APPENDIX G
ESSENTIAL FISH HABITAT

G. ESSENTIAL FISH HABITAT ASSESSMENT

This assessment of Essential Fish Habitat (EFH) is for the Alaska Railroad Corporation's (ARRC or the Applicant) proposed Port MacKenzie Rail Extension (the Project). The assessment considers the Applicant's proposed action and a range of reasonable alternatives that have been included in the Surface Transportation Board's (STB or the Board) Section of Environmental Analysis' (SEA) Environmental Impact Statement (EIS).

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance EFH for those species regulated under a Federal fisheries management plan. Section 305(b)(2) of the Magnuson-Stevens Act requires Federal agencies to consult with the National Oceanic and Atmospheric Administration's National Marine Fisheries Service on all actions, or proposed actions, authorized, funded, or undertaken by the agency that could adversely affect EFH.

The EFH guidelines (50 Code of Federal Regulations [CFR] 600.06-600.930) outline the process for Federal agencies, the National Marine Fisheries Service, and the Fishery Management Councils to satisfy the EFH consultation requirements under Section 305((b)(2)-(4)) of the Magnuson-Stevens Act. As part of the EFH consultation process, the guidelines require Federal agencies to prepare a written EFH assessment describing the effects of their actions on EFH.

This appendix provides an EFH assessment for STB actions related to the Project. SEA has initiated consultation with National Marine Fisheries Service and has developed mitigation measures for EFH designated waters crossed by the Project and used by anadromous salmon under National Marine Fisheries Service jurisdiction.

G.1 Description of the Proposed Project

The Applicant proposes to construct and operate 30 to 45 miles of single-track rail line between Port MacKenzie (the Port) and the existing ARRC main line between Wasilla and north of Willow, Alaska (Figure G-1). The rail line would be designed for transportation of commercial freight and would include construction of other facilities needed to support rail line operations. Anticipated train traffic would be two freight trains, daily on average, in each direction. A terminal reserve area along the southern terminus of the rail line would consist of yard sidings, storage areas, and a terminal building to support train maintenance.

The EIS considers eight build alternatives that consist of southern and northern segments, with possible connector segments between (Figure G-1). The southern segments, Mac West and Mac East, would run either east or west of the Point MacKenzie Agricultural Project. The northern segments – Willow, Houston-Houston North, Houston-Houston South, and Big Lake, would run from north of the Point MacKenzie Agricultural Project to points on the main line near Willow, Houston, and east of Big Lake, respectively. Connector segments link the north and south segments to create eight possible routes for the proposed rail line. The Applicant proposes a 200-foot-wide right-of-way for the rail line. Construction activities are anticipated to occur within the 200-foot-wide right-of-way, unless otherwise noted.

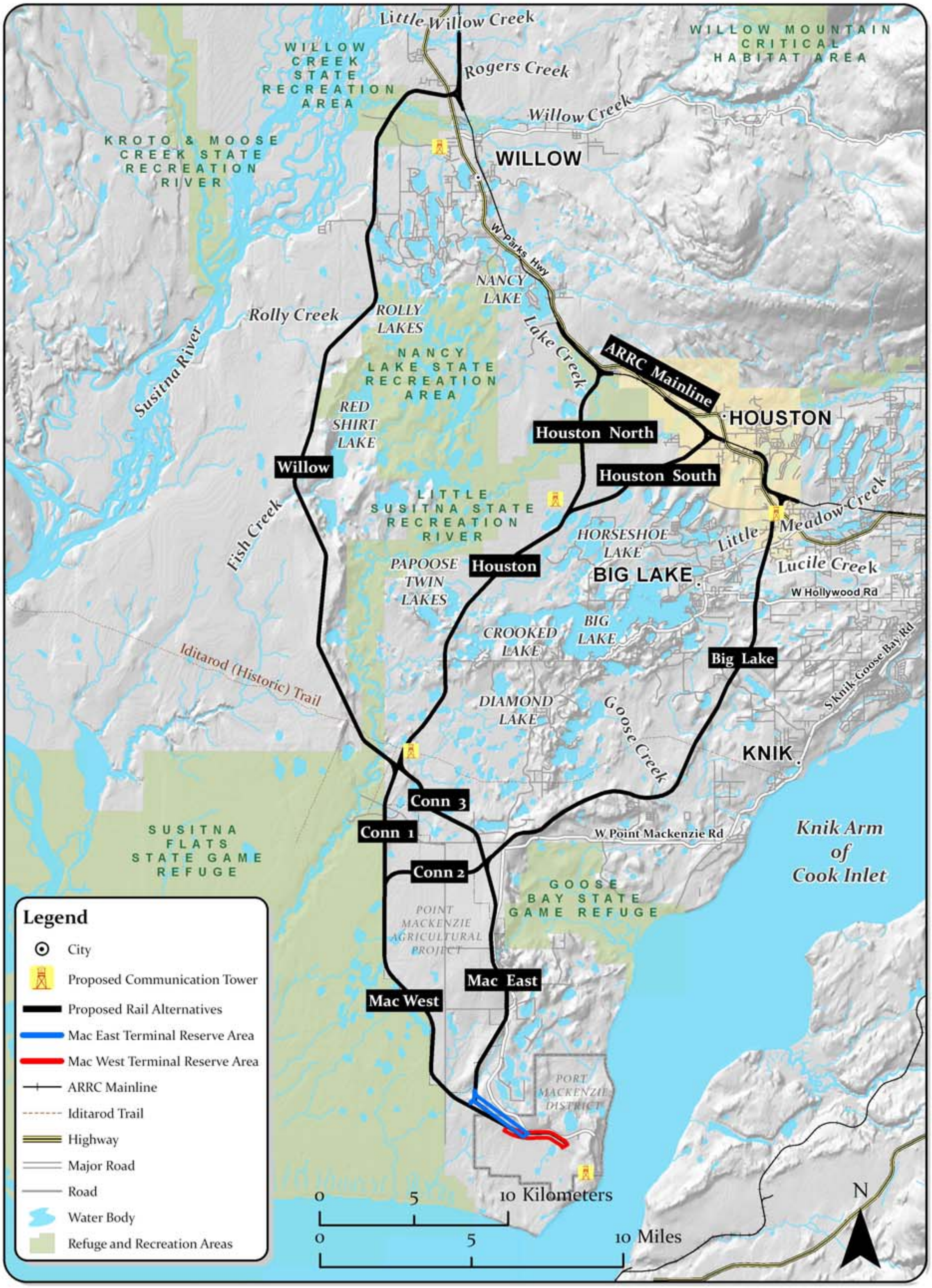

Figure G-1. Overview Map of Project Alternatives Evaluated

The project potentially crosses Willow Creek and Fish Creek – Susitna River drainages; the Little Susitna River drainage; Lucile Creek, Fish Creek, and Goose Creek – Knik Arm drainages; and several other small Cook Inlet drainages (Figure G-1). Rail bridges and culverts would be required for crossing important EFH-bearing waterbodies. The current location, type, and size of all proposed bridges and culverts are considered approximate and preliminary, and the exact locations, types, and sizes would be determined during the final design and permitting process.

Some crossings are currently identified as "drainage structures," which are crossings that may be a bridge or culvert, depending on final design and permitting. The Applicant has stated that all bridges and culverts would be designed to allow fish passage in accordance with Alaska Department of Natural Resources (ADNR) Title 41 Fish Habitat Permit.

G.2 Essential Fish Habitat

Congress defined EFH under the Magnuson-Stevens Act for federally managed fish species as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1801-1883). Salmon species that inhabit Cook Inlet– Chinook or king salmon (*Oncorhynchus tshawytscha)*, chum or dog salmon (*Oncorhynchus keta)*, coho or silver salmon (*Oncorhynchus kisutch)*, pink or humpy salmon (*Oncorhynchus gorbuscha)*, and sockeye or red salmon (*Oncorhynchus nerka)* – are federally regulated. Therefore, the freshwater resources these species use are protected under the EFH provisions of the Magnuson-Stevens Act.

The proposed rail alternatives cross important EFH in the upper Cook Inlet: the Willow Creek, Rolly Creek and Fish Creek drainages – Susitna River tributaries; the Little Susitna River drainage; the Big Lake drainage, the Goose Creek drainage and drainages in the East Susitna Flats. These drainages support between one and five of the federally managed salmon species.

Figure G-2 shows streams documented as supporting EFH-protected fisheries in the study area (Johnson and Daigneault, 2008). Salmon runs in the study area begin in May as Chinook salmon travel upstream to spawn and continue through September when coho salmon spawn throughout area streams (Table G-1). All salmon require freshwater spawning habitats (Table G-2).

All five Pacific salmon are commercially harvested in the Upper Cook Inlet (ADF&G, 2007b). Typically, the Upper Cook Inlet salmon harvest is about 5 percent of the statewide commercial salmon harvest, and is harvested by nearly 10 percent of all holders of statewide salmon permits (Shields, 2007). The commercial salmon harvest in Upper Cook Inlet has ranged from 1.8 to 5.7 million fish, primarily sockeye salmon, with a 10-year average of 3.5 million salmon per year (Table G-3). In the study area, the salmon harvest in 2007 in Alaska Department of Fish and Game (ADF&G) Upper Cook Inlet Fisheries Management Subdistricts 247-41, 247-42, and 257-50 represented less than 1 percent of the Upper Cook Inlet harvest (Shields, 2007).

Chinook salmon stocks in late May are the earliest run of salmonids that provide Upper Cook Inlet commercial fishing opportunity. As the season progresses, sockeye, chum, and coho salmon also become available to commercial fisheries, and commercial fishing continues throughout the summer. The ADF&G monitors salmon stocks returning to index streams in the

