4.5 Wetland Resources

This section describes the analysis of potential impacts to wetland resources from the proposed Port MacKenzie Rail Extension. Section 4.1 lists applicable regulations. Section 4.5.1 defines the wetlands study area, Section 4.5.2 describes the methods SEA employed to analyze impacts to wetlands, Section 4.5.3 describes the affected environment, and Section 4.5.4 describes potential impacts to wetlands.

4.5.1 Study Area

The Applicant proposed that a 1,000-foot-wide corridor study area for each proposed segment would be adequate to assess potential impacts to wetland functions outside the 200-foot right-of-way (ROW). The U.S. Army Corps of Engineers agreed to the 1,000-foot corridor with reservations, including the potential that additional wetlands delineation and analysis might be needed if any of the proposed rail alternatives or their segments were rerouted through areas outside the study area corridor, possibly causing the Applicant time delays and additional costs. SEA determined that the 1,000-foot-wide corridor was acceptable, and used available information on the location and classification of wetlands within 500 feet of the centerline of proposed rail line segments. SEA quantitatively assessed impacts within the 200-foot ROW, and generally characterized potential impacts to wetlands outside the 200-foot ROW.

4.5.2 Analysis Methodology

SEA independently verified information on wetlands within 500 feet of the centerline of the proposed rail segments, based on a 2008 field study that used the USACE delineation manual and assessed wetland functions (HDR 2008). Unless otherwise noted, this EIS assumes that construction activities would occur within the 200-foot-wide ROW and that construction activities would disturb the entire ROW. SEA calculated the aerial extent of wetlands that would be directly affected by the proposed project using Geographic Information System analysis of delineated wetland areas within the 200-foot-wide rail line ROW.

SEA used information on wetlands functions and values developed using a combination of Geographic Information System modeling to assess variables at the watershed level and the application of *A Rapid Procedure for Assessing Wetland Functional Capacity* (Magee and Hollands, 1998; HDR, 2008). SEA used the wetlands functional assessment to describe potential impacts to wetland functions that would result from project alternatives. SEA compared impacts by alternative and assessed comparisons of wetland functions between the alternatives (low functioning, moderate functioning, and high functioning). Low-functioning wetlands include wetlands assessed with a functional capacity value of 0.33 and lower, moderate-functioning wetlands include wetlands assessed with a functional capacity value above 0.33 and below 0.66, and high-functioning wetlands include wetlands assessed with a functional capacity value of 0.66 or higher. See Appendix C for a more detailed description of analysis methodology.

4.5.3 Affected Environment

Wetlands are areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life

in saturated soil conditions (33 CFR 328.3(b)). By regulatory definition, wetlands support hydrophytic vegetation, show signs of wetland hydrology, and contain hydric soils. Less than 1 percent of the wetlands in the study area did not appear to have surface connections to waterways or other wetlands. These wetlands could be isolated and might not fall under Corps of Engineers jurisdiction.

Appendix C describes wetland communities in the study area. Based on field delineations completed by ARRC and aerial photos, SEA independently verified the wetland community types within the study area. Table 4.5-1 summarizes wetland types within 500 feet of the centerline of the proposed rail line segments.

Table 4.5-1
Summary of Wetland Types within 500 Feet of the Centerline of Proposed Rail Line Segments[a]

Wetland Type (NWI Code[c])	Proportion of Wetland Area by Category (percent)[b]	Wetland Area (acres)
Broadleaf Forest Wetlands (PFO1)	5.7	48
Needleleaf Forest Wetlands (PFO4)	92.9	786
Mixed Forest Wetlands (PFO#/#)	1.4	12
Subtotal Forest Wetlands (PFO) [d]	**25.1**	**846**
Broadleaf Scrub/Shrub Wetlands (PSS1)	41.6	829
Needleleaf Scrub/Shrub Wetlands (PSS4)	9.2	183
Mixed and Other Scrub/Shrub Wetlands (PSS#/#)	49.2	981
Subtotal Scrub/Shrub Wetlands (PSS)	**59.3**	**1,993**
Emergent Wetlands (PEM)	**10.9**	**367**
Palustrine Waters (P)	29.9	47
Riverine Waters (R)	23.6	37
Lacustrine Waters (L)	46.5	73
Subtotal Other Wetlands and Waters	**4.7**	**157**
All Wetlands and Waters		***3,363***

[a] Source: HDR 2008.
[b] Proportion of wetland area for broader wetland types (PFO, PSS, and Other Wetlands and Waters) are in bold. Proportion of wetland areas within each wetland type are listed for Forested Wetlands (PFO 1,PFO4, PFO#/#), Scrub/Shrub Wetlands (PSS1, PSS4, PSS#/#), and Other Wetlands and Waters (PEM, P, R, Other Waters).
[c] National Wetland Inventory (NWI) Codes as defined by Classification of Wetlands and Deepwater Habitats (Cowardin *et al.*, 1979): PFO = Palustrine Forested; PSS = Palustrine Scrub/Shrub; PEM = Palustrine Emergent; R = Riverine; L = Lacustrine.
[d] Totals might not equal sums of values due to rounding.

- Forested wetlands: Forested wetlands are one of the predominant wetland types within the study area. Forested wetlands include broadleaf, needleleaf, and mixed broadleaf/needleleaf forest communities. Forested wetlands function to increase nutrient export, modify stream flow, and contribute to the diversity and abundance of wetland fauna. Needleleaf forested wetland communities also have high functional capacities for improving water quality.
- Scrub/shrub wetlands: Scrub/shrub wetlands also dominate the study area and include broadleaf, needleleaf, and mixed shrub communities. Like forested wetlands, scrub/shrub wetlands also function to increase nutrient export and modify stream flow. Scrub/shrub wetland communities also have high functional capacities for improving water quality and contributing to the abundance and diversity of wetland fauna because of the abundance of browse and nesting habitat. Seasonally flooded broadleaf scrub/shrub communities adjacent

to streams have a high functional capacity for contributing to the food chain by exporting nutrients downstream.

- Emergent wetlands: Emergent wetlands are less common within the study area. Emergent wetlands are dominated by graminoid species – sedges and grasses. They can also contain scattered shrubs. Emergent wetlands associated with a stream function to buffer floodwaters, moderate stream flow, contribute to the food chain through nutrient export, and in some cases, provide habitat for juvenile fish, waterfowl, and other wildlife.
- Other waters and riverine wetlands: Other waters and riverine habitats in the study area include ponds (with and without aquatic bed vegetation such as lilypads, horsetails, and pondweed), lakes (waterbodies larger than 20 acres), and perennial and intermittent streams. Open water wetlands, lakes, and ponds are highly valued for their functions to improve water quality, buffer storm and floodwaters, and provide valued habitat for a variety of wildlife. Streams and riverine communities are considered sensitive habitats due to their high value for fish habitat and sensitivity to disturbance (Hall *et al.*, 1994).

4.5.3.1 Unique or Sensitive Wetlands

The 2008 field delineation identified the Goose Creek Fen within the study area. Goose Creek Fen is a floating mat fen system located on either side of Goose Creek along the Big Lake Segment. Approximately 18 acres of the fen is within the study area. Fens are peat wetlands fed by a combination of precipitation, groundwater, and surface water (Gore, 1983). Fens typically have a higher potential of hydrogen (pH) and greater nutrient content than bogs, and support more diverse plant communities that provide habitat for a number of aquatic and terrestrial organisms. Where they are connected to surface water systems, fens help to maintain the quality of stream water and provide valuable wildlife habitat. Because of their unique features, fens are important ecological features. Unlike many freshwater wetlands, floating mat wetlands adjacent to streams are renewed by fresh water inputs and are not degenerated into acidic muskegs with low wildlife productivity (Bedford and Godwin, 2003). The Goose Creek fen receives overbank flooding from Goose Creek and provides the high-value function of moderating stream flows during periods of high water. These floating wetlands provide high-value rearing habitat for anadromous fish species because they protect fish from predators and keep them warm during winter. These wetlands also function to export carbon into the food chain through the decaying plant matter that makes up the floating mat. A high carbon-export function is highly valued, because it helps support the food chain locally and in downstream habitats.

