Northern hawk owl	*Surnia ulula*	R	Northern shrike	*Lanius excubitor*	U
Great gray owl	*Strix nebulosa*	R	Pine grosbeak	*Pinicola enucleator*	U
Boreal owl	*Aegolius funereus*	U	Common redpoll	*Acanthis flammea*	C
Northern saw-whet owl	*Aegolius acadicus*	U	Pine siskin	*Spinus pinus*	C
Belted kingfisher	*Megaceryle alcyon*	C	White-winged crossbill	*Loxia leucoptera*	C
Hairy woodpecker	*Picoides villosus*	C			

Notes: C = Common, U = Uncommon, R = Rare
Sources: USFWS (2010a, No date), Eskelin and O'Connor (2008), National Audubon Society (2002), eBird (2013).

Table 3.22-8. Birds of conservation concern in the project area

Species Name	Scientific Name	Agency Status	Species Name	Scientific Name	Agency Status
Trumpeter swan	*Cynus buccinators*	KNWR[b] ADF&G[c]	Western wood-pewee	*Contopus sordidulus*	ADF&G[c]
Common loon	*Gavia immer*	ADF&G[c]	Steller's Jay	*Cyanocitta stelleri*	ADF&G[c]
Horned grebe	*Podiceps auritus*	USFWS[a] ADF&G[c]	Violet-green swallow	*Tachycineta thalassina*	ADF&G[c]
Red-necked grebe	*Podiceps grisegena*	ADF&G[c]	Boreal chickadee	*Poecile hudsonicus*	ADF&G[c]
Osprey	*Pandion haliaetus*	ADF&G[c]	Red-breasted nuthatch	*Sitta canadensis*	ADF&G[c]
Bald eagle	*Haliaeetus leucocephalus*	USFWS[a] ADF&G[c]	Brown creeper	*Certhia americana*	ADF&G[c]
Sharp-shinned hawk	*Accipiter striatus*	ADF&G[c]	American dipper	*Cinclus mexicanus*	ADF&G[c]
Northern goshawk	*Accipiter gentilis*	KNWR[b]	Golden-crowned kinglet	*Regulus satrapa*	ADF&G[c]
Merlin	*Falco columbarius*	ADF&G[c]	Swainson's thrush	*Catharus ustulatus*	ADF&G[c]
Solitary sandpiper	*Tringa solitaria*	USFWS[a] ADF&G[c]	Hermit thrush	*Catharus guttatus*	ADF&G[c]
Lesser yellowlegs	*Tringa flavipes*	USFWS[a] ADF&G[c]	Gray-cheeked thrush	*Catharus minimus*	ADF&G[c]
Wilson's snipe	*Gallinago delicate*	ADF&G[c]	American robin	*Turdus migratorius*	ADF&G[c]
Arctic tern	*Sterna paradisaea*	USFWS[a] ADF&G[c]	Varied thrush	*Ixoreus naevius*	ADF&G[c]
Great-horned owl	*Bubo virginianus*	ADF&G[c]	Townsend's warbler	*Dendroica townsendi*	USFWS[a] ADF&G[c]
Western screech-owl	*Megascops kennicottii*	ADF&G[c]	Wilson's warbler	*Wilsonia pusilla*	ADF&G[c]
Northern hawk owl	*Surnia ulula*	ADF&G[c]	Northern waterthrush	*Parkesia noveboracensis*	ADF&G[c]
Great gray owl	*Strix nebulosa*	ADF&G[c]	Fox sparrow	*Passerella iliaca*	ADF&G[c]
Boreal owl	*Aegolius funereus*	ADF&G[c]	Dark-eyed junco	*Junco hyemalis*	ADF&G[c]
Northern saw-whet owl	*Aegolius acadicus*	ADF&G[c]	Rusty blackbird	*Euphagus carolinus*	ADF&G[c]
Northern flicker	*Colaptes auratus*	ADF&G[c]	Pine grosbeak	*Pinicola enucleator*	ADF&G[c]
Blackpoll warbler	*Dendroica striata*	ADF&G[c]	White-winged crossbill	*Loxia leucoptera*	ADF&G[c]
Olive-sided flycatcher	*Contopus cooperi*	USFWS[a] ADF&G[c]	Pine siskin	*Spinus pinus*	ADF&G[c]
Northern shrike	*Lanius excubitor*	ADF&G[c]			

[a] USFWS Birds of Conservation Concern (USFWS 2008).

[b] KNWR Species of Special Interest (USFWS 2010a).

[c] ADF&G "Species of Greatest Conservation Need" (ADF&G 2006a).

USFWS developed the BCC list of migratory and non-migratory bird species that represent the highest conservation priorities (USFWS 2008). The USFWS defines BCC as species, subspecies, and populations that are not already Federally listed as threatened or endangered but that without additional conservation actions are likely to become candidates for Federal listing (USFWS 2008). The KNWR published a list of species of special interest in the *Revised Comprehensive Conservation Plan* and EIS (USFWS 2010a). The State of Alaska no longer maintains a list of Species of Special Concern. It uses its Comprehensive Wildlife Conservation Strategy (sometimes referenced as its Wildlife Action Plan) to assess the conservation needs of particular species and lists species nominated for consideration as potential planning targets. This list is intended to represent the "species of greatest conservation need" that should be considered for planning purposes in Alaska (ADF&G 2006a).

The following paragraphs present an overview of bird species and/or groups that occur in the project area.

Waterbirds and Cranes

Waterbirds include ducks, geese, swans, loons, grebes, gulls, terns, and shorebirds, most of which nest in ponds, marshes, and shallow waters along lake shorelines with emergent vegetation. Shorebirds and cranes generally nest in wetland habitats, although some shorebirds also nest in upland habitats. In winter, several waterfowl species remain in the open waters of the Kenai River.

The outlet of Kenai Lake is frequently ice-free during the winter and attracts a variety of waterbirds. Trumpeter swans overwinter at the outlet of Kenai Lake, downstream along the Kenai River, and in other areas with open water during the winter. Mallards, common mergansers, and common and Barrow's goldeneyes can be found in areas with open water during winter. Mew gulls, glaucous-winged gulls, and glaucous-winged/herring gull hybrids are common along Kenai Lake and the Kenai River during the summer (USFWS 2010a, eBird 2013, West 2008). Sandhill cranes migrate through the Kenai Peninsula, stopping at estuaries, tundra areas, and wetlands where some remain to nest (West 2008).

While abundant nesting habitat for waterbirds is present on the KNWR as a whole, the project area contains very little waterbird nesting habitat. Trumpeter swans are a common nesting species on the KNWR but do not likely nest in the project area. Canada goose, common and red-breasted merganser, American wigeon, green-winged teal, and Barrow's goldeneye are likely to breed in the project area. Three species of loons (common, red-throated, and Pacific) have been documented as breeding in the KNWR. Common and Pacific loons may nest along the shoreline of Kenai Lake. Red-necked grebes may nest on Kenai Lake or smaller waterbodies adjacent to the project area. Most shorebird species in the project area are migrants; however, a few likely nest in the project area, including lesser yellowlegs, spotted sandpipers, solitary sandpipers, semipalmated plovers, and Wilson's snipe (USFWS 2010a, West 2008).

Raptors

Raptors that occur in the project area include hawks, eagles, owls, and falcons. Raptors typically inhabit forested areas, open country, and riparian habitat. Raptors such as golden eagles and peregrine falcons inhabit cliffs. Several species of raptors are present year-round in the project area including bald eagles, gyrfalcon, northern goshawk, and several species of owls.

Golden eagles do not nest in the project area, but may nest in the cliffs above it and occasionally pass through. Observations by a local resident in 2015 of golden eagles in the area of the Langille and Juneau mountains were recorded as part of public comment on the Draft Supplemental EIS. A pair of golden eagles nesting on a ledge around 2,500 feet elevation of Juneau Mountain was also observed in the 1980s.

Bald eagles are present year-round in the project area. Bald eagles are common at the outlet of Kenai Lake and downstream along the Kenai River for several miles where they feed on spawned-out salmon in the fall and winter (West 2008). Bald eagles in the project area feed and nest along an approximately 500-foot-wide band of forested and riparian habitat along the Kenai and Russian rivers, Cooper and Quartz creeks, Juneau Creek below the falls, and along the shores of Kenai Lake (Forest Service 1990). Agency-identified nesting areas in the project area are summarized on Map 3.22-4 (HDR 2004a). Overall, bald eagle use of the Kenai River corridor is high, and it is thought that more adult eagles could be present than those associated with the nests in any given year.

The USFWS has developed guidelines for avoiding disturbance of bald eagles at nest sites, including the recommendation of 330-foot primary and 660-foot secondary buffer zones between bald eagle nests and disturbance activities such as motorized traffic and standard road construction (USFWS 2007). A buffer of 0.5 mile (2,640 feet) is recommended for blasting and the generation of other loud intermittent noises (USFWS 2007). For all activities, the actual size of the buffer zone needed could vary depending on the individual eagle's tolerance for human disturbance as well as whether the activity will be visible from the nest.

An aerial survey of the project area for bald eagle nests was conducted in April 2014. The survey identified 4 active and 21 inactive eagle nests within the project area (see Map 3.22-4). A localized ground survey was conducted in November 2015 based on public comment that the number of active bald eagle nests was underestimated; the comment indicated a nest location near Jim's Landing. The survey resulted in identification of one new nest located near the Kenai River east of Juneau Creek. Because the survey was conducted in November, the activity status of the nest is unknown, although one adult and one immature eagle were spotted nearby. No nest was sighted near Jim's Landing; however, limited road access made searching the area challenging. Of the 26 nests identified, four nests are currently less than 330 feet from the existing Sterling Highway. There are 4 additional nests located between 330 and 660 feet from the existing highway. The locations of all 26 nests located within the project area are shown on Map 3.22-4.

Landbirds

Landbirds belong to many diverse groups and include both migrant and resident birds. Most landbird species that nest and rear young in the project area between May and August or September migrate outside of Alaska for the winter. Landbirds found in the project area include sparrows, warblers, finches, thrushes, kinglets, chickadees, woodpeckers, jays, and ravens. Common, year-round residents in the project area include black-billed magpie, common raven, black-capped chickadee, pine grosbeak, common redpoll, and pine siskin (Table 3.22-7 and Table 3.22-8). Resident birds remain active during the winter and rely primarily on berries and seeds. Resident ravens and gray jays scavenge on winter- or predator-killed carrion. Four woodpecker species—downy, hairy, three-toed, and black-backed—occur year-round in the project area (USFWS 2010a, West 2008).

Landbirds utilize a broad range of habitats in the project area that include mature, intermediate, and early stage forests, riparian forests, muskegs, and willow shrub thickets. The project area provides breeding habitat for a variety of these species, including: dark-eyed junco, yellow-rumped and orange-crowned warbler, Swainson's thrush, boreal chickadee, ruby-crowned kinglet, gray jay, alder and olive-sided flycatcher, and American robin (USFWS 2010a, West 2008).

Upland Game Birds

Spruce grouse are important subsistence and game birds in the project area (HDR and USKH 2013). Spruce grouse inhabit forested habitat, whereas the related willow ptarmigan and rock ptarmigan rely on the subalpine shrub and alpine tundra habitats found in upper elevations above the project area.

3.22.1.3 Amphibians

The wood frog (*Rana sylvatica*) occurs on the KNWR (USFWS 2010a) and likely lives in other parts of the project area. It is considered widespread and relatively common in most of Alaska (Gotthardt 2005).

The wood frog has no special regulatory status, but is considered a State "species of greatest conservation need" (ADF&G 2006a). It was selected as a management/indicator species for the project based on interagency consultation (HDR 2004a).

No specific habitat use areas in the project area for amphibians were identified during agency consultation (HDR 2004a), but wood frogs likely occur in the project area wetlands (Map 3.20-1) and hibernate under forest litter and snow (MacDonald 2003). Loss and degradation of its wetland habitat, especially in Southcentral Alaska, is of concern for wood frogs (Gotthardt 2005). The fungal pathogen *Batrachochytrium dendrobatidis*—otherwise known as chytrid fungus—has been linked to amphibian declines worldwide. Chytrid fungus was documented by Reeves and Green (2006) for the first time in Alaska on the KNWR. Proximity to roads has been positively correlated with risk of skeletal abnormalities in Alaskan wood frogs, possibly due to chemical contamination of gravel and their habitat, or by the roads facilitating introduction of predators, parasites, or pathogens (Reeves et al. 2008). Abnormality prevalence (up to 20 percent of frogs sampled) at road-accessible sites in the KNWR is among the highest reported in the published literature (Reeves, et al. 2008).

There are three non-native amphibian species documented in Alaska, but none have been documented on the Kenai Peninsula as of 2008 (McClory and Gotthard 2008) or in the KNWR as of 2010 (USFWS 2010a).

3.22.2 Environmental Consequences (Threatened and Endangered Species)

In accordance with Section 7(a)(2) of the Endangered Species Act of 1973 (87 Stat. 884, as amended, 16 USC§1531 *et seq.*), FHWA initiated Section 7 Consultation with letters to both USFWS and NMFS requesting concurrence that endangered, threatened, or candidate species or their habitat would not be affected by the project. USFWS and NMFS responded with letters of concurrence stating that no ESA listed species occur in the project area, thus concluding the Section 7 Consultation (Balogh 2006, Mecum 2006). Recent review of the USFWS and NOAA websites verified that no ESA-listed species are present in the project area (USFWS 2013, NOAA 2013). Therefore, neither the No Build Alternative nor any of the build alternatives would affect listed threatened or endangered species.

No State-listed endangered species are known to occur in the project area as of August 2013 (ADF&G 2013a); therefore, no alternatives would adversely affect State-listed endangered species.

3.22.3 Environmental Consequences (Brown Bear)

A variety of direct and indirect impacts to brown bears would occur under all alternatives, including the No Build Alternative. The existing and proposed road infrastructures represent human-induced landscape-scale changes to brown bear habitat. Impacts that negatively affect females (especially those of reproductive age) would likely have the greatest effect on the population. Mitigation is proposed that is common to all mammals. The mitigation subsection under this Brown Bear discussion presents this mitigation, and sections associated with other species refer back to this section.

3.22.3.1 No Build Alternative

Direct and Indirect Impacts

Existing impacts to brown bears would be expected to continue and increase under the No Build Alternative as traffic levels, human population, and recreation levels increased. These would likely result in increased impacts to bears including:

- Avoidance of habitats in the highway corridor;
- Physical and traffic impediments to highway crossings; and
- Injury or mortality from collisions.

Bear management zones are addressed in the *Chugach National Forest Revised Land and Resource Management Plan*; see subsections 3.2.3.1 and 3.2.3.2. Brown Bear Management Standard 1 prohibits roads within 750 feet of brown bear management zones, while Brown Bear Management Guideline 1 indicates that long-term concentrated human activities should be located 1 mile or more from important seasonal brown bear concentrations. The existing highway (No Build Alternative) is within about 0.6 mile of Area 9 and within about 500 feet of Area 11, which the Forest Service have identified as both brown bear management zones and important seasonal brown bear concentrations. The Forest Plan states that the Standard "does not prohibit the relocation, reconstruction, or maintenance of existing roads and trails in these areas."

3.22.3.2 Issues Applicable to the Build Alternatives

Direct and Indirect Impacts

As discussed in Section 3.22.1.1, natural or human-induced landscape-scale changes influence brown bear populations through habitat loss, changes in habitat suitability, changes in habitat use (e.g., displacement from habitat or disruption of movement patterns), or reduced survival (Goldstein, Suring and Preston 2004). Changes in human activity can also result in changes in direct bear mortality (e.g., hunting, vehicle collisions, or DLP kills).

Impacts to brown bears are likely to occur under all build alternatives as a result of:

- Habitat loss (permanent loss of vegetation)
- Habitat alteration including fragmentation, changes in habitat quality, and changes in the availability of food resources

- Modification of brown bear behavior and use of existing habitat
- Increased brown bear mortality through changes in the probability of DLP kills or vehicle collisions

Brown bear habitat loss would include the permanent removal of vegetation (Table 3.22-9). The amount of habitat lost in each alternative is related to the length and footprint of the segments of each alternative built on a new alignment and the degree to which these segments pass through existing brown bear use areas (see also Map 3.22-1). Information on the acreage of vegetated habitat permanently lost[3] under each alternative is presented in Table 3.22-9. Impacts to interagency-identified areas of predicted use by brown bears are discussed by alternative, below.

Impacts related to the alteration of brown bear habitat include habitat fragmentation and the creation of impediments to bear movement between important seasonal habitats, changes in habitat quality, and changes in the availability and accessibility of fish resources. Similar to habitat loss, the extent of habitat fragmentation and impediments to bear movement expected under each alternative are related to the length and placement of those segments built on a new alignment (see Table 3.22-9 and Map 3.22-1).

Habitat fragmentation also could create impediments to movement between important seasonal habitats (Map 3.22-1). Although studies have documented brown bear avoidance of roads and roaded areas (Kasworm and Manley 1990, Schoen et al. 1994, Farley et al. 2001, Waller and Servheen 2005), at least some Kenai Peninsula brown bears would move to seasonally attractive habitats (e.g., salmon streams) despite roads and traffic (Graves et al. 2006). Because salmon are a critical food source for Kenai Peninsula brown bears, it is likely that bears would continue to access and use the Kenai River and its tributaries under any of the build alternatives. However, changes and/or reductions in bear access and use of the habitats near the project area are expected, with the greatest impact on females with cubs (Graves et al. 2006).

