WETLAND ASSESSMENT AND ADVANCED MITIGATION PROPOSAL

Tarlatt Slough Mitigation Site

Pacific County, Washington

Prepared by:

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June 8, 2010

Washington State
Department of Transportation

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Prepared By:

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Executive Summary

The Washington State Department of Transportation is proposing to restore 48.58 acres of historically diked tidal marsh at the southernmost end of Willapa Bay. The site is located North of where Tarlatt Slough enters Willapa Bay (Sections 2, 3, 11 & 12, Township 10 N, Range 11 W), in Pacific County.

The 49.26 acre site is owned by WSDOT. Historically the site was part of the tidal wetland/marsh system at the mouth of Tarlatt Slough in Southern Willapa Bay. The site is bounded on the West by the Long Beach Peninsula, on the North and East by Willapa Bay and on the South by Tarlatt Slough.

The project will restore 48.58 acres wetland by:

- removing a perimeter berm that disconnects the site from tidal action
- filling two man-made east-west drainage ditches that were excavated in attempts to drain the site
- re-establishing the historic tidal channel network across the site

This restoration will result in significant improvements to ecosystem functions at the site. WSDOT is proposing to use this functional lift as the basis for mitigation needed for anticipated project impacts in the Willapa Bay area. A Willapa Bay Watershed-based Programmatic Mitigation Agreement between WSDOT and several state and federal resource agencies (WSDOT 2002) was developed for environmental mitigation in advance of highway construction impacts in the Water Resource Inventory Area 24 (WRIA 24). That agreement is the basis for the proposed Tarlatt Slough Mitigation Site.

Development of this restoration site in advance of projected impacts will not eliminate the need for individual projects to meet requirements for minimization and avoidance measures. Regulatory authorities will determine appropriate mitigation compensation during the permitting process of future projects.

Improvements to ecosystem function that will result from restoration at this site include:

- Complete removal of the perimeter berm will fully restore tidal influences to the site and re-establish estuarine wetland.
- Restoration of the historic tidal channel network across the site and re-establish connections to Tarlatt Slough and Willapa Bay.
- Restoration of hydraulic connections will rehabilitate the onsite wetlands and restore natural estuarine conditions.
- Filling of artificial drainage features will restore the natural marsh plain surface elevations and allow the return of normal tidal action across the entirety of the site.

Summary of Proposed Mitigation Site

Region	Southwest Region
Township/Range/Section	T10N R11W S02,03,10,11
Mitigation Location	Southwest Corner of Willapa Bay, Pacific County
WRIA	24 – Willapa
Total Area of Mitigation Site	49.26 acres
Wetland Re-establishment Area	1.45 acres
Wetland Rehabilitation Area (excludes regulatory buffer area that will be rehabilitated as estuarine wetland)	41.68 acres
Regulatory Buffer Area	6.13 acres regulatory buffer (125' buffer along west side of site, composed of 0.68 acres upland and 5.45 acres rehabilitated wetland.)
Tidal Channel Re-establishment	13,700 linear feet
Years of Monitoring	10 Years

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Acronyms and Abbreviations

Ecology	Washington State Department of Ecology
LWD	large woody debris
PEM	palustrine emergent
PFO	palustrine forested
PSS	palustrine scrub-shrub
ROW	right-of-way
SR	State Route
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
WDFW	Washington State Department of Fish and Wildlife
WSDOT	Washington State Department of Transportation
WRIA	Water Resource Inventory Area

Chapter 1. Introduction

In 2003, the Washington State Department of Transportation (WSDOT) acquired 49.26 acres directly north of Tarlatt Slough for use as a wetland mitigation site. The Tarlatt Slough Mitigation Site is located at the southern end of Willapa Bay (See Figure 1). The site is bounded on the west by the Long Beach Peninsula, on the north and east by Willapa Bay, and on the south by Tarlatt Slough. The South Unit of the Willapa Bay National Wildlife Refuge surrounds the site to the east and to the south across Tarlatt Sough. The boundary of the Willapa Bay Wildlife Refuge includes several private in holdings, including this parcel currently owned by WSDOT.