There are 11,250 acres of wetland mitigation bank lands throughout the MSB (MSB, 2007). The MSB has identified mitigation bank lands for preservation (through conservation easements or other tools) to offset potential development throughout the MSB (Figure 4.5-1). "Wetland Functional Assessment and Wetland Delineation: Big Lake South Bank Plan Su-Knik Wetland Mitigation Bank" (Herrera Environmental Consultants, 2008) describes a portion of these mitigation bank lands. The mitigation bank areas are important to wetlands management in the MSB. They are ecologically valuable lands that protect and support fish and wildlife habitat and provide water recharge and filtering areas important for human uses (MSB, 2007). The MSB Big Lake South mitigation bank consists of multiple parcels in three separate geographic units that total approximately 2,039 acres of upland and wetland. The Goose Creek and Threemile Creek geographic units would be within the Big Lake Segment ROW. The total area of the

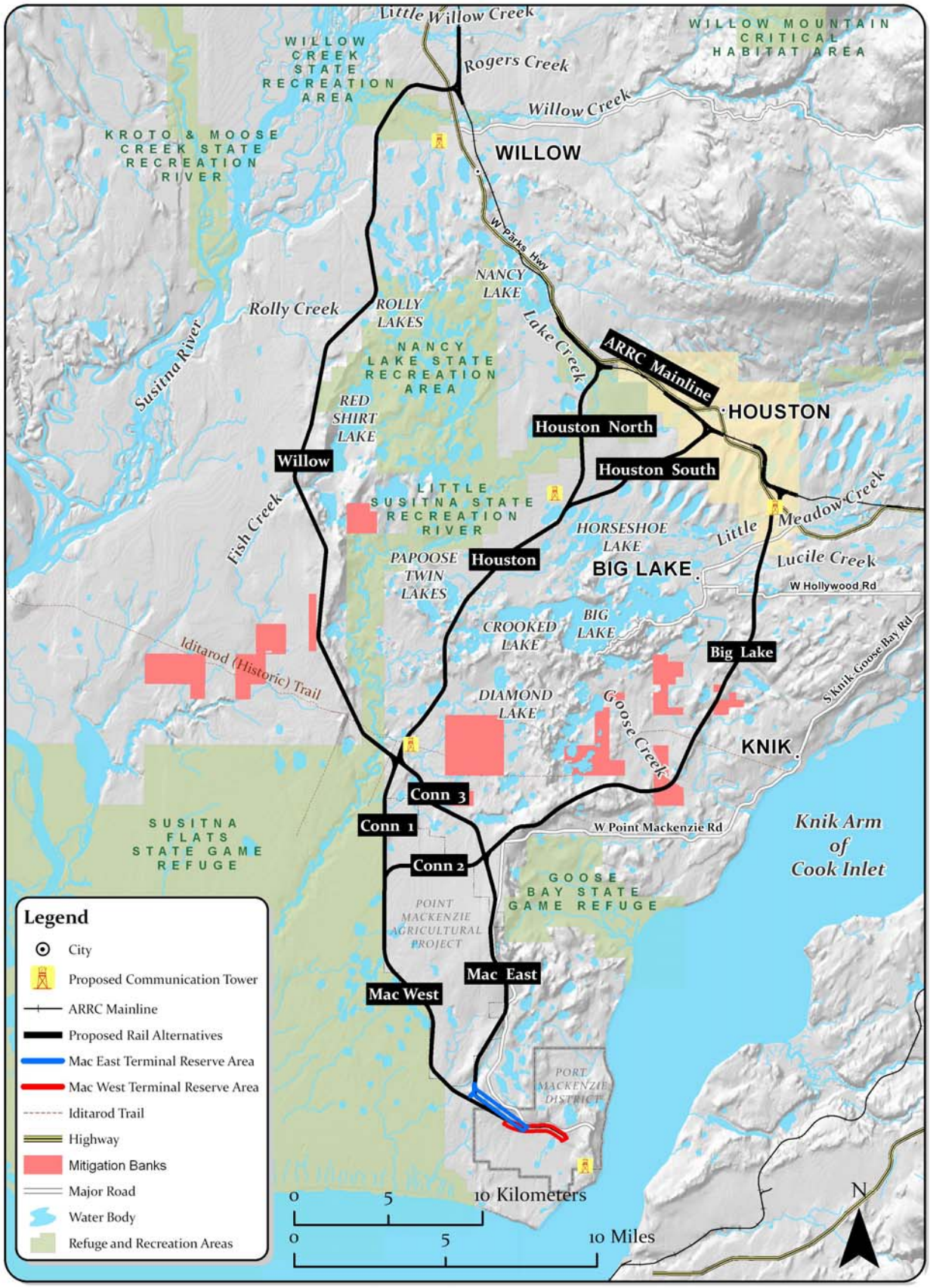

Figure 4.5-1. Mitigation Banks near the Proposed Port MacKenzie Rail Extension

Goose Creek geographic unit is 837 acres, 18 acres of which would be within the Big Lake Segment ROW. The total area of the Threemile Creek geographic unit is 320 acres, 7 acres of which would be within the Big Lake Segment ROW. According to the MSB report identifying the bank lands, most of the wetlands within the Goose Creek and Threemile Creek geographic units are riverine wetlands (Herrera Environmental Consultants, 2008). The report categorizes forested, scrub/shrub, and emergent wetlands as riverine wetlands for purposes of assessing their function for the mitigation bank report. These wetlands provide highly valued functions for floodwater retention, nutrient export, and as plant and animal habitat support (Herrera Environmental Consultants, 2008). It should also be noted that Goose Creek Fen is within the Goose Creek geographic unit.

4.5.3.2 Wetland Functions and Values

Wetland functions are the chemical, physical, and biological processes or attributes that contribute to the self maintenance of a wetland and determine the ecological significance of wetland properties (HDR, 2008). Wetlands serve specific functions for the environment, such as controlling erosion, or supply humans a benefit, such as providing recreation areas. Wetland functions (and values) for study area wetlands that were identified and evaluated include storm and floodwater storage (flood control), stream flow moderation (maintaining aquatic habitat and aesthetic appreciation opportunities), groundwater recharge/discharge (replenishing water supplies), sediment removal and nutrient cycling (water quality protection and nutrient export), and contributions to the abundance and diversity of wetland vegetation and wildlife (maintaining aquatic habitat and fish and wildlife harvest opportunities) (USEPA, 2001; HDR, 2008).

Wetlands in the study area are very highly functional because they are predominantly intact, undisturbed systems (Herrera Environmental Consultants, 2008). The primary factors influencing the performance of wetland functions in the study area are climatic conditions, quantity and quality of water entering and leaving the wetland, and disturbances or alterations in the wetland or the surrounding ecosystem (HDR, 2008). An assessment of the functional capacity of wetlands in the study area by the Applicant and reviewed by SEA indicates (HDR, 2008):

- Wetlands without an outlet tend to have a high functional capacity to store storm and floodwater.
- All wetlands have a high functional capacity to modify water quality.
- Wetlands without an outlet tend to have a low functional capacity to modify stream flow.
- Wetlands with an outlet tend to have a high functional capacity to export detritus.
- Wetlands have a moderately high functional capacity to contribute to the abundance and diversity of wetland fauna.
- Riverine waters and wetlands with outlets have higher functional capacity to perform groundwater discharge and lower functional capacities to perform groundwater recharge.
- Wetlands performing moderate to high stream flow moderation functions were rare compared to other functions.

4.5.4 Environmental Consequences

This section describes the results of SEA's analysis of potential impacts to wetlands (as defined above) within the 200-foot ROW of the proposed Port MacKenzie Rail Extension alternative segments. On average, approximately 29 percent of the area within the ROW would be considered wetlands, according to the U.S. Army Corps of Engineers established criteria for determining wetlands (Environmental Laboratory, 1987; USACE, 2007). Rail line construction would directly affect wetlands within the ROW and could also affect wetlands within 500 feet on either side of the rail line centerline. Rail line construction would require clearing, excavation, and placement of fill material in wetlands. The placement of fill would cause a permanent loss of wetland functions within the fill area and could result in additional impacts to adjacent wetland areas inside and outside the ROW. Because many wetland functions depend on the size of the wetland or the contiguous nature of the wetland with other habitats, clearing and filling a wetland could lower the ability of adjacent wetlands to perform functions that depend on size or an unfragmented connection to a waterbody. The extent of impacts into the adjacent wetland both inside and outside the ROW would depend on the immediate area surrounding the impact, such as adjacent waterbodies, size of contiguous wetland being fragmented, and sensitivity of the wetland type to fragmentation. Appendix C includes detailed wetlands data for each alternative segment.

