



State of Alaska
Department of Fish and Game
Division of Sport Fish

Nomination Form
Anadromous Waters Catalog

Region Southcentral

USGS Quad(s) Anchorage C-8

Anadromous Waters Catalog Number of Waterway Unknown 247-41-10100-2150-3051

Name of Waterway Muleshoe Lake Outflow

USGS Name Local Name

Addition Deletion Correction Backup Information

For Office Use

Nomination #	<u>11-191</u>	<u>[Signature]</u>	<u>6/13/11</u>
Revision Year:	<u>2012</u>	Fisheries Scientist	Date
Revision to:	Atlas _____ Catalog _____	<u>[Signature]</u>	<u>6/13/11</u>
	Both <u>X</u>	Habitat Operations Manager	Date
Revision Code:	<u>A-1</u>	<u>[Signature]</u>	<u>3/21/11</u>
		AWC Project Biologist	Date
		<u>[Signature]</u>	<u>9/28/11</u>
		Cartographer	Date

OBSERVATION INFORMATION

Species	Date(s) Observed	Spawning	Rearing	Present	Anadromous
coho salmon	09/02/2010 and 09/23/2010		Yes		<input checked="" type="checkbox"/>
rainbow trout	09/02/2010 and 09/23/2010		Yes		<input type="checkbox"/>
stickleback	09/02/2010 and 09/23/2010			Yes	<input type="checkbox"/>
longnose sucker	09/02/2010 and 09/23/2010			Yes	<input type="checkbox"/>
sculpin	09/02/2010 and 09/23/2010			Yes	<input type="checkbox"/>

IMPORTANT: Provide all supporting documentation that this water body is important for the spawning, rearing or migration of anadromous fish, including: number of fish and life stages observed; sampling methods, sampling duration and area sampled; copies of field notes; etc. Attach a copy of a map showing location of mouth and observed upper extent of each species, as well as other information such as: specific stream reaches observed as spawning or rearing habitat; locations, types, and heights of any barriers, etc.

Comments:

Sample Location H-9.6 (Long -149.972254, Lat 61.573709)	
Date: 09/02/2010	Date: 09/23/2010
Method: Minnow Trap	Method: Electrofish
Soak Time: 1,549 minutes	Bfish Time: 649 seconds
Catch: coho juveniles - 414	Catch: coho juveniles - 12
rainbow juveniles - 2	
stickleback - 8	
Longnose sucker - 2	

Further Detail given on p.15 of Appnx. A (attached)

Extend stream w/ coho salmon READING

Name of Observer (please print): Patrick Blair

Signature: [Signature]

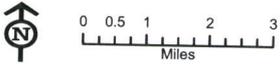
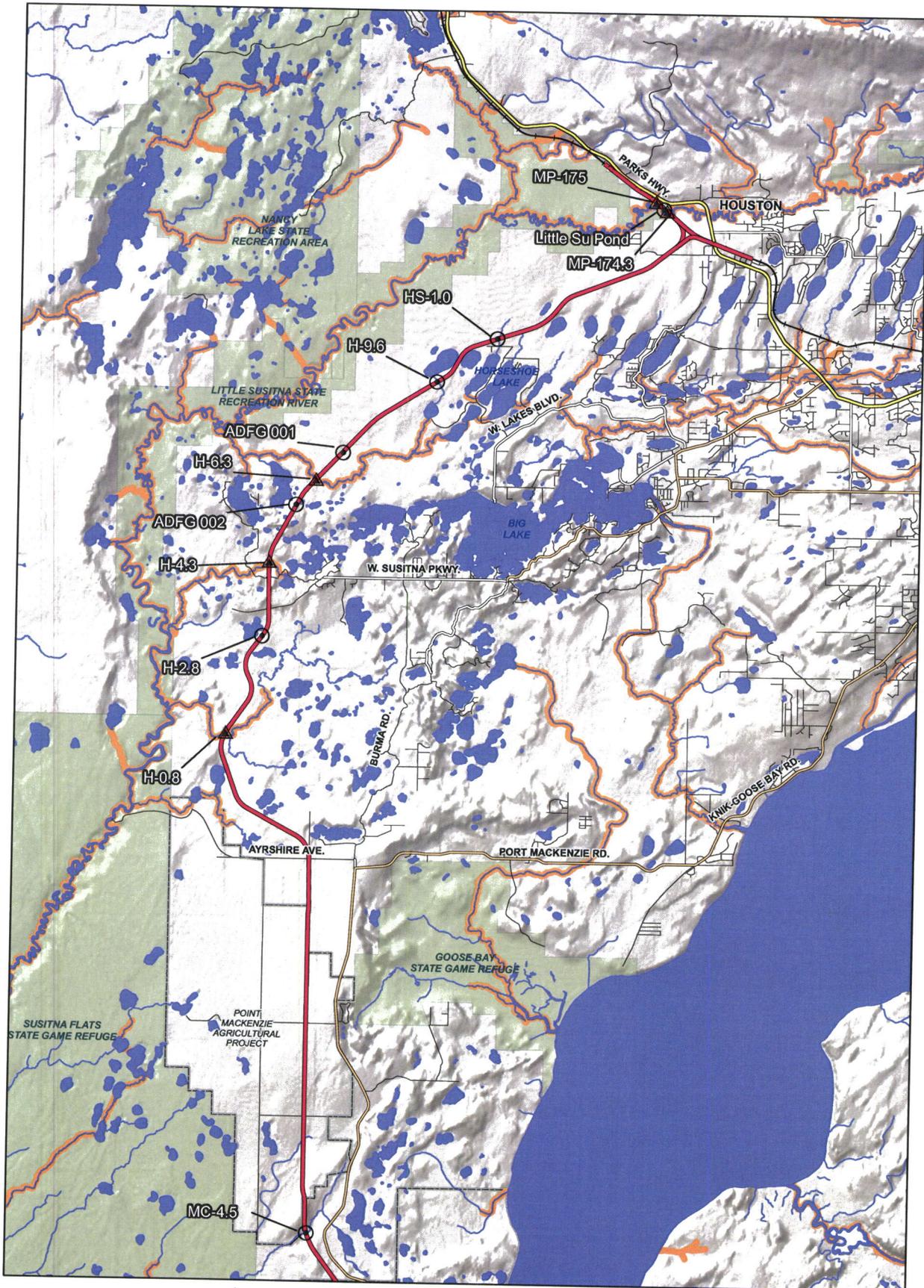
Agency: HDR Alaska Inc.

Address: 2525 C Street, Ste. 305
Anchorage, Alaska 99503

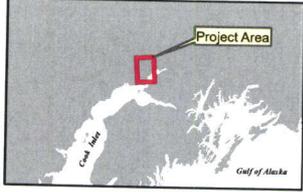
Date: 03/21/2011

This certifies that in my best professional judgment and belief the above information is evidence that this waterbody should be included in or deleted from the Anadromous Waters Catalog.

Signature of Area Biologist: _____ Date: _____ Revision _____



Date: 01 December, 2010
 Projection: Alaska State Plane Zone 4, NAD 83
 Author: HDR Alaska, Inc.
 Sources: ADNRR, ARRC, HDR Alaska, Inc.,
 MSB GIS, TNH-Hanson, USGS.



- LEGEND**
- Fish / Habitat Sampling
 - △ Habitat Only
 - Proposed Alignment
 - ADFG Anadromous Waters

Figure 1
 Alaska Railroad Corporation
 Port MacKenzie Rail Extension
 Fish Presence and Habitat
 Sampling Locations - 2010





Port MacKenzie Rail Extension Project

Fisheries Field Report

Prepared for:



Matanuska-Susitna Borough
350 E. Dahlia Avenue
Palmer, Alaska 99645



Alaska Railroad Corporation
327 West Ship Creek Avenue
Anchorage, Alaska 99501

Prepared by:



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January 2011

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1 Introduction

The Alaska Railroad Corporation (ARRC) proposes to extend rail service to Port MacKenzie from the existing main line of the Alaska Railroad near Houston, Alaska (Figure 1). A fish habitat permit from the Alaska Department of Fish and Game (ADF&G) will be required for crossings of the proposed rail line that may impact anadromous fish habitat. Early consultation with ADF&G area habitat managers indicated that insufficient data existed related to fisheries resources and aquatic habitat within the Port MacKenzie Rail Extension (PMRE) project area. Specifically, ADF&G indicated that prior investigations conducted for the project's Draft Environmental Impact Statement (DEIS) had not comprehensively located and assessed all potential fish bearing water bodies along the proposed rail centerline. Consequently, ADF&G requested that further sampling be conducted to address this issue. In 2010, ARRC conducted extensive field data recovery to supplement existing information to assist ADF&G in evaluating the Title 16 Habitat permit application that will be submitted in association with the project.