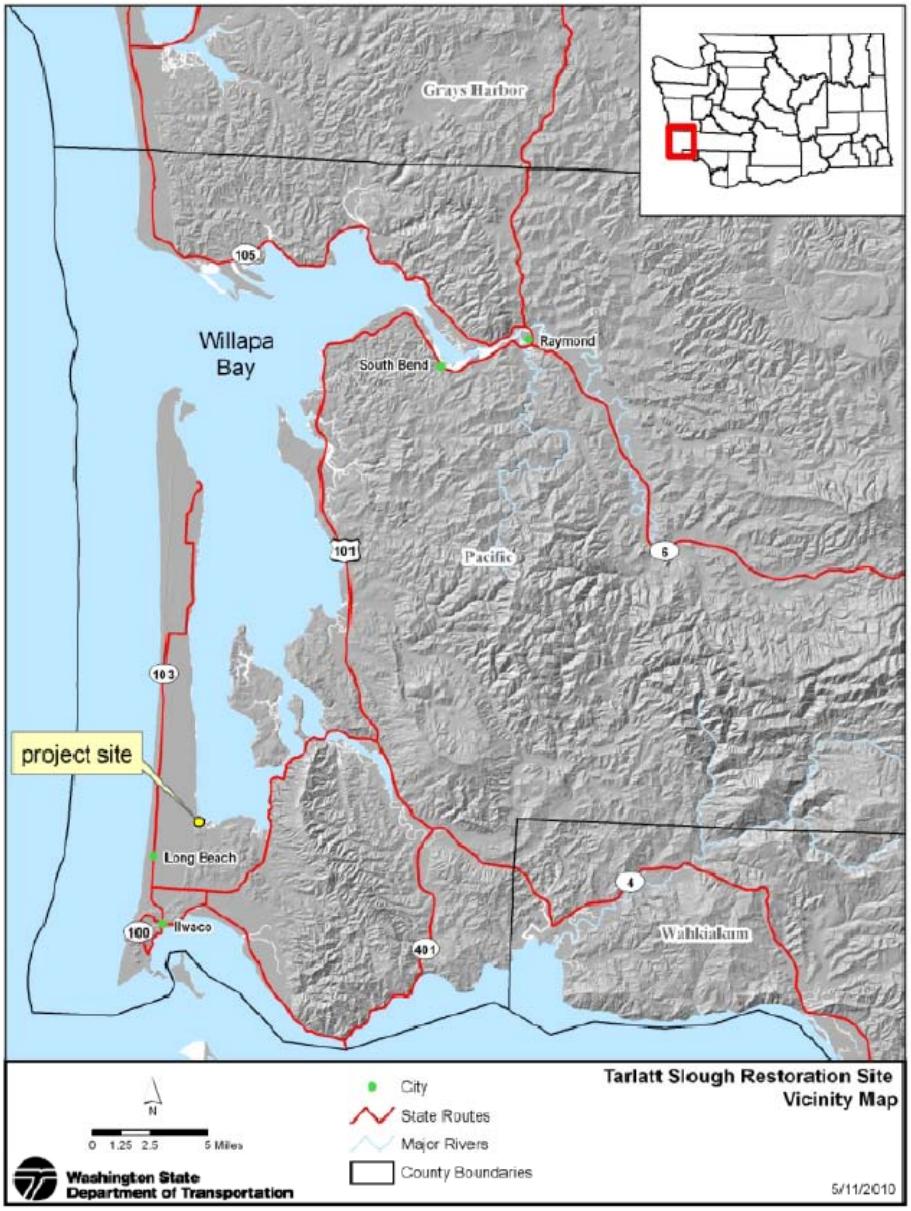

Figure 1. Vicinity Map

Historically the site was part of the tidal marsh system at the mouth of Tarlatt Slough in southern Willapa Bay. The site was altered by the construction of a perimeter berm and internal drainage ditches. These were built to prevent the site from flooding and to facilitate the previous owner's use of the property. Water carried by the drainage ditches emptied into the borrow ditch along the inside of the perimeter berm to facilitate the drainage of pasture land.