The existing highway represents a landscape-level barrier to north-south brown bear movements. Where alternatives include new alignment, this adds an additional roadway impediment that would roughly parallel the existing roadway impediment and the natural barrier of the Kenai River. The extent to which multiple east-west barriers cross north-south brown bear passage corridors is an additional consideration in determining impacts to brown bear habitat. Table 3.22-9 summarizes the length of new road in important bear habitat predicted use areas and the segments that add a double roadway impediment to bears transiting the area.

Brown bear habitat alteration also includes changes in habitat quality. Brown bears on the Kenai Peninsula heavily use areas within approximately 6,560 feet (2,000 meters) of salmon spawning areas. All portions of the new highway segments are within approximately 6,560 feet of anadromous fish streams, although habitat quality varies among alternatives (see Table 3.22-9). Roads constructed near salmon streams could reduce brown bear use of these areas (Suring, Farley, et al. 2006). New development and activity, particularly the construction of bridge and culvert crossings of anadromous streams, could affect fish resources (see Section 3.21, Fish and Essential Fish Habitat) and availability of this resource to brown bears. Where the project might affect fish resources and availability, the brown bear population could be affected.

[3] Estimates of brown bear habitat loss are based on the total acreage of vegetation removed under each build alternative. See Section 3.20, Wetlands and Vegetation, for additional information on mapped vegetation types within the project area.

Table 3.22-9. Summary of Build Alternative impacts to brown bear habitat

	Alternative			
	Cooper Creek	**G South**	**Juneau Creek**	**Juneau Creek Variant**
Total length of alternative (miles)	14.2	14.2	14.7	14.3
Total length of new highway segment (miles)	3.5	5.6	10	9
Length of alternative within Bear Use Area (Map 3.22-1)	2.7	3.5	4.3	4.4
Length of double highway barrier to movement within bear use area	0.15	0.9	3.9	3.6
Vegetated habitat loss in the project area (acres) [a]	190	211	262	257
Vegetated habitat loss in the project area (%)[a]	1.3%	1.4%	1.8%	1.7%
Total bear habitat on Kenai Peninsula affected by habitat loss (%)[b]	0.006%	0.006%	0.007%	0.007%
Habitat avoidance area along existing highway/No Build Alternative (acres)[c]	5,596	5,596	5,596	5,596
Additional habitat avoidance area included under new alignment (acres)[c]	605	1,468	2,834	2,640
Crossings of anadromous fish streams	• 2 bridges replaced • 4 new culverts • 1 creek rerouted • 1 new bridge, no in-water structures	• 1 bridge replaced • 5 new culverts • 2 new bridges, 1 with no in-water structures	• 1 new culvert • 1 new bridge, no in-water structures	• 1 new culvert • 1 new bridge, no in-water structures
Quality of habitat lost	• Impacts Kenai River corridor and bench from Kenai Lake to Cooper Creek. • Impacts areas and streams that have less intense brown bear use compared to other parts of project area.	• Impacts high-quality brown bear movement and feeding corridors along Kenai River and lower Juneau Creek. • Could permanently deter bear movement to and from these areas, and feeding in these areas.	• Impacts high-quality brown bear movement corridor on bench area west of Juneau Creek and feeding/resting areas along Kenai River. • Could permanently deter bear movement to and from these areas, and feeding in these areas.	

[a] Vegetated habitat lost is based on vegetation mapping discussed in Section 3.20, Wetlands and Vegetation. Total vegetated habitat lost is based on those acreages as a percent of the total project area acreage (14,961 acres).

[b] Total Kenai Peninsula bear habitat (5,347 mi^2) taken from Del Frate (1993) and USFWS and Forest Service (2014).

[c] Sources: Combes (2008), Larsen (2008), Waller and Servheen (2005). Acreage calculated using a 3,280-foot (1,000-meter)-wide roadway avoidance corridor, placed around the alignment centerline (500 meters to each side). The "additional" avoidance acreage is associated with the highway segments built on new alignment for each alternative. The existing/No Build alignment avoidance acreage, calculated at 5,596 acres, remains for all build alternatives. It includes highway segments built on the existing alignment and segments that will become the "old" highway, but will still create an avoidance area for bears.

Project-related changes to brown bear behavior and habitat use have the potential to impact brown bear populations through decreased population sustainability (Goldstein, Suring and Preston 2004). Potential impacts to brown bear habitat use were evaluated using models to predict patterns of habitat use by female brown bears (Goldstein, Suring and Preston 2004). Known habitat use areas were used to identify variables important to brown bear habitat selection (e.g., distance to cover; density of salmon spawning streams and lakes; density of human development, roads, and trails; and elevation). These factors were used to determine the probability of female brown bear occurrence within the project area for each of the build alternatives (Goldstein, Suring and Preston 2004).

Findings of the study show that as road density in brown bear habitats increases, the probability of occurrence of female brown bears with cubs in these areas decreases for all build alternatives (Goldstein, Suring and Preston 2004). Changes in road density and the correlated change in the probability of occurrence of female brown bears with cubs are discussed for each build alternative below.

Bear habitat avoidance areas were also quantified using a 3,280-foot-wide (1,000-meter) buffer zone centered on the new highway alignments (Waller and Servheen 2005). Highway segments built on a new alignment would add additional avoidance areas to the 5,596 acre avoidance area that surrounds the existing highway. These values are presented by alternative in Table 3.22-9.

The USFWS, in its role as a cooperating agency for this project, has expressed concerns related to noise effects on wildlife and indicated that brown bears would likely be affected by increased noise levels from new highway infrastructure. Many of the potential impacts already described are caused in part by noise pollution. Noise impacts can extend beyond the surface of the road and create impacts as described in Section 3.15.1.5, Wildlife and Noise. In addition, brown bears are sensitive to human disturbance when selecting den sites (Goldstein, Poe, et al. 2010), and an increase in the area affected by noise pollution could reduce the area of their available denning habitat. Activity within 1 kilometer of den sites could cause variable responses, such as increased heart rates in hibernating bears (Reynolds, Reynolds III and Follman 1986) or even den abandonment (Linnell, et al. 2000). Although brown bears hibernate in a variety of habitats, most hibernate at higher elevations, often above tree line and far from human disturbance. Brown bears may den within hearing range of some of the high intensity, instantaneous noises from traffic associated with any of the build alternatives. The USFWS also provided information that sound measurements within KNWR indicated that road traffic noise was discernable more than 0.5 mile (2,640 feet) from the source, and had been measured at up to 2 miles in the winter within KNWR Wilderness. As all alternatives, except the Juneau Creek Alternative, would use the existing highway alignment through KNWR, increases in noise pollution are expected to be negligible in the KNWR beyond that predicted for the No Build Alternative.

Behavioral changes due to human activity associated with new highway segments may also impact population sustainability. Brown bears may have higher energetic costs (i.e., expend more energy) due to increased human encounters/disturbance, as well as crossing highways at greater speeds than normal (Graves et al. 2006). Seasonal traffic volumes on the existing highway can intensify the barrier to bear movement. USFWS has expressed concern that intersection illumination may affect bears and their movement and the resulting light reflecting off snow and low clouds may exacerbate this impact. DOT&PF has reduced the number of intersections proposed to be lighted to two for each alternative: those at each end of the new highway segment. Increased road density on the landscape may result in brown bears avoiding—in part or

completely—certain crossings, as bears are less likely to cross in areas with two parallel roads than one road (Graves et al. 2006). Human food-conditioning of bears likely would increase with increased traffic and human use of the area.

All build alternatives are likely to have impacts on brown bear mortality through changes in the probability of DLP kills and vehicle collisions. The consequences of bear mortality resulting from vehicular collisions or DLPs are directly related to bear population status. At lower numbers, each bear death is a more substantial loss to the population. Increased road density, traffic volume, and vehicle speed may increase or decrease collision rates with brown bears, depending on avoidance effects, bear population level, and quality of nearby habitat (Huijser et al. 2008). Under all build alternatives, the segments built on the existing alignment would have wider shoulders and clear zones, resulting in better visibility that could reduce bear-vehicle collisions. However, average travel speeds would be greater throughout the entire project area, which could offset any decreases or possibly increase collision rates. Bear-vehicle collisions likely also would be reduced on any "old" highway segments not incorporated into a build alternative because those segments would become a local road with only about 30 percent of the total traffic volume.

Potential changes in the probability of DLP kills in the project area were also evaluated by the Forest Service study using models to evaluate spatial patterns of brown bear DLP kills. The Forest Service study suggested that for those brown bears that continue to use the project area, the probability of encounters with humans, as well as DLP kills, will increase for all build alternatives (Goldstein, Suring and Preston 2004). Increased road density was the primary factor influencing the change in probability of DLP kills among the build alternatives. Dispersed recreation originating with a new highway alignment and new trailheads along each new alignment would be a change that could lead to increased encounters and DLP kills and possibly to increased poaching, especially where new alignments are farthest from existing subdivisions and other regularly occupied areas. Changes in road density and impacts on the probability of DLP kills are discussed below by alternative.[4]

Bear management zones are addressed in the *Chugach National Forest Revised Land and Resource Management Plan*; see Section 3.2.3.2. All alternatives would be in or near these zones. Brown Bear Management Standard 1 prohibits roads within 750 feet of brown bear management zones, while Brown Bear Management Guideline 1 indicates that long-term concentrated human activities should be located 1 mile or more from important seasonal brown bear concentrations. All alternatives, including the No Build Alternative, would be located within these distances from the edges of areas the Forest Service has identified as brown bear management zones and important seasonal brown bear concentrations or would cross these areas. If the Forest Service determined the selected alternative was inconsistent with the Brown Bear

[4] Impacts to brown bears reported by Goldstein, Suring, and Preston (2004) were based on an assumption that all build alternatives would induce increased human population growth, development, and road density in the project area. Since 2004, DOT&PF has elected to retain access rights for the segment of each alternative that would be built on a new alignment to limit indirect changes in human population growth or development patterns resulting from this project. Despite invalidating a key assumption, the patterns in Goldstein's findings still are relevant because all of the build alternatives would increase road density through the construction of segments built on new alignments. However, the increase in road density and magnitude of correlated increase in impacts on brown bear habitat use and the probability of DLP kills as a result of the project would be lower than values reported in the 2004 study because of the DOT&PF commitment to limit access to the new highway alignments. Increased recreation on trails and dispersed in the backcountry is expected to originate from the new alignments and proposed trailheads, and this likely would lead to greater human-bear encounters and DLP kills than occur today.

Management Standard 1, it would likely mean the alternative could not be approved without a plan amendment. Guideline 1 would discourage any alternative within approximately 1 mile of Areas 8, 9, and 11 on Map 3.22-1. See the following sections regarding each build alternative.

None of the build alternatives is likely to change bear mortality due to lawful hunting. New highway segments could increase access to areas that are now relatively remote through the creation of new official trailheads and unofficial access points (temporary access roads, etc.). These sites may increase hunting pressure on bears. However, ADF&G monitors harvests and alters hunting regulations to maintain bear populations at sustainable levels.

None of the alternatives would indirectly cause changes in human population growth or development patterns in the project area. Therefore, no impacts to bears and bear habitat as a result of such development would be attributable to the project. Impacts associated with human population growth and community development are addressed in Section 3.27, Cumulative Impacts.

Construction Impacts

Construction would require staging areas, disposal sites for cleared vegetation and unusable or excess soils, and access roads. Therefore, construction activities anticipated in the build alternatives would result in:

- Temporary loss/alteration of habitats
- Displacement from adjacent habitats
- Changes to typical use and/or movements through the area

Information on the acreage of vegetated habitat temporarily impacted by construction activities under each of the build alternatives is presented in Map 3.20-2 (in Section 3.20, Wetlands and Vegetation) and Table 3.22-10. The acreage of vegetated habitat lost is based on a 10-foot buffer around all proposed construction limits.

Table 3.22-10. Construction impacts on vegetated habitat under build alternatives

	Cooper Creek	G South	Juneau Creek	Juneau Creek Variant
Amount of vegetated habitat temporarily affected (acres)	100	118	123	112

Construction and replacement of bridges over anadromous fish streams could temporarily displace bears that typically fish in these waterways and increase competition between bears at other fishing sites.

During and after construction, disturbed areas may have reduced habitat quantity and quality. Noise from construction activities could displace and/or modify movements and behavior of brown bears until project completion. In addition, food and garbage associated with construction activities have the potential to draw bears and other wildlife to the construction site. As a preventive measure, bear-proof containers would be used to discourage such habituation of wildlife.

Mitigation

Measures to minimize harm to vegetated habitat (considered a proxy for brown bear habitat) are documented in Section 3.20. Timing windows for construction activities within the Kenai River (e.g., pile driving; see Section 3.21) would reduce temporary impacts to a brown bear food source. Additional avoidance and minimization measures to reduce impacts to brown bears and brown bear habitat would be pursued during the design phase, and in collaboration with the resource agencies.

Wildlife Mitigation Study

To identify the best locations for mitigation measures that would help to retain wildlife movement patterns, DOT&PF sponsored a wildlife mitigation study (Suring et al. 2017) in collaboration with wildlife management agencies. The scope of the study (the study plan) was developed in consultation with an interagency wildlife team (USFWS, Forest Service, and ADF&G). The results of the study, initiated in 2014, have been used to refine the location of wildlife crossing structures (further addressed below) to accommodate wildlife movement for brown bears and moose, as well as for other species, including black bear, Dall sheep, wolverine, and Canadian lynx. The study identified corridors and habitat use areas where animals are most likely to want to cross the highway during different times of the year.

The wildlife mitigation study was designed to identify wildlife movement patterns with a goal of identifying locations for potential wildlife crossings that would be incorporated into the highway design and remain effective for wildlife movement over the long term. The wildlife mitigation study included a desktop modeling phase and a year-long field verification phase. The study was formally peer-reviewed and finalized in 2017. The field verification effort used camera-capture technology to indicate frequency of appearance of different species throughout the year to verify and adjust the desktop model that predicts wildlife use areas and corridors, including areas where animals are likely to cross the existing and proposed highway alignments. These data were coupled with data from multiple other studies both within the project area and at other locations around the world. Data inputs included, for example, past bear and moose tracking studies using collars that transmit location and movement data, existing wildlife collision data for the project area, and data on wildlife movement habits from outside the project area. This information helped biologists predict wildlife concentrations and movement areas, and ultimately locations where wildlife crossing structures would be effective.

DOT&PF and FHWA have proposed locations of proposed wildlife crossing structures based on results of the final study. Appendix I, *Wildlife Crossings - Analysis and Recommendations*, provides detail. During design, a memorandum of understanding (MOU) will be developed with wildlife agencies to document agreements about crossing location refinements, and about design and methodology of a monitoring study.

Wildlife Crossing Structures

The primary mitigation proposal under any alternative is to provide dedicated wildlife crossings under or over the highway. All alternatives would use similar crossing structure types that would provide sufficient openings that wildlife would be likely to use them. Crossing structures would be designed to facilitate wildlife movement based on the topography and other specific characteristics of each crossing site. The FHWA Central Federal Lands Highway Division, in a 2011 *Wildlife Crossing Structure Handbook* (FHWA 2011), provides guidance for basic

structure dimensions for large mammal underpasses and overpasses that would be appropriate for brown bear and moose crossings:

- Large mammal underpass, opening width: minimum 23 feet, recommended >32 feet
- Large mammal underpass, opening height: minimum 13 feet, recommended >13 feet
- Large mammal overpass, width for wildlife: minimum 130 feet

For this project, DOT&PF would use large mammal underpasses with horizontal clearances of 23 feet to 32 feet, depending on structure type, and with vertical clearances of 18 feet, where feasible. Several structure types are possible. The opening dimensions also apply to bridges modified to provide for wildlife passage. For this project, wildlife overpasses would be 130 feet wide. DOT&PF has determined approximate wildlife mitigation costs for each alternative (to be conservative, the EIS uses the upper end of the range of costs in Appendix I). See further detail under each alternative, below, and in Appendix I, *Wildlife Crossings – Analysis and Recommendations*. The following bulleted items apply to all alternatives:

- Provide dedicated large mammal underpasses with clearance for wildlife of 23 to 32 feet horizontally and up to 18 feet vertically (round steel pipe partly filled, with ends cut to match the fill slope, and with partial wing walls, or similar, to be determined in consultation with wildlife agencies).
- Provide dedicated large mammal overpasses with a width of approximately 130 feet.
- Modify the design of major bridges planned as part of each alternative as needed to provide adequate clearance for wildlife passage along each bank.
- Add small-diameter wildlife crossings (<23 feet), principally intended for black bear, wolf, wolverine, and other smaller animals, with the number and placement informed by results of the wildlife mitigation/movement study. Where possible, this would be accomplished by "oversizing" drainage culverts.
- Add natural barriers such as boulders, as a first choice, or fencing as determined necessary to reasonably direct animals to the wildlife crossings and bridge underpasses without unreasonably limiting current popular access for people to the Kenai River, trails, and other recreation sites.
- Install wildlife crossing caution signs for drivers in areas where the wildlife mitigation study and previous collision history suggest higher expected use by wildlife, on both "old" highway (if not already signed) and new highway.