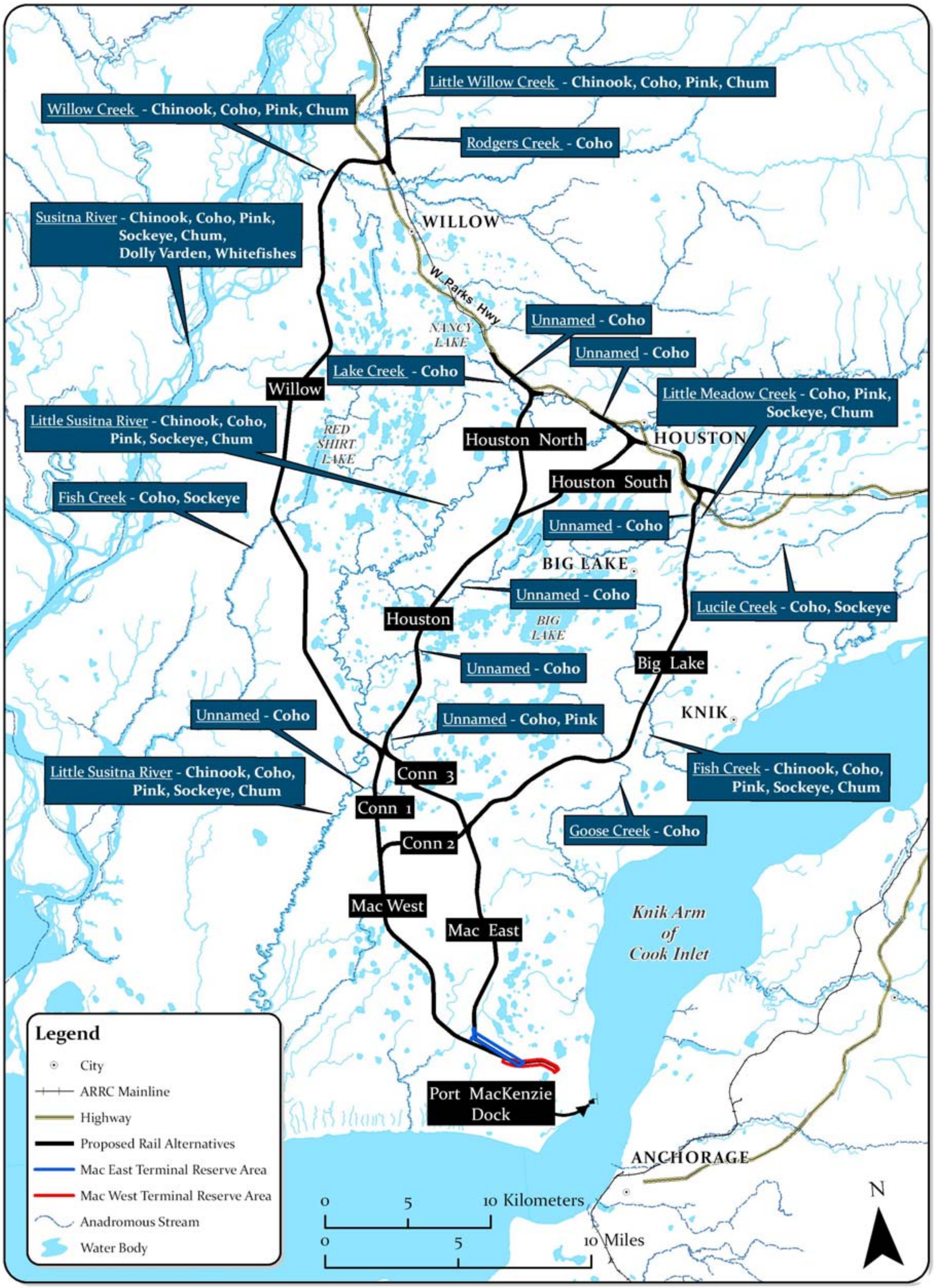

Figure G-2. Waters Documented as Important for Spawning, Rearing, or Migration of Salmon in Southcentral Alaska (Johnson and Daigneault, 2008)

Table G-1
Salmon Spawning Run Timing within the Port MacKenzie Rail Extension Study Area[a]

Salmon and Streams	May	June	July	August	September
Chinook Salmon					
Parks Highway Streams	■	■	■		
Susitna River Streams		■			
The Little Susitna River	■	■	■		
Lower	■	■			
Upper		■	■		
Chum Salmon (less abundant)					
Susitna River Streams			■	■	
Coho Salmon					
Parks Highway Streams				■	■
Susitna River Streams			■	■	
The Little Susitna River			■	■	■
Lower			■	■	
Upper				■	■
Pink Salmon (abundant in even years)					
Susitna River Streams			■	■	
Sockeye Salmon					
Susitna River Streams			■	■	
The Little Susitna River			■	■	

[a] Source: ADF&G, 2009a.

Table G-2
Salmon Habitat and Ecology[a] (page 1 of 2)

Common Name (Species)	Spawning Habitats/ Rearing Habitats	Overwinter Habitats	Ecology
Chinook Salmon (*Oncorhynchus tshawytscha*)	Spawn in fast deep water over gravelly or rocky bottoms of clearwater streams where they can dig redds; fry and juveniles use sloughs, backwaters, tributaries, shallows along gravel bars and beaver ponds. Can rear for 1-3 years in fresh water.	Overwinter as eggs or juveniles. Can be found in Willow Creek and the Little Susitna River.	Juveniles smolt and outmigrate in spring following hatching, and outmigration appears to occur soon after ice breakup, peaking in mid to late May. Extensive movement within the river system in the first year of life, adults return to spawn after 4- to 5-year marine residence.
Chum Salmon (*Oncorhynchus keta*)	Spawn in small side channels and areas of larger rivers with upwelling springs; fry emerge from the gravel in spring and immediately outmigrate downriver, feeding on small insects and other detritus.	Overwinter as eggs.	Fry emerge from the gravel in early to mid April, with peak outmigration before the end of May. Adults return to spawn after 3- to 5-year marine residence (adults infrequently found in study area).
Coho Salmon (*Oncorhynchus kisutch*)	Spawn in gravel areas of clearwater habitats, usually spring-fed; juveniles use ponds, and pools in streams and rivers or stream margins, usually among submerged woody debris and in scour pools.	Juveniles overwinter near springs and in spring-fed streams; areas with upwelling are important for both egg and fry survival.	Spend 1 to 3 years in streams, spend 1 year in marine waters before returning. Sizeable run in the Little Susitna River.

Table G-2
Salmon Habitat and Ecology[a] (page 2 of 2)

Common Name (Species)	Spawning Habitats/ Rearing Habitats	Overwinter Habitats	Ecology
Pink Salmon (*Oncorhynchus gorbuscha*)	Spawn in the lower reaches of freshwater streams in shallow riffles over coarse gravel; eggs hatch midwinter in the gravel and emerge in late winter to migrate to marine waters.	Eggs in the gravel until spring; do not overwinter as juveniles in Southcentral Alaska.	Two-year cycle that is stronger on even years; can be found in most area streams during summer migration.
Sockeye salmon (*Oncorhynchus nerka*)	Usually spawn in rivers and streams and upwelling areas along lake beaches. Eggs hatch during winter and young emerge and move into rearing areas along lakes and streams.	Juveniles use deeper large lakes for overwintering.	In stream systems with large lakes; spawning in streams and rivers, will occur in backwater sloughs or oxbows. The Fish Creek-Big Lake drainage has a moderate run of sockeye salmon.

[a] Source: ADF&G, 2007a; 2007b; 2009a; Mecklenburg *et al*., 2002.

Table G-3
Upper Cook Inlet Commercial Salmon Harvest 1997 to 2007[a]

Year	Chinook	Sockeye	Coho	Pink	Chum	Total
1997	13,292	4,176,738	152,404	70,933	103,036	4,516,403
1998	8,124	1,219,242	160,660	551,260	95,654	2,034,940
1999	14,383	2,680,510	125,908	16,174	174,541	3,011,516
2000	7,350	1,322,482	236,871	146,482	127,069	1,840,254
2001	9,295	1,826,833	113,311	72,559	84,494	2,106,492
2002	12,714	2,773,118	246,281	446,960	237,949	3,717,022
2003	18,490	3,476,159	101,756	48,789	120,767	3,765,961
2004	27,476	4,926,220	311,056	357,939	146,164	5,768,855
2005	28,171	5,238,168	224,657	48,419	69,740	5,609,155
2006	18,029	2,192,730	177,853	404,111	64,033	2,856,756
2007	17,625	3,316,779	177,339	147,020	77,240	3,736,003
Average, 1997 – 2006	15,732	2,983,220	185,076	216,363	122,345	3,522,736

[a] Source: Shields, 2007.

study area for salmon escapement (adult salmon returning to spawning grounds – or those that have “escaped” harvest) to ensure sustainability of salmon stocks (Table G-4).

The Susitna River is the largest salmon-producing stream in the ADF&G Upper Cook Inlet Fisheries Management Northern District. Proposed rail alternatives would cross four tributaries to the main-stem Susitna River – Rodgers Creek (a tributary to Little Willow Creek), Willow Creek, Rolly Creek (upstream from EFH) (Johnson and Daigneault, 2008), and Fish Creek.

Salmon stocks from the Susitna River and its tributaries are an important component of commercial fishery in Northern Cook Inlet, although the contribution of Willow Creek, Rodgers Creek, and Fish Creek stocks to the Susitna River salmon stocks is not known (Tobias and Willette, 2008).

Salmon stocks in streams that the proposed Port MacKenzie Rail Extension segments would cross contribute to commercial, recreational, subsistence, and personal-use fisheries. In the study area, Chinook salmon stocks are found in Little Willow Creek, Willow Creek, the Little Susitna

Table G-4
Salmon Escapement in Index Streams in the Port MacKenzie Rail Extension Study Area[a]

System	Sustainable Escapement Goals: Data Source	Sustainable Escapement Goals: Range	Escapements: 2004	2005	2006	2007
Chinook Salmon						
The Little Susitna River	Single aerial survey index	900 to 1,800	1,694	2,095	1,855	1,731
Little Willow Creek	Single aerial survey index	450 to 1,800	2,227	1,784	816	1,103
Willow Creek[b]	Single aerial survey index	1,600 to 2,800	2,985	2,463	2,217	1,373
Coho Salmon						
The Little Susitna River	Weir[c]	10,100 to 17,700	40,199	16,839	8,786	17,573
Sockeye Salmon						
Fish Creek (Big Lake)	Weir	20,000 to 70,000	22,157	14,215	32,562	27,948

[a] Sources: Shields, 2007; Tobias and Willette, 2008.
[b] Willow Creek escapement includes hatchery fish.
[c] Weir washed out of the Little Susitna River in 2005 and 2006; counts were incomplete.

River, and Fish Creek - Big Lake drainage. Chum salmon are found infrequently in the study area, with spawning stocks of unknown size in the Little Willow Creek, Willow Creek, the Little Susitna River, Little Meadow Creek and Fish Creek - Big Lake drainage. Chum salmon are harvested incidentally to the catch of other salmon. Coho salmon stocks can be found in most streams in the study area. Pink salmon stocks are found in the study area in Little Willow Creek, Willow Creek, the Little Susitna River, an unnamed tributary of the Little Susitna River, Little Meadow Creek, and Fish Creek - Big Lake drainage. Pink salmon are harvested as part of the overall commercial catch, but are not targeted by Upper Cook Inlet fisheries. Sockeye salmon stocks from the Fish Creek - Big Lake drainage, the Little Susitna River, Little Meadow Creek, Lucile Creek, and Fish Creek - Susitna River drainage all contribute to commercial and subsistence harvests. Stocks of sockeye salmon can be sizeable when reproduction is successful. In recent decades, stocks of native sockeye salmon have been of concern due to overstocking of hatchery fish, degradation of habitat, and predation by non-native northern pike (*Esox lucius*).

There are two subsistence fisheries south of the study area (the Tyonek and Yentna rivers fisheries) and two personal-use fisheries in the study area on the Fish Creek-Big Lake drainage (Shields, 2007). The Fish Creek personal-use dip-net fishery sustained an annual mean harvest of 9,700 sockeye salmon from 1987 to 2001 (Shields, 2007). The ADF&G closed the Fish Creek dip-net fishery by Emergency Order in 2001 due to declining escapements and reduction in stocking levels, but could reopen the fishery when escapements are projected to be above 70,000 sockeye salmon (ADF&G, 2009a). However, sockeye salmon escapements have been below 50,000 since 2004 (Table G-4).

G.3 Effects of the Proposed Project on Essential Fish Habitat

Rail line construction would require multiple stream crossings at locations that have EFH. Project construction methods and timing, the type of stream crossing structure installed, and daily operations procedures would influence the severity and types of impacts to fish and fish habitat at each stream crossing. The primary potential impacts of crossing structures to fish and fish habitat would be loss and degradation of instream habitats due to placement of structures, alteration of stream hydrology and water quality, and blockage of movements. Each stream crossing would result in site-specific impacts to aquatic and riparian habitats. Stream channel characteristics such as area of runs, glides, riffles, and pools; water velocities; channel substrates such as cobble, gravel, sand, and silt; bank morphology and composition; water quality; bank vegetation; and unblocked access interact to determine salmon use and habitat suitability for eggs, larvae, and juvenile or adult salmon. The general type of crossing structure; that is, bridge or culvert, used at a crossing would also influence potential impacts to fish and fish habitat through habitat loss, alteration, degradation, and access.