These historic changes disconnected this portion of the tidal marsh plain and associated tidal channels from Tarlatt Slough and Willapa Bay. The borrow ditch and drainage features were introduced into the natural tidal marsh plain topography on the interior of the constructed berm. Inside the perimeter berm, these changes to site hydrology have resulted in conversion from estuarine marsh with extensive tidal channels to a palustrine freshwater marsh with no tidal connection. On the bay side of the constructed berm, tidal action has developed new tidally influenced channels that closely parallel the Northern and Eastern section of the constructed perimeter berm. Flow in these channels is divided, with one path connecting to a distributor channel of Tarlatt Slough to the south, and the other connected directly to an existing channel that flows northeast directly into Willapa Bay.

The proposed mitigation plan restores the site to historic conditions by removing fill associated with the perimeter berm and filling both the borrow ditch and the drainage ditches to restore historic marsh plain elevations and re-establish the historic tidal channel network.

This report identifies and describes the wetlands on site and documents the existing conditions. The information will also be used to support applications for the following permits that are anticipated for this project:

- U. S. Army Corps of Engineers (USACE) - Section 404 Permit
- Washington State Department of Ecology - Section 401 Water Quality Certification and Coastal Zone Management Consistency determination
- Washington Department of Fish and Wildlife - Hydraulic Project Approval (HPA)
- Pacific County Critical Areas and Shorelines Permit

Field work was conducted by WSDOT Biologists on September 22 and October 5-6, 2009. The wetland delineation identifies one wetland located on the interior of the berm onsite totaling approximately 48 acres.

Chapter 2. Proposed Project

2.1 Location

The site is located at the outlet of Tarlatt Slough into Willapa Bay in Pacific County, (Township 10 N, Range 11, and Sections 2, 3, 11 & 12). Prior to disturbance the site was 49.26 acres of estuarine marsh habitat with numerous tidal channels connected to Tarlatt Slough and Willapa Bay.

2.2 Purpose and Description

The purpose of this project is to fully restore natural tidal processes and rehabilitate the site to historic estuarine wetland conditions for use as mitigation for future WSDOT highway improvement projects within the Willapa Bay Watershed (WRIA 24). Removal of the perimeter berm, re-establishment of the historic tidal channel network, and planned connections to existing tidal channels at the edges of the site will restore hydrologic and ecological processes and provide significant functional lift to the currently degraded area.

The five bridge replacement projects listed below have scheduled advertisement dates and will propose to use mitigation value developed through this restoration project.

- SR 105 North River Bridge Replacement
- SR 105 Smith Creek Bridge Replacement
- US 101 Middle Nemah Bridge Replacement
- US 101 Bone River Bridge Replacement
- SR 6 Willapa River (Lily Wheaton) Bridge Replacement

Projects may be added or removed from this list based on legislative priorities and budget constraints. WSDOT plans to use mitigation value remaining to compensate for additional impacts to aquatic resources from future projects that occur in WRIA 24 or within reasonable proximity to the Willapa Bay Estuary.

Chapter 3. Methods

Wetland boundaries within the Tarlatt Slough Restoration Site were delineated using the routine methods described in the: *Washington State Wetlands Identification and Delineation Manual* (Ecology 1997), the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987), and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains Valleys and Coasts Region* (USACE 2008).

The Interim Western Mountains, Valleys, and Coast Region Supplement (USACE 2008) was used to make wetland determinations based on climate, vegetation, soils, and hydrology for the site.

Wetland boundaries were delineated based on observations of hydrology, soils and plant communities, in conjunction with background information and data from:

- Natural Resources Conservation Service (NRCS) National Water and Climate Center WETS station data (NRCS 2002) (Appendix C)
- National Oceanic and Atmospheric Administration (NOAA) Archived Local Climatological Data (NOAA 2009) (Appendix C)
- U.S. Geological Survey (USGS) 7.5 minute topographic maps (Appendix D-2)

- Pacific County Hydric Soils List (NRCS 2009) (Appendix D-3)
- National Wetland Inventory (NWI) maps (USFWS 1996). (Appendix D-4)
- Current and historic aerial photographs (Appendix D-5)

Chapter 4. Existing Conditions

4.1 Landscape Setting

The Tarlatt Slough Mitigation Site is located at the southern end of Willapa Bay. Long Beach peninsula lies to the West of the site.