Throughout the planning process for the PMRE project area, several alignment alternatives were investigated (PEAR 2008 and DEIS 2010). The Mac East Variant (commonly referred to as Mac Central) to Houston to Houston South alignment is the only alignment addressed in this investigation (Figure 1), and is referred to as the proposed alignment in this document. Based upon available information and in comparison to other alternative alignments, the proposed alignment in the application's opinion represents the Least Environmentally Damaging Practicable Alternative (LEDPA) per U.S. Army Corps of Engineers definition. The Final Environmental Impact Statement (FEIS), expected early 2011, will identify the Surface Transportation Board's preferred alternative.

This document describes the methods used for collecting baseline fisheries and aquatic habitat data for the proposed alignment in response to the request made by ADF&G, as well as describes pertinent project history related to baseline data collection and analysis.

2 Background

In 2007, Entrix collected baseline data for fisheries, hydrology and water quality at 122 locations (Noel et al. 2008) in support of the DEIS for the PMRE project. The 2007 effort included sampling at 24 locations in the vicinity of the proposed alignment.

As part of the NEPA process, the ARRC also provided a planning level Wetlands Technical Report and Functional Assessment to support the proposed DEIS alternatives (HDR Alaska Inc. 2008 and DEIS 2010). Additional wetlands data was collected during the 2010 field season in support of the proposed alignment.

The 2008 wetlands report and supplemental work conducted in 2010 provide information on soils, plant communities, and hydrology for the proposed alignment. This data describes the presence, duration and function of surface water throughout the project corridor, including crossing locations. Information collected as part of the wetlands field events was used to supplement fisheries data and help with determining the likelihood of fish presence/absence in the vicinity of the proposed alignment.

3 Purpose and Objectives

The purpose of this document is to provide supplemental fisheries information to ADF&G to assist in the evaluation of fish habitat in support of Title 16 permitting for the PMRE project. The objectives are as follows:

1. Identify potential water bodies and other likely fish habitat within the proposed alignment work limits that were not previously sampled or designated as anadromous in the Anadromous Waters Catalog (AWC) using desktop evaluation of existing information (including imagery, topography, hydrology mapping, and wetland mapping) and an aerial reconnaissance flight,.
2. Assess sites identified in Objective 1 for fish presence using field sampling and observational methods.
3. Describe habitat characteristics at potential crossing locations for use in fish passage crossing design.

4 Methods

4.1 Selection of Sample Locations for 2010 Fieldwork

Initially, HDR fish scientists analyzed existing stream mapping, fish presence data, aerial photography, wetland mapping, and topography within the proposed alignment corridor in a GIS database. Data sheets and GPS locations from the 2007 fisheries and hydrology studies conducted in support of the DEIS (Noel et al., 2008) were reviewed in detail to identify areas that (1) had either seasonal or permanent surface water, (2) were connected to or within close proximity to a known fish stream, or (3) were sampled for fish. These sites were uploaded into a handheld GPS for field verification and included as potential fish sampling sites as part of the 2010 field sampling program.

In addition, a detailed analysis of PMRE wetland field data was conducted to further identify areas that could potentially support resident or anadromous fish. As part of the PMRE wetland study, a total of nearly 700 locations were visited in 2008 and 2010. At each location, detailed information on soil characteristics, hydrology, and plant community composition were collected (HDR 2008, 2010). Wetland field data and mapping were categorized by hydrologic regime in GIS and each wetland with seasonal, semi-permanent, or permanent surface water was evaluated for its connectivity to a stream. Furthermore, using the habitat portion of 242 wetland functional assessment data forms, scientists searched for documentation of incidental fish or fish habitat observations. All areas within the vicinity of the proposed alignment that were classified as permanently, semi-permanently, or seasonally flooded were assessed and discussed with ADF&G for potential inclusion into the 2010 field sampling program.

Following the GIS-based desktop review, an HDR fisheries scientist and an ADF&G Habitat Biologist conducted a helicopter flyover of the proposed alignment to verify sites identified as having the potential to support fish and identify any new sites requiring field sampling. The helicopter flew the proposed alignment centerline between approximately 50 and 200 feet above ground level for optimal visibility.

4.2 Fish Presence / Absence Sampling

Field sampling occurred between September 2 and October 1, 2010. Rights of entry were obtained from landowners prior to accessing properties.

The minimum sampling area at each potential crossing location included the length of the waterbody within the anticipated 200 foot right of way (ROW). Areas immediately outside of the ROW were sampled when more data was necessary or sampling opportunities were not available directly onsite.

Locations not already established as anadromous by ADF&G were sampled for fish presence/absence and aquatic habitat. Locations where anadromy had already been identified were sampled only for aquatic habitat characteristics, as crossing structures at these locations will be designed to meet or exceed fish passage standards in accordance with Alaska Statute 16.05.871 (Anadromous Fish Act).

Fish sampling was conducted primarily using minnow traps. At each sampling location, four 1/4 inch mesh baited minnow traps were deployed within representative habitat types. Traps were soaked for periods of approximately (but not longer than) 24 hours. Electrofishing was conducted as a method to collect species that may not recruit to minnow traps following the minnow trapping event. Electrofishing was conducted only at locations where conditions permitted, i.e., absence of adult fish, open areas without dense shrub growth in the stream. Visual observation was used to verify the presence of adults and electrofishing was not conducted when adult salmonids were present. Fish sampling locations were electrofished (where appropriate) for a period of approximately 10 minutes. Angling was not employed as a sampling method, as it was deemed inappropriate for use in the small and dense shrub covered sampling locations.

4.3 Aquatic Habitat

Aquatic habitat characteristics were recorded at all sampling locations. Wetted stream width and bank full width were measured at four equally spaced stream transects. Measurements were collected using a laser range finder. At sampling locations where no pools were identified, maximum channel depth was measured in at least four thalweg locations using a standard stadia rod. At sampling locations where pools were identified, maximum pool depth and pool tailout depth were measured within all pool habitats at each crossing location using a standard stadia rod. Undercut bank dimensions including approximate depth of undercut and approximate length along each bank were estimated from multiple measurements along the stream bank using a standard stadia rod. Riparian cover type and amount were visually estimated and described. Presence and/or absence of instream woody debris was recorded. Stream classification was evaluated using the Rosgen stream classification method (Rosgen, 1996), which included stream gradient, dominant substrate size, stream sinuosity, width/depth ratio, and entrenchment ratio.

4.4 Quality Assurance

All data collected in the field underwent a two-level quality process (QC). Level 1 QC consisted of a daily review of field forms and notes for completeness, as well as general error checking. Level 2 QC, conducted in Excel after data entry, consisted of a line-by-line review of the entered data against the data as recorded in the field. Levels 1 and 2 QC were completed prior to generating the descriptive statistics Section 5, Results.

5 Results

5.1 Selection of Sites

Data collected in 2007 (Noel et al., 2008) included sampling at 24 locations in the vicinity of the proposed alignment. Site conditions at 9 of these 24 locations were conducive to supporting fish habitat;

specifically sites with surface water, sites connected to other fish bearing waters, and sites where ordinary high water was collected were included. Five of the 9 locations, (H-6.3, H-4.3, H-0.8, MP-175, and MP-174.3), are streams already mapped as anadromous in the AWC (Johnson and Blanche, 2010).