A wildlife overpass would be a tunnel for the highway. A 130-foot highway tunnel generally requires tunnel lighting. Power likely would be provided to a tunnel site via a drop from the transmission line that crosses the Sterling Highway near MP 55.5, with the power distribution line buried in the highway embankment. Providing power/light at wildlife overpasses/highway tunnels would result in no additional clearing in the highway right-of-way and negligible visual or other impact. During the dark months (fall/winter), a small amount of light may emanate from tunnel entrances in locations that otherwise would be dark, but this light would be on a highway, where headlights are understood to be present on a continual basis.

DOT&PF, FHWA, and the wildlife agencies (USFWS, Forest Service, and ADF&G) would agree during final design on the details for wildlife crossing structures, based on the information

in Appendix I and the MOU. Field visits also would be scheduled for USFWS, Forest Service, and ADF&G wildlife biologists as part of final design. Criteria to be used in determining which specific types of crossings and locations, specific extent of fencing, and other exact mitigation measures to implement include:

- Expected effectiveness (or use by species)
- Concentration of use by multiple species/usefulness of the measure for multiple species
- Technical feasibility and terrain
- Current and projected land use and ownership
- Cost and prudent expenditure of public funds
- Consideration of input from the public and other agencies

The process to be used to make final wildlife mitigation decisions is anticipated to be a continuing cooperative effort and negotiation among ADF&G, USFWS, Forest Service, DOT&PF, and FHWA through the final design process. This Final EIS and associated Appendix I include as much detail as available at this time. A commitment to further refinement during project design via the MOU will be included in the ROD.

All alternatives include a large mammal underpass at Fuller Creek, near MP 57.2. This underpass would have its own set of impacts that are not necessarily accounted for elsewhere in the EIS but are described here:

- To make space for a wildlife structure would require raising the highway, creating large ramps of fill. The fill footprint of the highway would expand, compared to the base preliminary plan. This would increase the vegetation impact but would not entail wetland impacts.
- The creek at this location descends from Fuller Lakes running south. Near the highway, it jogs to the west, crosses to the south side of the highway, and parallels the highway. The wildlife crossing would be placed approximately where the creek currently crosses the highway. The creek channel, a salmon stream, would be reconstructed to pass under the highway with the large mammal underpass, generally a better situation for fish passage and habitat. The creek channel downstream of the crossing site likely would be reconstructed slightly to the south for 200–400 feet to make space for the increased width of the highway footprint. Overall, channel reconstruction would be an effort to improve salmon passage and salmon habitat, but at the time of construction and for a period of a couple of years thereafter it would be a disruption to habitat.
- The parking area for Fuller Lakes Trail is located approximately 950 feet east of the current Fuller Creek culvert location. Ramping the highway up for the wildlife crossing would begin near the trailhead. There is expected to be no change to the trailhead and parking area; a driveway would be defined (even without the wildlife crossing), and this paved apron may be sloped somewhat differently than it would have been to match the grade of the parking area with the grade of the highway.
- The wildlife agencies have requested a minimum of 18 feet of vertical clearance for all wildlife underpasses. Preliminary design indicates that 15 feet of clearance is possible at this location, but 18 feet may not be possible because of roadway geometry issues and the

need to mesh with existing riverbank erosion protection near MP 57 and with the entrance to the Fuller Creek Trail parking lot. This crossing primarily targets bears, and 15 feet should be adequate for bears but may inhibit moose on occasion.

Unless otherwise noted for each alternative below, wildlife structures are expected to fit into the highway as designed with negligible additional impact.

Mitigation commitments are binding, and the mitigation funding indicated for each alternative in the sections below will be allocated. Wildlife mitigation measures will be designed, constructed, and maintained as primary components of the new highway, not as "enhancements" that could be cut later if funding shortfalls were to occur. Project construction cost estimates in Sections 3.5.2.2 and 3.27.7.5 include wildlife mitigation.

Wildlife Corridor/Habitat Preservation and Restoration

- All alternatives contribute to a wildlife movement constriction at MP 57, where a bend of the Kenai River touches the highway. At this location, in final design, DOT&PF would examine the potential of moving the highway farther north to provide a narrow strip of land between the highway and the river that wildlife could use to connect areas of habitat east and west without crossing the highway. The mountain slope north of the highway may not allow for highway movement, but the potential will be examined.
- All areas affected by construction activities under any of the build alternatives would be revegetated with native species following construction. Vegetation on temporary access road corridors (e.g., beneath the proposed Cooper Creek Bridge, in Juneau Creek Canyon, and across Bean Creek, depending on the alternative) would be restored through seeding with native seed mix. Temporary access roads would be removed and the corridors blocked with a barrier and signed to minimize the chance that these areas would become off-road vehicle or pedestrian trails, which would effectively increase road density and provide increased access for hikers and hunters that could lead to increased human-bear encounters.
- Section 3.15, Noise, addresses FHWA's noise abatement policies. Noise abatement measures are not proposed for large habitat or dispersed recreation areas, based on established DOT&PF and FHWA noise policy. Noise barriers, the most effective solution, can have negative impacts such as requiring additional habitat clearing, interrupting scenic views, and decreasing wildlife mobility. According to the noise analysis completed for the EIS, they are also not cost effective in the wide open spaces associated with the project area (See Appendix D, *Highway Traffic Noise Assessment*.) However, at the time of final pavement design, DOT&PF will consider traffic noise abatement through the use of rubberized asphalt throughout, if the testing that has been ongoing in recent years shows it is durable and if DOT&PF approves it for use (currently it is in testing and is not approved for use).

Other

- Fund a wildlife agency effort to conduct a camera trap study to refine wildlife crossing locations, fencing, and related measures prior to finalizing design.
- Fund agency monitoring of wildlife crossing structures in the post-construction period, with details to be determined during the design phase.

- Install bear resistant trash containers, where trash containers are requested by agencies that will be managing pullouts or parking areas established as part of the project. The final decisions about locations for such trash containers will be identified during design coordination with these agencies.
- Install bear-awareness signs at two locations within each DOT&PF pullout established as part of the project—conveying clear, concise, consistent, and motivating messages regarding food storage regulations and proper human behavior, to be developed with the land management and wildlife agencies.
- Develop mitigation measures specific to fish and essential fish habitat that would benefit bears by reducing impacts related to food availability. Timing windows for construction activities near and within anadromous fish streams would avoid and minimize displacing bears and other wildlife foraging for these food sources. These measures are discussed in Section 3.21, Fish and Essential Fish Habitat.
- Install project lighting at the intersections of the alternative and the "old" highway that would incorporate shielded and directional lighting fixtures to direct most light downward. During final design, DOT&PF would consult with the wildlife agencies regarding the potential use of long-wavelength tinted lights, to meet both wildlife mitigation needs and standards for highway safety at intersections outside the community of Cooper Landing.

The costs for wildlife mitigation for each alternative are listed below under each alternative.

Agency coordination has been ongoing on the topic of wildlife, and brown bears in particular; see Section 3.27.24 of Cumulative Impacts and Chapter 5, Comments and Coordination, for more information.

3.22.3.3 Cooper Creek Alternative

Direct and Indirect Impacts

The proposed footprint of the Cooper Creek Alternative would eliminate 190 acres of vegetated habitat within the project area (Table 3.22-9). This represents 1.3 percent of total vegetated habitat within the project area and less than 0.01 percent of total bear habitat on the Kenai Peninsula.

The Cooper Creek Alternative would alter existing brown bear habitat. About 2.7 miles of the 14.2-mile alternative traverses important bear use areas (see Map 3.22-1, Table 3.22-9). All 3.5 miles of the segment of roadway built on a new alignment would lie within approximately 6,560 feet (2,000 meters) of anadromous fish streams (this corridor serves as an approximation of heavily used bear habitat). Furthermore, the Cooper Creek Alternative would involve five new crossings of anadromous fish streams (Table 3.22-9 and Map 3.21-1 in Section 3.21, Fish and Essential Fish Habitat). However, this alternative would not bisect habitat identified by the interagency team as important for brown bears (Map 3.22-1). Use of the Cooper Creek area by brown bears is lower than at other streams in the project area as a result of reductions to the anadromous fish runs caused by the Cooper Lake hydroelectric project. The clear span bridge over Cooper Creek also would minimize this alternative's potential to impede brown bear north-south movement.

The Cooper Creek Alternative would also likely result in changes to brown bear behavior and use of existing habitat. The Cooper Creek Alternative would result in an increase in road density and thus a corresponding decrease in the probability of occurrence of females with cubs during spring (see Section 3.22.3.2 and Goldstein, Suring and Preston (2004)). However, the Cooper Creek Alternative was found to have the smallest increase in road density of the build alternatives and likely would have a smaller negative impact on the probability of brown bear occurrence than the other build alternatives (Goldstein, Suring and Preston 2004). The Cooper Creek Alternative follows much of the existing alignment. Where it would be separated from the "old" highway (see Table 3.22-9, above), the new alignment would occur mostly in an area already influenced by community development and road infrastructure in Cooper Landing and not as heavily used by wildlife as lower Juneau Creek and the Russian River confluence area.

Brown bear avoidance areas were quantified using a 3,280-foot-wide (1,000-meter-wide) (Waller and Servheen 2005) buffer zone centered on the new highway alignment segments. The estimated avoidance area adjacent to the segment of the Cooper Creek Alternative built on a new alignment is an additional 605 acres over the 5,596 acre area surrounding the existing highway, for a total of 6,201 acres (Table 3.22-9).

A USFWS study within KNWR indicated that road noise had an effect zone of more than 0.5 mile from the source, with road noise in winter audible up to 2 miles from the Sterling Highway. Noise is a contributing factor to the bear avoidance area (approximately one-third mile from a roadway), and behavior modification may extend farther. The existing highway noise effect zone (using a 0.5-mile zone along either side of the highway) extends across about 9,500 acres. The Cooper Creek Alternative would add traffic noise effects to an additional 640 acres of brown bear habitat.

General noise impacts to wildlife from the Cooper Creek Alternative are described in Section 3.15.2.3, and many of the impacts described above include noise as a contributing factor. A specific noise impact to bears as a result of the Cooper Creek Alternative would be potential avoidance of a movement corridor at Cooper Creek. Cooper Creek provides a north-south movement corridor and food resource for brown bears. Increased noise impacts over a larger area within the lower Cooper Creek drainage could reduce habitat use and result in brown bear avoidance. The nearest alternative movement corridor is the Russian River, where increased brown bear activity could result in increased competition among individual bears for resources and an increase in human-bear conflicts.

The intersections of the new highway with the "old Sterling Highway" would be lighted for the Cooper Creek Alternative, near MP 48 (Snug Harbor Road) and near MP 51 (Map 2.6-3 in Chapter 2 shows the intersections for the Cooper Creek Alternative). Intersection illumination may affect bears and their movement, and the resulting light reflecting off snow and low clouds may exacerbate this impact.

Bear management zones are addressed in the *Chugach National Forest Revised Land and Resource Management Plan*; see Section 3.2.3.2 and Section 3.2.3.3 The Cooper Creek Alternative would pass through or along the edge of Areas 1 and 16 on Map 3.22-1, as does the existing highway, and would be within the recommended 1-mile separation from Area 11 (1,800 feet), as is the existing highway. Implementing the alternative in these areas would not be consistent with the Forest Plan, but the plan would not require amendment.

Impacts to bears related to vehicle collisions would be similar to those described in Section 3.22.3.2. The Cooper Creek Alternative would include the upgrade of segments built on the existing alignment (MP 45–48 and MP 51.5–58), resulting in better visibility that could reduce bear-vehicle collisions. However, travel speeds would be greater throughout all segments of the alternative, which could offset any decreases, or possibly increase collision rates. Bear-vehicle collisions would likely be reduced on the "old" highway between MP 48 and 51 because of lower traffic volumes.

The probability of bear mortality from DLP kills likely would increase as a result of the Cooper Creek Alternative, which would bring an increase in road density (Goldstein, Suring and Preston 2004) and associated human activity (e.g., dispersed recreation).

Construction Impacts

Construction activities under the Cooper Creek Alternative (Map 2.5-7 in Chapter 2, Alternatives) would result in the temporary loss or alteration of 100 acres of vegetated habitat (Table 3.22-10). Construction would occur in one area of predicted use for brown bears (see Maps 2.5-7 and Map 3.22-1), which could displace them from that area and adjacent habitats, as well as affect their movements through the area. Other construction activities for the Cooper Creek Alternative would result in impacts similar to those discussed in Section 3.22.3.2.

Mitigation

Wildlife mitigation common to all build alternatives is described extensively above in Section 3.22.3.2.

The Cooper Creek Alternative would include four dedicated large mammal underpasses. In addition, the Schooner Bend and Cooper Landing replacement bridges each would be extended and/or raised and would include the earthwork necessary to provide adequate clearance for wildlife passage on each side of the Kenai River. The new Cooper Creek Bridge would be a long, high bridge that would provide relatively free wildlife movement beneath it. The wildlife mitigation proposal for this alternative is estimated to cost between $.7 million and $7.5 million, in addition to the wildlife study already completed. Map 3.22-5 indicates the proposed crossing locations (see also Appendix I, *Wildlife Crossings - Analysis and Recommendations*).

Cooper Creek Alternative dedicated wildlife structures would be located where adjacent property is KNWR or CNF lands, except for an underpass east of Cooper Lake Dam Road (south of existing MP 49.7). That underpass would be located adjacent to Borough lands, which could someday be developed. DOT&PF would work with the Borough during final design to investigate reservation of a green space/wildlife corridor within these lands.

3.22.3.4 G South Alternative

Direct and Indirect Impacts

The proposed footprint of the G South Alternative would eliminate 211 acres of vegetated habitat within the project area (Table 3.22-9). This represents 1.4 percent of total vegetated habitat within the project area and less than 0.01 percent of total bear habitat on the Kenai Peninsula. Some of this habitat (approximately 10 percent) is in the lower Juneau Creek drainage, cited by wildlife and land management agencies as an area especially important for bears (see Map 3.22-1).

The G South Alternative would also alter existing brown bear habitat. All 5.6 miles of new roadway would lie within approximately 6,560 feet (2,000 meters) of anadromous fish streams. This alternative also would involve five new crossings, as well as the replacement of one existing crossing, of anadromous fish streams (Table 3.22-9 and Map 3.21-1). In addition, the segment built on a new alignment would fragment habitat identified by the interagency working group as important for brown bears (Map 3.22-1). There are currently no infrastructure barriers to bear movement on the north side of the Kenai River between about MP 50 and MP 53. The 5.6-mile segment built on a new alignment is expected to restrict wildlife movement, with particular concern about brown bear movement in northwest-southeast directions through the Kenai Mountains between salmon-rich Chickaloon River tributaries such as Thurman Creek (outside the project area, inside the KNWR) and lower Juneau Creek (inside the project area, outside the KNWR). This is a new east-west impediment to brown bear movement, with the new highway roughly parallel to the existing barriers of the Sterling Highway and the Kenai River. About 3.5 miles of the 14.2 mile G South Alternative would traverse important bear use and movement areas, 0.9 mile of which creates a parallel, double roadway barrier to brown bear movement with the old highway (see Map 3.22-1, Table 3.22-9). The proposed new bridge at Juneau Creek would span the lower Juneau Creek drainage and allow bear passage up and down the stream corridor, but the highway approaches likely would alter bear movements in and out of the canyon.

The G South Alternative also likely would result in changes to brown bear behavior and use of existing habitat. The G South Alternative would result in an increase in road density and a corresponding decrease in the probability of occurrence of females with cubs during spring (Goldstein, Suring and Preston 2004). The increase in road density under the G South Alternative is predicted to be moderate (greater than the road density predicted for the Cooper Creek Alternative but less than that of the Juneau Creek and Juneau Creek Variant alternatives). Thus, the predicted impact on the probability of brown bear occurrence in the project area would be somewhere between that predicted for Cooper Creek Alternative and the Juneau Creek and Juneau Creek Variant alternatives (Goldstein, Suring and Preston 2004).

Brown bear avoidance areas were calculated using a 3,280-foot-wide (1,000-meter) buffer zone centered on the segment of the alternative built on a new alignment. The estimated avoidance area adjacent to the new G South highway segment would be an additional 1,468 acres (Table 3.22-9). The total avoidance area would become 7,064 acres, including the 5,596 acre avoidance area surrounding the existing highway. Some of this habitat is in the lower Juneau Creek drainage, cited by wildlife and land management agencies as an area especially important for bears (Areas 9 and 11; see Map 3.22-1).

The segment of G South Alternative built on a new alignment generally remains within 3,280 feet of the existing highway alignment. There are small slivers of undisturbed habitat between the highways that are outside each of the defined avoidance areas (see above). These areas, totaling 117 acres, may themselves become less attractive habitat as they are wedged between avoidance areas. Brown bear avoidance would likely extend to include this area for a more conservative total avoidance area estimate of 7,181 acres.

A USFWS study within KNWR indicated that road noise had an effect zone of more than 0.5 mile from the source, with road noise in winter audible up to 2 miles from the Sterling Highway. Noise is a contributing factor to the bear avoidance area (approximately one-third mile from a roadway), and behavior modification may extend farther. The existing highway noise effect zone

(using a 0.5 mile zone along either side of the highway) extends across about 9,500 acres. The G South Alternative would add traffic noise effects to an additional 1,600 acres of brown bear habitat.

General noise impacts to wildlife from the G South Alternative are described in Section 3.15.2.4, and many of the impacts described above include noise as a contributing factor. A specific noise impact to bears as a result of the G South Alternative would be potential avoidance of a movement corridor at Juneau Creek. Juneau Creek is both a brown bear movement corridor and a food resource for brown bears. Increased noise impacts over a larger area within this drainage could reduce habitat use and result in brown bear avoidance. The attraction of salmon in lower Juneau Creek would likely result in bears crossing the G South Alternative in this area, either under the bridge crossings of Juneau Creek and Kenai River or at-grade, where there would be risk of vehicle-animal collisions.