4.5.4.1 Proposed Action

Common Impacts

There would be impacts to wetlands from excavation and direct placement of fill into wetlands for construction of the rail line, access road, and other associated facilities within the 200-foot ROW. ARRC would place associated facilities inside the 200-foot ROW where possible. During final design and permitting, ARRC may need to construct outside the ROW for work spaces, borrow areas, and associated facilities. These areas would be identified by the Applicant during final design and permitting, and the Applicant would avoid wetland areas as much as practicable. If a wetland is used as a borrow area, excavation of the wetland would not eliminate the water body, but would convert it to a different type of water body (See Section 4.2.4.1 for additional borrow area impacts). Wetland areas adjacent to the rail line ROW could also be affected through fragmentation. Wetland hydrology, vegetative cover, habitat, and other functions would be altered or diminished by the effects of the rail bed and rail line operations. The following sections describe construction impacts within the 200-foot ROW that would be common to all alternative segments, and potential impacts to wetlands outside the 200-foot ROW. Although common to all alternative segments, potential impacts outside the 200-foot ROW would depend on the size and type of wetland size being crossed in any given location.

Construction

Wetlands would be both excavated and filled within the footprints of the rail bed and access road. Construction activities resulting in the direct loss of wetlands, through excavation or fill placement, would predominantly affect the most common wetland types within the area – forested and scrub/shrub. Loss or alteration of wetlands also could eliminate or reduce adjacent wetland function. Filling or draining wetlands would prevent surface water storage and reduce wetland water quality enhancement functions, while accelerating the flow of water downstream,

thereby increasing the potential for flooding. Construction activities would affect wetland functions and values, both short and long term.

Loss of Fish, Wildlife, and Plant Habitats

Fill placed in wetlands would result in permanent direct loss of habitat. Changing the hydrologic regime of wetlands by fragmenting the connection between larger wetland areas could also result in impacts to the ability of adjacent wetlands to support a high diversity of wetland fauna. For example, permanently flooded areas that provide valuable habitat for waterfowl could be drained by culverts. When floods or other high-water events occur, culverts could sink into the underlying peat, or rise up and become perched, and over time could prevent the movement of water from one side of the rail bed to the other. In this way, wetlands on one side of the rail bed might be drained, changing the hydrology of the wetland system. A change in the hydrology of the system could result in impacts to wetlands adjacent to the rail bed, and could reach outside the extent of the 200-foot ROW. Where the rail bed embankment would fragment or interrupt contiguous emergent and scrub/shrub communities, the ability of the wetland to provide wildlife habitat also would be affected. Channel modifications that change instream water temperatures could diminish habitat suitability for fish and wildlife (USEPA, 1993). During construction, fugitive dust generated by excavation and grading would cause short-term, local increases in levels of air-borne particulates. Loose soil blowing from haul-truck beds and traffic in vehicle access and construction staging areas could generate fugitive dust. Dust deposited in wetlands could affect plant growth by changing soil productivity and permeability and reducing water quality, which could result in reduced wetland plant diversity next to haul roadways.

Degradation of Water Quality

Reduction in total wetland area and alteration of wetland hydrology would reduce the capacity of regional wetlands to improve water quality. For example, changing the natural sheet flow of a contiguous wetland to channelized flow through culverts could reduce the residence time of water within the wetland and would lower the capability of the wetland to improve water quality. Removal of wetland and riparian vegetation during rail line construction activities would expose mineral soils to erosion and cause increased sediment loading to wetlands (Childers and Gosselink, 1990). High sediment loads entering wetlands through channels and drainage ditches can smother aquatic vegetation and benthic invertebrates, fill in riffles and pools, and increase water turbidity (USEPA, 1993). Borrow areas established next to wetlands could also degrade water quality through sedimentation and increased turbidity in the wetland (Irwin, 1992). Silts and fines precipitate from still waters, leading to sedimentation, which reduces water storage capacity, smothers vegetation, and reduces oxygen concentrations, which ultimately affects wetland richness, diversity, and productivity.

Loss of Storm and Floodwater Storage Capacity

Removal of wetland vegetation would reduce the capacity of the wetlands to impede and redistribute storm and floodwaters (USEPA, 2001). Storm and floodwater storage capacity is directly related to the size of the wetland and the existence of an outlet for water. Emergent wetlands are especially adept at moderating floodwaters during storm events because of their vegetation composition and deep organic soils. Disturbance or fragmentation of a large undisturbed wetland by reducing its size or creating a water outlet through installation of a

culvert would reduce the capacity of the wetland to store floodwaters. Impacts to floodwater storage capacity could reach beyond the 200-foot ROW, depending on the location of fragmentation within the wetland.

Loss of Riparian Zones

Riparian habitats are adjacent to waterbodies and are the transition areas between terrestrial and aquatic ecosystems (NRC, 2002). They provide a mechanism through which energy, materials, and water pass and are significant in ecology, environmental management, and civil engineering because of their role in soil conservation, their biodiversity, and their influence on aquatic ecosystems. Riparian zones act as natural filters, protecting aquatic environments from excessive sedimentation, polluted surface runoff, and erosion (Nakasone *et al*., 2003). They supply shelter and food for many aquatic animals and shade that is an important part of stream temperature regulation. Research shows riparian zones are instrumental in water quality improvement for both surface runoff and water flowing into streams through subsurface or groundwater flow (Mengis *et al.*, 1999).

The direct loss of wetland vegetation due to construction activities could also affect adjacent riparian vegetation. Depending on the type of crossing proposed at a given location, riparian vegetation could be altered upstream and downstream of the crossing. In some cases, these changes could be outside the 200-foot ROW. For example, alteration of localized water velocities and flow patterns, and impacts to floodplains could alter the mean high water line of the water body. This change in water level could cause riparian vegetation to become submerged; in some cases this would cause a loss of vegetation. Section 4.4 describes impacts to floodplains in more detail.

Loss and Degradation of Hydric Soils

Impacts to wetland soils would result from filling, excavating, or clearing for construction of the rail bed and associated facilities, resulting in the permanent loss of some hydric soils that sustain wetlands. The presence of thick organic mats within wetlands is directly related to the ability of a wetland to provide water quality functions to the surrounding watershed (HDR, 2008). Soil stability depends on vegetative cover, and when vegetation is disturbed, soil can become unstable.

Interruption and Reduction of Natural Hydrologic Functions

Disturbances in wetland hydrology, such as interruption of surface flow or creation of outlets, could create surface impoundments or increase outflow. When the water table of a wetland drops because of decreased inflow or increased outflow, there can be changes in vegetation and degradation of the peat layer, which can ultimately result in degradation of the wetland and reduction or elimination of its functions. Rail bed embankments could fragment normal sheet flow through wetlands, leading to the creation of surface impoundments that would decrease water circulation and lead to water stagnation. Decreased water circulation also results in increased water temperature, lower dissolved oxygen levels, changes in salinity and pH, the prevention of nutrient outflow, and increased sedimentation (USEPA, 1993). Rail beds and roadbeds could create impoundments even with installation of properly placed and maintained culverts. Once installed, even a properly sized culvert can become an ice trap because its

location within an embankment exposes the culvert to maximum cooling conditions (Freitag and McFadden, 1997). This is of special concern in the study area because weather conditions are subject to alternating periods of freeze and thaw, which can cause ice to build up in culverts.

Operations

Most effects to wetlands within the ROW would occur during construction, while some effects would occur during rail line operations. Railroad maintenance would include clearing of vegetation, repairs to the tracks and associated structures (access road, ditches, bridges, and culverts), and cleaning out ditches and culverts. These activities would be infrequent and short in duration.

Maintenance and use of the access road could include the use of rock salt and sand for increasing traction, which could damage or kill vegetation and aquatic life (Campbell *et al.*, 1994). Soil stabilizers and chemical agents used along roadways could damage wetland plants (USEPA, 1993). Any toxic substances, such as rock salt and bridge maintenance materials, that are spilled on the access road could adhere to sediments and could subsequently accumulate in impoundments as a result of decreased water circulation, leading to bioaccumulation of contaminants by wetland biota. Bioaccumulation of toxins occurs at higher trophic levels, which could ultimately cause toxicity.