The aerial reconnaissance flight with an ADF&G Habitat Biologist was flown on September 22, 2010. Observational conditions were optimal, with clear, sunny skies, and light wind. The alignment was flown slowly at low elevation (approximately 50 to 200 feet) from north to south and landings were made at locations indicated by the ADF&G Habitat Biologist. Two additional sample locations were added to the initially selected sample locations as a result of this reconnaissance (ADF&G 001 and ADF&G 002). Using GIS, one additional site (Little Susitna Pond) was selected due to its proximity to the Little Susitna River.

As a result of this process, 12 sites were identified for field investigation to obtain additional fish and aquatic habitat information. All sample locations chosen demonstrated the presence of surface water and/or had topography that suggested potential surface water connectivity to fish bearing waters.

Table 1 provides summary details regarding each sample location including longitude and latitude, AWC Stream Number (if assigned), and the type of sampling conducted at each location. Sampling locations are listed from north to south along the currently proposed alignment (Houston South to Mac Central). The sample location names reflect those assigned in DEIS (2008) where applicable. Locations are depicted in Figure 1.

Table 1: Fish and aquatic habitat sampling locations identified for fall 2010 field investigations in support of ADF&G Habitat Permitting for the Port MacKenzie Rail Extension.

Sample Name and Description	Longitude	Latitude	AWC Stream Number	Sample Type
MP-175 - Milepost 175, Tributary to Little Susitna River	-149.833833	61.630084	247-41-10100-2255	Habitat Only
Little Susitna Pond	-149.828610	61.627710	NONE	Fish / Habitat
MP-174.3 - Milepost 174.3, Little Susitna River	-149.826765	61.627243	247-41-10100	Habitat Only
HS-1.0 - Houston South milepost 1.0, Tributary to Little Horseshoe Lake	-149.933984	61.587244	NONE	Fish / Habitat
H-9.6 - Houston milepost 9.6, Outflow of Muleshoe Lake	-149.972254	61.573709	NONE	Fish / Habitat
ADF&G 001 - new site	-150.031490	61.551430	NONE	Fish / Habitat
H-6.3 - Houston milepost 6.3, Tributary to Little Susitna R.	-150.048326	61.543094	247-41-10100-2150	Habitat Only
ADF&G 002 - new site	-150.060850	61.535220	NONE	Fish / Habitat
H-4.3 - Houston milepost 4.3, Tributary to Little Susitna R.	-150.077382	61.517458	247-41-10100-2100	Habitat Only
H-2.8 - Houston milepost 2.8, Lake Drainage	-150.081067	61.494550	NONE	No Habitat to Sample
H-0.8 - Houston 0.8, Outlet of Diamond Lake	-150.103104	61.464647	247-41-10100-2090	Habitat Only
MC-4.5 - Mac Central milepost 4.5, Baker Farm Road Crossing	-150.045553	61.310856	NONE	Fish / Habitat

5.2 Fish Presence

Field sampling events were conducted on September 2, 2010 and September 23, 2010. Of the twelve sample locations visited, five sites (MP-175, MP-174.3, H-6.3, H-4.3 and H-0.8) are designated anadromous in the AWC (Johnson and Blanche, 2010), therefore no fish presence data needed to be collected. One sample location (H-2.8) lacked surface water and was not sampled for habitat or fish presence/absence. The remaining six locations were sampled for both fish presence/absence, Table 2.

Juvenile coho salmon were found at three new locations (H-9.6, H-1.0, and ADF&G 002) providing evidence of anadromy at these previously undocumented areas. Juvenile rainbow trout were found at H-9.6 and H-1.0. Sticklebacks were the only species found at one of these six locations (MC 4.5). No fish were found at two of these six locations (Little Susitna Pond and ADF&G-001).

Table 2 summarizes the fish sampling results by location from north to south along the proposed alignment. Detailed information by sampling site is presented in Appendix A. Site photos are located in Appendix B.

Detailed information for each fish captured in this study (sampling dates, GPS coordinates, gear types, soak times, species, length, disposition, and other data) were provided to ADF&G in electronic format in fulfillment of conditions of the fish resource permit (HDR, 2010).

Table 2: Fish capture summary by sampling location for fall 2010 field investigations in support of ADF&G Habitat Permitting for the Port MacKenzie Rail Extension.

Sample Location	Coho	Rainbow	Stickleback	Sculpin	Long Nose Sucker
Little Susitna Pond	0	0	0	0	0
HS-1.0	72	2	8	0	2
H-9.6	426	2	121	1	2
ADF&G 001	0	0	0	0	0
ADF&G 002	10	0	4	0	0
H-2.8*	-	-	-	-	-
MC-4.5	0	0	142	0	0

*This site lacked surface water.

5.3 Habitat Assessment

Habitat data was collected during multiple field site visits from September 2, 2010 to October 1, 2010. Habitat characteristics were assessed at 11 of the 12 sample locations (sample location H-2.8 had no aquatic habitat available to measure). Habitat data are summarized in Table 3 below and detailed by sample location in Appendix A. See Figure 1 for sampling locations. Site photos are located in Appendix B.

Table 3: Habitat data summary by sampling location for fall 2010 field investigations in support of ADF&G Habitat Permitting for the Port MacKenzie Rail Extension.

Sample Location	Average Bankfull Width (m)	Channel Depth (m)	Floodplain Width (m)	Substrate	Rosgen Stream Classification ²
Little Susitna Pond	5.25	0.85	No floodplain	Organic	NA
MP-175	13.2	NA	22.0	Organic	E6

MP-174.3	28.2	2.00	35.5 ¹	Gravel and Sand	G4c or G5c
HS-1.0	2.08	0.64	50.5	Organic	E6
H-9.6	1.72	0.34	42.0	Organic	E6
H-6.3	4.19	0.83	75.0	Organic	E6
H-4.3	1.68	0.35	24.0	Organic	E6
H-0.8	3.95	NA	90.4	Small Gravel	C4-Riffle C5-Pool
MC-4.5	3.15	0.46	50.0	Organic	E6

¹Floodplain width measured in the field at proposed crossing location. Floodplain width only used for purposes of Rosgen Classification. FEMA floodplain values for 100 year event reported in the DEIS (2008) are 1950 feet wide.

²Rosgen stream classifications identified at the sampled locations are characterized as:

- G4c: An entrenched single thread channel, having a low width to depth ratio and moderate sinuosity. Stream slopes typically average less than 2.0 percent. Stream channel bed materials are comprised primarily of gravel sized particles.
- G5c: An entrenched single thread channel, having a low width to depth ratio and moderate sinuosity. Stream slopes typically average less than 2.0 percent. Stream channel bed materials are comprised primarily of sand sized particles.
- C4: A slightly entrenched single thread channel, having moderate to high width to depth ratio and high sinuosity. Stream slopes typically range from 0.1 to 2.0 percent. Stream channel bed materials are comprised primarily of gravel sized particles.
- C5: A slightly entrenched single thread channel, having moderate to high width to depth ratio and high sinuosity. Stream slopes typically range from 0.1 to 2.0 percent. Stream channel bed materials are comprised primarily of sand sized particles.
- E6: A slightly entrenched single thread channel, having a very low width to depth ratio and very high sinuosity. Stream slopes average less than 2.0 percent. Stream channel bed materials are comprised primarily of silt and/or clay sized particles.

6 Conclusion/Discussion

During 2010 agency consultation, ADF&G expressed concerns that the DEIS may not provide sufficient data to support the Title 16 fish habitat permit application for the PMRE project. This fisheries investigation was initially developed to supplement previously collected information (Noel, et. al., 2008) and fill information gaps identified by ADF&G.

HDR conducted a comprehensive review of the PMRE proposed alignment to identify and evaluate potential water crossings that could support fish and require a ADF&G Habitat permit to cross. Based on a review of historical data, a GIS-based analysis of digital data, and an aerial survey, HDR in consultation with ADF&G identified 12 sites requiring field sampling. Five of these sites were known to support anadromous fish, and juvenile anadromous salmonids were positively identified at three locations that were previously undocumented in the AWC.