G.3.1 Methodology

SEA analyzed potential impacts to EFH fisheries resources from proposed rail line construction and operations for each crossing based on current and potential salmon use; existing habitats; salmon habitat requirements; salmon seasonal movement patterns; proposed conveyance types and sizes; potential stream blockage; and the stream contributions to important recreational, commercial, or subsistence/personal-use salmon fisheries. SEA based the analysis of potential instream fish habitat on the review of stream-crossing characteristics and reported salmon presence and habitat use data (Johnson and Daigneault, 2008); and fish habitat data collected at or near proposed stream crossings during SEA field investigations in 2008 (Noel *et al.*, 2008). Streams are determined to contain EFH if they are cataloged anadromous waters (Johnson and Daigneault, 2008), or if EFH was determined to be present during SEA stream-crossing investigations in 2008 (Noel *et al.*, 2008).

The Applicant performed a hydrologic review of the study area to identify surface water resources, including pre- and post-project drainage patterns, flow rates, and floodplain limits and encroachments. This review also included a preliminary determination of the types and sizes of conveyance structures for many of the anticipated water crossings. Channel-width data collected during 2008 field studies conducted by SEA at fish-bearing stream crossings were found to not always match the size of the conveyance structure determined during the earlier preliminary design (Noel *et al.*, 2008). SEA determined that it would not be reasonable to use the potential impacts that would be anticipated for these undersized structures to distinguish between alternatives because the hydrologic review and Applicant-proposed conveyance structures are preliminary, and the final conveyance structure types and sizes would be determined during final permitting and design. ARRC would base final conveyance structure designs on the reasonable terms, conditions, and design criteria that would result from the ADF&G Fish Habitat permit that would likely ensure a conveyance structure size similar to the channel width to maintain flow conditions suitable for fish passage.

G.3.2 Common Impacts

Rail line construction would result in short-term disturbance and potential long-term salmon habitat loss and modification at steam crossings along the approximately 35 to 40 miles of rail line. The following paragraphs describe the types of potential construction-related impacts to salmon and salmon habitats that would be common to all proposed rail line stream crossings.

G.3.2.1 Loss or Alteration of Instream and Riparian Habitats

During construction, there would be a temporary loss of instream habitat where water was diverted from the existing stream channel to facilitate installation of bridge pilings, bank armoring, or culverts. Bridge abutments or instream pilings, armoring around abutments and nearby banks, and installation of instream culverts would remove streambed and shoreline areas that would otherwise be available for fish use. Bridge and culvert installation would cause the loss of rearing, foraging, and cover habitat along the banks; scouring of spawning areas through removal of instream large woody debris; loss of overhanging bank habitat structure and vegetation; and alteration of stream flows.

During construction, the riparian corridor would be cleared of vegetation as necessary for bridge, culvert, rail, and access road construction. Riparian corridors along stream banks provide important instream habitat protection from stream bank erosion and sedimentation. Stream bank vegetation moderates stream temperature in summer, provides cover for fish to hide from predators, and provides a velocity refuge for juvenile fish (Marcus *et al.*, 1990). Removal of riparian vegetation and disturbance to stream banks could contribute to increased erosion, increased sediment loading to the stream, increased turbidity, elevated water temperatures, reduced productivity, and a reduction in overall habitat complexity (Hicks *et al.*, 1991; Waters, 1995). Sedimentation resulting from construction activities could temporarily adversely affect juvenile fish, eggs, and larvae in nearby spawning beds and invertebrate forage production (Waters, 1995).

G.3.2.2 Mortality from Instream Construction

During construction, there could be direct mortality of fish when equipment is driven through a streambed. Redds, eggs, and fry within or downstream of the construction site could be lost or their viability reduced through sedimentation, excessive vibration, and scour caused by construction equipment. Movement of construction equipment could cause compaction of the soils and gravels in the streambed, resulting in the death of larval fish and eggs. In areas where there is a soft sediment bottom, equipment movement could create areas that redirect stream flow, and portions of the streambed could become dry and isolated, resulting in mortality of fish as they become isolated from free-flowing waters. Water diversions and temporary dewatering could also impact developing eggs and pre-emergent fry (Becker *et al.*, 1982; Becker *et al.*, 1983; Holland, 1987) through desiccation or freezing. Eggs, larvae, and juvenile fish would be more susceptible to mortality from instream construction because larger fish would be expected to avoid equipment and could move away from the construction area.

G.3.2.3 Blockage of Fish Movement

Depending on timing, construction-related activities could block fish movements. Construction methods that depend on water diversions during open-water construction could create temporary physical barriers to fish passage or alter stream flows sufficiently to create either high- or low-water conditions that prevent fish movements within and between lakes, tributaries, and rivers to rearing or spawning habitats. Connectivity between tributaries and mainstem habitats is particularly important for maintaining productivity of juvenile salmonids (Bramblett *et al.*, 2002). Instream construction could reduce stream flows sufficiently to block upstream migration of adult salmon or displace juvenile or small fish from rearing and foraging habitats due to high flows. Blocked spawning fish might attempt to use inadequate spawning areas, which could result in uncertain survival of eggs, larvae, and juvenile fish, and ultimately could result in reduced productivity. Winter construction supported by ice bridges could cause blockage of stream flow and over-ice flooding near the crossing in spring, restricting movements of salmon between lake, tributary, mainstem, and marine rearing or spawning habitats.

G.3.2.4 Degradation of Water Quality

Clearing of vegetation from the ROW, grading, construction of access roads, and placement of bridges and culverts would expose soil to erosion from wind, rain, stream-flow, and runoff. Erosion delivers sediment to streams, which can degrade water quality and reduce fish habitat quality and productivity through sedimentation and turbidity (Waters, 1995). While increased erosion and sedimentation might be temporary during construction, increased fine sediments reduce oxygen exchange, which results in lower survival of eggs and larvae in spawning gravels (Grieg *et al.*, 2005). High turbidity could result in avoidance behavior, reduced foraging success in sight-feeding fish (Barrett *et al.*, 1992), induced physiological stress, and increased mortality (Waters, 1995).

Fuel leaks from construction equipment could reduce water quality and result in toxic affects to fish and aquatic invertebrate forage. Spills and leaks could enter the water either directly as equipment crossed streams or indirectly with runoff from bridges and adjacent roadbeds or railbeds.

G.3.2.5 Alteration of Stream Hydrology and Ice Breakup

Construction activities could cause changes in flow patterns through the hyporheic zone, the region beneath a stream bed where there is mixing of shallow groundwater and surface water. Excavation and vegetation clearing would dislodge fine sediments that could infiltrate the hyporheic zone and clog interstitial spaces, and vibrations from construction equipment can cause substrates to settle and become compacted (Sear, 1995; Huggenberger *et al.*, 1998). Hyporheic flow and groundwater upwelling (springs) are important in salmonid egg development (Baxter and McPhail, 1999; Brown and Mackay, 1995). There could be permanent changes in subsurface flow from bank and substrate armoring, instream support structures, and changes in channel morphology caused by bridges and culverts interrupting lateral stream migration.

ARRC might use ice bridges to provide a means of moving equipment across streams during the winter construction period. Ice bridges are made by thickening and sometimes grounding ice across the stream. The thickened ice melts more slowly than the stream ice and during spring breakup could contribute to the formation of ice dams. Ice dams can also form in areas where bridges and culverts constrict stream channels. Ice dams could cause scour of the streambed and erosion along the upstream side of affected streams. The movement of the ice and rush of water when the dam fails could damage spawning beds.

G.3.2.6 Noise and Vibration Impacts

Depending on the timing of construction, there could be potential impacts to salmonids from underwater pile driving noise and vibration during bridge construction. Exposure to pile driving vibration and noise could displace juvenile fish, trigger avoidance behavior, and disrupt fish sense of hearing and the function of the lateral line, the sensory organ that detects vibration (Hastings et al., 1996; McCauley et al, 2003). Whereas it is possible that fish could swim away from a sound source, thereby decreasing exposure to sound, eggs are often stationary or move very slowly and could be exposed to extensive human-generated sound if it is presented in the surrounding water column or substrate. However, data are limited or inconclusive concerning the effects of sound, including pile driving noise, on developing eggs (Hastings and Popper, 2005; California Department of Transportation, 2009). The few studies on the effects on fish eggs, larvae, and fry are insufficient to reach any conclusions with respect to the way sound would affect survival (Hastings and Popper, 2005).

G.3.3 Operations Impacts

Many potential impacts to stream crossings initiated during construction would continue to contribute to impacts to fisheries resources during rail line operations. Operations-related impacts would be common for all stream crossings along the proposed rail line.

G.3.3.1 Loss or Alteration of Instream and Riparian Habitats

Bridges that have abutments or pilings in the streambed cause permanent losses of fish spawning and rearing habitats, as discussed above. Instream bridge supports lead to upstream scour and downstream bed-load deposition, which extends the area of instream habitat the structure affects. Bridges and open-bottom culverts also create shade that results in degradation and loss of overhanging riparian vegetation that juvenile fish use for cover and forage. Bridges typically require placement of riprap, which permanently displaces vegetation that filters runoff, resulting in a permanent loss of juvenile rearing habitat along the hardened bank beneath the bridges (Schmetterling *et al.*, 2001; Fischenich, 2003).

Culverts placed directly in the streambed cause permanent loss of any existing spawning and rearing habitats, alter stream flow and stream bottoms on either end of the culverts, and change adjacent riparian habitat. When culverts are installed, fill is usually placed around the culvert, and streambanks upstream and downstream of the culvert are reinforced with riprap. During high-water events, water can bypass improperly sized culverts and create scour pools, causing additional streambank erosion. As erosion continues over time, there can be additional loss of habitat as more riprap is added.

Bridge abutments and culverts could impede the transport of large woody debris, which provides rest areas, shade, and cover for fish and substrate for aquatic vegetation and invertebrates (House and Boehne, 1986; Marcus *et al.*, 1990). When large woody debris blocks conveyance structures, the debris is typically removed from the stream system and placed beyond the flood plain, resulting in permanent loss of this habitat structure and an interruption in the downstream transport of large woody debris.

Culverts placed in the soft substrate across wetlands could sink over time, creating ponds on the upslope side of the railbed and drying on the down slope side of the railbed. If a culvert blocks water flow, nutrients would no longer be cycled through wetlands to receiving waters, which would affect nutrient input to aquatic plants and animals that provide forage for fish. If surface water exchange between wetlands and streams was interrupted, stream flows could be reduced and riparian vegetation along the stream corridor could begin to decline, which would result in erosion, bank sloughing, and increased sedimentation during high-water conditions.

G.3.3.2 Blockage of Fish Movement

Improperly embedded and maintained culverts and the surrounding fill could change the ability of the culvert to convey water. Flooding levels exceeding the culvert design could result in the culvert becoming more deeply embedded in the streambed, and over time the culvert opening could become inefficient at passing fish to upstream habitats. Habitat loss would increase as culverts failed and fish movements were blocked, preventing fish populations from accessing upstream and downstream habitats.

Bridges and culverts could also create constrictions, restricting the downstream movement of large woody debris important for productive salmonid habitats (House and Boehne, 1986), or ice, causing ice jams and flooding. Water in undersized culverts often freezes solid and is slow to melt due to the insulation of road or rail embankments, blocking spring movements of fish to foraging and spawning habitats.

G.3.3.3 Degradation of Water Quality

Maintenance activities such as clearing drainage ditches and management of vegetation in the ROW could cause an increase in turbidity and sedimentation over natural background levels in streams. ARRC does not propose to transport hazardous materials along the proposed Port MacKenzie Rail Extension; however, spills of nontoxic bulk materials could have physical impacts if spills occurred at or near stream crossings.

G.3.4 Impacts by Segment and Segment Combinations

Most segments and segment combinations would cross streams or waterbodies providing EFH that could be affected by proposed rail line construction and operations (Figure G-3; Table G-5). The paragraphs below describe notable site-specific potential impacts to EFH habitats by rail line segment. Potential impacts to EFH by segment are summarized in Table G-6.