Storm water discharges from the rail bed and roadbed would convey storm water and low concentrations of pollutants to wetlands along the receiving waterways and drainage channels, potentially altering soil chemistry and soil pH and affecting vegetation adjacent to the rail line. Runoff from bridges can increase loadings of hydrocarbons, heavy metals, toxic substances, and deicing chemicals directly into wetlands (USEPA, 1993). Moreover, precipitation runoff could have a similar effect on the pH of wetlands, depending on the parent materials for the rail bed and roadbed. The primary pollutants that cause degradation are sediment, nutrients, salt, heavy metals, and selenium. Other impacts could include low dissolved oxygen and pH (USEPA, 1993).

Fugitive dust generated by vehicles using the access road could affect wetlands next to the access road by covering vegetation with fine dust particles and inhibiting photosynthesis. Train operations could produce fugitive dust. Fugitive dust settling in wetlands along the rail line ROW could affect soil pH, surface hydrology, and sheet flow (DNRP, 2004).

Sparks from rail line operations and maintenance are not known to have been a common cause of fires, but could increase the potential for fires. Fires caused by operations could impact wetlands outside the 200-foot ROW. However, the increased risk of fire in these areas from rail line operations would be low, and wide-ranging changes in fire management for the area surrounding the rail line would be unlikely.

Impacts by Segment and Segment Combinations

Wetlands would be permanently removed or altered through direct excavation and filling for the rail line and associated facilities. The intensity of impact would depend on the size of the area to be excavated and filled during rail line construction and operations. Overall, wetlands along all the segments are high functioning for five out of eight functions analyzed for the project (61 to

62 percent of wetlands along each segment are high functioning). All segments are relatively low functioning for groundwater recharge. Wetlands along all segments are moderate functioning for streamflow moderation and storm and floodwater storage. This section describes the wetland types and areas within the 200-foot ROW for alternative segments and segment combinations. This section also compares wetland functions between segments and segment combinations where there would be notable differences. Appendix C includes additional detail regarding wetland functions. Impacts outside of the 200-foot ROW cannot be quantitatively assessed, and would depend on the type of wetland crossed, the type and size of drainage structures, value of nearby water bodies and habitat, and proposed avoidance, minimization and mitigation measures (see Chapter 19). When possible, these impacts are discussed in more general terms.

Southern Segments and Segment Combinations

Wetland communities within the 200-foot ROW of the southern segments and segment combinations would be directly affected through the loss of 98 to 279 acres (depending on segment or segment combinations) of wetlands through excavation, filling, or related construction activities (Figure 4.5-2 and Table 4.5-2). Impacts described for segments, including Mac East and Mac West, include impacts to the terminal reserve areas outside the 200-foot ROW. Impacts from construction activities would be permanent and would eliminate or limit most wetland functions. In general, the southern segments and segment combinations have a higher proportion of lower functioning wetlands within the 200-foot ROW than the northern segments and segment combinations. Approximately 13 percent of the wetlands potentially affected by the proposed rail line along the southern segments and segment combinations are low functioning.

Most of the affected wetlands would be scrub/shrub and forested communities common in the region (Hall *et al.*, 1994). Most forested wetlands along the southern segments and segment combinations are comprised of needleleaf communities. In some locations, the direct loss of wetlands to construction activities would eliminate adjacent riparian zones. All four southern segments and segment combinations (Mac West-Connector 1, Mac West-Connector 2, Mac East-Connector 3, and Mac East) would include the crossing of streams and skirting of lakes and ponds, which could impact the waterbody and the adjacent riparian wetlands through the placement and operation of drainage structures. The acreages of other wetlands and waters along the southern segments and segment combinations would be relatively minor, with these waters making up 1 percent or less of the study area. Table 4.5-2 details the acreages of other wetlands and waters the four southern segments and segment combinations could impact.

Mac West-Connector 1 Segment Combination

This segment combination would have the potential to affect the largest wetland acreages near the southern terminus of the proposed rail line (279 acres within the 200-foot ROW and terminal reserve area). Compared to other segments and segment combinations, the Mac West-Connector 1 Segment Combination has wetlands that are proportionally the highest functioning for export of detritus and groundwater discharge (98 and 92 percent) (also see Appendix C). The Mac West-Connector 1 Segment Combination would affect a higher proportion and acreage of scrub/shrub wetlands, predominately mixed needleleaf/broadleaf scrub/shrub wetland communities than other southern segments and segment combinations (Table 4.5-2). The Mac

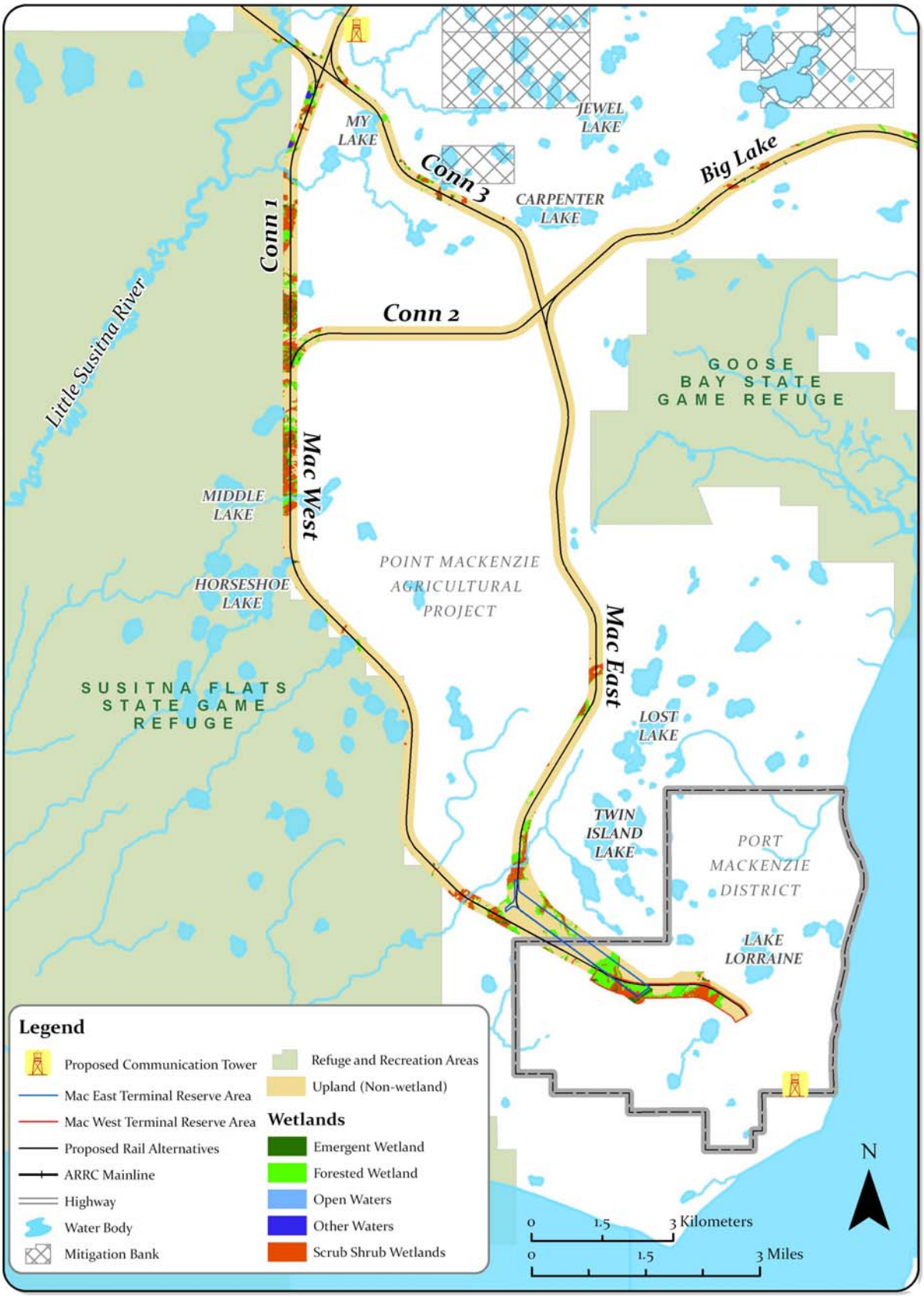

Figure 4.5-2. Wetlands near the Mac East, Mac West, and Connector Segments

Table 4.5-2
Wetlands within the 200-foot Right-of-Way of the Southern Segments and Segment Combinations[a, b]