The intersections of the new highway with the "old Sterling Highway" would be lighted for the G South Alternative, near MP 46.7 and MP 51.5 (Map 2.6-4 in Chapter 2 shows the intersections for the G South Alternative). Intersection illumination may affect bears and their movement, and the resulting light reflecting off snow and low clouds may exacerbate this impact.

Bear management zones are addressed in the *Chugach National Forest Revised Land and Resource Management Plan*; see Section 3.2.3.2 and Section 3.2.3.4. The G South Alternative would cross Area 11 (Map 3.22-1) at lower Juneau Creek for about 2,000 linear feet. A portion of this area is Forest land, and a portion encompasses State-owned land. The G South Alternative also would pass through Area 9, which is a much smaller area focused on Juneau Creek. The highway would be high above the creek on a bridge 1,320 feet long, but pier foundations and a temporary construction access road could be located in or adjacent to Area 9. Implementing the alternative on CNF land could require amendment to the Forest Plan.

The Forest Service, in its role as a cooperating agency, has indicated that the potential impacts on bears and the impacts of interaction of bears and people in the Juneau Creek drainage are "difficult to predict but may be significant," and should be emphasized in this EIS. The Forest Service indicated further mitigation measures would be appropriate but had none to suggest. It may not be possible to fully mitigate the potential problem of the road bringing people on foot into this valley where, currently, thick vegetation, steep terrain, and the Kenai River keep human incursions very low and bear occurrence high.

The G South Alternative would pass through Areas 1, 4, and 11 and along the edge of Area 16 (the existing highway passes near Area 11 and along the southern edge of Area 16) and would not maintain the 1-mile separation distance suggested by Brown Bear Management Guideline 1.

Impacts to bears related to vehicle collisions would be similar to those described in Section 3.22.3.2. Segments of the existing road (MP 45–46.5 and MP 52–58) would be upgraded with wider shoulders and clear zones, resulting in better visibility that could reduce bear-vehicle collisions. Bear-vehicle collisions likely would be reduced on the "old" highway between MP 45 and 52 because of lower traffic volume. However, travel speeds would be greater throughout all segments of the alternative, which could offset any decreases, or possibly increase collision rates.

The probability of bear mortality from DLP kills would likely increase as a result of the G South Alternative, which would bring an increase in road density (Goldstein, Suring and Preston 2004) and associated human activity (e.g. dispersed recreation).

As stated in Section 3.8, Park and Recreation Resources, an access road and staging areas for construction of the large bridge a short distance west of Juneau Creek would create new, easier public access after the work was complete. The construction access areas would be closed, obliterated and blocked with barriers, made impassable to vehicles, and revegetated, and the highway shoulders adjacent would be signed "No Parking" in this area. However, it may be difficult to keep people from hiking in and thereby keeping the access open, potentially creating a new sport-fishing access point, which could result in increased human-bear conflicts. This could become a new management issue for ADF&G, Alaska Department of Natural Resources, and the Forest Service.

Construction Impacts

Construction activities under the G South Alternative (Map 2.5-7) would result in the temporary loss or alteration of 118 acres of vegetated habitat (Table 3.22-10). Construction would occur in three areas of predicted use for brown bears (see Maps 2.5-7 and Map 3.22-1), which could displace them from those areas and adjacent habitats, as well as affect their movements through the area. Other construction activities for the G South Alternative would result in impacts similar to those discussed in Section 3.22.3.2.

Mitigation

Wildlife mitigation common to all alternatives is described extensively above in Section 3.22.3.2.

The G South Alternative would include three dedicated large mammal underpasses. In addition, the replacement Schooner Bend Bridge would be extended and would include the earthwork necessary to provide adequate clearance for wildlife passage on each side of the Kenai River. The new Kenai River Bridge would be raised to provide clearance for wildlife passage on each side of the Kenai River. The Juneau Creek Bridge would be a long, high bridge that would provide relatively free wildlife movement beneath it. The wildlife mitigation proposal for this alternative is estimated to cost between 2.7 and $6.9 million, in addition to the wildlife study already completed. Map 3.22-5 shows the locations of the proposed wildlife crossings (see Appendix I for details).

In addition, the following mitigation measures would be specific to the G South Alternative:

- Physically remove (obliterate) the construction access route for Juneau Creek Bridge and place barriers to ensure it is not accessible by vehicles and to discourage development of a foot path.
- Restore the staging and material disposal site in the area near the Juneau Creek Bridge to include tree and shrub plantings and revegetation with native seed mix.
- Post enforceable no parking signs between the Juneau Creek Bridge and Kenai River Bridge.
- Consider fencing as an option in this area as well.

These measures are meant to retain existing conditions to the greatest extent possible, leaving the lower Juneau Creek valley principally as wildlife habitat and minimizing potential for future human-bear encounters. However, see earlier discussion in this subsection about the difficulty of mitigation in this area.

The proposed dedicated wildlife underpasses would be located adjacent to KNWR and CNF lands.

3.22.3.5 Juneau Creek and Juneau Creek Variant Alternatives

Direct and Indirect Impacts

The proposed footprints of the Juneau Creek (preferred alternative) and Juneau Creek Variant alternatives would eliminate 262 and 257 acres of vegetated habitats, respectively, within the project area (Table 3.22-9). These values represent 1.8 and 1.7 percent, respectively, of total vegetated habitat within the project area and less than 0.01 percent of total bear habitat on the Kenai Peninsula. Much of the habitat loss (approximately 25 percent) would be in areas identified by wildlife and land management agencies as important bear habitat and movement areas (Map 3.22-1).

The Juneau Creek and Juneau Creek Variant alternatives also would alter existing brown bear habitat. The 10 or 9 miles of new roadway, respectively, would be within approximately 6,562 feet (2,000 meters) of anadromous fish streams (Table 3.22-9). Both alternatives would involve one new crossing of an anadromous fish stream (Table 3.22-9 and Map 3.21-1).

There are currently no infrastructure barriers to bear movement on the north side of the Kenai River between about MP 50 and MP 53. The segment of each alternative built on a new alignment would fragment habitat identified as important for brown bears (Map 3.22-1). This includes the potential disruption of brown bear movement in northwest-southeast directions through the Kenai Mountains between salmon-rich Chickaloon River tributaries such as Thurman Creek (inside the KNWR) and Juneau Creek/Kenai River (outside the KNWR). The 10 or 9 miles of new roadway would present an additional east-west barrier to wildlife movement, roughly parallel to the impediments created by the existing highway and the Kenai River. About 4.3 miles of the 14.7-mile Juneau Creek Alternative would traverse important bear use and movement areas. About 3.9 miles of the new alignment segment would include a parallel, double roadway barrier to brown bear movement with the old highway (see Map 3.22-1, Table 3.22-9). About 4.4 miles of the 14.3 mile Juneau Creek Variant Alternative would traverse important bear use and movement areas. About 3.6 miles of the new alignment segment would include a parallel, double roadway barrier to bear movement with the old highway.

The Juneau Creek Alternative (but not Juneau Creek Variant Alternative) would impact land within KNWR specifically designated for wildlife conservation.

The Juneau Creek and Juneau Creek Variant alternatives likely would result in changes to brown bear behavior and use of existing habitat. These alternatives would result in an increase in road density and a corresponding decrease in the probability of occurrence of females with cubs during spring (Goldstein, Suring and Preston 2004). The increase in road density under the Juneau Creek Alternative is predicted to be the highest of the build alternatives evaluated. As a result, this alternative is predicted to result in the greatest decrease in probability of occurrence for females with cubs during spring (Goldstein, Suring and Preston 2004). The Juneau Creek Variant Alternative was developed later and was not analyzed, but is assumed to be similar to the Juneau Creek Alternative.

Brown bear avoidance areas were calculated using a 3,280-foot-wide (1,000-meter) buffer zone centered on the segments of these alternatives built on a new alignment. The estimated avoidance area adjacent to these segments is an additional 2,834 and 2,640 acres, respectively (Table

3.22-9). The total avoidance areas would become 8,430 acres and 8,236 acres, respectively, including the 5,596-acre avoidance area surrounding the existing highway. Much of this habitat is in the Juneau Creek drainage and other areas cited by wildlife and land management agencies as especially important for bears (Areas 8, 11 and 16; see Map 3.22-1).

A USFWS study within KNWR indicated that road noise had an effect zone of more than 0.5 mile from the source, with road noise in winter audible up to 2 miles from the Sterling Highway. Noise is a contributing factor to the bear avoidance area (approximately one-third mile from a roadway), and behavior modification may extend farther. The existing highway noise effect zone (using a 0.5-mile zone along either side of the highway) extends across about 9,500 acres. The Juneau Creek Alternative would add traffic noise effects to an additional 3,700 acres of wildlife habitat, and the Juneau Creek Variant would add traffic noise effects to an additional 3,500 acres. Within KNWR, traffic noise under the Juneau Creek Alternative would extend farther than under current conditions due to alignment of this alternative through the southeast corner of the Mystery Creek Wilderness Area (shown on maps at the end of this chapter).

General wildlife noise impacts from the Juneau Creek and Juneau Creek Variant alternatives are described in Section 3.15.2.5, and many of the impacts described above include noise as a contributing factor. A specific noise impact to bears as a result of the Juneau Creek alternatives would be potential avoidance of a movement corridor parallel to the Juneau Creek canyon. Lower Juneau Creek (below the canyon) is both a brown bear movement corridor and a food resource for brown bears, while areas upstream are a movement corridor through the mountains to habitat and potential denning sites. Increased noise impacts over a larger area within this drainage could reduce habitat use and result in brown bear avoidance. It is likely that bears would continue to seek salmon in season in lower Juneau Creek and could cross the highway beneath the Juneau Creek canyon bridge or at-grade across the highway. Crossing the highway would put bears at risk of collision with vehicles. Crossing under the bridge on or near the Resurrection Pass or Bean Creek trails could increase the risk of human-bear encounters or DLP bear mortality.

For the two Juneau Creek Alternatives, lighting would occur at the intersections of the new highway with the "old Sterling Highway": MP 46.7, to the east, and near MP 55.8 for the Juneau Creek Alternative and near MP 55 for the Juneau Creek Variant Alternative (Maps 2.6-5 and 2.6-6 in Chapter 2 show the intersections). Intersection illumination may affect bears and their movement, and the resulting light reflecting off snow and low clouds may exacerbate the impact. The MP 55 and MP 55.8 areas are inside the KNWR boundaries or at the boundary; therefore, the effects of light would spill over into KNWR wildlife habitat.

Bear management zones are addressed in the *Chugach National Forest Revised Land and Resource Management Plan*; see Section 3.2.3.2 and Section 3.2.3.5. Both alternatives would pass through Area 11 for about 1.25 miles and close to Area 8 (see Map 3.22-1). These areas were identified by the Forest Service as a brown bear management areas associated with Juneau Creek. (Note that a portion of Area 11 is not CNF land). Implementing either alternative on CNF land in Area 11 could require amendment to the Forest Plan. In addition, the Juneau Creek alternatives would pass through areas identified by the Forest Service as areas of season brown bear concentration. This includes passing through Areas 1 and 4, as the existing alignment does today. These alternatives also would pass through Areas 11 and 16. The alternative would move most traffic farther from the Kenai River in Area 16 but would impact new areas of wildlife

habitat. The Juneau Creek alternatives would not maintain the 1-mile separation distance from these areas suggested by Brown Bear Management Guideline 1.

Impacts to bears related to vehicle collisions would be similar to those described in Section 3.22.3.2. Portions of the existing road (approximately from MP 45 to 46 and MP 56 to 58) would be upgraded with wider shoulders and clear zones, resulting in better visibility that could reduce bear-vehicle collisions. Also, bear-vehicle collisions likely would be reduced on the "old" highway between MP 46 and MP 55 or 56 (depending on the alternative) because of lower traffic volume. However, average travel speeds would be greater throughout all segments of these alternatives, which could offset any decreases in, and possibly could increase, collision rates.

The probability of bear mortality from DLP kills is likely to increase under the Juneau Creek Alternative as a result of an increase in road density (Goldstein, Suring and Preston 2004) and associated human activity (e.g., dispersed recreation). The predicted increase in the probability of DLP occurrence for the Juneau Creek Alternative was more than the predicted increase for the Cooper Creek or G South alternative (Goldstein, Suring and Preston 2004). The Juneau Creek Variant Alternative was not analyzed but is assumed to be similar to the Juneau Creek Alternative.

Construction Impacts

Construction activities under the Juneau Creek or Juneau Creek Variant alternative (Map 2.5-7) would result in the loss or alteration of 123 or 112 acres of vegetated habitat, respectively (Table 3.22-13). Construction would occur in four areas of predicted use by brown bears (see Maps 2.5-7 and Map 3.22-1), which could displace them from those areas and adjacent habitats, as well as affect their movements through the area. Other construction activities for the Juneau Creek and Juneau Creek Variant alternatives would result in impacts similar to those discussed in Section 3.22.3.2.

Mitigation

Wildlife mitigation common to all alternatives is described extensively above in Section 3.22.3.2.

The Juneau Creek alternatives each would include three dedicated large mammal underpasses and one dedicated large mammal overpass. The Juneau Creek Bridge would be a long, high bridge that would provide relatively free wildlife movement beneath it. The wildlife mitigation proposal for each of these alternatives is estimated to cost between $5.6 and $9.7 million, in addition to the wildlife study already completed. Map 3.22-5 shows the locations of the proposed wildlife crossings (see Appendix I for details).

The large mammal overpass proposed along the alignments of the Juneau Creek alternatives would take advantage of topographic cuts but would require extensive earthwork to bury a tunnel for the highway to pass through and provide a slope for wildlife to pass over. This could require work outside the proposed right-of-way on CNF land.

The proposed dedicated wildlife underpasses would be located adjacent to KNWR and CNF lands. The underpass located near Bean Creek to the east would be located on the border of CNF and State of Alaska lands. State lands in this area currently are managed under the *Kenai Area Plan* for habitat and dispersed recreation, and specifically are managed as if they were part of the Kenai River Special Management Area (State Park unit); however, they have not been formally protected by legislation. Therefore, DOT&PF would work with the Alaska Department of

Natural Resources and ADF&G during final design to investigate the need for additional protection for a green space/wildlife corridor serving principally east-west wildlife movement on State lands.

In addition, for each of the Juneau Creek alternatives, DOT&PF has committed to building underpasses on little-used Forest Service roads—West Juneau Creek and Chunkwood roads. These crossings of the highway west of the Juneau Creek canyon are not meant as wildlife crossings but may serve as a supplemental means for wildlife to avoid highway traffic and still cross the Juneau Creek alternatives, in addition to the proposed dedicated wildlife crossings (see Section 4.6.3 and Appendix I for information on wildlife crossings). While these underpasses of administrative roads are not intended as wildlife mitigation, their proposed locations and context are a consideration in evaluating the effects on wildlife.

3.22.4 Environmental Consequences (Moose)

3.22.4.1 No Build Alternative

Direct and Indirect Impacts

Existing impacts to moose would be expected to continue and increase under the No Build Alternative as traffic levels, human population, and recreation levels increased. These would likely result in one or more increased impacts to moose, including:

- Avoidance or reduced use of habitats along the highway corridor
- Reduced habitat quality depending on the right-of-way clearing procedures, timing, and colonizing plant species
- Physical and traffic impediments to highway crossings
- Injury or mortality from collisions, especially along MP 48 to 50 and MP 55 to 59

3.22.4.2 Issues Applicable to the Build Alternatives

Direct and Indirect Impacts

All build alternatives would likely result in one or more impacts to moose, including:

- Habitat loss (permanent loss of vegetation)
- Habitat fragmentation
- Reduced use of habitats due to avoidance of the highway corridor
- Reduced habitat quality depending on the right-of-way clearing procedures, timing, and colonizing plant species
- Traffic impediments to highway crossings
- Injury or mortality from collisions

Moose habitat loss would include the permanent removal of general moose habitat, rutting habitat, and both rutting and winter habitat (Table 3.22-11; see also Map 3.22-2, which illustrates the habitat areas). As shown on Map 3.22-2, the entire project area is designated moose habitat. The acreage of habitat permanently lost under each alternative, presented in Table 3.22-11,

includes both the new highway alignment footprints and the widening of the reconstructed segments of the existing highway for each build alternative.

Table 3.22-11. Moose habitat lost under build alternatives (acres and percent of habitat type in project area) [a]

Habitat type lost	Cooper Creek	G South	Juneau Creek	Juneau Creek Variant
Miles of the alternative built on new alignment	3.5	5.6	10	9
General habitat[b]	39 (1%)	39 (1%)	50 (2%)	41 (1%)
Rutting habitat	101 (2%)	108 (2%)	114 (2%)	116 (2%)
Rutting and winter habitat	70 (1%)	82 (1%)	111 (2%)	116 (2%)
Total habitat	**210 (1%)**	**229 (1%)**	**275 (2%)**	**273 (2%)**

[a] Moose habitat mapping used in the above analysis was obtained from ADF&G Alaska Habitat Management Guide (1985), which is a separate dataset from vegetation mapping used for other species. The above analysis should be used only as a general overview of potential impacts on moose from project alternatives. Acreage calculations subtract a 35-foot-wide corridor to approximate area already removed from moose habitat by the existing Sterling Highway. Percentages are rounded.

