Appendix L
Shoreline Habitat Assessment

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ANCHOR QEA

Memorandum

June 7, 2023

To: Hunter Young, U.S. Environmental Protection Agency

From: Julie Fox, Anchor QEA, LLC

cc: Bob Wyatt, NW Natural
Patty Dost, Pearl Legal Group
Ryan Barth, Nik Bacher, Elizabeth Greene, and Sydney Gonsalves, Anchor QEA, LLC

Re: US Moorings Project Area Shoreline Habitat Assessment—Portland Harbor Superfund Site, Portland, Oregon

Introduction

The purpose of this memorandum is to summarize the results of a shoreline habitat assessment conducted for the US Moorings Project Area (Project Area) located between approximately the downstream end of the St. Johns Bridge and river mile 6.1 on the western shoreline of the Portland Harbor Superfund Site (Figure 1) to support the *Final Revised First Phase Pre-Design Investigation Data Summary Report and Second Phase Pre-Design Investigation Work Plan*.

Consistent with the EPA-approved approach used for the adjacent Gasco Sediments Site Project Area, NW Natural proposes to use a Habitat Equivalency Analysis (HEA)-based approach during remedial design to determine potential mitigation required for the implementation of the sediment remedy. HEA has already been used for the evaluation of aquatic habitat in the Lower Willamette River as part of the Natural Resource Damage Assessment (NRDA) Restoration process associated with the Portland Harbor Superfund Site (Stratus 2010) and HEA is currently used by the National Marine Fisheries Service (NMFS) to assess habit value for species listed under the ESA (DEQ et al. 2016). In support of these efforts, the Portland Harbor Superfund Site NRDA Trustees and NMFS developed relative habitat values, which are key input parameters for the analysis (Attachment A). HEA has also been used by the U.S. Army Corps of Engineers (USACE) on various projects around the country to calculate appropriate mitigation requirements under Clean Water Act Section 404 since 2002 (Ray 2009). The habitat types presented in this memorandum are consistent with those presented in Attachment A.

Data Collection

Shoreline habitat data were collected by Anchor QEA on October 15, 2020, on the Project Area between the top of bank and +3.0 feet City of Portland datum (COP) (+5.1 feet North American Vertical Datum of 1988 [NAVD88]), which is the elevation of ordinary low water (OLW) at +3 feet COP (+5.1 feet NAVD88) along the Willamette River in this location. Due to access issues, the

shoreline adjacent to Advanced American Construction was not included in the habitat survey; however, this data gap will be filled during remedial design. Water levels during the site visit ranged from approximately +4.8 (+6.9 feet NAVD88) to +7.18 feet COP (+9.28 feet NAVD88). The 2020 habitat survey between the top of bank and +3.0 feet COP (+5.1 feet NAVD88) was conducted by walking the shoreline from downstream to upstream. Differences in slope, substrate, and vegetation data were observed and recorded using a Trimble Geo 7x handheld differential global positioning system (DGPS) unit. For areas of the shoreline underwater during the site visit, substrate data from previously collected core or grab sediment samples were used to derive the percent fines to the habitat type. Data were collected in a continuous manner by evaluating the entire shoreline to fully represent existing conditions. Photographs were also taken along the entire shoreline during the habitat assessment to further document habitat conditions (Attachment B).

Data Processing and Mapping

The DGPS unit provides approximately submeter accuracy following differential correction. Once corrected, survey data were plotted on a base map in ArcGIS and then intersected with contour data to derive the following elevation and bathymetric depth and slope categories:

- Riparian zone (includes the area from the ordinary high water [OHW] line to 400 feet upslope from the OHW line at +18 feet COP [+20.1 feet NAVD88])
- Active channel margin (ACM) (includes the area from OHW to OLW) and where slope is less than 5 horizontal to 1 vertical (5H:1V)
- ACM (includes the area from OHW to OLW) and where slope is greater than 5H:1V
- Below OLW to approximately +3.0 feet COP (+5.1 feet NAVD88)

Elevation contours were obtained from the 2018 Portland Harbor bathymetric survey performed by DEA, Inc., in areas below +12 feet COP (+14.1 feet NAVD88). Upland and riverbank elevations above +12 feet COP were obtained from Oregon Lidar Consortium data collected in 2014. These data were used to establish the depths of the habitat types present in the Project Area and slope categories for the ACM. Following the elevation and bathymetric depth and slope analysis, habitat types were then added to the habitat assessment maps shown in Figures 2a and 2b with areas of less than 5H:1V slope identified within the ACM only. Table 1 summarizes the habitat types and habitat area calculations by slope in the Project Area.