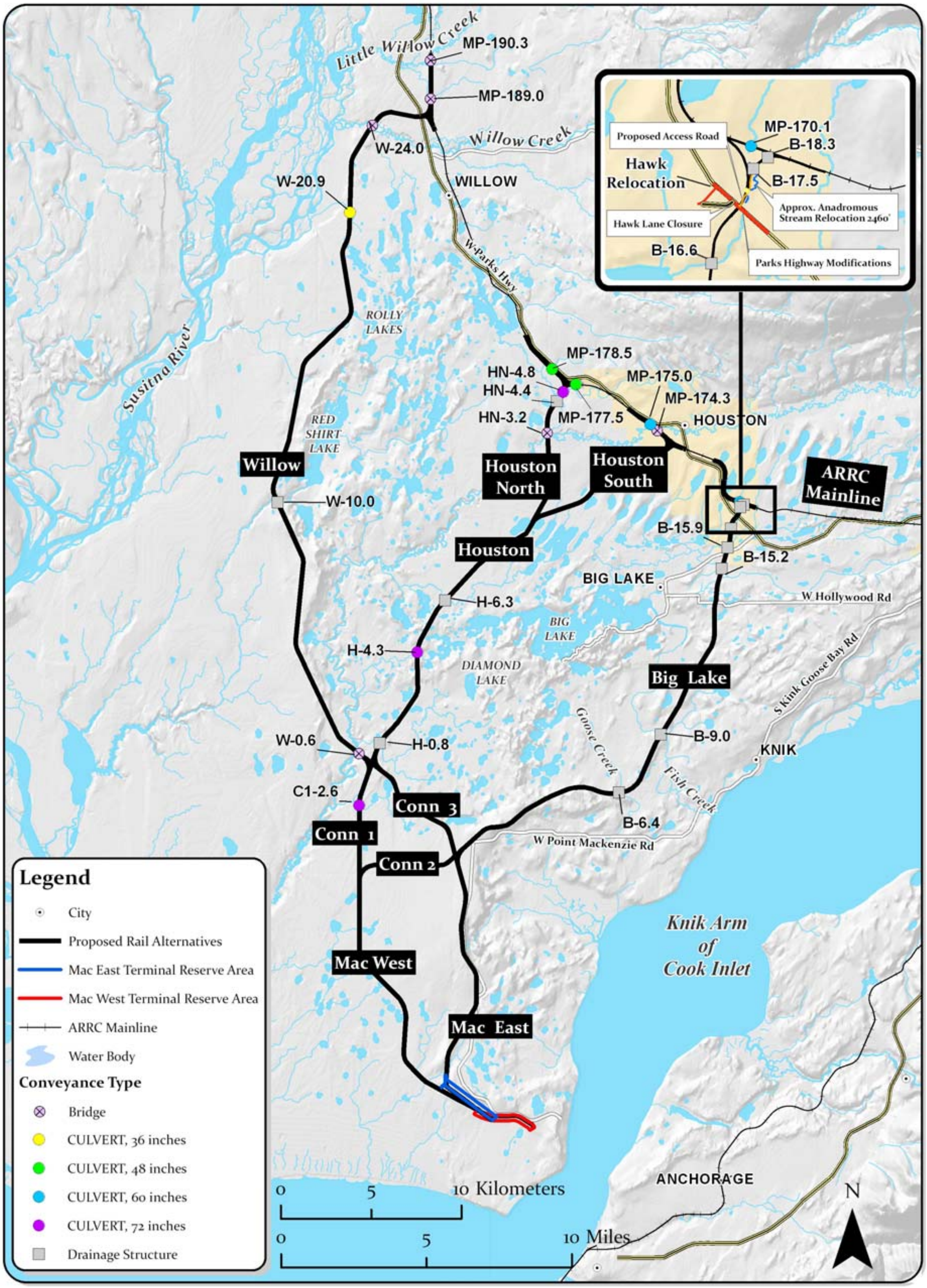

Figure G-3. Crossing Methods for EFH-Bearing Streams Crossed by the Port MacKenzie Rail Extension Project (Johnson and Daigneault, 2008; Noel *et al*., 2008)

Table G-5
EFH-Bearing Streams Crossed by the Proposed Port MacKenzie Rail Extension Project[a] (page 1 of 3)

Segment/Crossing Location	Crossing Identification	Stream Name	Alaska Department of Fish and Game Anadromous Catalog Number[b]	Waterbody Type
SOUTHERN SEGMENTS				
Connecter 1 Segment				
C1-2.6	C1-026	The Little Susitna Tributary	247-41-10100-2080: COpr	Stream
NORTHERN SEGMENTS				
Willow Segment				
MP-190.3	W-098	Little Willow Creek Tributaryd	0.2 mile upstream from COr	Stream
MP-189.0	W-101R	Rodgers Creek	247-41-10200-2130-3020: COr	Stream
W-24.0	W-106	Willow Creek	247-41-10200-2120: CHs, COsr, Ksr, Ps	Stream
W-20.9	W-110	Susitna River Tributarye	Nominated	Stream
W-10.0	W-118R	Fish Creek	247-41-10200-2020: COr, Sp	Stream
W-0.6	W-121R	The Little Susitna River	247-41-10100: CHs, COs, Ks, Ps, Sp	Stream
Houston North Segment				
MP-178.5	HN-065R	Lake Creek Tributary	247-41-10100-2231-3026: COr	Stream
MP-177.5	None	Lake Creek Tributary	247-41-10100-2231-3018- 4011: COr	Stream
HN-4.8	HNM-122R	Lake Creek Tributary	247-41-10100-2231-3018: COr	Stream
HN-4.4	HNM-123	Lake Creek	247-41-10100-2231: COr, Sp	Stream
HN-3.2	HN-067R	The Little Susitna River	247-41-10100: CHs, COs, Kp, Ps, Sp	Stream
Houston South Segment				
MP-175.0	HS-070R	The Little Susitna Tributary	247-41-10100-2255: COr	Stream
MP-174.3	HS-071R	The Little Susitna River	247-41-10100: CHp, COs, Ks, Ps	Stream
Houston Segment				
H-6.3	H-044	The Little Susitna Tributary	247-41-10100-2150: COr	Stream
H-4.3	H-046	The Little Susitna Tributary	247-41-10100-2100: COr, Kr	Stream
H-0.8	H-050R	The Little Susitna Tributary	247-41-10100-2090: Ps, COsr	Stream
Big Lake Segment				
MP-170.1	BL-003	Outlet Cheri Lake	247-50-10330-2050-3025: COr	Stream
B-18.3	None	Inlet to Long Lake	247-50-10330-2050-3025: COr	Stream
B-17.1 to B-17.6	None	Inlet to Long Lake	247-50-10330-2050-3025: COr	Stream
B-16.6	BL-007R	Inlet to Long Lake	247-50-10330-2050-3025: COr	Stream
B-15.9	BL-008	Little Meadow Creek	247-50-10330-2050-3050: CHp, COrs, Pp, Ss	Stream
B-15.2	BL-010R	Lucile Creek	247-50-10330-2050-3030: Sp, COr	Stream
B-9.0	BL-019R	Fish Creek	247-50-10330: CHp, COrs, Kp, Ps, Sp	Stream
B-6.4	BL-022R	Goose Creek	247-50-10360: COsr, Kr	Stream

Table G-5
EFH-Bearing Streams Crossed by the Proposed Port MacKenzie Rail Extension Project[a] (page 2 of 3)

Segment/Crossing Location	Fish	Channel Width (feet)	Conveyance Type[c]	Conveyance Size[c]	Habitat[b] SP	R	M	OW	Potential Blockage[b]
NORTHERN SEGMENTS (cont'd)									
Connecter 1 Segment									
C1-2.6	Anadromous	27	Culvert	72 inches	--	Y	Y	--	No
Willow Segment									
MP-190.3	Anadromous	12.3	Bridge	NA	Y	Y	Y	--	No
MP-189.0	Anadromous	36.3	Bridge	NA	--	Y	Y	Y	No
W-24.0	Anadromous	97.5	Bridge	NA	Y	Y	Y	Y	No
W-20.9	Anadromous	7.4	Culvert	36 inches	--	Y	Y	--	Yes - US
W-10.0	Anadromous	15	Drainage Structure	NA	Y	Y	Y	Y	No - BD
W-0.6	Anadromous	105	Bridge	NA	Y	Y	Y	Y	No
Houston North Segment									
MP-178.5	Anadromous	6.3	Culvert Extension	48 inches	--	Y	Y	--	Yes - US
MP-177.5	Anadromous	Less than 2	Culvert Extension	48 inches	--	Y	--	--	Yes - US & DS
HN-4.8	Anadromous	9	Culvert	72 inches	--	Y	--	--	Yes - US
HN-4.4	Anadromous	20	Drainage Structure	NA	--	Y	Y	--	Yes - US & DS
HN-3.2	Anadromous	97.5	Bridge	NA	Y	Y	Y	Y	No
Houston South Segment									
MP-175.0	Anadromous	14	Culvert Extension	NA	--	Y	Y	--	Yes - US
MP-174.3	Anadromous	46.5	Bridge	NA	Y	Y	Y	Y	No
Houston Segment									
H-6.3	Anadromous	16	Drainage Structure	NA	--	Y	Y	--	Yes - US
H-4.3	Anadromous	1 to 3	Culvert	72 inches	--	Y	Y	--	Yes - US & DS
H-0.8	Anadromous	14	Drainage Structure	NA	Y	Y	Y	Y	No

Table G-5
EFH-Bearing Streams Crossed by the Proposed Port MacKenzie Rail Extension Project[a] (page 3 of 3)

Segment/Crossing Location	Fish	Channel Width (feet)	Conveyance Type[c]	Conveyance Size[c]	Habitat[b] SP	R	M	OW	Potential Blockage[b]
NORTHERN SEGMENTS (cont'd)									
Big Lake Segment									
MP-170.1	Anadromous	1.5	Culvert Extension	60 inches	--	Y	Y	--	Yes - US & DS
B-18.3	Anadromous	<1	Drainage Structure	NA	--	Y	Y	--	Yes - US & DS
B-17.1 to B-17.6	Anadromous	<1	Stream Relocation	2,500 feet of relocation	--	Y	Y	--	Yes - US & DS
B-16.6	Anadromous	6.5	Drainage Structure	NA	--	Y	Y	--	Yes - US & DS
B-15.9	Anadromous	28	Drainage Structure	NA	Y	Y	Y	Y	Yes - US & DS
B-15.2	Anadromous	11.5	Drainage Structure	NA	--	Y	Y	Y	Yes - US & DS
B-9.0	Anadromous	28	Drainage Structure	NA	Y	Y	Y	Y	Yes - US & DS
B-6.4	Anadromous	6	Drainage Structure	NA	--	Y	Y	Y	Yes - DS

[a] Source: Johnson and Daigneault, 2008; Noel *et al.*, 2008.
[b] Anadromous catalog codes: K = Chinook salmon, CH = chum salmon, CO = coho salmon, P = pink salmon, S = Sockeye salmon, p = present, r = rearing, s = spawning. Kr = Chinook rearing observed but not noted in Alaska Department of Fish and Game Anadromous Catalog. Habitat abbreviations: Rearing (R), Migration (M), Over-wintering (OW), Spawning (SP) and habitats for Chinook, chum, coho, pink or sockeye salmon: Y = verified, -- = not present, P = probable. Potential Blockage abbreviations: BD = beaver dam, US = artificial - up stream, DS = artificial – down stream.
[c] Culverts are closed cylindrical structures; size is diameter. Culvert extension is an extension of an existing culvert. Drainage structures could include multiplate culverts, precast arches, or single or multiple short-span bridges; type and size to be determined during final design and permitting. Bridges are single or multiple 23-foot short-span bridges. (HDR Alaska, Inc., and TNH-Hanson, LLC, 2008; Pochop, 2008). NA = Not Available.
[d] Spawning substrates, adult coho salmon and juvenile salmonids observed (Noel *et al.*, 2008).
[e] Nominated for the Anadromous Stream Catalog based on data from survey (Noel *et al.*, 2008).