[b] Suitable habitat within the known range of moose, including but not limited to known seasonal and life function use areas (e.g., winter use areas, calving or rutting areas).

In addition to the loss of habitat, new highway segments would fragment moose habitat and reduce habitat quality. Habitat alteration would occur primarily in the right-of-way areas along the highway where natural vegetation would be cleared. In addition, increases in traffic volume and speed, as is associated with all of the build alternatives, would have the potential to increase wildlife-vehicle collisions and hinder wildlife movement. Disturbance and displacement from the new highway segments and associated human activity (e.g. dispersed recreation) is expected, resulting in less habitat availability and possibly reduced population size. Hikers, skiers, and snowmobilers, sometimes with dogs, are likely to traverse new backcountry areas and to walk some trails in higher volumes, which is likely to disturb and displace moose. Also, highway noise has the potential to disturb, displace or modify wildlife behavior. USFWS, in its role as a cooperating agency for this project, has expressed concerns related to noise impacts on wildlife, and provided information that their sound studies within KNWR indicated that road noise had an effect zone of more than 0.5 mile (2,460 feet) from the source, and up to 2 miles in the winter within Wilderness areas. USFWS indicated that moose would likely be affected by increased noise levels from new highway infrastructure. All of the build alternatives would increase the amount of moose habitat affected by traffic noise at different magnitudes. When exposed to chronic noise, moose will expand their home range size in directions away from the disturbance (Anderson, Linnell and Langvatn 1996). Moose are more sensitive to noise during late winter and calving (Anderson, Linnell and Langvatn 1996, Pigeon 2001). The discussion of habitat potentially impacted can be found under Direct and Indirect Impacts discussions for Brown Bears.

Physical features of the highway, especially steep embankments or retaining walls, may function as barriers to movement for moose, resulting in less use of their current range. Table 3.22-12 summarizes the length of new road in moose habitat predicted use areas (from Map 3.22-1) and

the segments that add a parallel roadway impediment to moose transiting the area. Intersection illumination may affect moose and their movement, and the resulting light reflecting off snow and low clouds may exacerbate this impact.

Table 3.22-12. Moose habitat fragmentation by alternative

	Cooper Creek	G South	Juneau Creek	Juneau Creek Variant
Length of alternative built on new alignment (miles)	3.5	5.6	10	9
Length of alternative within Moose Habitat Predicted Use Area (miles)	3.1	3.2	5.1	5.1
Length of new alignment in Moose Habitat Area that parallels existing highway	NA	0.2	4.4	4.1

Direct mortality from moose-vehicle collisions could increase due to increased road density (where both the "old" highway and a segment built on a new alignment would occur), especially where road segments built on new alignments would bisect high-quality moose habitat and in areas known for high rates of moose-vehicle collisions (MP 48–50 and 55–59). Note that only the Juneau Creek Alternative would include a second road in the MP 55–59 area.

Increased traffic speeds, coupled with increased traffic volume (as anticipated under all alternatives, including the No Build Alternative), would increase the probability of vehicle-moose collisions (Seiler 2005) or, alternatively, could increase displacement of moose in this area. However, lower traffic volume on the "old" highway segments likely would decrease collisions in that area. All new and reconstructed highway segments would be wider, with substantially better sight distance throughout their lengths, allowing for increased visibility and maneuvering room for both drivers and wildlife. Areas along each alignment with a higher potential for vehicle-moose collisions are discussed for each build alternative in the following sections.

While new residential and commercial development is likely to occur within the project area by 2043, and while that new development would impact wildlife and wildlife habitat, it would not be the result of the build alternatives.

New highway segments would increase access to areas that are now relatively remote and could increase hunting pressure on moose and otherwise likely would create new or greater disturbances from dispersed recreational activity. ADF&G would likely monitor hunting and alter hunting regulations to maintain moose at sustainable levels.

Construction Impacts

Construction would require staging areas, disposal sites for cleared vegetation and unusable soils, and access roads. Therefore, construction activities for all build alternatives would likely result in:

- Temporary loss/alteration of habitats
- Displacement from adjacent habitats

- Changes to typical use and/or movements through the area

During and after construction, disturbed areas may have reduced habitat quantity and quality in some areas. Disturbance could also improve habitat in areas that change from dense forest to shrubs and forbs used by moose for foraging. These changes adjacent to the new and rebuilt highway segments could attract moose to the highway edge and could lead to greater risk of vehicle-moose collision. Noise from construction activities could displace and/or modify moose movement and behavior until project completion.

Information on the acreage of general, rutting, and rutting and wintering moose habitats impacted by construction activities under each of the build alternatives is presented in Map 3.22-2 and Table 3.22-13.

Table 3.22-13. Construction impacts on moose habitat under build alternatives

Habitat type	Habitat Temporarily Affected (in acres)[a]			
	Cooper Creek	G South	Juneau Creek	Juneau Creek Variant
General	9	9	10	9
Rutting	70	14	14	14
Rutting and wintering	19	93	88	88
Total	**98**	**116**	**112**	**111**

[a] Includes construction staging areas, disposal areas, and a 10-foot buffer beyond the construction footprint.

Mitigation

To address wildlife mitigation for moose, as well as bears and other mammals, DOT&PF sponsored a wildlife mitigation/movement study steered by the wildlife management agencies. This study identified appropriate mitigation measures to reduce fragmentation, displacement, impediments to movements, and collisions. Section 3.22.3.2 provides a more detailed description of the study, preliminary wildlife crossing locations, and other identified mitigation measures that are applicable to all build alternatives.

3.22.4.3 Cooper Creek Alternative

Direct and Indirect Impacts

The Cooper Creek Alternative would result in the loss of approximately 210 acres of moose habitat (Table 3.22-11). This area represents approximately 1 percent of the total moose habitat in the project area.

Vegetation types within the footprint of the 3.5-mile segment built on a new alignment for the Cooper Creek Alternative are primarily mature stands of Lutz spruce and mountain hemlock, typically considered low-quality moose habitat. However, 2 acres of deciduous shrub thickets, considered high-quality moose browse, would be affected. The new alignment would include 3.5 miles of new right-of-way habitat that could benefit moose, depending on the colonizing plant species and right-of-way clearing procedures.

The new highway segment would cross one riparian area in addition to the Cooper Creek crossing. No areas of predicted use for moose were identified by the resource agencies along the 3.5-mile Cooper Creek Alternative segment built on a new alignment; however, along those segments of the alternative built on the existing alignment, this alternative would cross four areas of predicted use for moose (Areas 1, 13, 15, and 19; see Map 3.22-1). Two of these areas have been identified by resource agencies as areas of higher potential for moose-vehicle collisions. About 3.1 miles of the 14.2 mile Cooper Creek Alternative traverses areas of predicted use for moose.

The Cooper Creek Alternative follows much of the existing highway alignment. Where it would be separated from the "old" highway (see Table 3.22-12, above), the new alignment would occur mostly in an area already influenced by community and road infrastructure development in Cooper Landing and not as heavily used by wildlife as lower Juneau Creek and the Russian River confluence area. No portion of the new alignment would include a double parallel movement barrier within an area of predicted use for moose.

The existing highway noise effect zone (using a 0.5-mile zone along either side of the highway) extends across about 9,500 acres. The Cooper Creek Alternative would add traffic noise effects to an additional 640 acres of moose habitat. Most impacts to moose described here include a component of noise pollution. General impacts from traffic noise due to the Cooper Creek Alternative are described in Section 3.15.2.3. The Cooper Creek drainage is a movement corridor for moose, as it provides forage and escape cover from predators. Increased noise pollution may cause moose to avoid this drainage, resulting in increased densities elsewhere in lower quality habitat or exposure to increased predation.

Moose-vehicle collisions and the displacement impacts related to increased road density, traffic volume, and speeds that could increase collisions are similar to those discussed for all build alternatives (see Section 3.22.4.2).

Construction Impacts

Construction activities for the Cooper Creek Alternative would result in impacts similar to those discussed for all build alternatives. These include temporary loss/alteration of habitats, displacement from adjacent habitats, and changes to typical use and/or movements through the area. In total, approximately 98 acres of general, rutting, and rutting and winter moose habitat would be temporarily impacted by construction activities (see Table 3.22-13).

Mitigation

Wildlife mitigation common to all build alternatives is described above in Section 3.22.3.2. Proposed large mammal crossings as described in Section 3.22.3.3 for brown bear would also serve moose (see Appendix I).

3.22.4.4 G South Alternative

Direct and Indirect Impacts

The G South Alternative would result in the loss of approximately 229 acres of moose habitat (Table 3.22-11). This area represents approximately 2 percent of the total moose habitat in the project area.

Vegetation types along the 5.6 miles of new roadway are varied and include mature needle-leafed forests, early successional forests, and mature broad-leafed forests. The G South Alternative would cross a large logged area east of Juneau Creek that likely provides higher-quality moose browse. The G South Alternative also would cross an area of high-quality moose habitat near Bean Creek where the Forest Service conducted a hazardous fuels reduction project on approximately 74 acres in 2005 (Forest Service 2005a).[5]

In addition to crossings of Juneau Creek and the Kenai River, the G South Alternative would cross several riparian areas and would affect approximately 3 acres of deciduous shrub thickets, which are high-quality moose browse. The 5.6-mile segment of this alternative built on a new alignment would cross one area of predicted use for moose and four additional areas of predicted use identified as general wildlife movement areas, including movement by moose (Areas 4, 6, 7, and 9; Map 3.22-1). This segment built on new alignment would be a new impediment to moose movement, with 5.6 miles of new highway roughly parallel to the existing barriers of the Sterling Highway and the Kenai River. There are currently no infrastructure barriers to moose movement on the north side of the Kenai River between about MP 50 and MP 53. The G South Alternative also would cross four areas of predicted use for moose along those segments built on the existing alignment (Areas 1, 13, 15, and 19; Map 3.22-1; same as the Cooper Creek Alternative). About 3.2 miles of the 14.2 mile G South Alternative would traverse areas of predicted use for moose, 0.2 mile of which includes a parallel, double roadway barrier to north-south moose movement with the old highway (see Map 3.22-1, Table 3.22-12).

The 5.6-mile segment built on a new alignment would include an additional 5.6 miles of new modified habitat within the right-of-way, which could benefit moose, depending on the colonizing plant species and right-of-way clearing procedures.

The existing highway noise effect zone (using a 0.5-mile zone along either side of the highway) extends across about 9,500 acres. The G South Alternative would add traffic noise effects to an additional 1,600 acres of moose habitat. Most impacts to moose described here include a component of noise pollution. General impacts from traffic noise due to the G South Alternative are described in Section 3.15.2.4. The Juneau Creek drainage is a movement corridor for moose, as it provides forage and escape cover from predators. Increased noise pollution may cause moose to avoid this drainage, resulting in increased densities elsewhere in lower quality habitat or exposure to increased predation.

Moose-vehicle collisions and the displacement impacts related to increased road density, traffic volume, and speeds that could increase collisions are similar to those discussed for all build alternatives (see Section 3.22.4.2).

Construction Impacts

Construction activities for the G South Alternative would result in impacts similar to those discussed for all build alternatives. These include the temporary loss/alteration of habitats, displacement from adjacent habitats, and changes to typical use and/or movements through the

[5] The work included removal of dead and dying trees, removing the upper portion of trees greater than 8 inches in diameter, chipping of surface debris, and scarifying the soil surface to promote hardwood regeneration. This type of work not only reduces the fire hazard, but also creates high-quality moose habitat due to the early successional vegetation that grows in after the work is completed.

area. In total, approximately 116 acres of general, rutting, and rutting and winter moose habitat would be temporarily impacted by construction activities (Table 3.22-13).

Mitigation

Wildlife mitigation common to all build alternatives is described above in Section 3.22.3.2. Proposed large mammal crossings as described in Section 3.22.3.4 for brown bear would also serve moose (see Appendix I).

3.22.4.5 Juneau Creek and Juneau Creek Variant Alternatives

Direct and Indirect Impacts

The Juneau Creek and Juneau Creek Variant alternatives would affect approximately 275 and 273 acres of moose habitat, respectively (Table 3.22-11). These areas each represent approximately 2 percent of the total moose habitat in the project area. Vegetation types along the respective 10 or 9 miles of roadway built on a new alignment are varied and include mature needle-leafed forests, early successional forests, mature mixed forests, mature broad-leafed forests, and wet meadows. The Juneau Creek and Juneau Creek Variant alternatives would cross several logged areas east and west of Juneau Creek, as well as the Forest Service Bean Creek fuel reduction project area, that likely provide higher quality moose browse. As a result, an increase in moose-vehicle collisions is likely. Because higher numbers of moose use these areas, mitigation is proposed; see Section 3.22.3.2 for a description of the wildlife mitigation/movement study that identified the conceptual mitigation options. The Forest Service also conducted a 106-acre wildlife habitat improvement project north of Juneau Falls in 2005 (Forest Service 2005b). The wildlife habitat improvement area is north of the proposed Juneau Creek and Juneau Creek Variant alternatives' alignments and would not be affected by these alternatives.

In addition to a crossing of Juneau Creek, the Juneau Creek and Juneau Creek Variant alternatives would cross several riparian areas and approximately 5 acres and 3 acres, respectively, of deciduous shrub thickets, which are sources of high-quality moose browse. Juneau Creek, at the proposed bridge crossing, is a steep rock walled canyon, and no construction activity is anticipated below the canyon rim, so impacts to moose habitat in the bottom of the canyon is not expected. Impacts to moose from crossing of the remaining riparian areas are expected to be minimal due to the small amount of habitat affected by construction of the highway.

The 9-mile or 10-mile segments of roadway built on a new alignment would add an infrastructure barrier to wildlife movement that does not exist between about MP 50 and MP 53 on the north side of the Kenai River. The new road segments would cross the following areas of predicted use: one small area specifically for moose (Area 4); two areas near Bean Creek identified as general wildlife movement areas, including movement by moose (Areas 6 and 7); a general wildlife movement area along Juneau Creek (Area 8); and one large area west of Juneau Creek identified as an important feeding area for moose (Area 13; Map 3.22-1). The Juneau Creek and Juneau Creek Variant alternatives also would cross two areas of predicted use for moose along segments built on the existing alignment (Areas 1 and 19; Map 3.22-1). In total, both Juneau Creek alternatives would traverse about 5.1 miles of moose predicted use areas, About 5.1 miles of the Juneau Creek alternatives traverse areas of predicted use for moose. Of that, 4.4 miles of the Juneau Creek Alternative and 4.1 miles of the Juneau Creek Variant would

include a parallel, double roadway barrier to north-south moose movement with the old highway (see Map 3.22-1, Table 3.22-12).

The Juneau Creek and Juneau Creek Variant alternatives would likely cause moose habitat to become fragmented along the length of new alignments. These alternatives cross several areas that provide high-quality moose browse, including two areas where habitat improvements have been made specifically for moose. Habitat fragmentation and avoidance of habitat improvement areas and other areas predicted for use by moose could add to the nutritional stress on moose during winter.

The existing highway noise effect zone (using a 0.5-mile zone along either side of the highway) extends across about 9,500 acres. The Juneau Creek Alternative would add traffic noise effects to an additional 3,700 acres of wildlife habitat, and the Juneau Creek Variant would add traffic noise effects to an additional 3,500 acres of wildlife habitat. For the Juneau Creek Alternative, a portion of this additional noise impact area would be in the southeast corner of the Mystery Creek Wilderness due to alignment of the alternative across this corner. Most impacts to moose described here include a component of noise pollution. General impacts from traffic noise due to the Juneau Creek and Juneau Creek Variant alternatives are described in Section 3.15.2.5. The Juneau Creek drainage is a movement corridor for moose, as it provides forage and escape cover from predators. Increased noise pollution may cause moose to avoid this drainage, resulting in increased densities elsewhere in potentially lower quality habitat or exposure to increased predation. These alternatives would also bisect an area of moose habitat located between MP 51 and MP 56, north of the current alignment. Increased noise could result in avoidance of these areas. The Juneau Creek and Juneau Creek Variant alternatives would result in lower traffic noise impacts to moose habitat along the Kenai River, approximately between MP 48 and MP 54. While this area would continue to experience traffic noise from the existing highway alignment, the traffic volume and predicted noise would be less.

Moose-vehicle collisions and displacement impacts related to increased road density, traffic volume, and speeds that could increase collisions are similar to those discussed for all build alternatives (see Section 3.22.4.2). Note that only the Juneau Creek alternatives would include a second parallel road in the MP 55–59 area known for higher rates of moose-vehicle collisions.

Construction Impacts

Construction activities for the Juneau Creek and Juneau Creek Variant alternatives would result in impacts similar to those discussed for all build alternatives. These include the temporary loss/alteration of habitats, displacement from adjacent habitats, and changes to typical use and/or movements through the area. In total, approximately 112 and 111 acres, respectively, of general, rutting, and rutting and winter moose habitat would be impacted by construction activities for the Juneau Creek and Juneau Creek Variant alternatives (Table 3.22-13).

Mitigation

Wildlife mitigation common to all build alternatives is described above in Section 3.22.3.2. Proposed large mammal crossings as described in Section 3.22.3.5 for brown bear would also serve moose (see Appendix I).

3.22.5 Environmental Consequences (Other Mammals)

During consultations for this project, wolves, lynx, wolverines, river otters, black bears, Dall sheep, and mountain goats were identified by a 2004 interagency working group as management/indicator mammal species in the project area (HDR 2004a). This section discusses impacts on these mammals.