National Wetlands Inventory Code	Description	Mac West-Connector 1		Mac West-Connector 2		Mac East-Connector 3		Mac East	
		Area (acres)	Wetland Proportion (percent)	Area (acres)	Wetland Proportion (percent)	Area (acres)	Wetland Proportion (percent)	Area (acres)	Wetland Proportion (percent)
PFO1	Broadleaf Forest Wetlands	25	19.7	25	21.0	23	31.1	23	31.9
PFO4	Needleleaf Forest Wetlands	93	73.2	85	71.4	48	64.9	46	63.9
PFO#/#	Mixed Forest Wetlands	9	7.1	9	7.6	3	4.0	3	4.2
PFO	**Subtotal Forest Wetlands [c]**	**127**	**45.5**	**119**	**50.4**	**74**	**71.8**	**72**	**73.5**
PSS1	Broadleaf Scrub/Shrub Wetlands	24	18.6	22	22.0	7	25.0	5	20.0
PSS4	Needleleaf Scrub/Shrub Wetlands	9	7.0	5	5.0	1	3.6	1	4.0
PSS#/#	Mixed and Other Scrub/Shrub Wetlands	96	74.4	73	73.0	20	71.4	19	76.0
PSS	**Subtotal Scrub/Shrub Wetlands**	**129**	**46.2**	**100**	**42.4**	**28**	**27.2**	**25**	**25.5**
PEM	**Emergent Wetlands**	**22**	**7.9**	**16**	**6.8**	**1**	**0.9**	**1**	**0.1**
P	Palustrine Waters	0	27.3	None	None	None	None	None	None
R	Riverine Waters	0	18.2	None	None	0	100.0	0	100.0
L	Lacustrine Waters	1	54.5	1	100.0	None	None	None	None
	Subtotal Other Wetlands and Waters	**1**	**0.4**	**1**	**0.4**	**0**	**0.1**	**0**	**0.1**
	All Wetlands and Waters	***279***		***236***		***103***		***98***	

[a] Source: HDR, 2008; HDR, 2010.
[b] Wetland impacts within the Mac East and Mac West segments include impacts from the terminal reserve areas located outside the 200-foot right-of-way.
[c] Totals might not equal sums of values due to rounding.

West-Connector 1 Segment Combination would cross three large areas of patterned forested/scrub/shrub/emergent bog. Patterned bogs have a high functional value for contribution to abundance and diversity of wetland fauna due to the diversity of summer and winter browse vegetation, nesting habitat for song birds, and cover for other small mammals in the scrub/shrub areas, combined with ease of movement through the emergent areas (HDR 2008). Fragmentation of these patterned bogs by construction of the rail bed could lower the ability of adjacent wetlands to provide wildlife habitat. The Mac West-Connector 1 Segment Combination would also affect a lower proportion but higher total acreage of forested wetlands than other southern segments and segment combinations (Table 4.5-2).

Mac West-Connector 2 Segment Combination

Construction of this segment combination would impact about 236 acres of wetlands within the 200-foot ROW and terminal reserve areas (Figure 4.5-2 and Table 4.5-2). Like the Mac West-Connector 1 Segment Combination, this segment combination also would have a large proportion of high-functioning wetlands for the export of detritus and groundwater discharge functions compared to other segments and segment combinations. Though both the northern and southern segments and segment combinations are low functioning for groundwater recharge, the Mac West-Connector 2 Segment Combination has the highest proportion of wetlands in this category (87 percent). The Mac West-Connector 2 Segment Combination would cross predominantly mixed scrub/shrub and needleleaf forested wetlands. The Mac West-Connector 2 Segment Combination would have large areas of patterned bog within the ROW that would be fragmented by construction of the rail line. Fragmentation of these patterned bogs could lower the adjacent wetland's ability to perform certain functions outside the 200-foot ROW.

Mac East-Connector 3 Segment Combination

This segment combination has the potential to affect the least wetland acreages (103 acres within the 200-foot ROW and terminal reserve area), with only 19 percent of the segment combination being comprised of wetlands. The Mac East-Connector 3 Segment Combination would affect a higher proportion of forested wetlands, although the overall acreage would still be just under half that of the Mac West-Connector 1 Segment Combination. The presence of 0.1 acre of other wetlands and waters along this segment combination is one of the lowest of all the southern segments and segment combinations. Construction of Connector 3 Segment, while only impacting 5 acres of wetland overall, would impact wetlands adjacent to My Lake; these impacts could lower the ability of adjacent wetlands to provide wildlife habitat by fragmenting the wetlands adjacent to the lake. Other hydrological connections also could be modified, potentially causing impacts to wetland functions beyond the 200-foot ROW. Compared to other segments and segment combinations across all functions, the Mac East-Connector 3 Segment Combination has among the highest proportion of low-functioning wetlands along its length (13 percent) and therefore the lowest proportion of high-functioning wetlands along its length (60 percent).

Mac East

By itself, the Mac East Segment is very similar to the Mac East-Connector 3 Segment Combination because the Connector 3 Segment contributes only approximately 5 acres of

wetlands to the total. The Mac East Segment would impact 98 acres of wetlands within the 200-foot ROW and terminal reserve areas. These wetlands are predominantly forested wetlands (74 percent). Similar to the Mac East-Connector 3 Segment Combination, compared to other segments and segment combinations, the Mac East Segment would also have a higher proportion of low-functioning wetlands along its length.

Northern Segments and Segment Combinations

Construction of the northern segments and segment combinations (Willow, Big Lake, Houston-Houston North, and Houston-Houston South) would affect 85 to 198 acres of wetland communities within the 200-foot ROW (depending on segment and segment combination) through excavation, filling, or other construction activities, including the development of the rail line, sidings, a power line, a buried communications cable, and an access road (Figures 4.5-3 and 4.5-4, and Table 4.5-3). Impacts from construction activities would be permanent and would eliminate or limit most wetland functions within the footprint of the ROW.

Most of the affected wetlands would be broadleaf and mixed scrub/shrub communities, which comprise from about 60 to 80 percent of the wetland habitats in the study area. Shrub wetlands are a predominant feature of the landscape in Southcentral Alaska (Hall *et al.*, 1994). Forested wetlands along the northern segments and segment combinations consist completely of needleleaf communities (Table 4.5-3). Overall, the northern segments and segment combinations have a slightly higher proportion of high-functioning wetlands than the southern segments and segment combinations for all eight wetland functions. In some locations, the direct loss of wetlands to construction activities would eliminate adjacent riparian zones. Construction of each of the northern segments and segment combinations would include the crossing of streams and skirting of lakes and ponds, which could affect the waterbodies and the adjacent riparian wetlands through the placement of the drainage structure. The acreages of these other wetlands and waters the northern segments and segment combinations would affect would be relatively minor, because they comprise only 1 to 4 acres of the study area. Table 4.5-3 details the acreages of other wetlands and waters the four northern segments and segment combinations would affect.

Willow

Wetlands along this segment comprise 12 percent of wetlands within the 200-foot ROW, the lowest proportion of wetlands along any of the northern segments and segment combinations. Of the 85 acres of potentially affected wetlands, 58 percent are comprised of scrub/shrub wetlands, predominantly broadleaf communities (Figure 4.5-3 and Table 4.5-3). The Willow Segment would also affect a larger proportion of riverine waters than the other northern segments and segment combinations – approximately 2 acres. SEA cannot quantitatively assess downstream impacts to riverine wetlands outside the 200-foot ROW because detailed hydrology modeling has not been conducted. However, a decrease in riverine wetlands along a stream corridor would put more pressure on downstream habitats to make up for the lost functions, and could as a result lower the ability of the downstream wetland to perform such functions as buffering storm water flows or providing habitat for fish. Although wetlands along all segments and segment combinations are high functioning for groundwater discharge, the Willow Segment has the lowest proportion of wetlands in this category (77 percent).