Table G-6
Summary of EFH-Bearing Streams Crossed by Segments

	SOUTHERN SEGMENTS	NORTHERN SEGMENTS			
	Mac West-Connector 1	**Willow**	**Houston-Houston North**	**Houston-Houston South**	**Big Lake**
EFH Crossings	1	6	8	5	8
Habitat					
Spawning	0	4	2	2	2
Rearing	1	6	8	5	8
Migration	1	6	8	5	8
Over-Winter	0	4	2	2	4
Conveyance Structure					
Bridge	0	4	1	1	0
Culvert	1	1	4	2	1
Drainage Structurea	0	1	3	2	6
Relocation	0	0	0	0	1

Source: Johnson and Daigneault, 2008; Noel *et al.*, 2008.
[a] Drainage structures would be determined during the final design process and could include multi-plate culverts, pre-cast arches, and single or multiple short span bridges.

G.3.4.1 Southern Segments and Segment Combinations

The southern segments would cross only one EFH-bearing stream (Figure G-3; Table G-5). The Mac West-Connector 1 Segment Combination would cross a cataloged anadromous tributary of the Little Susitna River at C1-2.6 (Table G-5). This tributary provides rearing habitat for coho salmon and likely provides migratory access to upstream spawning and rearing habitats. Table G-7 contains salmon life stages and habitats in streams that could be crossed by the project. At present, the channel is stable, with an average width of about 27 feet (Noel *et al.*, 2008: Record 26). The culvert proposed at this crossing for the access road and railbed would be buried to approximately 40 percent of its diameter where possible, eliminating the existing emergent vegetation along the stream margin and submergent vegetation in the stream channel, and fragmenting coho salmon rearing habitat (Noel *et al.*, 2008: Record 26). Substrates at the crossing site are organic debris and fines, which would not provide spawning habitat for salmonids (Noel *et al.*, 2008: Record 26). This crossing does not appear to contain habitats capable of supporting spawning or overwintering for salmon (Table G-5).

G.3.4.2 Northern Segments and Segment Combinations

The northern segments and segment combinations would cross EFH-bearing streams at 24 locations (Figure G-3; Tables G-5 and G-6). The Willow Segment would cross the Little Susitna River and the Susitna River drainages, including six streams that support EFH. The Houston-Houston North Segment Combination would cross the Little Susitna River and the Little Susitna drainages, including eight crossings of streams that contain EFH. The Houston-Houston South Segment Combination would also cross the Little Susitna River and the Little Susitna drainages, including five streams with EFH. The Big Lake Segment would cross the Big Lake and Goose Creek drainages, including eight crossings of streams with EFH. Of the 24 potential northern segment crossings, conveyances could include 6 bridges, 7 culverts, 10 drainage structures, and

Table G-7
Salmon Life Stages and Habitats at EFH-Bearing Streams Crossed by the Proposed Port MacKenzie Rail Extension Segments[a,b] (page 1 of 3)

				Life Stages				Habitats				
Segment/Crossing Location	**Fish Presence**	**Crossing Identification**	**Record Number**	**Eggs**	**Fry/Larvae**	**Juveniles**	**Adults**	**Spawning**	**Rearing**	**Over-wintering**	**Summer Foraging**	**Migratory**
SOUTHERN SEGMENTS												
Connector 1 Segment												
C1-2.6	**The Little Susitna Tributary**	C1-026	26									
	Coho salmon					X	X		X		X	X
NORTHERN SEGMENTS												
Willow Segment												
MP-190.3	**Little Willow Creek Tributary[c]**	W-098	98									
	Coho salmon			X	X	X	X	X	X		X	X
MP-189.0	**Rogers Creek**	W-101R	101									
	Coho salmon					X	X		X	X	X	X
W-24.0	**Willow Creek**	W-106	106									
	Chinook salmon			X	X	X	X	X	X	X	X	X
	Coho salmon			X	X	X	X	X	X	X	X	X
	Pink salmon			X	X		X	X				X
	Chum salmon			X	X		X	X				X
W 20.9	**Susitna River Tributary[d]**	W-110	110									
	Coho salmon				X	X			X		X	X
W-10.0	**Fish Creek**	W-118R	118									
	Coho salmon			X	X	X	X	X	X	X	X	X
	Sockeye salmon				X		X					X
W-0.6	**The Little Susitna River**	W-121R	121									
	Chinook salmon			X	X	X	X	X	X	X	X	X
	Sockeye salmon				X		X					X
	Coho salmon			X	X	X	X	X	X	X	X	X
	Pink salmon			X	X		X	X		X		X
	Chum salmon			X	X		X	X		X		X
Houston North Segment												
MP 178.5	**Lake Creek Tributary**	HN-065R	65									
	Coho salmon					X	X		X		X	X
MP 177.5	**Lake Creek Tributary**	None										
	Coho salmon					X	X		X		X	X
HNM-4.8	**Lake Creek Tributary**	HNM-122R	122									
	Coho salmon					X	X		X		X	X

Table G-7
Salmon Life Stages and Habitats at EFH-Bearing Streams Crossed by the Proposed Port MacKenzie Rail Extension Segments[a,b] (page 2 of 3)

Segment/Crossing Location	Fish Presence	Crossing Identification	Record Number	Life Stages				Habitats				
				Eggs	Fry/Larvae	Juveniles	Adults	Spawning	Rearing	Over-wintering	Summer Foraging	Migratory
NORTHERN SEGMENTS (cont'd)												
Houston North Segment (cont'd)												
HNM-4.4	**Lake Creek**	HNM-123	123									
	Coho salmon					X	X		X		X	X
	Sockeye salmon				X		X					X
HN-3.2	**The Little Susitna River**	HN-067R	67									
	Chinook salmon					X	X		X	X	X	X
	Sockeye salmon						X					X
	Coho salmon			X	X	X	X	X	X	X	X	X
	Pink salmon			X	X		X	X		X		X
	Chum salmon			X	X		X	X		X		X
Houston South Segment												
MP- 175.0	**The Little Susitna Tributary**	HS-070R	70									
	Coho salmon					X	X		X		X	X
MP-174.3	**The Little Susitna River**	HS-071R	71									
	Chinook salmon					X	X		X	X	X	X
	Sockeye salmon						X					X
	Coho salmon			X	X	X	X	X	X	X	X	X
	Pink salmon			X	X		X	X		X		X
	Chum salmon			X	X		X	X		X		X
Houston Segment												
H-6.3	**The Little Susitna Tributary**	H-044	44									
	Coho salmon					X	X		X		X	X
H-4.3	**The Little Susitna Tributary**	H-046	46									
	Chinook salmon					X			X		X	X
	Coho salmon					X			X		X	X
H-0.8	**The Little Susitna Tributary**	H-050R	50									
	Coho salmon			X	X	X	X	X	X	X	X	X
	Pink salmon			X	X		X	X		X		X
Big Lake Segment												
MP-170.1	**Outlet Cheri Lake**	BL-003	3									
	Coho salmon					X	X		X		X	X
B-18.3	**Inlet to Long Lake**	None										
	Coho salmon					X	X		X		X	X

Table G-7
Salmon Life Stages and Habitats at EFH-Bearing Streams Crossed by the Proposed Port MacKenzie Rail Extension Segments[a,b] (page 3 of 3)

				Life Stages					Habitats			
Segment/Crossing Location	Fish Presence	Crossing Identification	Record Number	Eggs	Fry/Larvae	Juveniles	Adults	Spawning	Rearing	Over-wintering	Summer Foraging	Migratory
NORTHERN SEGMENTS (cont'd)												
Big Lake Segment (cont'd)												
B-17.1 TO B-17.6	**Inlet to Long Lake**	None										
	Coho salmon					X	X		X		X	X
B- 16.6	**Inlet to Long Lake**	BL-007R	7									
	Coho salmon					X	X		X		X	X
B-15.9	**Little Meadow Creek**	BL-008	8									
	Coho salmon			X	X	X	X	X	X	X	X	X
	Pink salmon						X					X
	Chum salmon						X					X
	Sockeye salmon			X	X		X	X		X		X
B-15.2	**Lucille Creek**	BL-010R	10									
	Coho salmon					X	X		X	X	X	X
	Sockeye salmon						X					X
B- 9.0	**Fish Creek**	BL-019R	19									
	Chinook salmon			X	X	X	X	X	X	X	X	X
	Sockeye salmon			X	X		X	X		X		X
	Coho salmon			X	X	X	X	X	X	X	X	X
	Pink salmon			X	X		X	X		X		X
	Chum salmon			X	X		X	X		X		X
B-6.4	**Goose Creek**	BL-022R	22									
	Chinook salmon					X			X	X	X	X
	Coho salmon			X	X	X	X		X	X	X	X

[a] Sources: ADF&G, 2007a; 2009a; Johnson and Daigneault, 2008; Noel *et al.*, 2008.
[b] Evaluation based on habitat at crossing location, waterbody connectivity, reported fish occurrence, and surveyed fish occurrence.
[c] Nominated for the Anadromous Stream Catalog based on data from survey (Noel *et al.,* 2008).
[d] Suitable spawning habitat for anadromous and resident game fish present (Noel *et al.*, 2008).

one stream-bed relocation (Tables G-5 and G-6). Nine of the 24 proposed northern segment crossings would cross habitats capable of supporting spawning salmon and 11 crossings could support overwintering juvenile salmon or eggs (Tables G-5 through G-7).

G.3.4.3 Willow Segment

The Willow Segment would cross four waters important for sustaining recreational and commercial salmon fisheries in Southcentral Alaska, including Rodgers Creek, Willow Creek, Fish Creek - Susitna River tributary, and the Little Susitna River. This segment would cross six stream crossings with waters supporting EFH; four crossings documented as important for salmon, one crossing that has been nominated as used (W-20.9), and one crossing (MP-190.3) where spawning habitat and adult salmon were observed spawning within a tributary in the floodplain of Little Willow Creek (Figure G-3; Table G-5; Johnson and Daigneault, 2008; Noel *et al.*, 2008). Spawning habitat suitable for salmon and overwintering habitats suitable for juvenile or eggs is present at four crossings.

ARRC proposes to construct bridges at four of the EFH stream crossings, a culvert at one crossing, and a drainage structure at one crossing. Two of the four bridges would likely require instream pilings within reaches of the Little Susitna River and Willow Creek with documented spawning habitat for four of five Pacific salmon. Two of these crossings (MP-190.3 and MP-189.0), at an unnamed tributary of Little Willow Creek and Rogers Creek, parallel existing crossings of the ARRC main line. Construction of similar bridges next to the existing bridges at crossings MP-190.3 (Noel *et al.*, 2008: Record 98) and MP-189.0 (Noel *et al.*, 2008: Record 101) would result in additional habitat loss and degradation at these locations. In addition, the end of the proposed rail line siding would encroach on the Little Willow Creek crossing of the main line and would result in placement of some fill into an oxbow of this creek.