Section 3.22.1.1 discusses known population and general habitat information for wolves, lynx, river otters, black bears, Dall sheep, and mountain goats in the project area. Detailed information on how these mammals use the project area is not available. However, the types of impacts are assumed to be similar to those described above for moose and brown bears. See Sections 3.22.3 (brown bears) and 3.22.4 (moose) for discussion applicable to general impacts on other mammals.

3.22.5.1 No Build Alternative

Direct and Indirect Impacts

Few new impacts on wolves, lynx, wolverines, river otters, black bears, Dall sheep, and mountain goats would be anticipated for the No Build Alternative. Impediments to movements, continued highway traffic noise effects, and some animal-vehicle collisions would be expected to increase as future traffic volumes rise. Increased traffic and human use could reduce prey species (for wolves, lynx, and wolverines), and increase DLP kills of black bears. Increased displacement from habitats adjacent to the highway could occur for some species.

3.22.5.2 Issues Applicable to the Build Alternatives

All build alternatives would result in direct impacts to wolves, lynx, wolverines, river otters, and black bears, including permanent loss of habitat from the proposed footprint, habitat fragmentation, and displacement of animals from habitat adjacent to the new highway segments (especially for wolves, lynx, and wolverines). These impacts could result in lower population sizes, impediments to movements across the new highway, and direct mortality resulting from vehicle collisions (especially of wolves, lynx, and black bears). For the larger species, the Kenai River and the existing highway represent a semi-permeable barrier to wildlife movement. Larger mammals move across the barrier, but their movement is changed by the feature. For smaller mammals, road infrastructure represents a reflective boundary. The segments of each alternative built on a new alignment would add another semi-permeable parallel barrier. This may cause different and greater impacts to wildlife movement and mortality.

River otters could be affected by project-related changes to rivers and streams, especially near Bean Creek (Map 3.22-1). A minor but permanent loss of habitat would occur with the placement of fill, piers, and culverts for water body crossings (the construction or replacement of bridges or culverts). In addition, vegetation clearing and the placement of fill for the roadway could affect river otter movements as they travel on land between water bodies (ADF&G 2008h). Installation of culverts may help connect fragmented river otter habitat.

Direct impacts on black bears would be similar to impacts reported for brown bears (3.22.3.2). This includes habitat loss, habitat fragmentation, behavioral changes due to human activity, and injury or mortality from traffic collisions. However, areas of predicted use for the two bear species differ. Three black bear areas were identified within the project area: the avalanche chutes near Kenai Lake (Area 2), which are frequented by black bears during the spring and fall;

an area near Cooper Creek (Area 10); and the area west of Juneau Creek (Map 3.22-1). All build alternatives would involve either a widened roadway (Cooper Creek Alternative) or a new alignment (G South, Juneau Creek, and Juneau Creek Variant alternatives) along the avalanche chutes above Kenai Lake. As a result, all build alternatives have the potential to displace black bears.

Increased road density and associated dispersed recreational use of lands near the new roads, traffic volumes expected under all alternatives (including the No Build Alternative), and vehicle speeds could increase wildlife-vehicle collisions (especially for black bears), or alternatively, increase displacement and create movement barriers, decreasing collisions. Increased traffic and associated human use near the new alignments could also increase DLP kills of black bears.

Increased traffic and human use could reduce prey species (for wolves, lynx, and wolverines), and increase poaching of black bears. Black bears tend to avoid brown bears, so any changes in habitat use and population size of brown bears may affect habitat use by, and population size of, black bears. In particular, black bears may be affected by increased noise, especially instantaneous high-intensity noises, during den site selection or hibernation. Traffic noise may increase disturbance impacts to mammals by compounding the effects described here or in Section 3.15.1.5, Wildlife and Noise. General impacts to mammals and other wildlife from noise are described in Section 3.15.2 for each alternative.

Because Dall sheep and mountain goats generally inhabit the higher elevation areas away from the proposed build alternatives, direct and indirect impacts on them would likely be minimal. There are no records of vehicle collisions with sheep or goats in the project area from 1999 to 2009 (Morton, personal communication 2011a, 2011b, 2011c); however, sheep and goats are found in the mountains north and south of the project area (see Map 3.22-3 for Dall sheep habitat). Therefore, vehicle collisions with sheep or mountain goats that might occasionally travel between northern and southern habitats are possible but anticipated to be infrequent.

None of the build alternatives are likely to change mortality due to hunting and trapping. New highway segments could increase access to areas that are now relatively remote through the creation of new official trailheads and unofficial access points (temporary access roads, etc.). These sites may increase hunting and trapping pressure on these “other” mammals. ADF&G monitors hunting and trapping and alters regulations to maintain mammal populations at sustainable levels.

Construction Impacts

Construction would require staging areas, disposal sites for cleared vegetation and unusable soils, and access roads. Construction and use of these temporary facilities for each of the build alternatives would result in impacts to wolves, lynx, wolverines, river otters, black bears, and Dall sheep such as:

- Temporary loss/alteration of habitats
- Displacement from adjacent habitats
- Changes to typical mammal use and/or movements through the area

During and after construction, disturbed areas would likely have reduced habitat quantity and quality by reducing habitat for prey species, foraging, and cover. Snowshoe hares, a major prey species for lynx, could benefit in areas where dense forest is replaced by shrubs. Construction of

bridges and installation of culverts could displace river otters during construction. Noise from construction activities could displace and/or modify movements and behavior of wildlife until project completion. Construction activities in mountainous areas (such as for the Juneau Creek and Juneau Creek Variant alternatives) could temporarily alter Dall sheep movements between mountainous areas (Map 3.22-3).

Mitigation

Wildlife mitigation, including preliminary wildlife crossing locations to reduce fragmentation, displacement, impediments to movements, and collisions, is common to all build alternatives and is described above in Section 3.22.3.2. Mitigation measures would be selected primarily to benefit brown bears and moose, but would also benefit other mammal species.

3.22.5.3 Cooper Creek Alternative

Direct and Indirect Impacts

Impacts to wolves, lynx, Dall sheep, mountain goats, and river otters would likely be minimal. Wolves and lynx generally favor use of areas north of the existing highway and likely avoid homes and roads found along the alignment for the Cooper Creek Alternative, which is located mainly south of the existing highway. The Cooper Creek Alternative is not expected to adversely affect river otters because the alternative would cross a limited amount of riparian areas potentially used by river otters.

Two areas of predicted use for black bears within the project area would be crossed under this alternative (Map 3.22-1, Areas 2 and 10). Therefore, the Cooper Creek Alternative could fragment black bear habitat, alter their movements, displace them from current habitats, and/or increase the number of collisions, possibly reducing their population size. Other impacts on black bears resulting from increased traffic, human use, and changes in brown bear habitat use and population size would be similar to those described for all build alternatives in Section 3.22.5.2.

The Cooper Creek Alternative mostly follows the existing highway alignment. Where it would be separated from the "old" highway (see Table 3.22-9, above), the new alignment would occur mostly in an area already influenced by development in Cooper Landing and not as heavily used by wildlife as lower Juneau Creek and the Russian River confluence area.

The Cooper Creek Alternative would be located outside mapped ranges for Dall sheep (Map 3.22-3). The potential for vehicle collision impacts on Dall sheep and mountain goats would be expected to be minimal, as described for all build alternatives (see Section 3.22.5.2).

Construction Impacts

Construction impacts to wolves, lynx, wolverines, black bears, Dall sheep, and mountain goats would be expected to be similar to those described for all build alternatives. Construction impacts to river otters would be less for the Cooper Creek Alternative than other build alternatives because it would cross a small and limited amount of riparian areas potentially used by river otters.

Mitigation

Wildlife mitigation common to all build alternatives is described above in Section 3.22.3.2.

3.22.5.4 G South Alternative

Direct and Indirect Impacts

The G South Alternative would be situated north of the existing highway and would cross primarily undisturbed areas. The loss of undisturbed habitat could affect more secretive species such as wolves, lynx, and wolverines, which prefer undisturbed habitats north of the existing highway (Bailey, personal communication 2001), by displacing them from foraging, denning, and resting areas. The G South Alternative would be located near or within the three river otter areas of predicted use (Map 3.22-1, Areas 5, 6, and 7) and would likely result in loss of habitat, habitat fragmentation, and displacement of river otters. Lower Juneau Creek is recognized as an "animal movement corridor" (Map 3.22-1, Area 9), so the new highway segment, even with a bridge over Juneau Creek, could change or disrupt wildlife movements, especially during daylight and/or high-traffic situations.

One area of predicted use for black bears within the project area would be crossed under this alternative (Map 3.22-1, Area 2). Other impacts on black bears resulting from increased traffic, human use, and changes in brown bear habitat use and population size would be similar to those described for all build alternatives in Section 3.22.5.2.

For the G South alternative, the segment built on a new alignment would lie north of the Kenai River. A portion of this area, particularly between about MP 50 and MP 51.5, is a region that currently has no linear infrastructure barrier to wildlife movement.

The G South Alternative would be located outside mapped ranges for Dall sheep (Map 3.22-3). The potential for vehicle collision impacts on Dall sheep and mountain goats would be expected to be minimal, as described for all build alternatives (Section 3.22.5.2).

Construction Impacts

Construction impacts on wolves, lynx, wolverines, river otter, black bears, Dall sheep, and mountain goats would be expected to be similar to those described for all build alternatives.

Mitigation

Wildlife mitigation common to all build alternatives is described above in Section 3.22.3.2.

3.22.5.5 Juneau Creek and Juneau Creek Variant Alternatives

Direct and Indirect Impacts

The Juneau Creek and Juneau Creek Variant alternatives would involve the construction of 10 and 9 miles, respectively, of new roadway north of the existing highway. Wolves, lynx, and wolverines prefer habitat north of the existing highway; therefore, habitat lost and fragmented under these alternatives could impact these mammals. A reduction in foraging, denning, and resting areas would be expected for wolves, lynx, and wolverines.

The Juneau Creek and Juneau Creek Variant alternatives would cross several riparian areas, resulting in habitat loss, fragmentation, and displacement of river otters (Map 3.22-1, Areas 5, 6, and 7).

Two areas of predicted use for black bear would be crossed with these alternatives (Map 3.22-1, Areas 2 and 16) and could impede black bear movements, increase displacement and habitat fragmentation, and increase collisions. Other impacts on black bears resulting from increased

traffic, human use, and changes in brown bear habitat use and population size would be similar to those described for all build alternatives in Section 3.22.5.2.

For the two Juneau Creek alternatives, the segment built on a new alignment would lie north of the Kenai River over a long distance. A portion of this area, particularly between about MP 50 and MP 53, is a region that currently has no linear infrastructure barrier to wildlife movement. In areas between MP 53 and about MP 55/56, the segment built on a new alignment would add a new second barrier north of the Kenai River.

The Juneau Creek and Juneau Creek Variant alternatives would be located outside mapped ranges for Dall sheep (Map 3.22-3). However, Dall sheep have been observed moving across the Juneau Creek Valley from Slaughter Mountain to Round Mountain (Spraker, personal communication 2001) and are documented as using the lower portions of the cliff bands close to the proposed routes. It is thought that sheep could be attracted to grasses within the right-of-way during early summer. In addition, noise and human activity associated with these northernmost alternatives have the potential to impact important sheep winter range and/ or lambing areas. It is possible that the increased highway noise and human activity in the Juneau Creek canyon area would interrupt some sheep and goat movement east-west between mountains, but it is likely that the animals would continue to travel between mountains on occasion, as they apparently do now through the Cooper Landing area and across the existing highway. The potential for vehicle collision impacts on Dall sheep and mountain goats would be expected to remain low, as described for all build alternatives (Section 3.22.5.2).

Construction Impacts

Construction impacts on wolves, lynx, wolverines, river otters, black bears, and mountain goats would be expected to be similar to those described for all build alternatives. Construction activities for the Juneau Creek and Juneau Creek Variant alternatives could temporarily alter Dall sheep movements between mountainous areas (Map 3.22-3). However, should the Juneau Creek or Juneau Creek Variant alternatives be constructed, concentrated human activities (such as construction camps) are not anticipated to be located in areas that would affect important wintering and lambing habitat for the Dall sheep.

Mitigation

Wildlife mitigation common to all build alternatives is described above in Section 3.22.3.2.

3.22.6 Environmental Consequences (Birds)

3.22.6.1 No Build Alternative

Direct and Indirect Impacts

Few new impacts on birds would be anticipated for the No Build Alternative. Disturbance and displacement from habitats adjacent to the highway and some bird-vehicle collisions could increase as future traffic volumes rise.

A 2014 survey of bald eagle nests in the project area identified four inactive nests located less than 330 feet from the existing highway and an additional four inactive nests located between 330 feet and 660 feet from the existing highway (see Table 3.22-15 and Map 3.22-4). As discussed in Section 3.22.1.2, USFWS recommends 330-foot primary and 660-foot secondary buffer zones between bald eagle nests and disturbance activities such as motorized traffic and

standard road construction (USFWS 2007). While the eight nests identified are already located within the recommended buffer zones, bald eagles nesting in the project area are likely tolerant of the ongoing existing noise and disturbance from highway traffic because they consistently nest in this area. Future increases in traffic volume on the existing highway could increase bald eagle disturbance, but are unlikely to have substantial impact on bald eagle nesting in the project area.

3.22.6.2 Issues Applicable to the Build Alternatives

The following discussion of environmental consequences focuses on species identified as species of concern by USFWS and ADF&G. Within that discussion, special attention is given to potential impacts to bald eagles due to protections under the Bald and Golden Eagle Protection Act and the potential for impacts to nesting eagles. Impacts to general bird habitat and other bird species are also discussed.

Direct and Indirect Impacts

Direct impacts on birds would include a permanent loss of habitat, disturbance from human activity along the roadway, disturbance from recreational use originating at the highway but dispersed in the backcountry, and direct mortality from collisions with vehicles. All build alternatives would result in a permanent loss of bird habitat. Vegetation clearing and fill placement would result in a loss of bird habitat used for some or all of the following activities: foraging, resting, breeding, perching, and nesting. Vegetation clearing and fill placement could result in decreased reproduction rates, behavior modification, increased mortality, and displacement to other habitat. Habitat quality adjacent to the roadway may be reduced because of increased disturbance from human activity. Disturbance from traffic volume and noise can create avoidance zones that extend as far as 3,280 feet (1,000 meters) or more from the road itself for certain bird species (Reijnen and Foppen 2006) and result in impacts as discussed in Section 3.15.2. The introduction of illumination of the intersections of the new and old highway may decrease adjacent habitat use and modify behaviors. Depending on the species, birds may be attracted to artificial lighting, or they may avoid artificially lit areas. In addition, artificial lighting could cause disorientation during certain times of the year. Table 3.22-14 presents direct impacts on bird habitat for all project alternatives.

Table 3.22-14. Area of bird habitat eliminated (in acres)

Habitat type	Dominant bird group(s)	Build alternative			
		Cooper Creek	G South	Juneau Creek	Juneau Creek Variant
Needle-leafed forests	Raptors, landbirds	88	70	119	121
Broad-leafed forests	Raptors, landbirds	12	26	25	17
Mixed needle-leafed and broad-leafed forests	Raptors, landbirds, upland game birds	80	106	105	107
Shrub thickets	Landbirds, upland game birds	4	3	2	1
Moist meadows	Landbirds, waterbirds	5	4	4	4

Habitat type	Dominant bird group(s)	Build alternative			
		Cooper Creek	G South	Juneau Creek	Juneau Creek Variant
Wet meadows	Landbirds, waterbirds	1	1	7	7
Total		**190**	**211**	**262**	**257**

Species of Concern. Habitat loss and disturbance could affect a number of USFWS BCC, KNWR "species of special interest," and ADF&G "species of greatest conservation need," as listed in Table 3.22-1.

Waterbird species of concern that may potentially be affected by the build alternatives include the red-necked and horned grebe, arctic tern, common loon, and trumpeter swan. Shorebird species of concern that may potentially be affected include the lesser yellowlegs, solitary sandpiper, and Wilson's snipe. Direct impacts on waterbirds would include loss of habitat from the placement of piers for bridges, disturbance/displacement of birds from construction activities, disturbance from vehicular traffic, and direct mortality from collisions with vehicles or structures. Highway construction would affect some portion of the banks of the Kenai River and its tributaries, resulting in a small loss of breeding and nesting areas for waterbirds.

Raptor and owl species of conservation concern (USFWS BCC, KNWR "species of special interest," and ADF&G "species of the greatest conservation need") that may be affected by project alternatives include the osprey, bald eagle, golden eagle, sharp-shinned hawk, northern goshawk, merlin, and six species of owls (Table 3.22-8). As part of public comment on the Draft Supplemental EIS, a local resident noted that night calls of great horned, boreal, and saw whet owls during spring are no longer heard since logging operations occurred in the Juneau Bench area. It is likely that the loss of larger, older trees may have displaced some nesting birds. Additional vegetation clearing for the project alternatives may displace additional birds. However, nesting habitat for these owl species is relatively common throughout the project area, so the impacts are anticipated to be negligible. The golden eagle may occasionally pass through the project area; however, they are not expected to be impacted by any of the project build alternatives because they nest in cliffs.