Table 1
Habitat Area Calculations

Habitat Category	Area Calculations in Square Feet				
	Riparian (< 400 feet above OHW)	ACM (OLW to OHW)		Shallow Water (0 to 15 feet below OLW)	Deep Water (> 15 feet below OLW)
		< 5H:1V	> 5H:1V		
Naturally vegetated forest	718	—	—	—	—
Naturally vegetated grass/shrub	3,173	—	—	—	—
Invasive species	9,114	—	—	—	—
Unvegetated/paved/buildings/riprap	18,723	4,603	30,921	—	—
Unarmored and unvegetated (61–80% Fines)	—	8,897	6,966	—	—
Unarmored and unvegetated (81–100% Fines)	—	95,140	2,797	—	—
Pilings	—	129	202	20,562	—
Floating structures	—	—	202	1,758	—
Gravel and finer substrates	—	—	—	177,413	—
Deep water with natural substrates	—	—	—	—	149,460
Uncharacterized[1]	8,605	14,918	19,980	—	—
Total Area	**40,333**	**123,687**	**61,068**	**199,733**	**149,460**

Notes:
1. Uncharacterized areas will be categorized during remedial design.
ACM: active channel margin (between OHW and OLW)
OHW: ordinary high water (+18 feet COP; +20.1 feet NAVD88)
OLW: ordinary low water (+3 feet COP; +5.1 feet NAVD88)

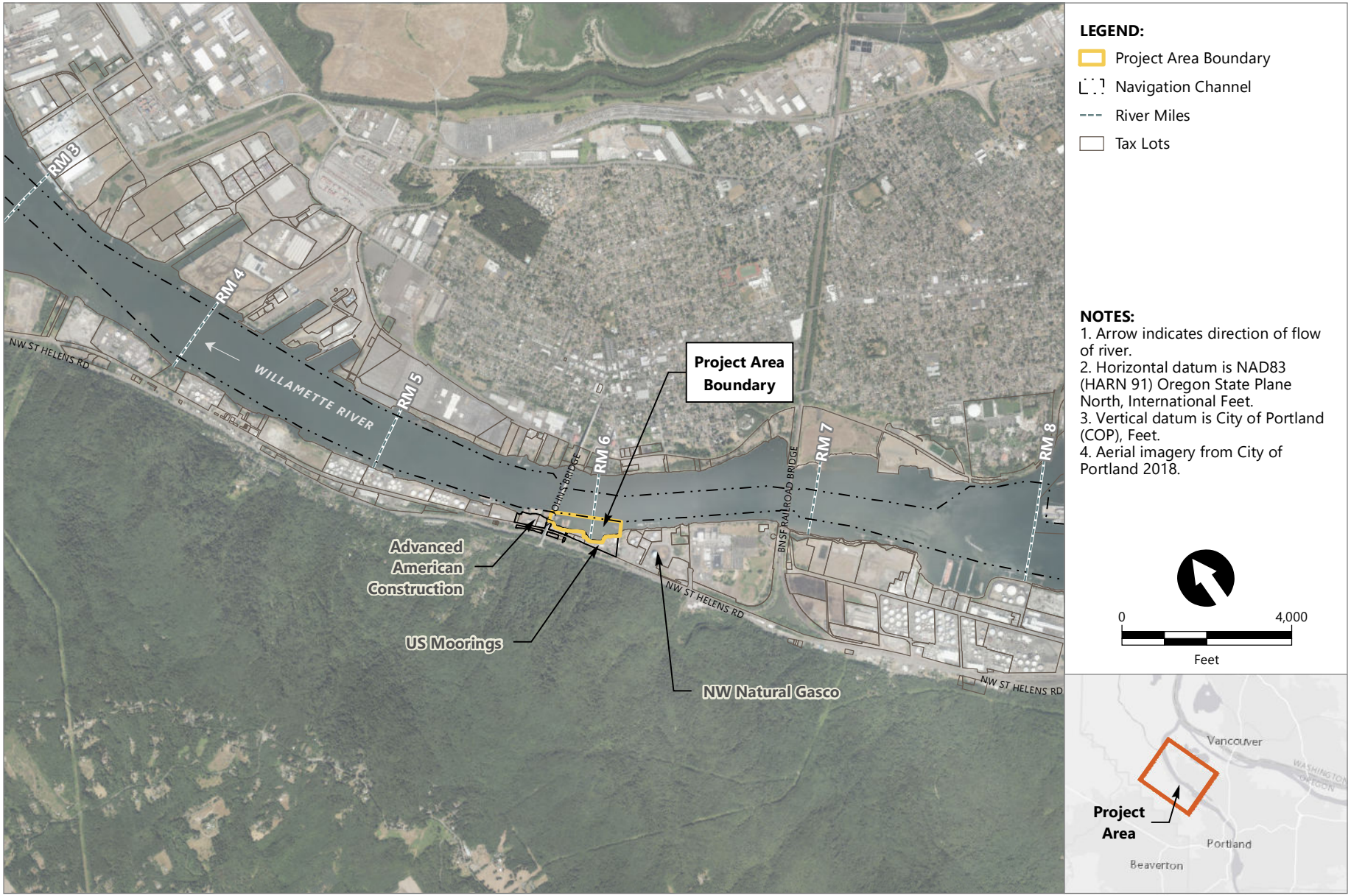
References

DEQ (Oregon Department of Environmental Quality), NOAA (National Oceanic and Atmospheric Administration) Fisheries, and U.S. Army Corps of Engineers, 2016. *Permitting Assistance Tools for Bankwork Projects in or Near Portland Harbor*. November 2016.