This report likely provides the most complete dataset for the proposed alignment corridor, and will be used to support design and preparation of permit applications for the PMRE Project. Data presented in this document is currently being used by project engineers to develop design criteria and select the appropriate crossing structures that meet regulatory requirements for fish passage and hydrologic connectivity.

7 References

- HDR Alaska Inc. 2010. Fish sampling within the proposed Port MacKenzie Rail Extension corridor. Fish Resource Permit No. SF2010-259. HDR Alaska Memorandum to Bob Piorkowski, dated November 16, 2010.
- HDR Alaska Inc. 2008. Draft – Port MacKenzie Rail Extension Project, Wetlands Technical Report and Functional Assessment. Prepared for the Matanuska-Susitna Borough and the Alaska Railroad Corp. Anchorage, Alaska.
- HDR Alaska Inc. and TNH Hansen LLC. 2008. Preliminary Environmental and Alternatives Report for the Port MacKenzie Rail Extension. Prepared for the Matanuska-Susitna Borough and the Alaska Railroad Corporation. Anchorage, Alaska.
- Johnson, J. and P. Blanche. 2010. Catalog of waters important for spawning, rearing, or migration of anadromous fishes – Southwestern Region, Effective June 1, 2010. Alaska Department of Fish and Game, Special Publication No. 10-08, Anchorage.
- Noel, L. E., L. Bontrager, K. McDonnell, and C. Anderson. 2008. Unpublished Fisheries and Hydrology Field Study Data Deliverable. Prepared by ENTRIX, Inc. and USKH, Inc., Anchorage, AK, for the Port MacKenzie Rail Extension EIS, Surface Transportation Board, Section of Environmental Analysis, Washington D.C. Digital Data Deliverable.
- Rosgen, Dave, L. 1996. Applied River Morphology. Wildand Hydrology, Pogosa Springs, Colorado.
- Surface Transportation Board (STB). 2010. Draft Environmental Impact Statement, Alaska Railroad Corporation Construction and Operation of a Rail Line Extension to Port MacKenzie, Alaska. Prepared for the EPA in cooperation with the Federal Railroad Administration, U.S. Army Corps of Engineers-Alaska Division, and the U.S. Coast Guard. Washington D.C.

Figure 1. Sample location map.

APPENDIX A.
Summary Fish Presence/Absence and Habitat Data by Sample Location

Appendix A-1.

Milepost 175

This location is the proposed crossing of a tributary to the little Susitna River. The water appears to be discharging through submerged culverts under the existing elevated railway bed and into a slough of the Little Susitna River. The ADF&G has identified this location as anadromous for juvenile coho salmon rearing in the AWC; consequently, no fish sampling was conducted in association with this effort. Aquatic habitat data collected at this location are summarized below.

Milepost 175: Table 1 – Aquatic Habitat Data Summary (September 02, 2010)

Avg. Wetted Width (m)	5.25
Avg. Bankfull Width (m)	5.25
Avg. Max Pool Depth (m)	NA – no pools
Avg. Pool Tailout Depth	NA – no pools
Approx. Undercut Bank Dimensions	NA – no UCB
Avg. Channel Depth (m)	0.85
Dominant Riparian Cover	Grasses and alders provide overhanging vegetation approximately 2-3 feet deep refugia along both banks.
Stream Gradient	0.0%
Dominant Substrate	Organic
Stream Sinuosity	1.18
Width/Depth Ratio	6.18
Floodplain Width (m)	22.0
Entrenchment Ratio	4.19
Rosgen Stream Classification:	E6



MP 175: Aerial view of the current railroad crossing (HDR, September 2010)



MP 175: Aerial view looking to the south (HDR, September 2010)



MP 175: View looking upstream with riparian vegetation (HDR, September 2010)



MP 175: View with riparian vegetation and current railroad crossing (HDR, September 2010)

Appendix A-2.

Little Susitna Pond

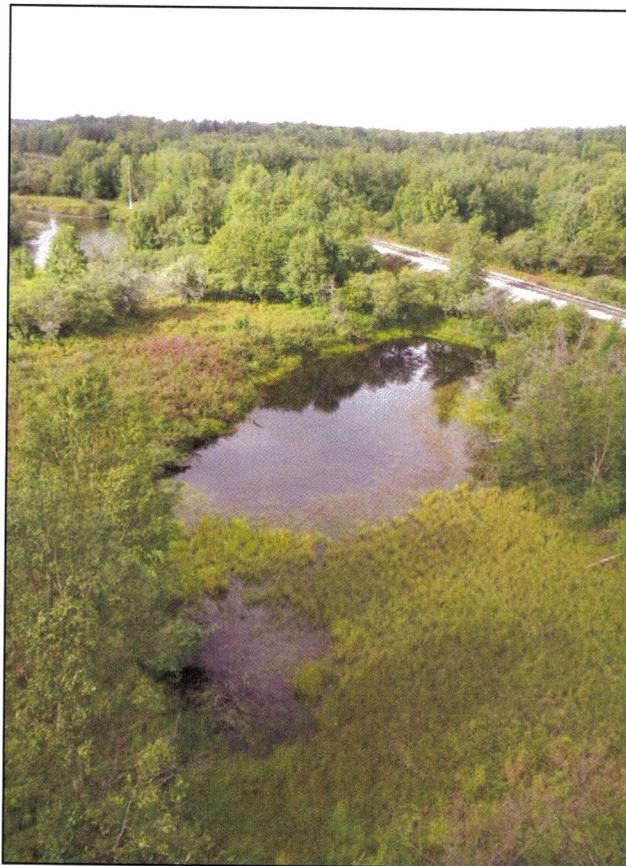
This location is an isolated pond adjacent to the Little Susitna River just south of the existing railway bridge over the Little Susitna River. No surface water connection was found between the pond and the river. No fish were caught at this location. Aquatic habitat data collected at this location are summarized below.

Little Susitna Pond: Table 2 – Aquatic Habitat Data Summary (September 02, 2010)

Avg. Wetted Width (m)	13.2
Avg. Bankfull Width (m)	13.2
Avg. Max Pool Depth (m)	Maximum pond depth not recorded
Avg. Pool Tailout Depth	NA
Approx. Undercut Bank Dimensions	NA- no UCB
Avg. Channel Depth (m)	NA- no channel
Dominant Riparian Cover	Shoreline of pond dominated by dense growth of wild rose, grasses, willow and alder shrubs, and willow and alder trees.
Stream Gradient	NA
Dominant Substrate	Organic
Stream Sinuosity	NA
Width/Depth Ratio	NA
Floodplain Width (m)	No floodplain
Entrenchment Ratio	NA
Rosgen Stream Classification:	NA



Little Susitna Pond: Aerial view with current railroad crossing (HDR, September 2010)



Little Susitna Pond: Aerial view with current railroad crossing (HDR, September 2010)



Little Susitna Pond: Riparian vegetation (HDR, September 2010)



Little Susitna Pond: Cross sectional view (HDR, September 2010)

Appendix A-3.

Milepost 174.3

This location is the proposed crossing of the Little Susitna River adjacent to the existing main line bridge. The existing bridge abutments restrict stream flow. The impinged flow has increased scour between the abutments and caused increased deposition of fines downstream of the bridge. The ADF&G has identified this location as anadromous for juvenile coho salmon rearing in the AWC, as well as the presence of coho and pink salmon spawning and Chinook rearing upstream of the bridge. Consequently, no fish sampling was conducted in association with this effort. Aquatic habitat data collected at this location are summarized in Table 3.