Direct and indirect impacts specific to bald eagles are similar to those discussed for other bird species, including the permanent loss of habitat, direct mortality from collisions with vehicles, and disturbance and displacement as a result of human activity and highway noise. For all build alternatives, direct impacts from the loss of habitat would include the potential reduction in food sources (including decrease in available hunting areas and reduced availability of prey base), cover, breeding habitat, and perching sites. The removal of riparian habitat used by bald eagles for breeding and foraging could reduce roosting and foraging habitat in the area. Bald eagle mortality could increase if birds are struck by vehicles while foraging for vehicle-killed carrion on or along the roadway. Although there are anticipated to be impacts to bald eagles within the project area as a result of all build alternatives, the impacts should not be substantial given the abundance of available habitat for bald eagles in the Kenai Peninsula.

Bald eagles that are subjected to disturbance during the breeding season may seek new, more remote nest sites (Fraser and Anthony 2008). As discussed in Section 3.22.1.2, USFWS recommends 330-foot primary and 660-foot secondary buffer zones between bald eagle nests and

disturbance activities such as motorized traffic and standard road construction (USFWS 2007). A 2014 aerial survey identified 8 nests already within the 660-foot buffer zone of the existing highway (4 nests within the 330-foot primary zone and 4 nests within the 330- to 660-foot secondary zone). The locations of the 8 nests within the USFWS-defined buffer zones of the area of high traffic and activity along the existing highway and the Kenai River are shown in Table 3.22-15. All 26 nests identified in the larger project area are shown on Map 3.22-4.

The build alternatives generally increase the distance of the new highway and the majority of area traffic from the Kenai River and where most of the bald eagle nests are located. The existing highway segments would exist in the same location relative to eagle nests (Table 3.22-15) but, where not rebuilt, would be expected to carry only 30 percent of traffic in the project area, reducing the intensity of traffic-related disturbance to nests in those areas.

Table 3.22-15. Distances (in feet) from documented bald eagle nests in USFWS-defined buffer zones

Nest	Nest Status[a]	Existing Conditions/ No Build[b]	Build Alternative			
			Cooper Creek[c]	G South[c]	Juneau Creek[c]	Juneau Creek Variant[c]
9	Active	>660	>660	>660	>660	649
10	Inactive	402	387	387	>660	>660
11	Inactive	>660	>660	>660	>660	0
12	Inactive	306	232	232	>660	>660
14	Inactive	50	119	119	>660	>660
15	Inactive	433	495	495	>660	>660
16	Inactive	59	106	106	>660	>660
17	Active	309	433	>660	>660	>660
18	Active	651	>660	>660	>660	>660
23	Inactive	525	>660	>660	>660	>660
25	Inactive	>660	451	>660	>660	>660

[a] Nests status can change from year to year; therefore, this information should only be considered accurate for the survey year (2014). However, the number of active and inactive nests is unlikely to change significantly.

[b] The distance was calculated from the bald eagle nest to the nearest edge of the pavement of the existing highway.

[c] The distances were calculated from the bald eagle nest to the cut and fill line of each build alternative. Nests present within the alternative footprint would be identified as "0."

Source: Nest location data based on HDR (2014c) and HDR (2015).

There are three nests identified in the project area that are within the USFWS buffer zones of a build alternative but not the existing highway. One nest is within the 330-foot primary buffer zone and two nests are within the 660-foot secondary buffer zone. These are discussed below as impacts of specific alternatives. See also the Construction Impacts section below for discussion of construction noise and activity on eagle nests.

Other Species and Habitat Issues. Passerines (perching birds) potentially affected by the build alternatives include a variety of woodpeckers, thrushes, warblers, sparrows and other passerine species of concern that may occur in the project area (see Table 3.22-7). The majority of these species nest in mixed deciduous/coniferous forests, willow thickets, and forest edges that are typical of the project area and could be affected by vegetation clearing for construction of road alignments. See Table 3.22-14 for a comparison of bird habitat types that would be lost under

each alternative. Acreages were calculated by overlapping construction cut and fill areas with the project vegetation layer.

Linear developments fragment landbird habitat, which increases the amount of edge habitat. Edge habitat can increase landbird nest predation by concentrating predator forage activity, such as gray jays and ravens, along the newly created edge habitats. Habitat fragmentation and increased edge habitat would lead to a reduction in core habitat size, which could ultimately result in decreased reproductive potential in the project area.

Construction Impacts

Construction activities would disturb or displace birds in and immediately adjacent to the construction footprint. During construction, noise, dust and equipment exhaust in the air, and water quality impacts would temporarily displace birds from foraging, resting, and nesting habitat for several summer seasons in a row. Disturbance-related displacement from favored breeding habitats could result in birds consuming extra energy searching for, and competing with other birds to find, suitable replacement habitats. This could result in nesting in less-favored areas where nests may be damaged or accessed more easily by predators, which could limit survival of offspring or adults. To ensure no impacts to birds already nesting, removal of trees will be conducted during the late summer and winter months to avoid nesting times.

Once construction is complete, the disturbance area (10 feet) immediately adjacent to the cut and fill limits, would be revegetated with native species and would be expected to gradually resume natural vegetation character.

Waterbirds are sensitive to noise disturbance from construction activities during the summer months when they are nesting, brood rearing, molting, and/or congregating in staging areas prior to migration. Some individuals could experience lowered productivity resulting from nest and/or brood abandonment, and erratic sleeping and/or feeding patterns resulting from disturbance.

Bald eagles are sensitive to visual and auditory disturbances, especially during the early part of the nesting cycle (e.g., during nest building, incubation, and the first 5 weeks of nestling life). The presence of humans or construction noise near bald eagle nests has been found to cause changes in almost all aspects of eagle breeding behavior. Responses to disturbances include frequent flushing from the nest, not leaving the nest to feed, expending energy on defending the nest rather than maintaining the nest, and abandoning the nest (Steidl and Anthony 2000). Changes in eagle behavior are influenced by several factors, such as timing of disturbance in the breeding cycle, type of disturbance, disturbance proximity and intensity, degree of previous exposure, and environmental conditions. Studies have shown that the distance at which a disturbance first becomes visible to an eagle greatly influences its response (Steidl and Anthony 1996).

The noise and motion of construction activities could result in reproductive failure (Wright and Schempf 2008), displace bald eagles nesting within the project area to less suitable habitat, or result in birds leaving nests unattended, risking eggs during incubation. The National Bald Eagle Management Guidelines (USFWS 2007) recommend maintaining a buffer of at least 660 feet between construction activities and an active nest if the activity will be visible from the nest site. The buffer is intended to restrict all vegetation clearing, external construction, and landscaping activities within 660 feet of the nest to outside the bald eagle nesting season. If the nest is not visible from the construction activity, a buffer of 330 feet should be maintained.

The USFWS also recommends an increased buffer zone of 0.5 mile (2,640 feet) between eagle nests and blasting or other loud intermittent noises such as pile driving (USFWS 2007). All build alternatives are found within the 0.5-mile blasting buffer zone for multiple bald eagle nests, with the Cooper Creek and G South alternatives overlapping with the greatest number of nest buffer zone areas (21 and 20 nests, respectively) and the Juneau Creek and Juneau Creek Variant alternatives overlapping the fewest (10 nests). Whether or not impacts from blasting or other loud intermittent noises occur depends on the specific locations and timing of blasting activities. Proposed avoidance, minimization, and mitigation efforts for potential impacts within the recommended primary, secondary, and blasting buffer zones are discussed below.

Mitigation

To meet requirements of the MBTA, clearing of vegetation on lands for project-related development would occur before or after the nesting season (from May 1 to July 15 in Southcentral Alaska).

As stated under Section 3.22.3.2, project lighting at the intersections of the alternative and the "old" highway would incorporate shielded and directional lighting fixtures to direct most light downward. During final design, DOT&PF would consult with the wildlife agencies regarding the potential use of long-wavelength tinted lights, to meet both wildlife mitigation needs and standards for highway safety at intersections outside the community of Cooper Landing.

During the final design and permitting phase of the project, DOT&PF would consult with USFWS to develop measures to avoid, minimize, and mitigate impacts to bald eagle nests to ensure compliance with the Bald and Golden Eagle Protection Act. As part of consultation, the USFWS will determine the need for DOT&PF to obtain an eagle disturbance permit. The permit application, if required, would be submitted prior to the start of construction for disturbance to nests within 660 feet of the cut and fill limits of the selected build alternative that cannot otherwise be avoided, minimized, or mitigated.

The following conservation measures, some of which are based on the National Bald Eagle Management Guidelines (USFWS 2007), are currently proposed to avoid, minimize, and mitigate impacts to bald eagles. These are general measures that will be modified to specifically address details of the chosen build alternative through further coordination with USFWS during design and permitting:

- Prior to construction, a survey would be conducted to reassess the activity of the nests in the project area and to determine whether new nests have been constructed.
- Construction activities adjacent to any known nests would occur, to the greatest extent practicable, only during Mid-September through February, when eagles would not be nesting.
- If determined necessary, DOT&PF and USFWS would assess the risk for tree blow-down with known nest trees and adjacent trees.
- DOT&PF would work with USFWS to develop a detailed nest monitoring plan to mitigate disturbance from construction activities in the primary and secondary buffer zones. Depending on the magnitude of the anticipated disturbance, this may include providing post-construction monitoring to determine whether the nest sites, communal

roosts, or important foraging areas continue to be used by eagles for up to 3 years following completion of the permitted activity (USFWS 2009).

3.22.6.3 Cooper Creek Alternative

Direct and Indirect Impacts

The Cooper Creek Alternative would result in the permanent loss of 190 acres of bird habitat, the lowest amount of acreage affected of the build alternatives (see Table 3.22-14). Other impacts would include disturbance from human activity along the roadway and on nearby public lands and direct mortality from collisions with vehicles. Impacts to birds are similar to those described for all build alternatives (see Section 3.22.6.2).

The Cooper Creek Alternative alignment is within 660 feet of seven documented bald eagle nests. The new highway segment of the Cooper Creek Alternative passes within 660 feet of one nest, and improvements to the existing Sterling Highway would occur within the primary buffer zone (330 feet) of three nests and within the secondary buffer zone (660 feet) of another three nests (Table 3.22-15). It is anticipated that bald eagles nesting in this area are likely habituated to the routine noise and movement from traffic on the existing highway because they consistently nest in this area. However, the improvements to the existing highway would also remove some riparian habitat, which could degrade bald eagle nesting and roosting habitat in this area.

Construction Impacts

Impacts related to construction of the Cooper Creek Alternative would be anticipated to be similar to those described for all build alternatives (see Section 3.22.6.2).

Construction activities would occur within 660 feet of seven documented bald eagle nests. There are 21 nests within 0.5 mile of the alignment that may be impacted by blasting or pile-driving activities from road and bridge construction activities. DOT&PF would work with USFWS to determine a mitigation/monitoring plan to avoid and minimize impacts on these bald eagle nests.

Mitigation

Mitigation measures to address potential impacts to birds under the Cooper Creek Alternative would be the same as those described for all build alternatives (see Section 3.22.6.2). This would include consultation with USFWS to develop measures to avoid, minimize, and mitigate impacts to all bald eagle nests within 660 feet of the cut and fill limits of the Cooper Creek Alternative.

3.22.6.4 G South Alternative

Direct and Indirect Impacts

The G South Alternative would result in the permanent loss of 211 acres of bird habitat (see Table 3.22-14). Other impacts would include disturbance from human activity along the roadway and on nearby public lands and direct mortality from collisions with vehicles. Impacts to birds are similar to those described for all build alternatives (see Section 3.22.6.2).

The G South Alternative alignment is within 660 feet of five documented bald eagle nests. Along the 5.6 miles of new roadway segments for the G South Alternative, there are no known bald eagle nests (HDR 2014c). Improvements to sections of the existing highway would also occur within the primary buffer zone (330 feet) of two documented bald eagle nests and within the secondary buffer zone (660 feet) of three nests within the project area (Table 3.22-15). Bald

eagles nesting in this area are likely habituated to the noise and movement from traffic on the existing highway because they consistently nest in this area. The improvements to the existing highway would also remove some riparian habitat that could affect bald eagle nesting, roosting, and foraging areas in the project area.

Construction Impacts

Bird impacts related to construction of the G South Alternative would be anticipated to be similar to those described for all build alternatives (see Section 3.22.6.2).

Construction activities along the road alignment would occur within 660 feet of five documented bald eagle nests, and a large disposal site near MP 50 (see Map 2.5-7) would be located approximately 440 feet north of an additional documented bald eagle nest (Nest 21 on Map 3.22-4).

There are 19 nests within 0.5 mile of the alignment that may be impacted by blasting or pile-driving activities from road and bridge construction activities. DOT&PF would work with USFWS to determine a mitigation/monitoring plan to avoid and minimize impacts on these bald eagle nests.

Mitigation

Mitigation measures to address potential impacts to birds under the G South Alternative would be the same as those described for all build alternatives (see Section 3.22.6.2). This would include consultation with USFWS to develop measures to avoid, minimize, and mitigate impacts to all bald eagle nests within 660 feet of the cut and fill limits and construction areas of the G South Alternative.

3.22.6.5 Juneau Creek and Juneau Creek Variant Alternatives

Direct and Indirect Impacts

The Juneau Creek and Juneau Creek Variant alternatives would result in the permanent loss of 262 and 257 acres, respectively, of bird habitat (see Table 3.22-14). Other impacts would include disturbance from human activity along the roadway and on nearby public lands and direct mortality from collisions with vehicles. Impacts to birds are similar to those described for all build alternatives (see Section 3.22.6.2).

There are no documented bald eagle nests located within 660 feet of the entire length of the Juneau Creek Alternative. There is one bald eagle nest located within the footprint of the Juneau Creek Variant after it splits from the Juneau Creek Alternative (see Map 3.22-4). Should the Juneau Creek Variant be selected as the preferred alternative, further evaluation would be conducted. A permit would be required to remove this nest if needed.

The improvements to the existing highway would also remove some riparian habitat that could affect bald eagle nesting, roosting, and foraging areas in the general project area.

Construction Impacts

Bird impacts related to construction of the Juneau Creek and Juneau Creek Variant alternatives would be anticipated to be similar to those described for all build alternatives (see Section 3.22.6.2).

A large soils disposal site near MP 50 (see Map 2.5-7) would be located approximately 440 feet north of an additional documented bald eagle nest (Nest 21 on Map 3.22-4) for both the Juneau Creek and Juneau Creek Variant alternatives.

There are ten nests within 0.5 mile of the alignment that may be impacted by blasting or pile-driving activities from road and bridge construction activities. DOT&PF would work with USFWS to determine a mitigation/monitoring plan to avoid and minimize impacts on these bald eagle nests.

Mitigation

Mitigation measures to address potential impacts to birds under the Juneau Creek and Juneau Creek Variant alternatives would be the same as those described for all build alternatives (see Section 3.22.6.2). This would include consultation with USFWS regarding avoidance and minimization measures to avoid impacts to the bald eagle nest identified along the Juneau Creek Variant Alternative.

3.22.7 Environmental Consequences (Wood Frog)

3.22.7.1 No Build Alternative

Direct and Indirect Impacts

Increased traffic may increase vehicle-caused mortality to wood frogs, but no other direct impacts on aquatic species within the project area are expected for the No Build Alternative. However, due to the proximity of the existing Sterling Highway to wetlands, waterways, and water bodies, and due to its narrow alignment with many sharp curves, there may be an increased likelihood of pollutants entering aquatic habitats due to vehicle crashes. These pollutants could cause detrimental effects on the health, longevity, and reproduction of aquatic species (Reeves, et al. 2008).

3.22.7.2 Issues Applicable to the Build Alternatives

Direct and Indirect Impacts

Widening segments of the existing Sterling Highway and building the new segment of each alternative would eliminate some wetlands and wood frog habitat, as well as fragment remaining habitat, as small species such as wood frogs are not likely to cross the highway. Increased road density and increased traffic would likely increase direct mortality to wood frogs as they moved among aquatic habitats and forests (HDR 2011a). On the segment of highway built on a new alignment under each alternative, new culverts would reduce the quality of habitat for wood frogs, although requirements for fish passage would be met wherever necessary and would minimize impact. Table 3.22-9 presents the number of anadromous stream crossings and Section 3.13.2 presents water body crossings per alternative, including replacement and new culverts.