Ray, G.L., 2009. *Application of Habitat Equivalency Analysis to USACE Projects.* Ecosystem Management and Restoration Program (EMRRP). ERDC TN-EMRRP-Ei-04. April 2009.

Stratus (Stratus Consulting), 2010. *Portland Harbor Superfund Site Natural Resource Damage Assessment Plan*. Prepared for the Portland Harbor Natural Resource Trustee Council. June 1, 2010.

Figures



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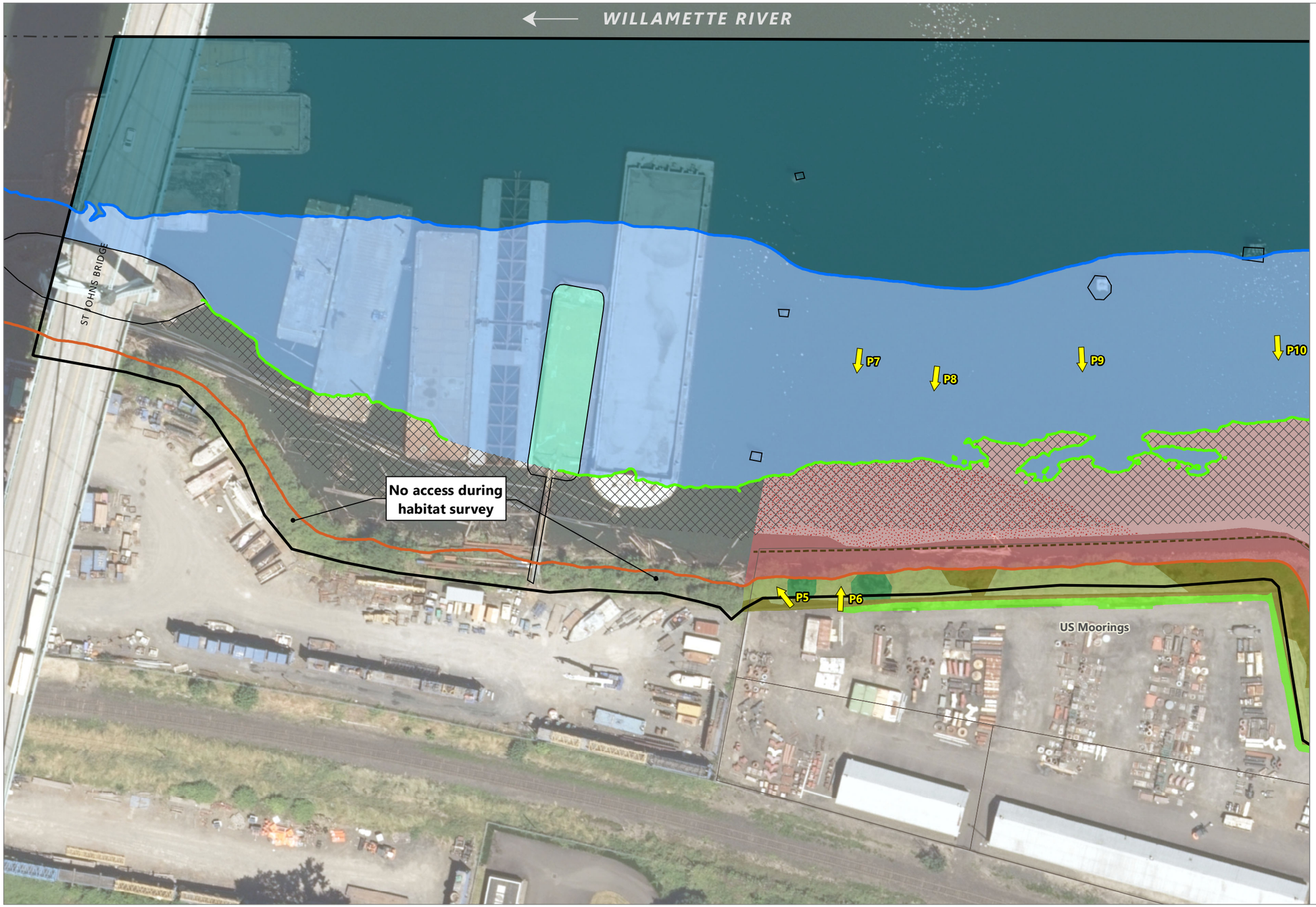
ANCHOR QEA

Figure 1
Vicinity Map
Shoreline Habitat Assessment
US Moorings Project Area
USMS0038141



LEGEND:

- Project Area Boundary
- Navigation Channel
- US Moorings Property Boundary
- Structures
- Approximate Sheet Pile Wall
- OHW (18.0 feet COP)
- OLW (3.0 feet COP)
- Main Channel - Shallow Water Lower Limit (-12 feet COP)
- Slope Shallower Than 5:1
- Riparian: invasive species
- Riparian: naturally vegetated forest
- Riparian: naturally vegetated grass/shrub
- Riparian: unvegetated/paved/buildings/riprap
- Active Channel Margin: Riprapped
- Active Channel Margin: unarmored and unvegetated (61-80% Fines)
- Active Channel Margin: unarmored and unvegetated (81-100% Fines)
- Shallow water with floating structures
- Shallow water, gravel and finer substrates
- Deep water with natural substrates
- Site Photos

NOTES:

1. Elevation contours and slope obtained from 2018 Portland Harbor bathymetric survey by DEA, Inc., in areas below +12 feet COP. Upland and riverbank elevations above +12 feet COP obtained from Oregon Lidar Consortium data collected in 2014.
2. Areas where slopes are shallower than 5:1 are only shown for the ACM which is located between OHW (+18 feet COP) and OLW (+3 feet COP).
3. Arrow indicates direction of flow of river.
4. Horizontal datum is NAD83 (HARN 91) Oregon State Plane North, International Feet.
5. Vertical datum is COP, Feet.
6. Aerial imagery from City of Portland 2022.

ACM: active channel margin
COP: City of Portland datum
OHW: ordinary high water
OLW: ordinary low water
NAD83: North American Datum of 1983

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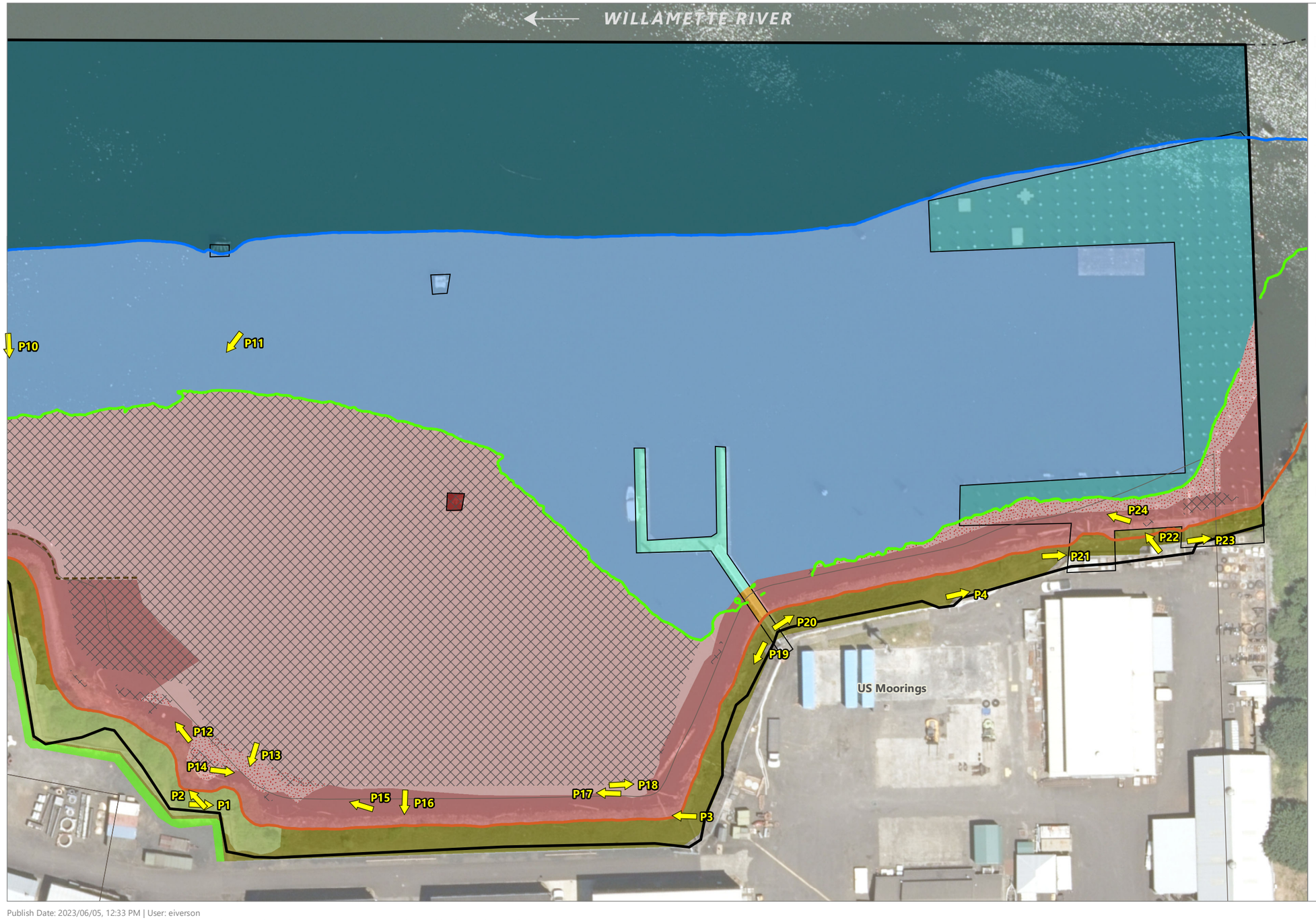
Figure 2a
US Moorings Habitat Assessment
Shoreline Habitat Assessment
US Moorings Project Area
USMS0038142