Willapa Bay is a coastal plain estuary that developed in a drowned river valley as sea levels rose over the last 10,000 years. The estuary is shaped by a partial ocean-built bar at the mouth. (Emmett et al, 2000). The tides are mixed semi-diurnal, with mean tidal range at the mouth of 1.9 m (Banas 2005). Fifty-five percent of the estuary surface area is intertidal.

Seven rivers and numerous small streams feed into Willapa Bay. River discharges into Willapa Estuary are driven by precipitation, with the largest discharges in the winter months. The highest salinities at the head of the estuary are associated with late summer when freshwater inputs from river discharges are the lowest.

The Willapa Bay estuarine environment is also influenced by freshwater from the Columbia River water mass under certain conditions. When wind, current and surface water movement cause this to occur, water from the Columbia River enters the Willapa Bay Estuary and the estuarine waters actively mix. This breaks down the horizontal and vertical stratification resulting in uniform salinity from top to bottom of the water column. Spring and summer have predominantly alternating wind directions that influence the development of downwelling or upwelling conditions that result in variations in salinity of the estuary. (Banas 2005)

Historic alterations to shorelines have disconnected significant areas from regular influence of the tides. Levees, ditching and associated tide gates have changed the landscape from estuarine influenced wetlands with extensive networks of tidal channels, to predominantly palustrine freshwater wetlands that are isolated from direct tidal influence.

Figure 2 shows the drainage network of the Tarlatt Slough watershed that is visible in the 2009 aerial photo from the Interior Department's National Agricultural Imagery Program.