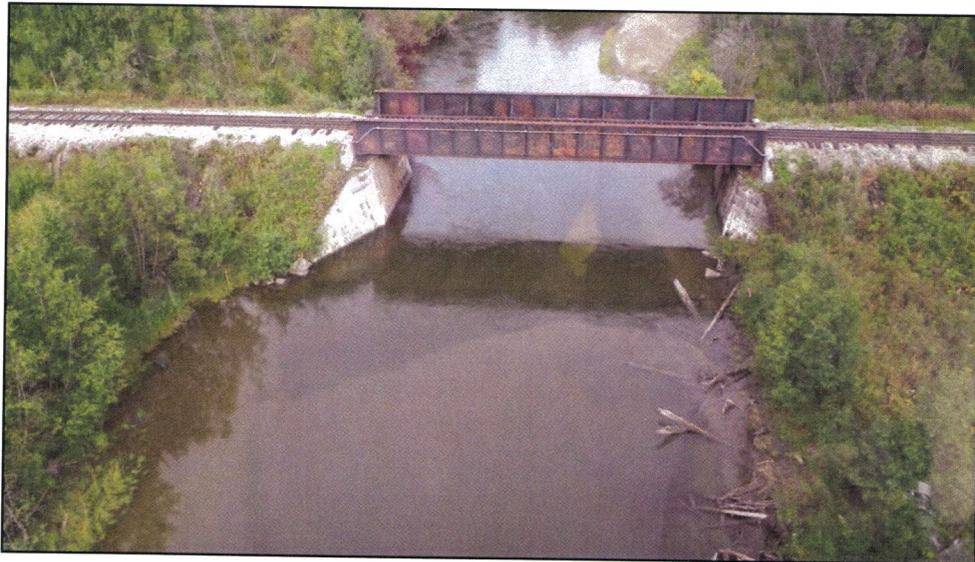
Milepost 174.3: Table 3 – Aquatic Habitat Data Summary (September 02, 2010)

Avg. Wetted Width (m)	26.88
Avg. Bankfull Width (m)	28.2
Avg. Max Pool Depth (m)	Not recorded
Avg. Pool Tailout Depth	Not recorded
Approx. Undercut Bank Dimensions	Approximately 70% of both banks provide UCB 0.15 to 0.25 m in depth.
Avg. Channel Depth (m)	Approximately 2.0 m
Dominant Riparian Cover	Alder trees and shrubs, as well as willow shrubs and grasses.
Stream Gradient	0.5%
Dominant Substrate	Gravel and sand
Stream Sinuosity	2.08
Width/Depth Ratio	14.1
Floodplain Width (m)	35.5*
Entrenchment Ratio	1.26
Rosgen Stream Classification:	G4c or G5c

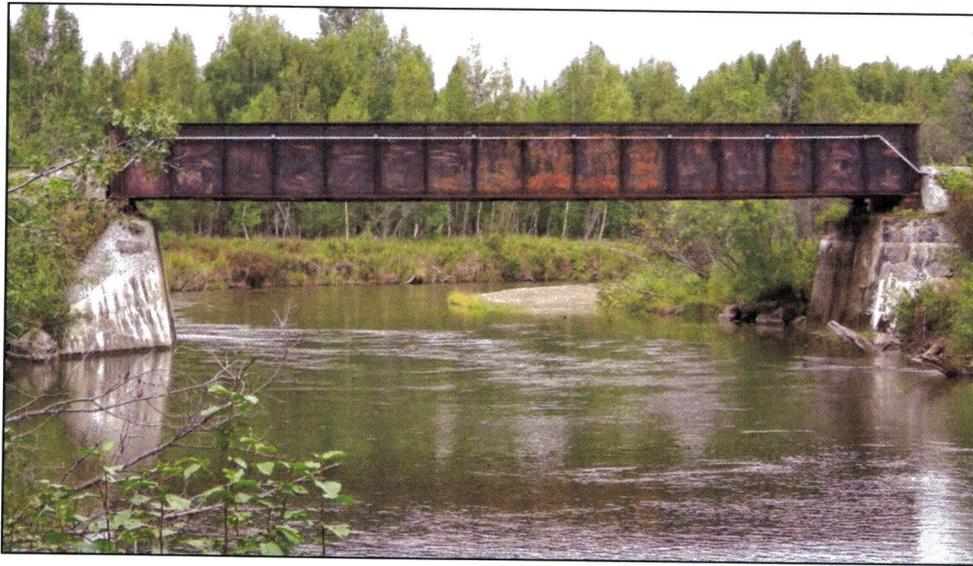
*Floodplain width measured in the field at proposed crossing location. Floodplain width only used for purposes of Rosgen Classification. FEMA floodplain values for 100 year event reported in the DEIS (2008) are 1950 feet wide.



MP 174.3: Aerial view of current railroad bridge looking upstream (Entrix 2008)



MP 174.3: Aerial view of current railroad bridge (Entrix 2008)



MP 174.3: View looking upstream to the northeast (HDR, September 2010)



MP 174.3: Large amounts of large woody debris in the water (HDR, September 2010)

Appendix A-4:

Houston South 1.0

This location is the proposed crossing of a tributary to Little Horseshoe Lake. Little Horseshoe Lake has been identified by ADF&G as anadromous for juvenile rearing coho (AWC Code 247-41-10100-2150-0030); however, no information was available in the AWC for the tributary. Four minnow traps were set in representative habitat types within the anticipated 200 foot ROW. Fish were also collected by electrofishing areas in the ROW where access for this method was found. Fish presence data collected at this location are presented in Table 4.

Houston South 1.0: Table 4 - Fish captured by minnow traps and electrofishing at site HS 1.0, September 02 and 23, 2010.

Species	Number	Species	Number
Coho Salmon	79	Rainbow Trout	2
Chinook Salmon	0	Dolly Varden	0
Sockeye Salmon	0	Stickleback	8
Pink Salmon	0	Sculpin	0
Chum Salmon	0	Longnose Sucker	2

The tributary drains southerly through a wetland and then a series of three or four partially crushed culverts under an elevated dirt road prior to discharging into the northern end of Little Horseshoe Lake. Within the proposed alignment ROW water flow is typically disseminate through the wetland with few areas of discernable channel bed or bank. Wetted and bank full widths were highly variable. The wetland is saturated to the surface with many areas of off-channel surface water. Surface flow and channel conditions suggest the entire width of the wetland within the ROW is part of the floodplain. Aquatic habitat data collected at this location are summarized in Table 5.

Houston South 1.0: Table 5 – Aquatic Habitat Data Summary (October 01, 2010)

Avg. Wetted Width (m)	2.08
Avg. Bankfull Width (m)	2.08
Avg. Max Pool Depth (m)	NA – no pools
Avg. Pool Tailout Depth	NA – no pools
Approx. Undercut Bank Dimensions	NA – no UCB
Avg. Channel Depth (m)	0.64
Dominant Riparian Cover	Overhanging sedges and shrubs provide some refugia along both banks.
Stream Gradient	1.0%
Dominant Substrate	Organic
Stream Sinuosity	1.53
Width/Depth Ratio	3.24
Floodplain Width (m)	50.5
Entrenchment Ratio	24.34
Rosgen Stream Classification:	E6



HS 1.0: Aerial view of stream looking southeast (HDR, September 2010)



HS 1.0: Aerial view of stream looking northwest (Hansen, July 2010)



HS 1.0: Typical cross sectional view of stream at minnow trapping site (HDR, September 2010)



HS 1.0: Typical view of stream looking to the northwest (HDR, September 2010)

Appendix A-5:

Houston 9.6

This location is the proposed crossing of the outflow of Muleshoe Lake. The small unnamed lake to the south of Muleshoe Lake has been identified as anadromous for rearing coho by ADF&G. However, no information was available for the tributary to that lake, which connects it to Muleshoe Lake through visible continuous surface water flow. Four minnow traps were set in representative habitat types within the anticipated 200 foot ROW. Fish were also collected by electrofishing areas in the ROW where access for this method was found. Fish presence data collected at this location are presented in Table 6.