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- Slope Shallower Than 5:1
- Riparian: invasive species
- Riparian: naturally vegetated grass/shrub
- Riparian: unvegetated/paved/buildings/riprap
- Active Channel Margin: Floating structures
- Active Channel Margin: Pilings
- Active Channel Margin: Riprapped
- Active Channel Margin: unarmored and unvegetated (61-80% Fines)
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Figure 2b
US Moorings Habitat Assessment
Shoreline Habitat Assessment
US Moorings Project Area
USMS0038143

Attachment A
Habitat Categories and Values

HABITAT EQUIVALENCY ANALYSIS MODEL

There are many aspects to the analysis of a project in a biological opinion from National Marine Fisheries Service, or NMFS. Habitat Equivalency Analysis, or HEA, is often used for one part of an evaluation. HEA is a model that allows NMFS to assess the value of habitat for species at a site listed under the processes of the Endangered Species Act, or ESA. Using HEA, NMFS compares habitat value at a site before a project is implemented with the habitat value after a project is complete. Value is measured in discounted service acre years, or DSAYs. HEA can also account for the time it takes habitats like trees in a riparian area to become fully functional by discounting the value, generally at a rate of 3% per year.

For a HEA analysis, each habitat type is assigned a value ranging from 0 to 1, with 1 being the highest and 0 being the lowest value habitat for ESA-listed species. Inputting the acreages and values associated with each habitat type present at a site before construction, the model can generate the total present habitat value of that site in DSAYs. Similarly, inputting the acreages and values associated with all habitat types planned for after project construction, the model can generate the total habitat value of the site after the project is completed. The pre-project and post-project habitat value of the site can then be compared to see if the project has resulted in a credit (post-project site has a higher habitat value than pre-project site) or debit (pre-project site has a higher value than post-project site). If construction of a project leads to a situation where the pre-project site had a higher value than the post-project site, then the debit from the HEA model can help inform the amount of mitigation that may be necessary. The HEA model can also be used to determine the habitat credit generated by a proposed mitigation project. Credits from a proposed mitigation project are compared to a project debit to see if they balance or result in additional credit, either of which indicates that the mitigation is adequate. Mitigation credits must come from the same habitat category, except that off-channel habitat credits can be applied to debits in any category because this is the primary limiting factor for salmonids in Portland Harbor. Alternatively, a project debit can be mitigated for by purchasing the equivalent DSAY credits from an approved mitigation bank.

Habitat Survey and Values Guide

NMFS will run the HEA model for each project and any proposed mitigation. A pre-project survey must be completed to determine the habitat types and acreages present at the site. This can be done by laying out transects or delineating vertical and horizontal segments of a given size and identifying dominant habitat types along the transects or within each segment. The segments should be small enough so that habitat type does not vary much within a single segment, and one habitat type is easily identifiable as dominant. Clear photographs of each segment or area are helpful as a reference and should be submitted with the habitat survey. Habitat types are listed in the attached table. If habitats are degraded or disconnected from adjacent habitats, these conditions should be documented in the survey. Projected post-project habitat types and their associated acreages can be calculated using project designs.

Note that the attached table contains values for use only in Portland Harbor. While not all habitat types have assigned values, additional values may be assigned as necessary on a project-by-project basis. In addition, pre- and post- project habitat values may be adjusted for a given project based on: the presence or absence of contaminants; the quality of adjacent habitats; or the species and life stages present and the stream where any proposed mitigation is located. “Shallow water habitat” means less than 20 feet of water depth as measured at the ordinary low water level. Shallow water habitat values listed in the table are for depths of 0-10 feet, with a second value in parentheses for depths of 10-20 feet. “Bioengineered” means the use of living and nonliving plant materials in combination with natural and synthetic support materials for slope stabilization, erosion reduction, and vegetative establishment. Treatments must fundamentally

rely on riparian plants to provide long term strength to the bank, though grading and inert materials may be used to assist establishment of planted live material.
Please contact Ms. Genevieve Angle at (503) 231-2223 or at Genevieve.Angle@noaa.gov with any questions regarding the HEA process or to request the HEA spreadsheet to experiment with the model for a pre-application stage project.