Impacts to water bodies and water quality (as discussed in Section 3.13), and impacts to wetlands (as discussed in Section 3.20) would have indirect impacts on wood frogs. In particular, wood frogs may develop skeletal abnormalities in areas associated with new highway segments (Reeves et al. 2008). Chytrid fungus may currently exist in the project area, or it may be introduced in the future through a number of different pathways. Currently, chytrid fungus is

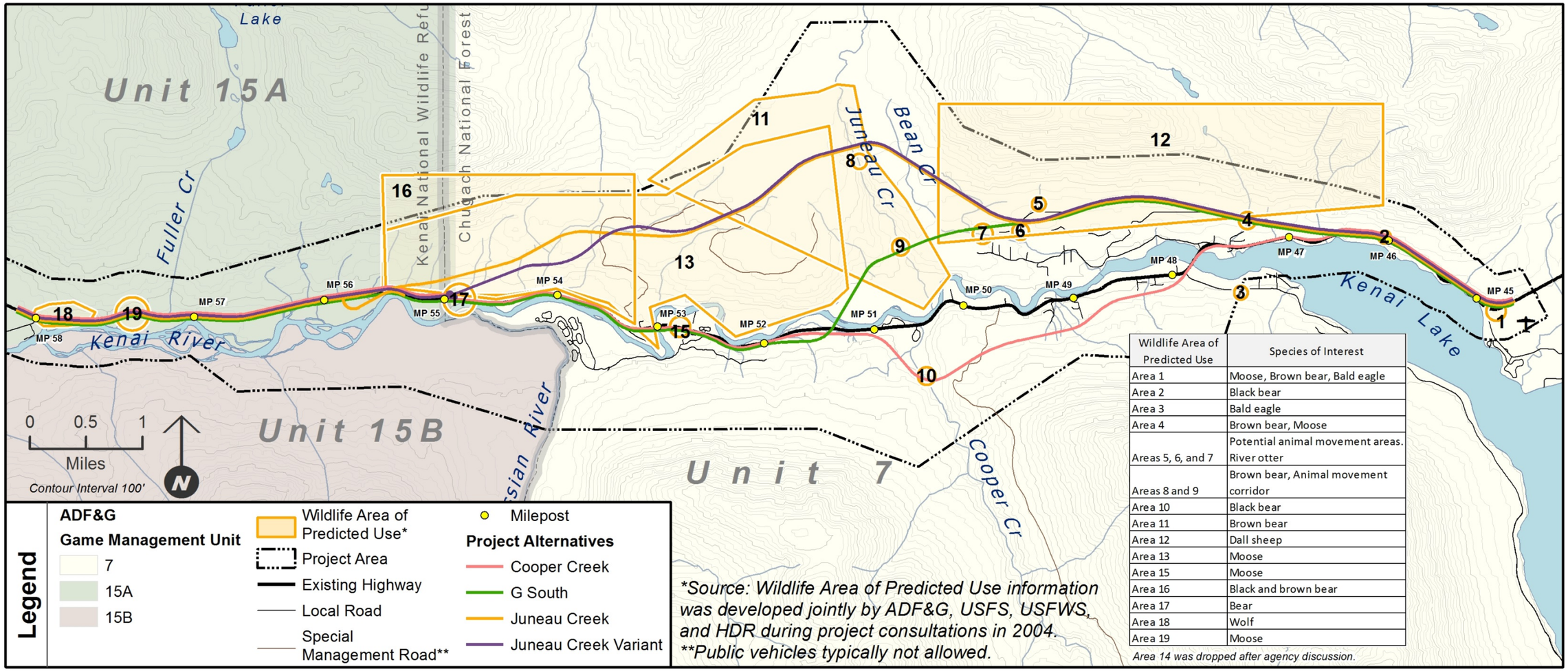
known to occur only in one location on the Kenai Peninsula and it is unlikely that the fungal pathogen would be transmitted through contaminated gravel during highway construction.

Construction Impacts

The operation of construction equipment in areas outside the permanent project footprint, such as along the edges of the construction area and on temporary access roads and staging areas, would likely result in mortality of some wood frogs and disturbance to habitat. In general, frogs would be expected to re-inhabit temporarily impacted habitat following construction.

Mitigation

Culverts would meet ADF&G-DOT&PF Memorandum of Agreement (ADF&G and DOT&PF 2002) requirements for fish passage. This would lessen potential impacts of new culverts, which would improve habitat over existing conditions at culverts that are not up to current standards and may improve habitat and passage for wood frogs.



Wildlife Area of Predicted Use	Species of Interest
Area 1	Moose, Brown bear, Bald eagle
Area 2	Black bear
Area 3	Bald eagle
Area 4	Brown bear, Moose
Areas 5, 6, and 7	Potential animal movement areas. River otter
Areas 8 and 9	Brown bear, Animal movement corridor
Area 10	Black bear
Area 11	Brown bear
Area 12	Dall sheep
Area 13	Moose
Area 15	Moose
Area 16	Black and brown bear
Area 17	Bear
Area 18	Wolf
Area 19	Moose

Area 14 was dropped after agency discussion.

Map 3.22-1. Wildlife areas of predicted use [Updated]

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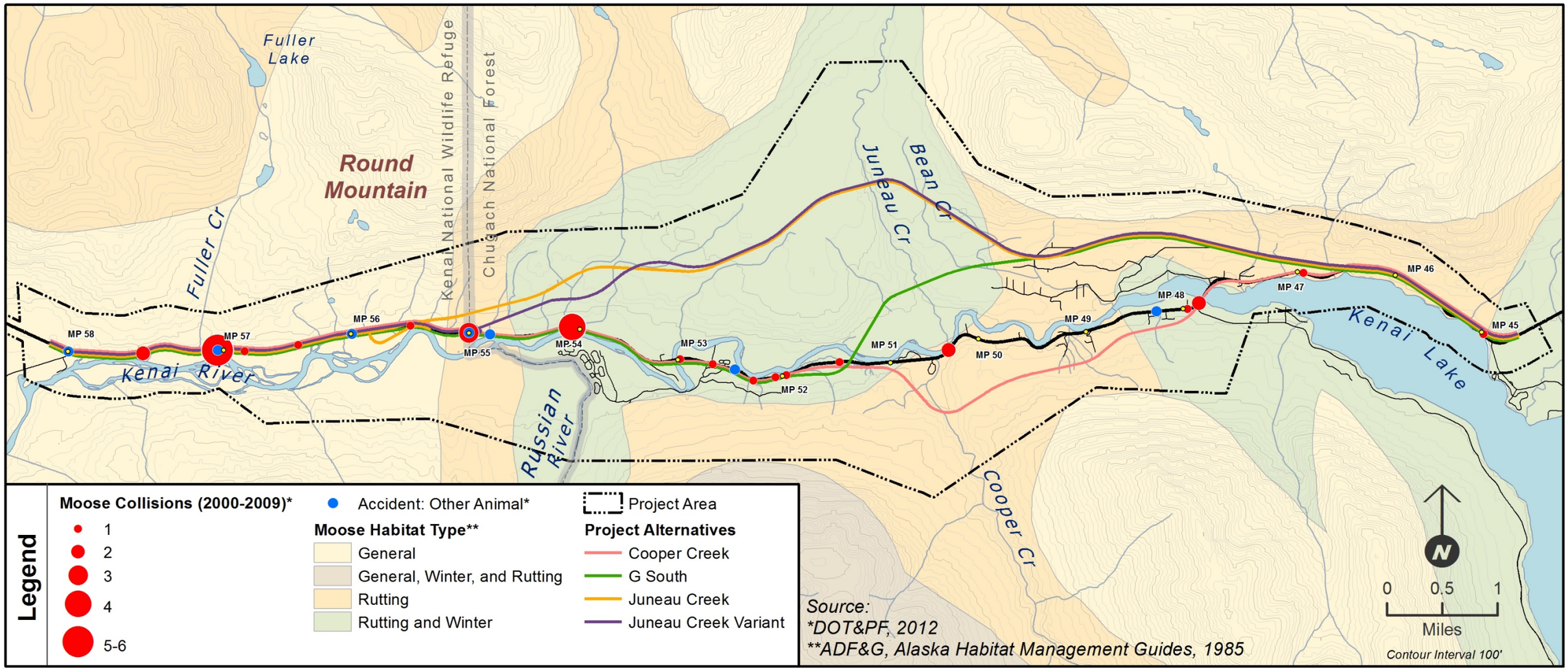

Map 3.22-2. Moose habitat in the project area

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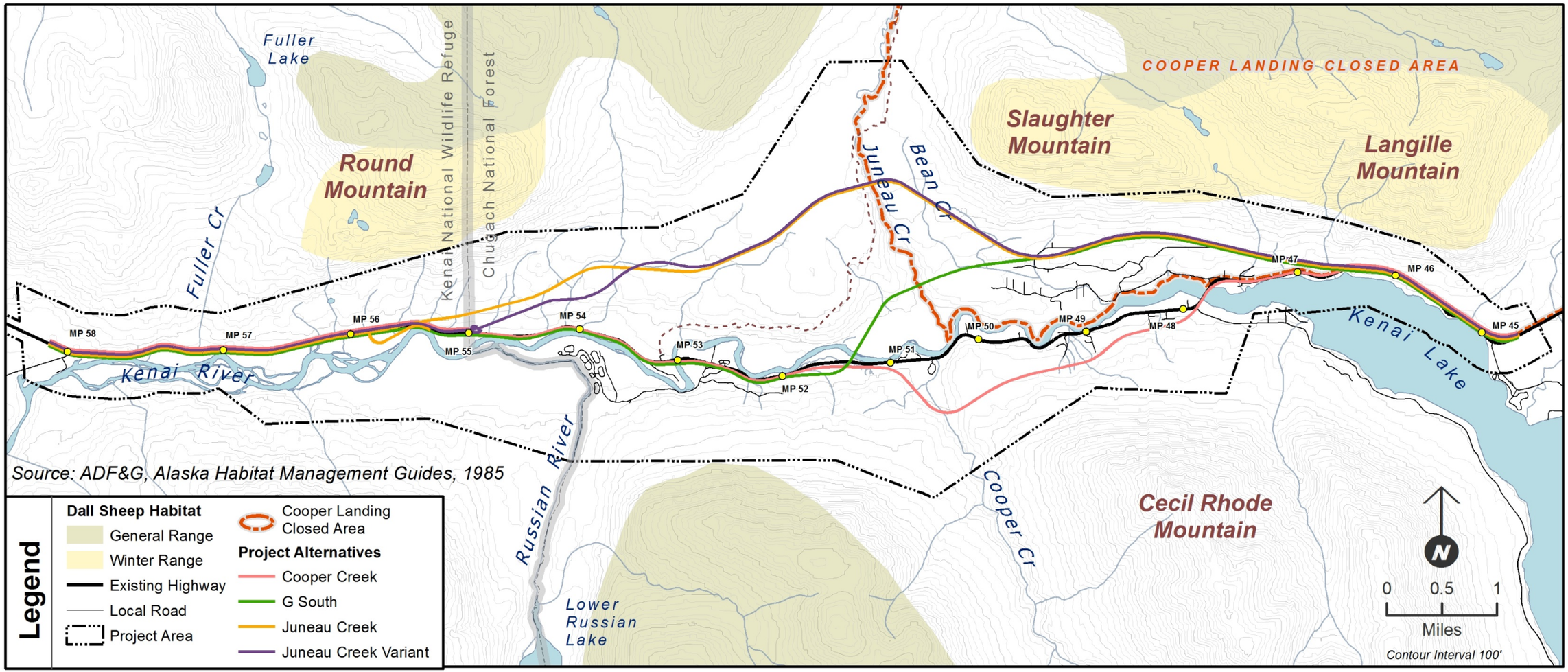

Map 3.22-3. Dall sheep habitat in the project area

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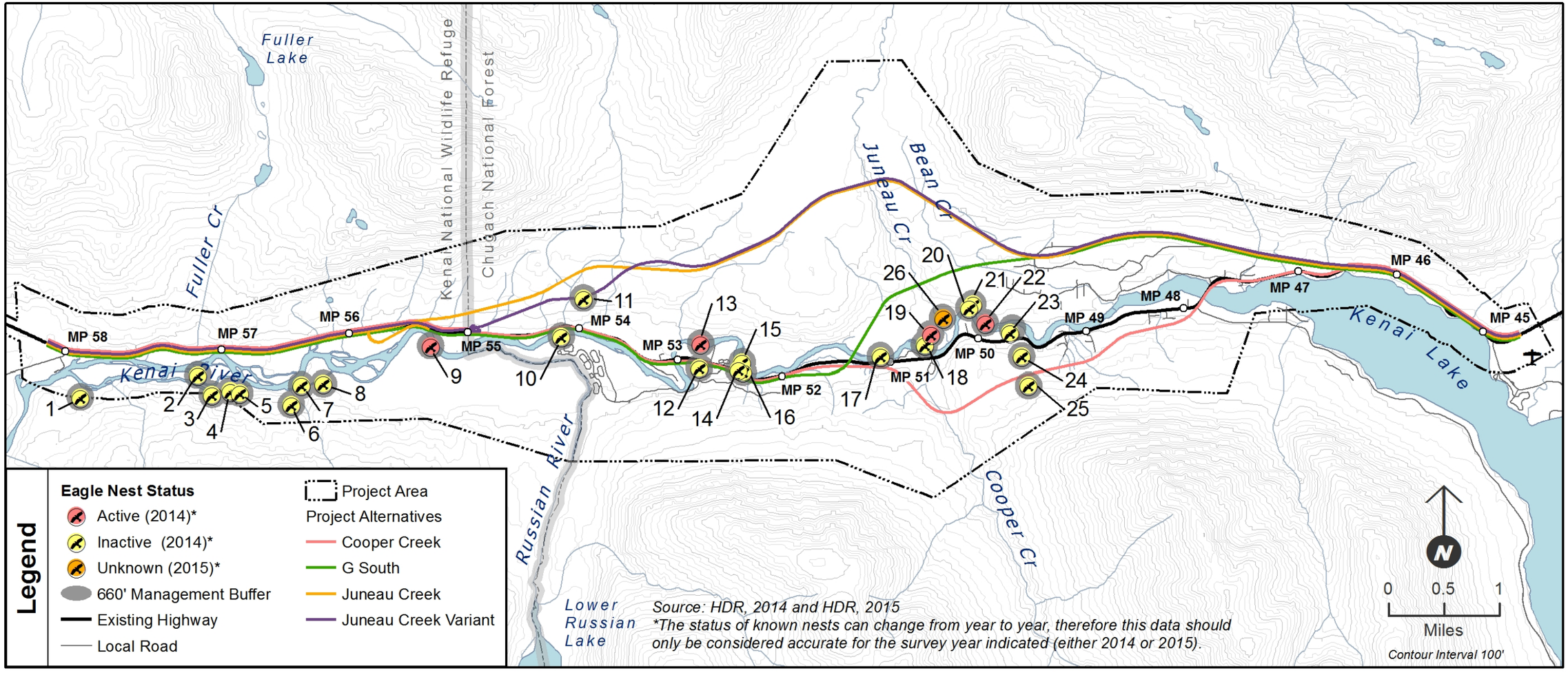

Map 3.22-4. Eagle nest locations in the project area [Updated]

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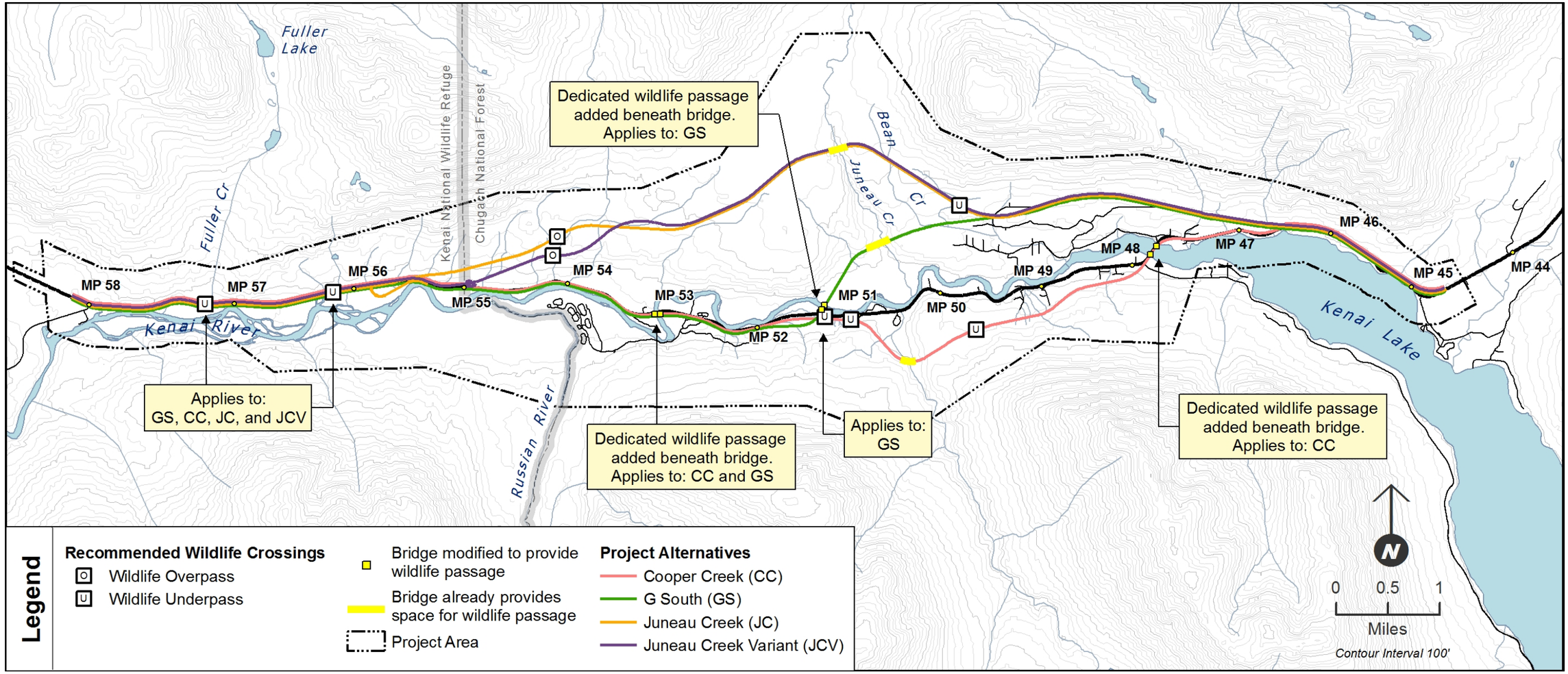

Map 3.22-5. Preliminary locations of wildlife crossings [New]

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