The crossing of Willow Creek (W-24.0; Noel *et al.*, 2008: Record 106) would be within the Willow Creek State Recreation Area, a popular sport fishery in the study area (ADF&G, 2009b). Construction of a crossing at this location would result in loss of spawning and rearing habitat from the bridge which could also potentially intercept large woody debris input from the surrounding spruce forest. Pink salmon were observed spread out along the left bank on a spawning bed at the W-24.0 crossing location (Noel *et al.*, 2008). The section of Willow Creek at the proposed crossing supports coho salmon rearing and migration and Willow Creek supports Chinook, chum, coho, and pink salmon (Johnson and Daigneault, 2008).

Upstream about 0.4 mile from the Fish Creek crossing (W-10.0; Noel *et al.*, 2008: Record 118), habitats were observed to be suitable for salmon spawning, rearing, and overwintering; however, no fish were observed or collected. There were several active beaver dams downstream from the site, including a new dam that had caused recent overbank flooding. This section of Fish Creek supports sockeye salmon (Johnson and Daigneault, 2008).The Willow Segment would cross the Little Susitna River, which is a stable productive system that supports all five Pacific salmon. Approximately 0.5 mile upstream of the proposed crossing site (W-0.6), there are habitats suitable for salmon spawning, rearing, migration, and overwintering (Noel *et al.*, 2008: Record 121). This section of the Little Susitna River supports spawning habitat for coho and pink salmon, rearing habitat for coho salmon, and migration habitat for Chinook, chum, and sockeye salmon (Johnson and Daigneault, 2008).

G.3.4.4 Houston-Houston North Segment Combination

The Houston-Houston North Segment Combination would cross waters important for sustaining recreational and commercial salmon fisheries in Southcentral Alaska, including Lake Creek and the Little Susitna River, and many unnamed tributaries to these waters. Construction of this segment combination would involve crossing eight streams that provide EFH (Figure G-3; Tables G-5 and G-6). There is spawning and overwintering habitat at 25 percent of the EFH stream crossings. ARRC would construct a bridge at the Little Susitna River crossing (HN-3.2), three drainage structures and four culverts. The bridge over the Little Susitna River would require instream pilings within a reach with documented spawning habitat for three of five Pacific salmon (Table G-5).

Crossings of streams along the existing main line (MP-178.5 and MP-177.5) might already have upstream blockages as a result of the main line, Parks Highway, or secondary road crossings (Table G-8). The main line crossing upstream of MP-178.5 would be an extension of the existing culvert, which is slightly perched above the stream bottom (Noel *et al*., 2008: Record 65). Upstream from the crossing at MP-177.5, a secondary road might be blocking this stream. Both streams (at MP-178.5 and MP-177.5) are tributaries of Lake Creek and have been documented as providing rearing habitat for coho salmon. The channel of Lake Creek is about 20 feet wide at the proposed crossing (HN-4.4) and provides rearing habitat for coho salmon and sockeye salmon also use the channel to access Nancy Lake. This reach of Lake Creek is within the Little Susitna State Recreation River and is considered high value for fish habitat and recreational use (Noel *et al.*, 2008: Record 123).

Table G-8
Summary of EFH-Bearing Streams Crossed by Alternatives (Page 1 of 2)

	Mac West-Conn 1-Willow	Mac West-Conn 1-Houston-Houston North	Mac West-Conn 1-Houston-Houston South	Mac West-Conn 2-Big Lake	Mac East-Conn 3-Willow	Mac East-Conn 3-Houston-Houston North	Mac East-Conn 3-Houston-Houston South	Mac East-Big Lake
Fish Communities								
Anadromous	7	9	6	8	6	8	5	8
Habitat								
Spawning	4	2	2	2	4	2	2	2
Rearing	7	9	6	8	6	8	5	8
Migration	7	9	6	8	6	8	5	8
Over-Winter	4	2	2	4	4	2	2	4
Potential Blockages								
None	5	3	3	0	4	2	2	0
Natural-Beaver Dams	1	0	0	0	1	0	0	0
Artificial-Up Stream	0	0	0	1	0	0	0	1
Artificial-Down Stream	1	3	2	0	1	3	2	0
Artificial-Up and Down Stream	0	3	1	7	0	3	1	7

Table G-8
Summary of EFH-Bearing Streams Crossed by Alternatives (Page 2 of 2)

Conveyance Structure								
Bridge	4	1	1	0	4	1	1	0
Culvert	2	5	3	1	1	4	2	1
Drainage[a] Structure	1	3	2	6	1	3	2	6
Relocation	0	0	0	1	0	0	0	1
Total Crossings	**7**	**9**	**6**	**8**	**6**	**8**	**5**	**8**

Source: Johnson and Daigneault, 2008; Noel *et al.*, 2008.
[a] Drainage structures would be determined during the final design process and could include multi-plate culverts, pre-cast arches, and single or multiple short span bridges.

The Little Susitna River is a highly productive system that supports all five Pacific salmon (ADF&G, 1988). The bridge proposed for the Little Susitna River crossing would likely require instream supports to span the channel, which has a wetted width of about 100 feet at this location (Noel *et al.*, 2008: Record 67).

The Houston Segment of the Houston-Houston North Segment Combination would cross three tributaries of the Little Susitna River that support EFH (H-6.3, H-4.3, and H-0.8). Two of these tributaries, at crossings H-6.3 and H-4.3, provide access for coho salmon to Horseshoe Lake and Finger Lake, respectively; and the other tributary, at crossing H-0.8, provides spawning habitat for pink and coho salmon (Noel *et al.*, 2008: Records 44, 46, and 50).

G.3.4.5 Houston-Houston South Segment Combination

The Houston-Houston South Segment Combination would cross waters important for sustaining recreational and commercial salmon fisheries in Southcentral Alaska, including the Little Susitna River and several unnamed Little Susitna tributaries. Construction of this segment combination would involve crossing five streams that provide EFH (Figure G-3; Tables G-5 and G-6). Spawning and overwintering habitats are present at 40 percent of the EFH stream crossings. ARRC would construct a bridge over the Little Susitna River crossing (MP-174.3) next to an existing bridge. The bridge over the Little Susitna River would require instream pilings within a reach with documented spawning habitat for three of five Pacific salmon. ARRC would use two culverts and two drainage structures to cross the remaining crossings.

The existing main line crosses, and the proposed rail line would cross, a small tributary of the Little Susitna River (MP-175.0; Noel *et al.*, 2008: Record 70) that connects to an abandoned meander. This stream, which is cataloged as coho rearing habitat, appears to have been blocked upstream by construction of Parks Highway and a submerged culvert in the existing rail bed (Noel *et al.*, 2008: Record 70).

The Little Susitna River crossing (MP-174.3) would be above the river's confluence with Lake Creek and would be above the occurrence of sockeye salmon, although pink salmon spawning has been documented above this reach (Johnson Daigneault, 2008). The crossing area provides some spawning habitat, but most of the Chinook salmon in the Little Susitna River system spawn in habitats upstream of Parks Highway (Ivey, 2009). Where the rail line would cross the Little Susitna River, meanders and oxbows parallel the existing rail line (MP-174.3; Noel *et al.*, 2008: Record 71). The proposed bridge would be just downstream of the existing rail bridge and some of these backwaters would be filled. The increased loss of riparian vegetation due to bridge construction and the filling of backwater habitats, and the increased need for bank hardening with riprap as the meandering channel continues to erode toward the existing rail bed, would decrease habitat suitability for spawning and rearing salmon.

The Houston Segment of the Houston-Houston South Segment Combination would cross three tributaries of the Little Susitna River that support EFH (H-6.3, H-4.3, and H-0.8; Table G-5). Two of these tributaries, at crossings H-6.3 and H-4.3, provide access for coho salmon to Horseshoe Lake and Finger Lake, respectively; and the other tributary, at crossing H-0.8, provides spawning habitat for pink and coho salmon (Noel *et al.*, 2008: Records 44, 46, and 50).

G.3.4.6 Big Lake Segment

The Big Lake Segment would cross waters important for sustaining recreational and commercial salmon fisheries in the Big Lake and Goose Creek drainages in Southcentral Alaska, including Little Meadow Creek, Lucile Creek, Fish Creek, and Goose Creek. Construction of this segment would involve crossing eight streams that provide EFH (Figure G-3; Tables G-5 and G-6). There is spawning habitat present at 25 percent of the crossings, and suitable overwintering habitats at 50 percent of the crossings. ARRC would construct one culvert, six drainage structures, and would fill and relocate a portion of a channel to cross EFH-bearing streams.

Five streams the Big Lake Segment would cross provide EFH habitat for coho salmon; sockeye salmon also use three of these streams (Johnson and Daigneault, 2008). One stream crossing next to the existing rail line provides connectivity for Cheri Lake (MP-170.1). ARRC would extend this existing crossing structure. The culvert at the outflow from Cheri Lake is perched above the stream bed (Noel *et al.*, 2008: Record 3). The stream that connects Cheri Lake and Long Lake is documented as coho salmon rearing habitat; the Big Lake Segment would cross this stream three times (MP-170.1, B-18.3, and B-16.6). The stream channel is not well defined and the rail bed would fill the reach between approximately Mile Post B-17.1 and Mile Post B-17.6. ARRC would relocate a 2,500-foot reach of stream channel into a new 2,400-foot-long channel. Parks Highway and two secondary roads upstream from the proposed rail line crossing at B-16.6 would also cross this stream. An existing culvert at the road crossing downstream from B-16.6 had been replaced at least once because there is a perched dry culvert and two culverts receiving flow from this stream (Noel *et al.*, 2008: Record 7). Water velocity is very slow at this location due to the improperly bedded road culverts, and it does not appear to gain sufficient velocity to provide for passage of adult salmon. With construction of the proposed Big Lake Segment there would be a total of eight crossings on the stream connecting Cheri and Long lakes and a relocation of the channel. The multiple culvert crossings appear to have reduced the capacity of this stream to provide habitat for salmon, although coho salmon were captured just above the road culvert, 400 feet downstream from the proposed rail line crossing at B-16.6 (Noel *et al.*, 2008: Record 7).

The Little Meadow Creek crossing (B-15.9) would be within a 28-foot-wide reach of the stream that provides spawning, rearing, migratory, and overwinter habitats for chum, coho, pink and sockeye salmon. Spawning sockeye salmon were observed during the field visit, along with redds created by earlier spawning salmon (Noel *et al.*, 2008: Record 8). The proposed drainage structure could adversely impact fish if it is not designed to allow passage for juvenile and adult fish to and from upstream and downstream lakes and tributaries, and movement of stream-bed gravels. The Lucile Creek crossing (B-15.2) contains juvenile rearing and likely overwintering habitat, and a migration passage for both coho and sockeye salmon (Noel *et al.*, 2008: Record 10).

The Fish Creek drainage supports Chinook, chum, coho, pink and sockeye salmon and contributes to sockeye salmon production in the Upper Cook Inlet. The crossing location (B-9.0) supports coho rearing and sockeye migration (Noel *et al.*, 2008: Record 19). Fish Creek supports a large and complex population of salmon. It is a migratory corridor to Big Lake that supports one of the most important sockeye salmon runs in the study area. The habitat at the crossing location is complex and undisturbed, with spawning gravels and deep pools for overwintering (Noel *et al.*, 2008: Record 19).

The Goose Creek drainage supports coho salmon spawning and rearing. The crossing location (B-6.4) is within a large fen complex with the stream surrounded by floating wetland vegetation (Noel *et al.*, 2008: Record 22). This system is likely primarily groundwater fed, with a relatively stable water level that remains unfrozen during winter and provides overwintering habitat for salmon. The proposed crossing would result in the loss of about 19 acres of high-value wetland habitat due to excavation, filling, and draining of the system required for construction of the rail bed approach to the drainage structure. These construction activities would likely result in reduced productivity as fish rearing habitat for this system. A crossing at this location would likely destroy unique habitat features because the fen would either have to be drained to provide an area for construction, or the water under the floating mat vegetation would have to be channeled and filled. This wetland is likely one of the largest juvenile rearing areas, other than lakes with large shelves, in the project area.