Draft HEA Habitat Values for ESA Consultation in Portland Harbor			
Habitat	**Habitat Characteristics**	**Yrs Until Full Function**	**Salmonid Value**
RIPARIAN (above ordinary high water)	naturally vegetated forest, <400 ft from active channel margin	40 [1]	0.5
	and in the historic floodplain	40 [1]	0.65
	naturally vegetated, grass/shrub	5	0.2
	and associated with historic floodplain	5	0.35
	invasive species (e.g. Himalayan blackberry)	NA	0.1
	vegetated riprap	NA	0.05
	unvegetated/paved/buildings/riprap	NA	0
ACTIVE CHANNEL MARGIN (between ordinary high water and ordinary low water)	sloped (<5:1 or 11°), unarmored and vegetated (native)	3	1
	sloped (<5:1 or 11°), unarmored and vegetated (invasive)	3	0.5
	sloped (>5:1 or 11°), unarmored and vegetated (native)	3	0.8
	sloped (>5:1 or 11°), unarmored and vegetated (invasive)	3	0.4
	sloped (<5:1), unarmored and unvegetated	1	0.8
	sloped (>5:1), unarmored and unvegetated	1	0.1
	sloped (<5:1), bio-engineered	3	0.2
	sloped (>5:1), bio-engineered	3	0.2
	Riprapped	NA	0
	sheetpile/seawall	NA	0
	Pilings	NA	1/2 value of margin type
	suspended structures over channel margins (e.g. docks)	NA	0.1
	floating structures (e.g. docks)	NA	0
MAIN CHANNEL (below ordinary low water)	shallow water, gravel and finer substrates	1	1 (0.9)
	shallow water, natural rock outcrop	NA [2]	1 (0.9)
	shallow water w. riprap/concrete/seawall in adjacent shoreline	NA	0.1 (0.1)
	shallow water with suspended structures	NA	0.1 (0.1)
	shallow water with floating structures	NA	0
	shallow water with pilings	NA	1/2 value of channel type
	deep water with natural substrates	1	0.1
	deep water with artificial substrates	NA	0.05
OFF CHANNEL	"cold" water tributary	1	1
	"warm" water tributary	1	0.9
	side channel	1	1
	alcove or slough with tributary	1	1
	alcove or slough with tributary ("warm")	1	0.9
	alcove or slough without tributary	1	0.8
	embayment (cove) with tributary	1	1
	embayment (cove) with tributary ("warm")	1	0.9
	embayment (cove) without tributary	1	0.8

NOTES: [1] achieves 80% of full function within 10 years; this time is adequate because of flood protection
[2] cannot be created
Credit for simply removing pilings is limited to 0.1 and for removing covering structures is limited to 0.5.

Portland Harbor Natural Resource Trustee Council
"Expert Panel" Discussion of Habitat Restoration for Chinook Salmon

Executive Summary

On November 30 and December 1, 2009, a panel of experts was convened by the Portland Harbor Natural Resource Trustee Council to develop a scientific foundation for restoration planning being conducted under the Natural Resource Damage and Assessment program (NRDA) for the Portland Harbor Superfund site. The Trustees have been engaged in the early phases of restoration planning since 2007, and have developed some preliminary approaches and priorities for restoration of natural resources and habitats that may have been injured by releases of hazardous substances in Portland Harbor. Before moving into a more formal phase of restoration planning and closer to settlements with Potentially Responsible Parties (PRPs), the Trustees paused to invite the review and input of recognized experts on salmon and salmon habitat in the Lower Willamette River, in order to identify a scientific framework and priorities to guide the development of a restoration plan.

The purposes of the two-day expert panel session were to:

- identify the most relevant scientific literature and technical resources to guide restoration planning;
- understand the primary habitat requirements and limiting factors for juvenile Chinook salmon in the Lower Willamette River; and
- identify the types, characteristics and geographic locations of habitat restoration actions that would provide the greatest benefit for juvenile Chinook salmon.

The expert panel was comprised of the following members:

- Tom Friesen, Fish Biologist, Oregon Department of Fish and Wildlife's Corvallis Research Lab
- Stan Gregory, PhD, Professor of Fisheries, Oregon State University
- Nancy Munn, PhD, Aquatic Ecologist and Policy Analyst, National Marine Fisheries Service, Habitat Division
- Chris Prescott, Watershed Ecologist, City of Portland's Bureau of Environmental Services

Other participants included:

- Charles "Pete" Peterson, PhD, Interdisciplinary Marine Conservation Ecologist, University of North Carolina

- Erin Madden, Chair, Portland Harbor Natural Resource Trustee Council, representative of Nez Perce Tribe
- Robert Wolotira, NOAA Restoration Center, Habitat Equivalency Analyst
- Megan Callahan Grant, NOAA Restoration Center, Restoration Planning Coordinator for Portland Harbor Natural Resource Trustee Council (facilitator)
- Megan Hilgart, NOAA Restoration Center (recorder)

Erin Madden provided an overview of the Portland Harbor Natural Resource Trustee Council, its authorities under CERCLA and NRDA, and its phased plan for making the public whole for losses of natural resources, habitats and services in Portland Harbor. Nancy Munn presented background information on Endangered Species Act listings of salmonids that utilize habitat in the Harbor area, and factors that have been identified as limiting recovery of these species. Robert Wolotira provided an overview of Habitat Equivalency Analysis, using a Puget Sound site as an example. Tom Friesen described the findings of his research on juvenile Chinook diet and habitat utilization in the Lower Willamette River. Stan Gregory and Chris Prescott provided relevant information on their biological and ecological research and monitoring of the Upper and Lower Willamette River.