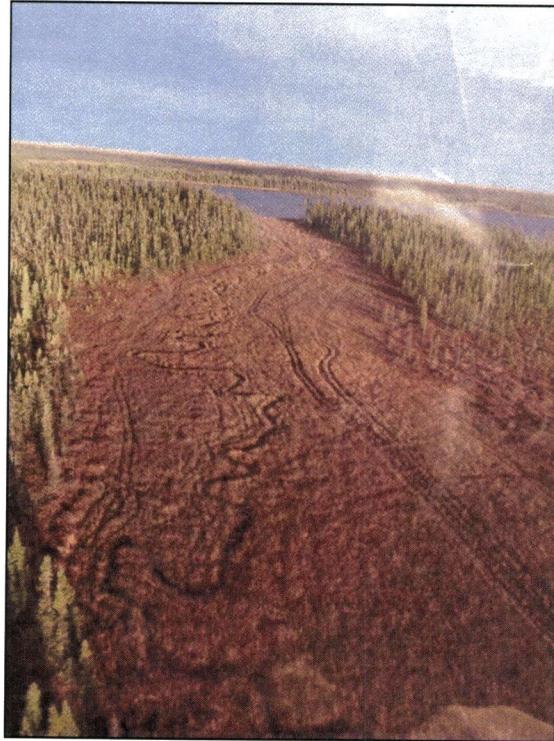
Houston 9.6: Table 6 – Fish Presence Summary (September 02 and 23, 2010)

Species	Number	Species	Number
Coho Salmon	426	Rainbow Trout	2
Chinook Salmon	0	Dolly Varden	0
Sockeye Salmon	0	Stickleback	120
Pink Salmon	0	Sculpin	1
Chum Salmon	0	Longnose Sucker	2

The outflow of Muleshoe Lake acts as a tributary to the smaller unnamed anadromous lake to the south. Within the ROW the waterbody flows through a single thread channel within a large wetland, but there are significant areas of adjacent wetlands that are either saturated to the surface or slightly inundated. The wetted widths and bank full widths are also approximately the same. These factors suggest the entire width of the wetland within the ROW is part of the floodplain. Aquatic habitat data collected at this location are summarized in Table 7.

Houston 9.6: Table 7 – Aquatic Habitat Data Summary (October 01, 2010)

Avg. Wetted Width (m)	1.62
Avg. Bankfull Width (m)	1.72
Avg. Max Pool Depth (m)	NA – no pools
Avg. Pool Tailout Depth	NA – no pools
Approx. Undercut Bank Dimensions	NA – no UCB
Avg. Channel Depth (m)	0.34
Dominant Riparian Cover	Dense shrubs and some sedges provide overhanging vegetation and refugia along both banks.
Stream Gradient	<0.5%
Dominant Substrate	Organic
Stream Sinuosity	1.91
Width/Depth Ratio	5.05
Floodplain Width (m)	42.0
Entrenchment Ratio	24.45
Rosgen Stream Classification:	E6



H 9.6: Aerial view of the stream to the southeast (HDR, October 2010)



H 9.6: Typical view looking upstream to the northwest (HDR, October 2010)



H 9.6: Aerial view of stream to the northwest (HDR, September 2010)



H 9.6: Typical view looking downstream to the southeast (HDR, October 2010)

Appendix A-6:

ADF&G 001

This location is a proposed crossing within a large wetland complex of floating mat, small pockets of open water, and small islands of black spruce. While small areas of open surface water are present, no surface flow and no connectivity to fish bearing waters were observed. Four minnow traps were set where site access allowed within the anticipated 200 foot ROW. Site conditions, e.g., floating vegetation mats, did not allow for electrofishing. No fish were caught at this location during sampling (September 23, 2010). No instream aquatic habitat data was collected during the field event, as no channel bed, channel bank, or surface flow were observed at this location. Floodplain width was estimated from GIS as being the approximate width (100-135 meters) of the wetland within the ROW.



ADFG 001: Aerial view of wetland complex and surface water looking north (HDR, October 2010)



ADFG 001: Aerial view of wetland complex looking north (HDR, October 2010)



ADFG 001: Typical surface water and wetland habitat looking southeast (HDR, October 2010)



ADFG 001: Typical wetland habitat looking southwest (HDR, October 2010)

Appendix A-7:

Houston 6.3

This location is the proposed crossing of a tributary to the Little Susitna River. Surface flow is through a highly sinuous and single thread channel through a shrub dominated wetland. Complex topographic relief adjacent to the active channel, combined with the presence of off-channel surface water suggests that the floodplain extends to the width of the wetland. The ADF&G has identified this location as anadromous for juvenile coho rearing in the AWC; consequently, no fish sampling was conducted in association with this effort. Aquatic habitat data collected at this location are summarized in Table 8.

Houston 6.3: Table 8 – Aquatic Habitat Data Summary (October 01, 2010)

Avg. Wetted Width (m)	3.41
Avg. Bankfull Width (m)	4.19
Avg. Max Pool Depth (m)	NA – no pools
Avg. Pool Tailout Depth	NA – no pools
Approx. Undercut Bank Dimensions	Approximately 6.0 m UCB along left bank, and 5.0 m UCB along right bank, ranging from 0.2 to 0.4 m in depth.
Avg. Channel Depth (m)	0.83
Dominant Riparian Cover	Tall grasses and moderately dense alder shrubs provide overhanging vegetation and refugia along both banks.
Stream Gradient	<0.5%
Dominant Substrate	Organic
Stream Sinuosity	2.16
Width/Depth Ratio	5.07
Floodplain Width (m)	75.0
Entrenchment Ratio	17.89
Rosgen Stream Classification:	E6



H 6.3: Aerial view of the channel and riparian area looking northwest during the fall (HDR, October 2010)



H 6.3: Aerial view of the area looking northwest during the summer (Hansen, July 2010)



H 6.3: Typical riparian growth (HDR, October 2010)



H 6.3: Typical channel depth (HDR, October 2010)

Appendix A-8:

ADF&G 002

This location is a proposed crossing through a wetland that connects East Papoose Lake to a smaller unnamed lake to the east. Four minnow traps were set in representative habitat types within the anticipated 200 foot ROW. The available sampling habitat consisted of small and shallow pockets of standing water between the sedges that did not allow electrofishing at this location. Neither of the lakes have been identified by ADF&G in the AWC; however, stickleback were found within the ROW at the crossing. Subsequent sampling during the site visit included setting one minnow trap each within East Papoose and the unnamed lake (both outside the ROW and on either side of the wetland connector). Both of these minnow traps caught juvenile coho. While no visible channel exists, the presence of juvenile coho in these unconnected lakes suggests that an active floodway exists between them that support anadromy during some periods. GIS evaluation of aerial photos indicated a likely surface channel between East Papoose and AWC stream 247-41-10100-2150. Fish presence data collected at this location are presented below. No aquatic habitat data was collected during the field event, as no channel bed, channel bank, or surface flow was observed at this location. Floodplain width was estimated from GIS as being the approximate width (40-50 meters) of the wetland within the ROW.

ADF&G 002: Table 9 – Fish Presence Summary (September 23, 2010)

Species	Number	Species	Number
Coho Salmon	10	Rainbow Trout	0
Chinook Salmon	0	Dolly Varden	0
Sockeye Salmon	0	Stickleback	4
Pink Salmon	0	Sculpin	0
Chum Salmon	0	Longnose Sucker	0



ADFG 002: Aerial view of wetland between two lakes looking northeast (HDR, October 2010)



ADFG 002: Aerial view of wetland between two lakes looking northwest (HDR, October 2010)



ADFG 002: Typical surface water conditions (HDR, October 2010)



ADFG 002: View looking northwest (HDR, October 2010)

Appendix A-9:

Houston 4.3

This location is the proposed crossing of a tributary to the Little Susitna River. Surface flow is conveyed in a sinuous and single thread channel through sedge and low shrub dominated wetland. The wetland within the ROW consists mostly of floating mat. Extensive, small, and interconnected surface water throughout adjacent wetland, and complex topographic relief, suggests that the floodplain extends to the width of the wetland. The ADF&G has identified this location as anadromous for juvenile coho rearing in the AWC; consequently, no fish sampling was conducted in association with this effort. Aquatic habitat data collected at this location are summarized below.