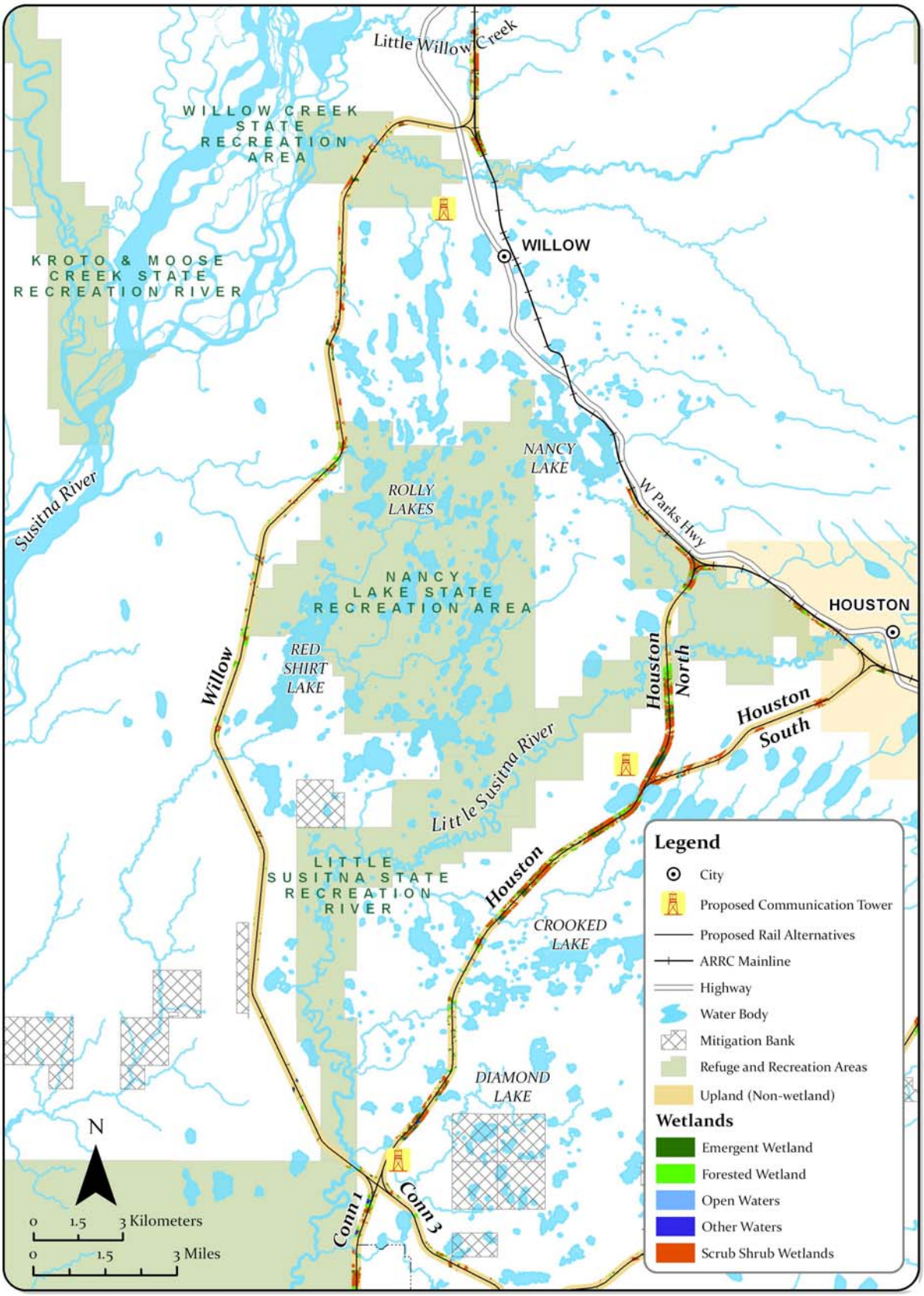

Figure 4.5-3. Wetlands near the Willow, Houston, Houston North, and Houston South Segments

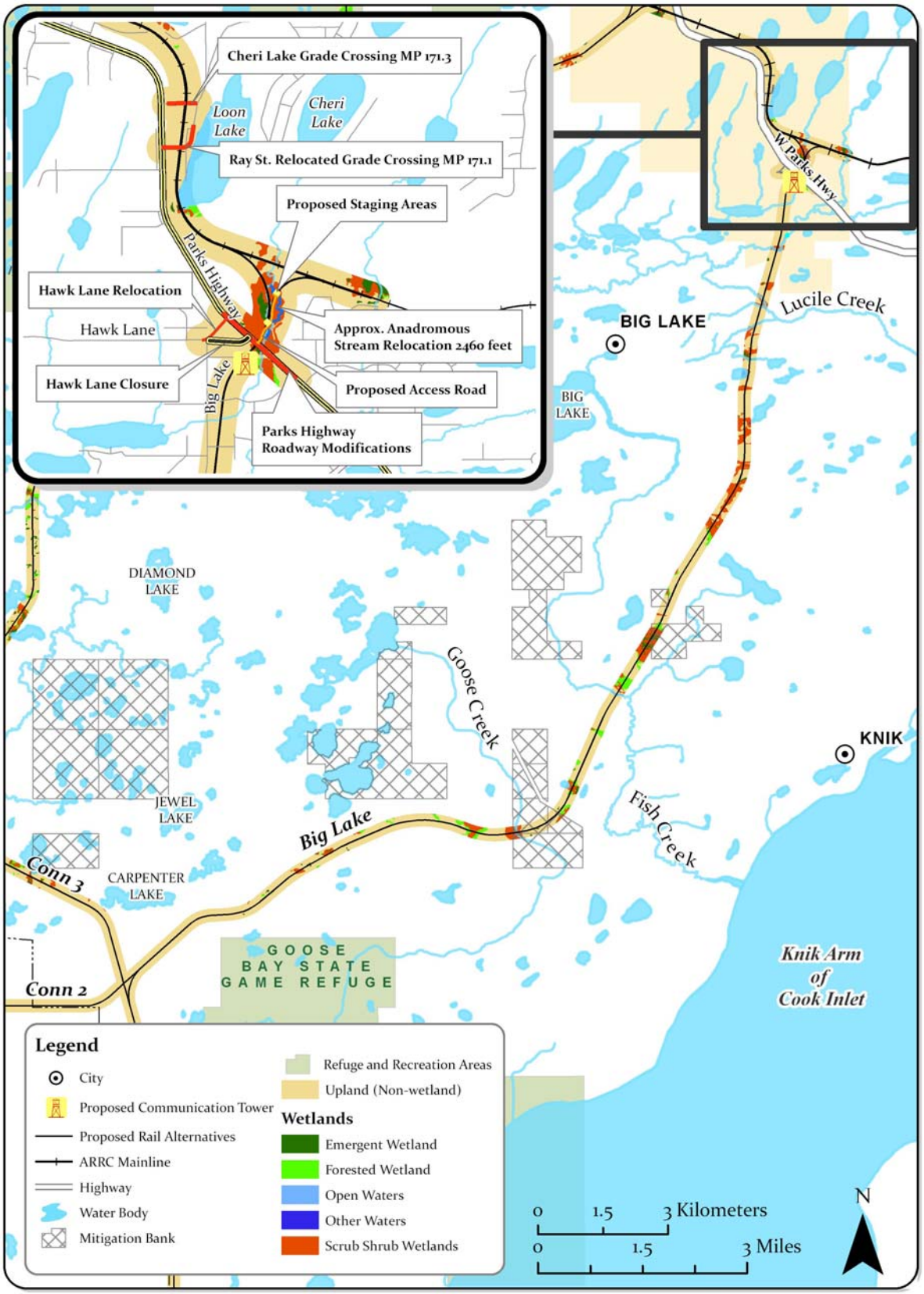

Figure 4.5-4. Wetlands near the Big Lake Segment

Table 4.5-3
Wetlands within the 200-foot Right-of-Way for the Northern Segments and Segment Combinations[a]