The expert panel reached consensus in the following areas:

1. Juvenile Chinook salmon utilize the Lower Willamette River for feeding and rearing before entering the Columbia River Estuary to a greater extent than previously believed. Chinook salmon are present almost year-round in the Lower Willamette.

2. Both yearling and subyearling (young-of-the-year) juvenile Chinook are found in the Lower Willamette. Although migration rates for subyearlings have not been directly evaluated, studies have shown that Chinook migration rate increases with fish size. Therefore, subyearlings may spend more substantial amounts of time than yearlings (more than two weeks) feeding and developing in the lower Willamette.

3. The area of the Lower Willamette that is most important for juvenile Chinook extends from Willamette Falls to the mouth of the Willamette (the broadest definition of the mouth or confluence with the Columbia includes the Lower Columbia mainstem from the Sandy River confluence upstream to the Lewis River confluence downstream), including the confluence areas of the major tributaries (Clackamas, Johnson, Kellogg and Tryon creeks), and Multnomah Channel.

4. The most limited or scarce habitat types within this area include any refuge from mainstem Willamette flows (alcoves and off-channel habitats, tributary mouths); shallow water and beach habitats with or without large wood assemblages; and undulating, natural shorelines. Other important potential limiting factors include temperature and toxics, as well competition and predation by non-native species that are more tolerant of high temperatures and toxics.

5. The extreme scarcity of key habitat types within the Portland Harbor study area (RM 1-11.8) makes it the expert panel's highest priority for restoration actions. Additional justification for this priority was provided by the panel
   - The study area contains the most impaired habitat in the river; the river is almost completely disconnected from its floodplain in this reach, with many ecosystem processes severely impaired. Further, physical alterations to the channel's edge severely limit availability of nearshore shallow water habitats.
   - The Lower Willamette is the first (lowermost) major tributary junction in the Columbia River basin.
   - A significant number of threatened and endangered (Columbia River and Willamette River) species use the area; all Willamette River stocks must pass through the study area twice during their life cycle.
   - The area's history of toxic contamination poses growth and survival challenges for juvenile salmonids, reducing their resiliency to other stressors.
   - The Lower Willamette contains the largest number of invasive/non-native species in the Willamette system, posing a further survival challenge to native salmonids.
   - There is an important opportunity for public education and outreach in the urban area.
   - Habitats within the study area are underserved by exsiting, non-NRDA sources of funding for restoration, compared to the mainstem Lower Columbia River, and tributaries such as the Clackamas River.

6. The expert panel developed a set of values for existing and potentially restorable types of habitat. The habitat types were evaluated based on their relative importance to juvenile Chinook, with the most important habitat types valued at 1.0, and all other habitat types valued relative to those "ideal" habitat types. These values will be used by the Trustees to identify the current, as well as potential future, value of specific habitats at specific locations as part of the Habitat Equivalency Analysis (HEA) model, and to calculate the increased habitat value or "lift" generated by restoration projects. The table of HEA values generated by the expert panel is attached to this summary.

7. The expert panel identified several characteristics that could increase the value of a restoration project. These include:
   - Restoration actions that would result in high quality habitat along both banks of a stretch of river
   - Projects that provide off-channel habitats or flow refuges at regular intervals ("stepping stones"), especially along the same side of the river
   - Restoration actions that provide a connection to a cold water tributary
   - Projects that provide cumulative ecosystem services (carbon sequestration, non-structural flood storage, wetland, wildlife benefits)
   - Projects of substantial size (expert panel noted that these are rare within the study area) so that ecosystem functions and processes are able to maintain habitats with minimal human manipulation or maintenance
   - Projects that restore multiple functional habitat types
   - Projects that protect existing, high-quality habitats
   - Projects that reconnect portions of the historic flood plain

Recommendations:

The expert panel recommended a strong emphasis on restoration of habitats within the Portland Harbor study area, but also noted the importance of habitats upstream and downstream of the study area. For upstream habitats (upstream of the study area to Willamette Falls), the panel recommended a focus on protecting intact habitats along the mainstem Willamette and tributary mouths that are currently developable and in private ownership. For downstream habitats (Multnomah Channel and Willamette River mouth and environs), the focus should be restoration of forested, complex and undulating shorelines, and the restoration of off-channel habitats.

Although the panel developed a table of initial relative values for each existing and potentially restorable habitat type (for habitat equivalency analysis), the panel members recommended that the Trustees contract out for an independent literature review, and that values be adjusted based on the results of that review.

The panel suggested that Potentially Responsible Parties should be required to direct a minimum of one third to one half of their total liability to restoration projects inside the study area. The panelists identified conservation banking as one possible mechanism to ensure timely and efficient implementation of high-priority restoration actions. The panel also stressed the importance of long-term monitoring, management and stewardship of restoration projects in order to ensure the highest possible degree of

scientific learning and the greatest chance of success, and encouraged the Trustees to account for these functions when estimating cost and value of restoration actions.