G.3.5 Impacts by Alternative

The proposed project alternatives would require a minimum of five and a maximum of nine crossings of streams that have been documented to contain EFH (Table G-8; Johnson and Daigneault, 2008; Noel *et al.*, 2008). The alternative requiring the minimum number of EFH-bearing stream crossings (5) is the Mac East-Connector 3-Houston-Houston South Alternative. The alternative requiring the maximum number of EFH-bearing crossings (9) is the Mac West-Connector 1-Houston-Houston North Alternative. Table G-8 summarizes salmon habitat use, proposed conveyance structures, and potential existing stream blockages for the 25 EFH-bearing stream crossings by alternative. Site-specific conditions at each EFH-bearing stream crossing are described in the section above.

G.3.5.1 Mac West-Connector 1-Willow Alternative

Construction of the Mac West-Connector 1-Willow Alternative would impact seven stream crossings that provide EFH (Table G-8). Spawning and overwintering habitats are present at 4 of these stream crossings. All streams this alternative would cross provide rearing habitats and salmon passage during seasonal migrations (Tables G-5 and G-8). ARRC would construct bridges at four of the seven EFH stream crossings, construct drainage structures at one of the seven crossings, and would install culverts at two of the seven crossings (Tables G-5 and G-8). Two of the four bridges would require instream pilings within reaches of the Little Susitna River and Willow Creek, both of which contain documented spawning habitat for four of five Pacific salmon (Table G-5). Six stream crossings for this alternative would be in undeveloped areas that do not have potential unnatural blockages because of ineffective culverts or other crossing structures, although one stream has a potential beaver dam blockage (Table G-8). This alternative would cross four waters important for sustaining recreational and commercial salmon fisheries in Southcentral Alaska, including Rodgers Creek, Willow Creek, Fish Creek (Susitna River tributary), and the Little Susitna River. Development of this alternative could change sport fishing access to the Fish Creek-Susitna River drainage and the lower reaches of the Little Susitna River.

G.3.5.2 Mac West-Connector 1-Houston-Houston North Alternative

Construction of the Mac West-Connector 1-Houston-Houston North Alternative would involve nine crossings of streams that provide EFH (Tables G-5 and G-8). There is spawning and overwintering habitat at 2 of the EFH crossings. All streams this alternative would cross provide rearing habitat and passage for salmon during seasonal migrations. ARRC would construct a bridge at the Little Susitna River crossing (HN-3.2) and would use three drainage structures to cross EFH streams. The bridge over the Little Susitna River would require instream pilings within a reach with documented spawning habitat for three of five Pacific salmon (Table G-5). ARRC would use culverts to cross the remaining five EFH streams (Tables G-5 and G-8). Six EFH stream crossings along this alternative would be in areas where development has created potential unnatural blockages because of ineffective culverts or other crossing structures. This alternative would cross waters important for sustaining recreational and commercial salmon fisheries in Southcentral Alaska, including Lake Creek and the Little Susitna River, and many unnamed tributaries to these waters. Development of this alternative could change access to the Little Susitna River and Lake Creek in the Little Susitna State Recreation River near Parks Highway.

G.3.5.3 Mac West-Connector 1-Houston-Houston South Alternative

Construction of the Mac West-Connector 1-Houston-Houston South Alternative would involve crossing six streams that provide EFH (Tables G-5 and G-8). There is spawning habitat at 2, and overwintering habitats at 4 of these stream crossings. ARRC would construct a bridge at the Little Susitna River crossing (MP-174.3) next to an existing bridge. The bridge over the Little Susitna River would require instream pilings within a reach with documented spawning habitat for three of five Pacific salmon (Table G-5). ARRC would use two drainage structures to cross EFH streams, and would use culverts to cross the remaining three EFH streams (Tables G-5 and G-8). All streams that this alternative would cross provide rearing habitat and passage for salmon during seasonal migrations. Half of the stream crossings along this alternative are in areas where development has created potential unnatural blockages because of ineffective culverts. This alternative would cross waters important for sustaining recreational and commercial salmon fisheries in Southcentral Alaska, including the Little Susitna River and several unnamed Little Susitna tributaries.

G.3.5.4 Mac West-Connector 2-Big Lake Alternative

Construction of the Mac West-Connector 2-Big Lake Alternative would involve crossing eight EFH streams (Tables G-5 and G-8). There is spawning habitat at two stream crossings and habitats appear suitable for overwintering at four stream crossings. All streams that this alternative would cross provide rearing habitat and passage for salmon during seasonal migrations. ARRC would not construct bridges along this alternative. ARRC would use six drainage structures to cross EFH streams. ARRC would use a culvert at one of the EFH streams and would relocate two sections totaling 2,440 feet of an EFH stream channel into 2,460 feet of new channel (Table G-5 and G-8). All EFH streams that this alternative would cross are in areas where development has created potential unnatural blockages because of ineffective culverts (Table G-5). This alternative would cross waters important for sustaining recreational and commercial salmon fisheries in the Big Lake and Goose Creek drainages in Southcentral Alaska, including Little Meadow Creek, Lucile Creek, Fish Creek, and Goose Creek. The crossing of Goose Creek would be within a large unique fen system that would likely be drained or filled to provide an area for construction, which would result in the loss of about 4 acres within the 200-foot ROW and likely extend outward within the 19-acre high-value wetland and juvenile rearing habitat.

G.3.5.5 Mac East-Connector 3-Willow Alternative

Construction of the Mac East-Connector 3-Willow Alternative would involve crossing six streams that provide EFH. There is spawning habitat at four of these stream crossings. All streams that this alternative would cross provide rearing habitat and passage for salmon during seasonal migration (Tables G-5 and G-8). ARRC would construct bridges at four of the six EFH stream crossings, and would construct a drainage structure and a culvert at the remaining two crossings (Figure G-3; Tables G-5 and G-8). Two of the four bridges would require instream pilings within reaches of the Little Susitna River and Willow Creek with documented spawning habitat for four of five Pacific salmon (Table G-5). One of the stream crossings along this alternative appears to have a potential unnatural blockage from ineffective culverts. One stream has potential beaver dam blockages (Table G-8). This alternative would cross four waters important for sustaining recreational and commercial salmon fisheries in Southcentral Alaska, including Rodgers Creek, Willow Creek, Fish Creek (Susitna River tributary), and the Little Susitna River. Development of this alternative could change sport fishing access to the Fish Creek-Susitna River drainage and the lower reaches of the Little Susitna River.

G.3.5.6 Mac East-Connector 3-Houston-Houston North Alternative

Construction of the Mac East-Connector 3-Houston-Houston North Alternative would involve crossing eight streams that provide EFH (Tables G-5 and G-8). There is spawning and overwintering habitat at 1 of these stream crossings. All EFH streams that this alternative would cross provide rearing habitat and passage for salmon during seasonal migrations. ARRC would construct a bridge at the Little Susitna River crossing (HN-3.2), and would use three drainage structures to cross EFH streams (Figure G-3). The bridge over the Little Susitna River would require instream pilings within a reach with documented spawning habitat for three of five Pacific salmon (Table G-5). ARRC would use culverts to cross the remaining four EFH streams (Tables G-5 and G-8). Most stream crossings along this alternative (75 percent) would be in areas where development has created potential unnatural blockages because of ineffective culverts (Table G-8). This alternative would cross waters important for sustaining recreational and commercial salmon fisheries in Southcentral Alaska, including Lake Creek and the Little Susitna River, and many unnamed tributaries to these waters. Development of this alternative could change access to the Little Susitna River and Lake Creek in the Little Susitna State Recreation River near Parks Highway.

G.3.5.7 Mac East-Connector 3-Houston-Houston South Alternative

Construction of the Mac East-Connector 3-Houston-Houston South Alternative would involve crossing five streams that provide EFH (Tables G-5 and G-8). There is spawning and overwintering habitat at 2 of the stream crossings. All streams that this alternative would cross provide rearing habitat and passage for salmon during seasonal migrations. ARRC would construct a bridge at the Little Susitna River crossing (MP-174.3) next to an existing bridge. The bridge over the Little Susitna River would require instream pilings within a reach with documented spawning habitat for three of five Pacific salmon (Table G-5). ARRC would use two drainage structures to cross EFH streams. ARRC would use culverts to cross the remaining two EFH streams (Figure G-3; Tables G-5 and G-8). Three of the stream crossings along this alternative are in areas where development has created potential unnatural blockages because of ineffective culverts (Table G-8). This alternative would cross waters important for sustaining recreational and commercial salmon fisheries in Southcentral Alaska, including the Little Susitna River and several unnamed Little Susitna tributaries.

G.3.5.8 Mac East-Big Lake

Construction of the Mac East-Big Lake Alternative would involve crossing eight streams that provide EFH (Tables G-5 and G-8). There is spawning habitat at 2 of the stream crossings, and habitats appear suitable for overwintering at 4 of stream crossings. All streams that this alternative would cross provide rearing habitat and passage for salmon during seasonal migrations. ARRC would not construct bridges along this alternative. ARRC would use six drainage structures to cross EFH streams (Figure G-3). ARRC would use a culvert to cross one of the EFH streams and would block a section of an EFH stream with fill which would be relocated to a new channel and crossed by a box culvert. All streams that this alternative would cross are in areas where development has created potential unnatural blockages because of ineffective culverts (Table G-8). This alternative would cross waters important for sustaining recreational and commercial salmon fisheries in the Big Lake and Goose Creek drainages in Southcentral Alaska, including Little Meadow Creek, Lucile Creek, Fish Creek, and Goose Creek. The crossing of Goose Creek would be within a large unique fen system that would likely be drained or filled to provide an area for construction, resulting in the loss of about 4 acres within the 200-foot ROW and likely extending outward within the 19-acre high-value wetland and juvenile rearing habitat.

G.3.6 No-Action Alternative

Under the No-Action Alternative, no EFH stream crossings would be constructed and no additional impacts to EFH would result. Existing stream crossing structures, recreational fishing, commercial fishing, recreational boating, and off-road vehicle activities would continue to impact EFH and salmon fisheries resources in the study area. Absent the proposed rail line, there could be other, non-project-related impacts to EFH. The area could experience increased development of privately held and some state land the Applicant would otherwise have purchased for rail line construction and operations. There could also be increased road construction and maintenance in the area to support materials transported by heavy trucks. Depending on the extent to which these potential alternative development activities would require stream crossings and would result in increased erosion and sedimentation, there could be impacts to EFH.

G.4 Mitigation

This section identifies mitigation measures that would avoid, minimize, or compensate for potential adverse impacts to EFH. Federal, State of Alaska, and local regulations and permit processes are in place to ensure that construction and operations activities are conducted in an environmentally responsible manner and that the Applicant would be required to comply with the resulting reasonable requirements and associated best management practices.

This section describes mitigation measures proposed by the Applicant, some of which are regulatory-related requirements and associated best management practices developed by SEA based on the information available to date, and consultations with appropriate agencies.