National Wetlands Inventory Code	Description	Willow		Big Lake		Houston-Houston North		Houston-Houston South	
		Area (acres)	Wetland Proportion (percent)	Area (acres)	Wetland Proportion (percent)	Area (acres)	Wetland Proportion (percent)	Area (acres)	Wetland Proportion (percent)
PFO1	Broadleaf Forest Wetlands	0	0	0	0	0	0	0	0
PFO4	Needleleaf Forest Wetlands	21	100.0	16	100.0	42	100.0	26	100.0
PFO#/#	Mixed Forest Wetlands	0	0	0	0	0	0	0	0
PFO	**Subtotal Forest Wetlands[b]**	**21**	**24.7**	**16**	**14.4**	**42**	**21.2**	**26**	**17.9**
PSS1	Broadleaf Scrub/Shrub Wetlands	35	70.4	44	50.3	49	39.9	30	31.0
PSS4	Needleleaf Scrub/Shrub Wetlands	2	4.0	14	16.3	9	7.0	7	7.4
PSS#/#	Mixed and Other Scrub/Shrub Wetlands	13	25.6	29	33.4	65	53.1	59	61.6
PSS	**Subtotal Scrub/Shrub Wetlands**	**50**	**58.8**	**87**	**78.4**	**123**	**62.1**	**96**	**66.2**
PEM	**Emergent Wetlands**	**11**	**13.0**	**7**	**6.3**	**29**	**14.7**	**20**	**13.8**
P	Palustrine Waters	1	26.7	0	0	3	61.1	2	70.8
R	Riverine Waters	2	73.3	1	55.6	1	38.9	1	29.2
L	Lacustrine Waters	0	0	<1	44.4	0	0	0	0
	Subtotal Other Wetlands and Waters	**3**	**3.5**	**1**	**0.9**	**4**	**2.0**	**3**	**2.1**
	All Wetlands and Waters	***85***		***111***		***198***		***145***	

[a] Source: HDR, 2008; HDR, 2010.
[b] Totals might not equal sums of values due to rounding.

There are approximately 6 acres of MSB wetland mitigation bank lands outside the 200-foot ROW but within 500 feet of the Willow Segment. Mitigation bank lands within 500 feet of the segment are designated as upland in this area and impacts to wetlands within the bank lands from construction of the rail bed would not be likely.

Big Lake

Construction of this segment would impact about 111 acres of wetlands (Figure 4.5-4 and Table 4.5-3). The Big Lake Segment would cross predominantly scrub/shrub wetlands, which comprise 78 percent of the total wetlands along the route. Most of the scrub/shrub wetlands along the Big Lake Segment are post-fire transitional scrub/shrub wetlands (Herrera, 2008). These wetlands have evolved in places where the previous forested wetland was burned away by the Miller's Reach 2 fire of 1996. As the canopy cover of these scrub/shrub wetlands increases over time, the dominant forest wetland community will begin to take over these areas. The Big Lake Segment would also impact 25 acres of wetland mitigation bank lands, primarily composed of riverine and riparian wetlands, but also including scrub/shrub wetlands and uplands. These areas are locally important to MSB and are highly valued (Herrera Environmental Consultants, 2008). Impacts to mitigation bank wetlands could be evaluated as reaching beyond the 200-foot ROW, because the value of these bank wetlands for the purposes of the mitigation bank is based on their contiguous, unfragmented state.

Construction of the Big Lake Segment would involve relocation of two sections and a total of 2,440 feet (0.45 mile) of an anadromous stream. The relocated stream channel (2,460 feet) would be located within emergent and scrub/shrub wetlands. The area where the stream is flowing is a large contiguous emergent and scrub/shrub wetland mosaic providing high-value functions to the watershed. Wetland impacts associated with the stream relocation could be minimized through careful construction methods to minimize impacts to adjacent wetlands and restoration of wetlands within the impact area after the stream relocation was completed. With proper construction, impacts to wetlands from the stream relocation would likely be temporary because the relocated stream would continue to feed fresh water into the emergent system and the wetland functions would continue as before.

There is a large floating mat fen along the Big Lake Segment, located on either side of Goose Creek. This wetland is unique to the study area and provides high-value functions to the watershed. The fen buffers floodwaters, moderates stream flow, contributes to the food chain through nutrient export, and provides safe and warm rearing habitat for overwintering juvenile fish and habitat for waterfowl. Impacts within the 200-foot ROW within the fen would be approximately 4 acres. However, the floating nature of the vegetation and the open water beneath make it likely that an area greater than 200 feet would be needed to construct the rail line. When compared to the other segments and segment combinations, the Big Lake Segment would have the highest proportion of high-functioning wetlands and the lowest proportion of low-functioning wetlands across all functions. Impacts outside the 200-foot ROW would be likely for construction of the rail line over Goose Creek fen, unless the Applicant proposed a bridge or other drainage structure that would minimize the impact footprint. Fragmentation of this fen by the rail line could significantly impact the entire fen system downstream of the rail line, depending on what type of drainage structure the Applicant proposed for the area.

Houston-Houston North Segment Combination

Construction of this segment combination would impact about 198 acres of wetlands, the highest proportion of wetlands of all the northern segments and segment combinations (88 percent) (Figure 4.5-3 and Table 4.5-3). The Houston-Houston North Segment Combination would cross predominantly mixed and broadleaf scrub/shrub wetlands. It also would impact the largest area of emergent wetlands and palustrine waters than all the other northern segments and segment combinations (32 acres). This is due to the presence of two patterned emergent/scrub/shrub bogs along the Houston North Segment (Figure 4.5-3). Patterned bogs like these contain undulating ridges of peat, providing a mosaic of habitats and providing high functional capacity for improvement of water quality, and due to their large size, storm and floodwater storage (HDR, 2008). Fragmentation of these habitats could result in impacts that reach beyond than the 200-foot ROW. The extent and intensity of the impacts (if any) outside the 200-foot ROW would depend on the type of drainage structures proposed at any given location, and the avoidance, minimization, and mitigation measures proposed for impacts at the site. The Houston North Segment would also fragment habitat adjacent to Houston Lake and could impact the adjacent wetlands north of the segment. These wetlands would no longer be contiguous with the Houston Lake wetlands and would not function as highly for some of the wetland functions (for example, improving water quality and providing habitat for wildlife) a forested wetland adjacent to a lake would provide. Compared to other segments and segment combinations, Houston-Houston North Segment Combination has the lowest proportion of low-functioning wetlands along its length (9 percent) and therefore one of the highest proportions of both moderate- and high-functioning wetlands.

Houston-Houston South Segment Combination

This segment combination would impact 144 acres of wetlands. The Houston-Houston South Segment Combination would predominantly cross scrub/shrub wetlands, with 67 percent of the ROW along this segment combination consisting of this wetland type. Scrub/shrub wetlands are known to provide wildlife habitat for a variety of species. Fragmentation of these habitats could decrease the ability of adjacent wetlands to provide wildlife habitat due to the smaller overall area of the wetland.

Summary of Impacts to Wetlands by Alternative

The largest sources of disturbance and impacts to wetlands from the proposed Port MacKenzie Rail Extension would be filling, excavating, or clearing for the rail bed and associated facilities. Impacts to wetlands from rail line construction and operations would vary by project alternative. Although some alternatives would require a relatively higher portion of wetlands fill, alternatives with fewer acres of fill could have a more intense impact to wetlands within the study area, depending on the sensitivity and/or importance of the affected wetland and the value of the adjacent habitat that would be fragmented as a result of the proposed project. In addition, the potential for impacts to wetlands could, in some cases, be significantly decreased, depending on the avoidance, minimization, and mitigation measures proposed for the area. Overall, wetlands within all proposed alternatives are high functioning for five of the eight wetland functions analyzed for the proposed rail line. Approximately 60 percent of the wetlands along any given alternative are functioning high overall, 29 percent are functioning moderately, and 11 percent

are functioning low for one or more wetland functions. The wetlands along the alternatives are highest functioning for export of detritus, groundwater discharge, wildlife habitat, modification of water quality, and vegetation diversity. Eighty-six to 100 percent of the wetlands along any given alternative perform these functions. Table 4.5-4 summarizes acreages of impacts to wetland types for each alternative. Appendix C provides more detail on specific wetland functions and area of impacts to those functions from each alternative. The following summarizes impacts to wetlands by alternative.