Table 1. Relative Chinook Salmon Lower Willamette Habitat Values

Habitat	Habitat Characteristics	Function Hab. Val	Yrs Until Full Function
Upland	forested, in hist. floodplain, >200 ft from ACM*	0.65	50
	forested, outside historic floodplain	0.15	40 (80% in 10 yrs)
	vegetated, grass/shrub outside floodplain	0.1	5
	vegetated, invasive spp. outside floodplain	0.05	--
	forested along tributary into Willamette	0.15	40
	forested and part of the historic floodplain	0.3	40
	vegetated, grass/shrub in historic floodplain	0.2	5
	vegetated, invasive spp in historic floodplain	0.1	--
	unvegetated/paved/buildings	0	--
Riparian	naturally vegetated forest, <200 ft from ACM	0.5	40** (80% in 10 yrs)
	and in the historic floodplain	0.65	50
	naturally vegetated, grass/shrub	0.2	5
	and associated with historic flood plain	0.35	5
	invasive species	0.1	3
Active channel margin	Sloped (<5:1 or 11°), unarmored and vegetated	1	3
	Sloped (>5:1 or 11°), unarmored and vegetated	0.2	3
	sloped (<5:1), unarmored and unvegetated	0.8	3
	sloped (<5:1), bio-engineered	0.4	3
	sloped (>5:1), bio-engineered	0.2	3
	riprapped	0.1	1
	sheetpile	0	--
	pilings (1 per 100 sq ft)	half value of margin type	
	covered structures over channel margins	max of 0.1	--
Main Channel	shallow water, gravel and finer substrates	1	1
	shallow water, natural rock outcrop	1	1
	shallow water with riprap or concrete	0.1	1
	shallow water with covering structures	0.1	--
	shallow water with pilings (1 per 100 sq ft)	0.5	1
	deep water with natural substrates	0.1	1
	deep water with artificial substrates	0.05	1
Off Channel	"Cold" water tributary	1	1
	"Warm" water tributary	0.9	1
	side channel	1	1
	alcove or slough with tributary	1	1
	alcove or slough without tributary	0.8	1
	embayment (cove) with tributary	1	1
	embayment (cove) without tributary	0.8***	1

*--ACM = Active Channel Margin

**--this time adequate for juvenile chinook because of flood protection.

***--around 0.6 further upstream

Attachment B
Photographs

P1: North Central Portion of Project Area, Top of Shoreline, Looking Southeast

P2: North Central Portion of Project Area, Top of Shoreline, Looking Northwest

P3: South Central Portion of Project Area, Top of Shoreline, Looking Northwest

P4: South Central Portion of Project Area, Top of Shoreline, Looking Southeast

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ANCHOR QEA

Figure B-1
Photographs 1 through 4
Appendix L: Shoreline Habitat Assessment
US Moorings Project Area
USMS0038155

P5: Northern Portion of Project Area, Top of Shoreline, Looking North

P6: Northern Portion of Project Area, Top of Shoreline, Looking Northeast

P7: Northern Portion of Project Area, From River, Looking Southwest

P8: Northern Portion of Project Area, From River, Looking Southwest

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Figure B-2
Photographs 5 through 8
Appendix L: Shoreline Habitat Assessment
US Moorings Project Area
USMS0038156

P9: Northern Portion of Project Area, From River, Looking Southwest

P10: North Central Portion of Project Area, From River, Looking Southwest

P11: North Central Portion of Project Area, From River, Looking West

P12: North Central Portion of Project Area, Toe of Slope, Looking North

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Figure B-3
Photographs 9 through 12
Appendix L: Shoreline Habitat Assessment
US Moorings Project Area
USMS0038157

P13: North Central Portion of Project Area, From Shoreline, Looking West

P14: North Central Portion of Project Area, From Shoreline, Looking Southeast

P15: Central Portion of Project Area, From Shoreline, Looking North

P16: Central Portion of Project Area, Toe of Slope, Looking Southwest

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Figure B-4
Photographs 13 through 16
Appendix L: Shoreline Habitat Assessment
US Moorings Project Area
USMS0038158

P17: South Central Portion of Project Area, From Shoreline, Looking Northeast

P18: South Central Portion of Project Area, From Shoreline, Looking Southeast

P19: Southern Portion of Project Area, Top of Shoreline, Looking West

P20: Southern Portion of Project Area, Top of Shoreline, Looking East

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Figure B-5
Photographs 17 through 20
Appendix L: Shoreline Habitat Assessment
US Moorings Project Area
USMS0038159

P21: Southern Portion of Project Area, Top of Shoreline, Looking Southeast

P22: Southern Portion of Project Area, Top of Shoreline, Looking North

P23: Southern Portion of Project Area, Top of Shoreline, Looking Southeast

P24: Southern Portion of Project Area, Along Riprap Slope, Looking North

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Figure B-6
Photographs 21 through 24
Appendix L: Shoreline Habitat Assessment
US Moorings Project Area
USMS0038160