Houston 4.3: Table 10 – Aquatic Habitat Data Summary (October 01, 2010)

Avg. Wetted Width (m)	1.59
Avg. Bankfull Width (m)	1.68
Avg. Max Pool Depth (m)	NA – no pools
Avg. Pool Tailout Depth	NA – no pools
Approx. Undercut Bank Dimensions	NA – No UCB.
Avg. Channel Depth (m)	0.35
Dominant Riparian Cover	Dense to very dense grass/sedge/shrub growth along both banks provide 85-100% overhanging vegetative cover.
Stream Gradient	<0.5%
Dominant Substrate	Organic
Stream Sinuosity	1.49
Width/Depth Ratio	4.86
Floodplain Width (m)	24.0
Entrenchment Ratio	14.31
Rosgen Stream Classification:	E6



H 4.3: Aerial view of channel looking southward (HDR, October 2010)



H 4.3: Aerial view of area looking southward (HDR, October 2010)



H 4.3: Typical channel depth (HDR, October 2010)



H 4.3: Typical channel and riparian conditions (HDR, October 2010)

Appendix A-10:

Houston 2.8

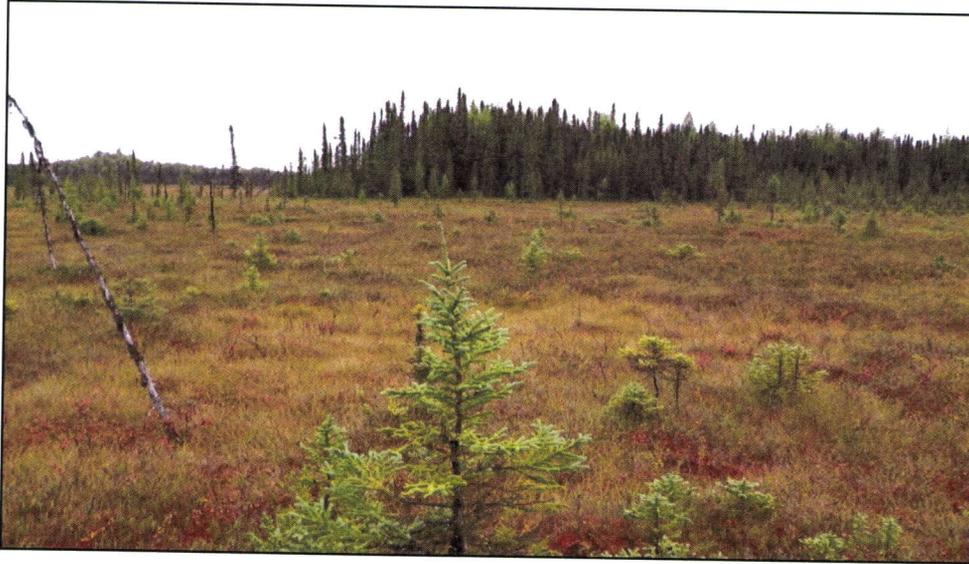
This location is a proposed crossing of a shrub dominated wetland that connects two unnamed lakes. On September 02, 2010 three transects were walked within the proposed alignment and one transect was walked on either side of the alignment ROW inside the wetland connector, but no signs of surface water, channel, or floodway were observed. No fish presence information was available for either of the unnamed lakes. No surface water was found to conduct fish and/or aquatic habitat sampling within or near the ROW.



H 2.8: Aerial view of wetland between two lakes looking northwest (HDR, September 2010)



H 2.8: Aerial view of the wetland between two lakes looking southeast (HDR, September 2010)



H 2.8: View looking across the wetland and down the proposed alignment (HDR, September 2010)



H 2.8: View looking across the wetland and towards the proposed alignment (HDR, September 2010)

Appendix A-11:

Houston 0.8

This location is the proposed crossing of a tributary to the Little Susitna River. Surface flow is through a highly sinuous and often multiple thread channel through a shrub dominated wetland. Relatively deep and complex topographic relief adjacent to the active channel, combined with the presence of off-channel surface water and multiple overflow channels suggests that the floodplain extends to the width of the wetland. The ADF&G has identified this location as anadromous for adult coho and pink salmon spawning and juvenile coho rearing in the AWC; consequently, no fish sampling was conducted in association with this effort. Aquatic habitat data collected at this location are summarized below.

Houston 0.8: Table 11 – Aquatic Habitat Data Summary (September 03, 2010)

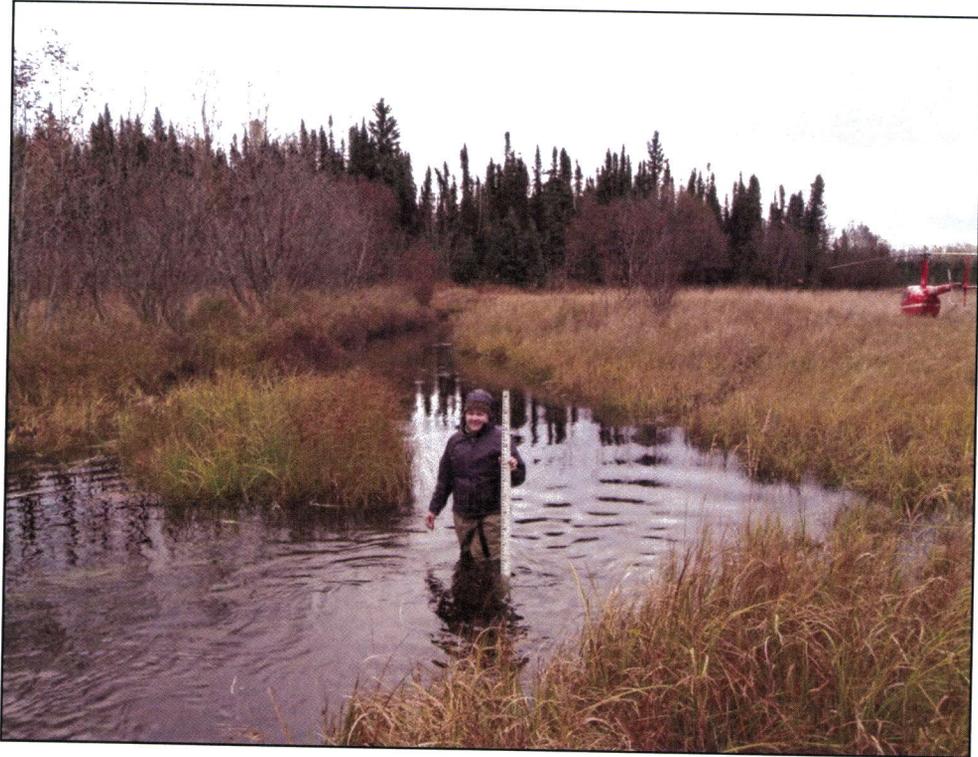
Avg. Wetted Width (m)	3.73
Avg. Bankfull Width (m)	3.95
Avg. Max Pool Depth (m)	0.77
Avg. Pool Tailout Depth	0.38
Approx. Undercut Bank Dimensions	NA – No UCB.
Avg. Channel Depth (m)	NA
Dominant Riparian Cover	Very dense shrub growth provides 2-3 feet of overhanging vegetative cover along both banks.
Stream Gradient	1.0-1.5%
Dominant Substrate	Small Gravel
Stream Sinuosity	1.83
Width/Depth Ratio	10.34
Floodplain Width (m)	90.37
Entrenchment Ratio	22.88
Rosgen Stream Classification:	C4-riffle; C5-pool