Mac West- Connector 1-Willow

Construction of this alternative would impact 363 acres of wetlands and waters within the 200-foot ROW and terminal reserve areas. Wetlands within the ROW would be permanently affected by the construction of the proposed project and would experience loss of function. Mac West-Connector 1-Willow would cover the largest overall area than any of the alternatives and would have the largest proportion of uplands along its length (72 percent). Although only 28 percent of this alignment is comprised of wetlands and waters, the Mac West-Connector 1-Willow Alternative would affect the third largest acreage of wetlands among the alternatives. Compared to other alternatives, Mac West-Connector 1-Willow would have among the largest proportion of wetlands that are low functioning for groundwater recharge (80 percent). Adjacent wetlands outside the 200-foot ROW might also be affected by fragmentation or hydrological modification, especially along the Mac West-Connector 1 Segment Combination of the alternative.

Mac West-Connector 1-Houston-Houston North

Construction of this alternative would impact 478 acres of wetlands and waters within the 200-foot ROW and terminal reserve areas. Compared to the other alternatives, this alternative would impact the greatest overall acreage of wetlands. It also would impact the greatest number of acres of forested, scrub/shrub, and emergent wetlands of all the alternatives, and would impact the highest acreage of waters (6 acres). Many of the wetlands along this alternative comprise areas of patterned bog that have a high functional value for contribution to abundance and diversity of wetland fauna. Compared to other alternatives, the Mac West-Connector 1-Houston-Houston North Alternative has one of the highest proportions of wetlands that are high functioning for both export of detritus (98 percent), and groundwater discharge (91 percent). Although this alternative would occupy less overall acreage compared to other alternatives, 45 percent of the alignment is comprised of wetlands, the highest of the alternatives.

Mac West-Connector 1-Houston-Houston South

Construction of this alternative would impact 424 acres of wetlands and waters within the 200-foot ROW and terminal reserve areas. Wetlands within the ROW would be permanently affected by construction of the proposed project and would experience loss of function. Like the Mac West-Connector 1-Houston-Houston North Alternative, Mac West-Connector 1-Houston-Houston South also has among the largest proportions of wetlands that are high functioning for export of detritus and groundwater discharge. Adjacent wetlands outside the 200-foot ROW could also be affected by fragmentation or hydrological modification, especially within the Mac West-Connector 1 Segment Combination. Compared to other alternatives, impacts to forested and

Table 4.5-4
Summary of Impacts to Wetlands (acres) within the 200-Foot Right-of-Way by Alternative[a,b,c]

Alternative	Forested Wetlands	Scrub/ Shrub Wetlands	Emergent Wetlands	Total Wetlands	All Waters[d]	Total Wetlands and Waters	Total Uplands
Mac West-Connector 1-Willow	148	179	32	359	4	363	942
Mac West-Connector 1-Houston-Houston North	169	253	50	472	6	478	577
Mac West-Connector 1-Houston-Houston South	153	226	41	420	4	424	643
Mac West-Connector 2-Big Lake	135	187	24	346	1	347	757
Mac East-Connector 3-Willow	94	78	13	185	3	188	1,095
Mac East-Connector 3-Houston-Houston North	116	151	30	297	4	301	712
Mac East-Connector 3-Houston-Houston South	100	124	21	245	3	248	779
Mac East-Big Lake	88	112	8	208	1	209	768

[a] Source: HDR, 2008; HDR, 2010.
[b] Acres for alternatives will not match the sum of the acres for individual segments. Segment curves and overlaps were eliminated to represent each alternative as one contiguous area.
[c] Wetland impacts within the Mac East and Mac West segments include impacts from the terminal reserve areas outside the 200-foot right-of-way.
[d] Includes palustrine, riverine, and lacustrine waters.

scrub/shrub wetlands along this alternative would be the second highest (153 and 226 acres, respectively).

Mac West-Connector 2-Big Lake

Construction of this alternative would impact 347 acres of wetlands and waters. The Big Lake Segment of this alternative would impact locally important MSB wetland mitigation bank areas that contain high-value wetlands. This alternative would also impact the unique floating fen located on either side of Goose Creek along the Big Lake Segment. Impacts to this high value wetland would depend on the size of drainage structure or crossing designed for the water body. The Mac West-Connector 2-Big Lake Alternative has among the largest proportion of high-functioning wetlands compared to other alternatives. This is likely due to the Big Lake Segment, because this segment also contains the largest proportion of high-functioning wetlands of all the segments. While the acres affected would not be as great as some of the other alternatives, there would be impacts to functions and values of locally important wetlands such as the floating fen, and the intensity of the impacts would depend on the avoidance, minimization, and mitigation measures proposed for the area.

Mac East-Connector 3-Willow

Construction of this alternative would impact 188 acres of wetlands and waters, the lowest impact to wetlands of all the alternatives. Compared to other alternatives, this alternative would have the lowest proportion of wetlands, with just 15 percent of the ROW being comprised of wetlands. Although the overall acreage of impacts to wetlands in the ROW would be relatively low for this alternative, impacts to riverine and open water wetlands could be locally significant, depending on the avoidance, minimization and mitigation measures incorporated into the project. Though wetlands crossed by all eight alternatives are high functioning for the export of detritus, Mac East-Connector 3-Willow has the lowest proportion of high-functioning wetlands compared to other alternatives (91 percent). This alternative also has the largest proportion of low-functioning wetlands and for the export of detritus function (9 percent). Although all alternatives cross high functioning wetlands overall, compared to other alternatives for individual functions, the Mac East-Connector 3-Willow Alternative stands out as having the lowest proportion of high-functioning wetlands across all functions. The alternative would cross a moderate number of riverine habitats and would pass between lakes and other open water habitat. Impacts to these wetland types could extend beyond the 200-foot ROW and terminal reserve areas, depending on best management practices incorporated into the project.

Mac East-Connector 3-Houston-Houston North

Construction of this alternative would impact 301 acres of wetlands and waters (approximately 30 percent of the area within the ROW and terminal reserve areas). Impacts to wetlands along this alternative would be the fourth lowest of all the alternatives. However, impacts to riverine and open water wetlands along this alternative would be the second highest of all the alternatives. Because of the sensitivity of these habitats to fragmentation, the presence of open and flowing water adjacent to and within the 200-foot ROW potentially increases the chances that impacts to wetlands could extend beyond the 200-foot ROW into adjacent habitats.

Mac East-Connector 3-Houston-Houston South

Construction of this alternative would impact 248 acres of wetlands and waters. Compared to other alternatives, this alternative would impact one of the lowest overall numbers of acres of wetlands and waters, with more than half of that impact being the loss of scrub/shrub wetlands. There could be impacts to wetlands outside the 200-foot ROW and terminal reserve areas from fragmentation of wetland communities that provide wildlife habitat. Although the overall acres of impacts to wetlands for this alternative would be relatively low, the intensity of the impacts could be greater than others, depending on the avoidance, minimization, and mitigation measures incorporated into the project.

Mac East-Big Lake

Construction of this alternative would impact 209 acres of wetlands and waters, with more than half of the impact to scrub/shrub wetlands. This alternative would have the lowest impact on both emergent and other waters than any of the alternatives. It would cover the lowest overall acreage of the alternatives, with the 200-foot ROW and terminal reserve areas comprising only 977 acres. However, this alternative would impact 25 acres of MSB wetland mitigation bank lands, and likely require additional mitigation to replace these high-value wetlands. This alternative would also impact the unique floating fen located on either side of Goose Creek along the Big Lake Segment. Impacts to this high-value wetland would depend on the size of drainage structure or crossing designed for the water body. The Mac East-Big Lake Alternative has the largest proportion of high-functioning wetlands compared to other alternatives. This is likely due to the Big Lake Segment, because this segment also contains the highest proportion of high-functioning wetlands compared to other segments. Although the acreage of impacts to wetlands would be relatively low for this alternative, impacts to sensitive habitats like the Goose Creek fen and the MSB mitigation bank could be more intense, depending on the avoidance, minimization, and mitigation measures incorporated into the project.

4.5.4.2 No-Action Alternative

Under the No-Action Alternative, the proposed Port MacKenzie Rail Extension would not be constructed and operated, and there would be no wetland/fill losses or reduction of wetland function.