G.4.1 Applicant's Voluntary Mitigation Measures

Voluntary mitigation measures proposed by the Applicant have been incorporated into the initial design of the proposed project in order to reduce the potential for adverse effects to EFH streams. The Applicant's voluntary measures for avoidance, minimization or mitigation of potential impacts include:

- For all project-related crossings of fish-bearing waters that incorporate bridges or culverts, the Applicant shall design, construct, and maintain the conveyance structures in accordance with the National Marine Fisheries Service 2008 publication, "Anadromous Salmonid Passage Facility Design" [National Marine Fisheries Service. 2008. Anadromous Salmonid Passage Facility Design. National Marine Fisheries Service, Northwest Region, Portland, Oregon] or equivalent and reasonable requirements.
- The Applicant shall time project-related construction in anadromous streams to minimize adverse effects to salmon during critical life stages when practicable. The Applicant shall incorporate timing windows [i.e., those time periods when salmon are least vulnerable to disturbances], as specified by the Alaska Department of Fish and Game Division of Habitat, into construction contract specifications for instream work. The Applicant shall design and construct stream crossings so as not to impede fish passage or impair the hydrologic functioning of the waterbody.
- The Applicant shall implement Essential Fish Habitat (EFH) conservation measures as agreed upon with the National Marine Fisheries Service during the EFH consultation process for this project.

- The Applicant shall obtain Federal permits required by Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act, from the U.S. Army Corps of Engineers prior to initiation of project-related construction activities in wetlands and waterbodies. The Applicant also agrees to obtain necessary state permits and authorizations (e.g., Alaska Department of Fish and Game Fish Habitat Permit, Alaska Department of Natural Resources Land Use Permit, and an Alaska Department of Environmental Conservation Section 401 water quality certification). The Applicant shall incorporate stipulations into construction contract specifications.
- The Applicant shall be subject to U.S. Environmental Protection Agency and Alaska Department of Environmental Conservation jurisdiction under the National Pollutant Discharge Elimination System (NPDES) for stormwater discharges resulting from project-related construction activities. Requirements that are commonly part of a Stormwater Pollution Prevention Plan associated with a NPDES Stormwater Construction Permit include the following:
    - Ground disturbance shall be limited to only the areas necessary for project-related construction activities.
    - During earthmoving activities, topsoil shall be reused wherever practicable and stockpiled for later application during reclamation of disturbed areas.
    - Appropriate erosion control measures shall be employed to minimize the potential for erosion of soil stockpiles until they are removed and the area is restored.
    - Disturbed areas shall be restored as soon as practicable after construction ends along a particular stretch of rail line, and the goal of restoration shall be the rapid and permanent reestablishment of native ground cover on disturbed areas to prevent soil erosion.
    - The bottom and sides of drainage ditches shall be revegetated using natural recruitment from the native seed sources in the stockpiled topsoil or a seed mix free of invasive plant species.
    - If weather or season precludes the prompt reestablishment of vegetation, temporary erosion control measures shall be implemented.
- The Applicant shall avoid and minimize impacts to waters of the United States, including wetlands, to the extent practicable. The Applicant shall provide compensatory mitigation for unavoidable impacts to wetlands as part of the U.S. Army Corps of Engineers Section 404 permit, to the extent practicable in accordance with the reasonable requirements of the Clean Water Act.
- The Applicant shall minimize the number of temporary stream crossings constructed to provide access for contractors, work crews, and heavy equipment to the extent practicable. Where needed, temporary structures shall be placed to avoid overly constricting active channels and shall be removed as soon as practicable after the crossing is no longer needed.
- The Applicant shall disturb the smallest area practicable around any streams and, as soon as practicable following project-related construction activities, revegetate disturbed areas using native vegetation.

- When project-related construction activities, such as culvert and bridge construction, require work in streambeds, the Applicant shall conduct activities, to the extent practicable, during either summer or winter low-flow conditions.
- The Applicant shall design and construct the proposed rail line in such a way as to maintain natural water flow and drainage patterns to the extent practicable. This shall include installing bridges or placing equalization culverts through the embankment as necessary, preventing impoundment of water or excessive drainage, and maintaining the connectivity of floodplains and wetlands.

G.4.2 SEA's Preliminary Mitigation Measures

In addition to the Applicant's voluntary measures, SEA has developed preliminary measures to protect salmon freshwater habitats which include:

- Unless otherwise approved by the Alaska Department of Fish and Game, project-related detonation of explosives within, beneath, or in proximity to fish-bearing waters shall not result in overpressures exceeding 2.7 pounds per square inch unless the water body, including its substrate, was frozen solid. Peak particle velocity stemming from explosive detonation shall not exceed 0.5 inch per second during the early stages of egg incubation.
- The Applicant shall not narrow an anadromous water body between its mean high water lines for the project, unless authorized in writing by Alaska Department of Fish and Game (ADF&G) prior to project-related construction, thereby enabling ADF&G to apply reasonable design criteria or requirements.
- During project construction, the Applicant shall not clear riparian vegetation within 100 feet of fish-bearing water bodies and 50 feet of non-fish-bearing water bodies and emergent wetlands, unless approved by the Alaska Department of Natural Resources.
- The Applicant shall design, construct, and operate the rail line and associated facilities, including bridge abutments, to maintain existing water patterns and flow conditions and provide long-term hydrologic stability by conforming to natural stream gradients and stream channel alignment and avoiding altered subsurface flow, to the extent practicable. Project-related supporting structures (e.g., bridge piers) shall be designed to minimize scour and increased flow velocity, to the extent practicable.
- During project-related design, the Applicant shall align road and track crossings of water bodies perpendicular or near perpendicular to water bodies, where practicable, to minimize crossing length and potential bank disturbance.
- During project-related construction, the Applicant shall remove all project-related construction debris (including construction materials, soil, or woody debris) from water bodies, including wetlands, as soon as practicable during the open-water period, or prior to break-up for debris on top of or within ice or snow crossings.
- The Applicant shall follow all applicable Federal regulations and standard protocols for transporting hazardous substances and other deleterious compounds to minimize the potential for a spill occurrence.

- The Applicant shall ensure that all project-related culverts and bridges are sufficiently clear of debris to avoid stream-flow alteration and increased flooding. The Applicant shall inspect all drainages, bridges, and culverts semi-annually (or more frequently, as seasonal flows dictate) for debris accumulation and remove and properly dispose of debris promptly.
- The Applicant shall comply with the reasonable requirements of Alaska Statute (AS) 16.05.841, Fishway Required, and AS 16.05.871, Protection of Fish and Game, regarding project-related winter ice bridge crossings and summer ford crossings of all anadromous and resident fish streams. If necessary, natural ice thickness could be augmented (through removing snow, adding ice or water, or other technique) if site-specific conditions, including water depth, are sufficient to protect fish habitat and maintain fish passage.
- Prior to construction, the Applicant shall complete jurisdictional delineations of wetlands and other surface waters that are subject to Section 404 of the Clean Water Act for all associated facilities proposed outside of the right-of-way.
- Prior to initiating project-related construction activities, the Applicant shall mark stream channels and existing culvert locations in the project construction area before snowfall obscures their location to avoid damage to these areas.
- The Applicant shall construct project-related water crossings in a manner that minimizes disturbances to streambeds, streambanks, and flow. Measures to meet these goals could include installing bridge piers during the winter, and initially constructing permanent project-related crossing structures, when practicable, to avoid the need to construct both temporary and permanent crossing structures.
- Prior to construction, the Applicant shall consult with the Alaska Department of Environmental Conservation or other regulatory agencies to determine appropriate regulations and associated requirements for project-related tank storage facilities. At a minimum, the Applicant shall place tank storage facilities as far as practicable from streams or rivers, and implement secondary containment measures (e.g., use of lined and bermed pits).
- The Applicant shall direct the operators of project-related vehicles to not drive in or cross streams other than at crossing points determined by the Alaska Department of Environmental Conservation and U.S. Army Corps of Engineers.
- During final design of the project, the Applicant shall conduct all siting, design, and development of the rail line and associated facilities according to the reasonable requirements within the jurisdiction of the Alaska Department of Natural Resources and the Alaska Department of Fish and Game.
- The Applicant shall return all project-related stream crossing points to their preconstruction contours to the extent practicable.
- The Applicant shall implement all reasonable best management practices imposed by the U.S. Army Corps of Engineers' (USACE) Section 404 Permit under the Clean Water Act to minimize project-related impacts to waters of the U.S., including wetlands. Standard best management practices are specified in the USACE Alaska District's Nationwide Permits General Best Management Practice Guide (U.S. Army Corps of Engineers, 2007. "Nationwide Permits: General Best Management Practices." Alaska District, Regulatory

Program. Online at: http://www.poa.usace.army.mil/reg/NWPs.htm) and could include the following:

- Containing sediment and turbidity at the work site by installing diversion or containment structures.
- Disposing of dredge spoils or unusable excavated material not used as backfill at upland disposal sites in a manner that minimizes impacts to wetlands.
- Revegetating wetlands as soon as possible, preferably in the same growing season, by systematically removing vegetation, storing it in a manner to retain viability, and replacing it after construction to restore the site.
- Using fill materials that are free from fine material.
- Stockpiling topsoil and organic surface material, such as root mats, separately from overburden and shall return it to the surface of the restored site.
- Dispersing the load of heavy equipment such that the bearing strength of the soil (the maximum load the soil can sustain) would not be exceeded. Suitable methods could include, but are not limited to, working in frozen or dry ground conditions, employing mats when working in wetlands or mudflats, and using tracked rather than wheeled vehicles.
- Using techniques such as brush layering, brush mattressing, live siltation (a revegetation technique used to trap sediment), jute matting and coir logs to stabilize soil and reestablish native vegetation.

G.5 Summary of Impacts to EFH

The primary impacts to EFH from construction and operation of the proposed Port MacKenzie Rail Extension would be loss and degradation of instream and riparian habitats due to placement of bridges, culverts, and drainage structures; alteration of stream and wetland hydrology; blockage of fish movements; and increased erosion and sedimentation from the removal of riparian vegetation. All crossings of EFH-bearing streams would result in some loss or alteration of stream and riparian habitats. Bridged crossings would likely result in a smaller area of instream habitat loss compared to culverts. In general, clear-span bridges (those without stream supports) would have less potential to create conditions that would cause loss of spawning habitats, blockage of fish movements, alteration of stream hydrology, and increased erosion and sedimentation.

Table G-8 summarizes impacts to EFH-bearing streams for each alternative. The proposed alternatives would cross between five and nine streams containing EFH. All EFH-bearing streams crossed by the alternatives provide rearing habitat and passage of salmon during seasonal movements. There are habitats suitable for salmon spawning at 9 of the 25 EFH-bearing streams and overwintering habitats at 11 of the 25 EFH-bearing stream crossings, depending on alternative (Table G-8). The proposed alternatives would include between zero and four bridges, one to five culverts, one to six drainage structures, and zero to one stream relocation. Proposed alternative include between one and eight crossing locations on streams with potential blockage from previous crossings that could include ineffective culverts.

All alternatives would cross waters important for sustaining recreational and commercial salmon fisheries, with the greatest number of important waters crossed by alternatives containing the Willow Segment and the fewest important waters crossed by alternatives containing the Houston-Houston South Segment. Of the three potential crossing locations on the Little Susitna River, the Houston-Houston South crossing (MP-174.3) and the Houston-Houston North segments would affect spawning habitat for three salmon species, while the Willow Segment crossing (W-0.6) would affect spawning habitat for four salmon species. The Houston-Houston South crossing of the Little Susitna River is also within a reach that is about half the wetted width of the crossings on the Houston-Houston North and Willow segment crossings. Alternatives that include the Willow Segment could alter sport fishing access to the Fish Creek-Susitna River drainage and the lower reaches of the Little Susitna River; alternatives that include the Houston-Houston North Segment could change access to the Little Susitna River and Lake Creek within the Little Susitna State Recreation River near Parks Highway. Alternatives that have a potential to increase sport harvest of federally managed salmon fisheries could result in reduced recruitment leading to reduced stocks prompting changes in Federal management. Alternatives that include the Big Lake Segment would cross Goose Creek, a large unique fen system that would likely have to be drained or filled to provide an area for construction, resulting in the loss of about 4 acres within the 200-foot ROW.

G.6 References

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