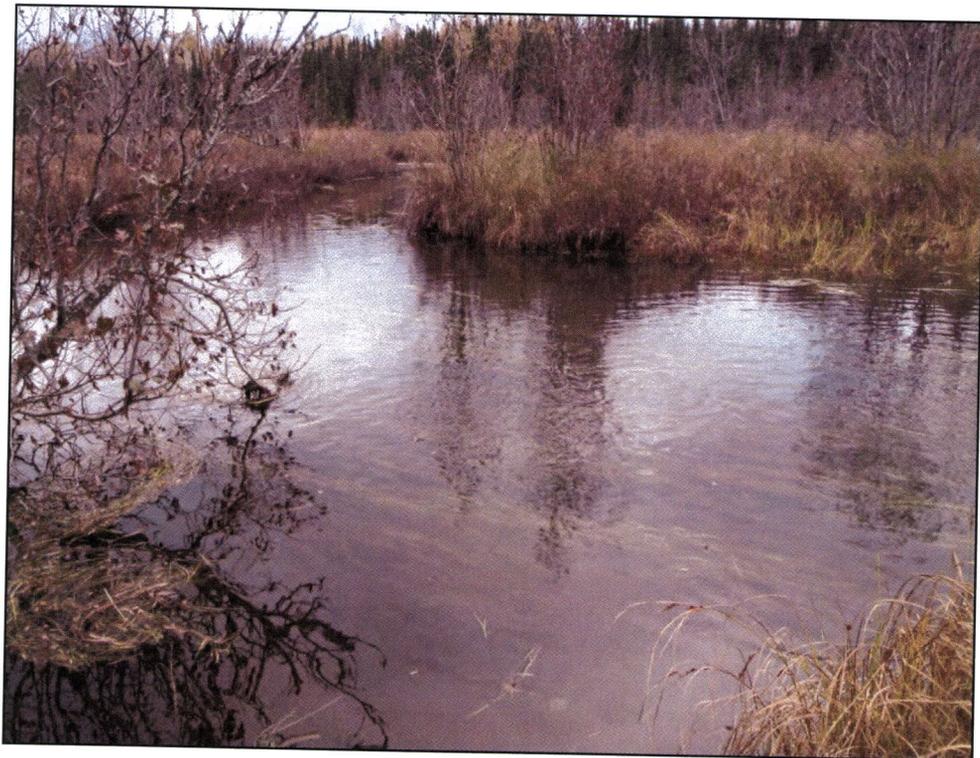
H 0.8: Aerial showing channel complexity during the fall (HDR, October 2010)



H 0.8: Aerial showing channel complexity and riparian growth during the summer (HDR, July 2010)



H 0.8: View of channel depth (HDR, October 2010)



H 0.8: Typical riparian conditions (HDR, October 2010)

Appendix A-12:

Mac Central 4.5 (Baker Farm Road)

This location is the proposed crossing of a discontinuous and intermittent drainage to AWC 247-41-10080-2036. Four minnow traps were set in representative habitat types within the anticipated 200 foot ROW. Fish were also collected by electrofishing areas in the ROW where access for this method was found. Fish presence data collected at this location are presented below.

Mac Central 4.5: Table 12 – Fish Presence Summary (September 02 and 23, 2010)

Species	Number	Species	Number
Coho Salmon	0	Rainbow Trout	0
Chinook Salmon	0	Dolly Varden	0
Sockeye Salmon	0	Stickleback	142
Pink Salmon	0	Sculpin	0
Chum Salmon	0	Longnose Sucker	0

This drainage is the only proposed crossing location outside the Little Susitna River watershed, and drains southwest through a breach in Baker Farm Road towards Upper Cook Inlet. Surface flow within the ROW is conveyed in a highly variable width channel with surface flow often disseminate through the wetland over floating vegetated mat. The channel has few areas of discernable channel bed or bank; however, where they do exist, wetted and bank full widths are the same, and the wetland is saturated to the surface in most places. These factors suggest the entire width of the wetland within the ROW is part of the floodplain. Aquatic habitat data collected at this location are summarized below.

Mac Central 4.5: Table 13 – Aquatic Habitat Data Summary (September 02, 2010)

Avg. Wetted Width (m)	3.15
Avg. Bankfull Width (m)	3.15
Avg. Max Pool Depth (m)	NA – no pools
Avg. Pool Tailout Depth	NA – no pools
Approx. Undercut Bank Dimensions	NA – no UCB
Avg. Channel Depth (m)	0.46
Dominant Riparian Cover	Sedge and wetland shrubs provide overhanging vegetation and shoreline refugia along extensive portions of both banks.
Stream Gradient	< 0.5%
Dominant Substrate	Organic
Stream Sinuosity	1.21
Width/Depth Ratio	6.85
Floodplain Width (m)	50.0
Entrenchment Ratio	15.87
Rosgen Stream Classification:	E6



MC 4.5 (Baker Farm Road): View looking upstream at road embankment (HDR, September 2010)



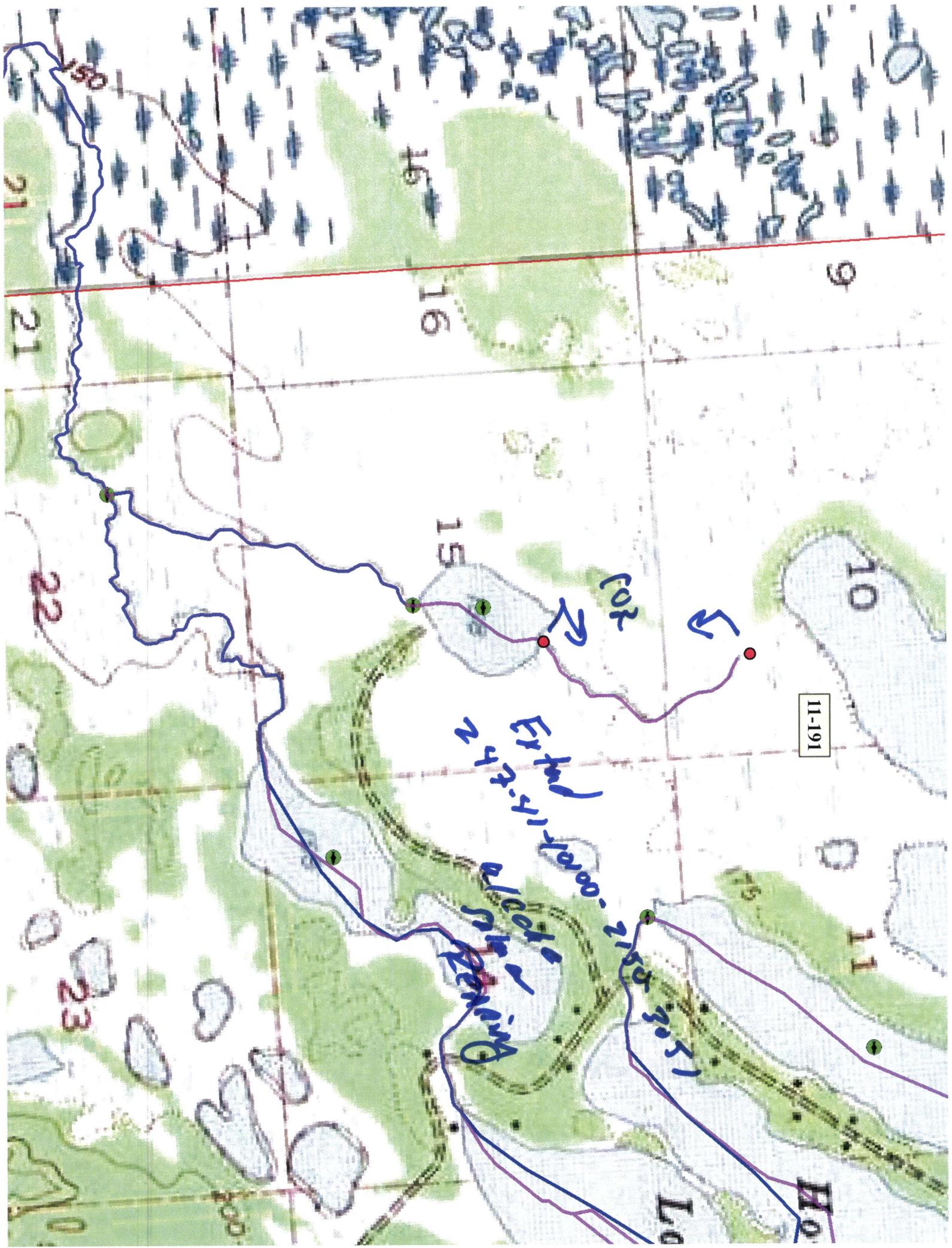
MC 4.5 (Baker Farm Road): Breach in road embankment (HDR, September 2010)



MC 4.5 (Baker Farm Road): Typical minnow trap set (HDR, September 2010)



MC 4.5 (Baker Farm Road): Typical channel conditions (HDR, September 2010)



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