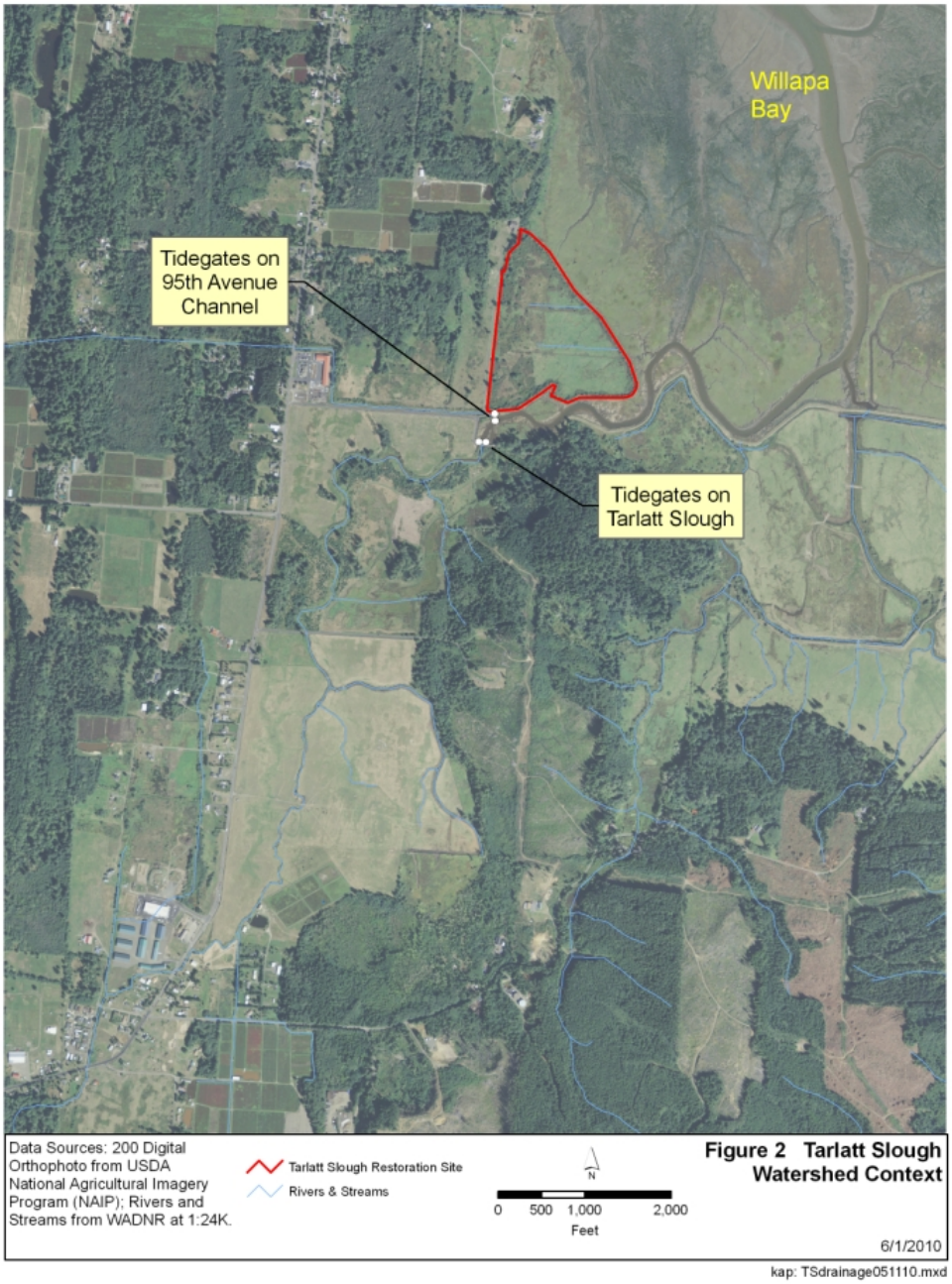

Figure 2. Tarlatt Slough Watershed Context

4.2 Site Conditions and History

WSDOT purchased the Tarlatt Slough Mitigation Site in 2003 for use as compensatory mitigation. The site is bordered by high tidal marsh on the north and east sides and Tarlatt Slough to the south. The majority of the site consists of degraded freshwater wetlands disconnected from natural tidal action by the existing perimeter berm located along the north and

eastern property boundary. The existing perimeter berm, the associated borrow ditch along the interior of the site and lateral drainage systems were likely constructed in 1959 as part of the local effort to improve drainage in the Tarlatt waterway (AMEC, 2010). This effort converted the site to non-tidal pasture land. A private driveway lies directly west of the site.

The borrow ditch that runs landward of the perimeter berm along its entire length collects water from a series of linear, east-to-west drainage ditches. The borrow ditch discharges through a 24-inch culvert under the private driveway (in the southwest corner of the parcel), which is the sole outlet for surface runoff leaving the site. This culvert then discharges into a ditch along 95th Avenue via a tide gate. The ditch along 95th Avenue empties into Tarlatt Slough via double tide gates. After restoration, this culvert under the driveway will serve no function, and will be plugged or disabled to prevent tides from bypassing tide gates on the drainage ditches that are designed to limit tidal flooding of adjacent properties. Figure 3 identifies these key features of the site.

Construction of the berm and associated drainage features in the past changed the hydrologic connections and hydrogeomorphic (HGM) class of the on-site wetlands. The HGM class of this wetland changed from estuarine tidal fringe to freshwater depressional. After the restoration effort is complete, the wetland will be returned to an estuarine tidal fringe HGM class. This will restore topography and hydrologic functioning to the natural, pre-bermed condition of the site.

Removal of the perimeter berm will restore estuarine influence and it is expected that the site will re-establish non-vegetated tidal sloughs and associated tidal marsh. The Tarlatt Slough Mitigation site is currently rated as a Category III depressional wetland using the 2004 Western WA Rating System, as updated in Version 2 July 2006. It scores low for water quality function (12 points); low for hydrologic functions (6 points); and high for habitat function (30 points). (See Appendix E)

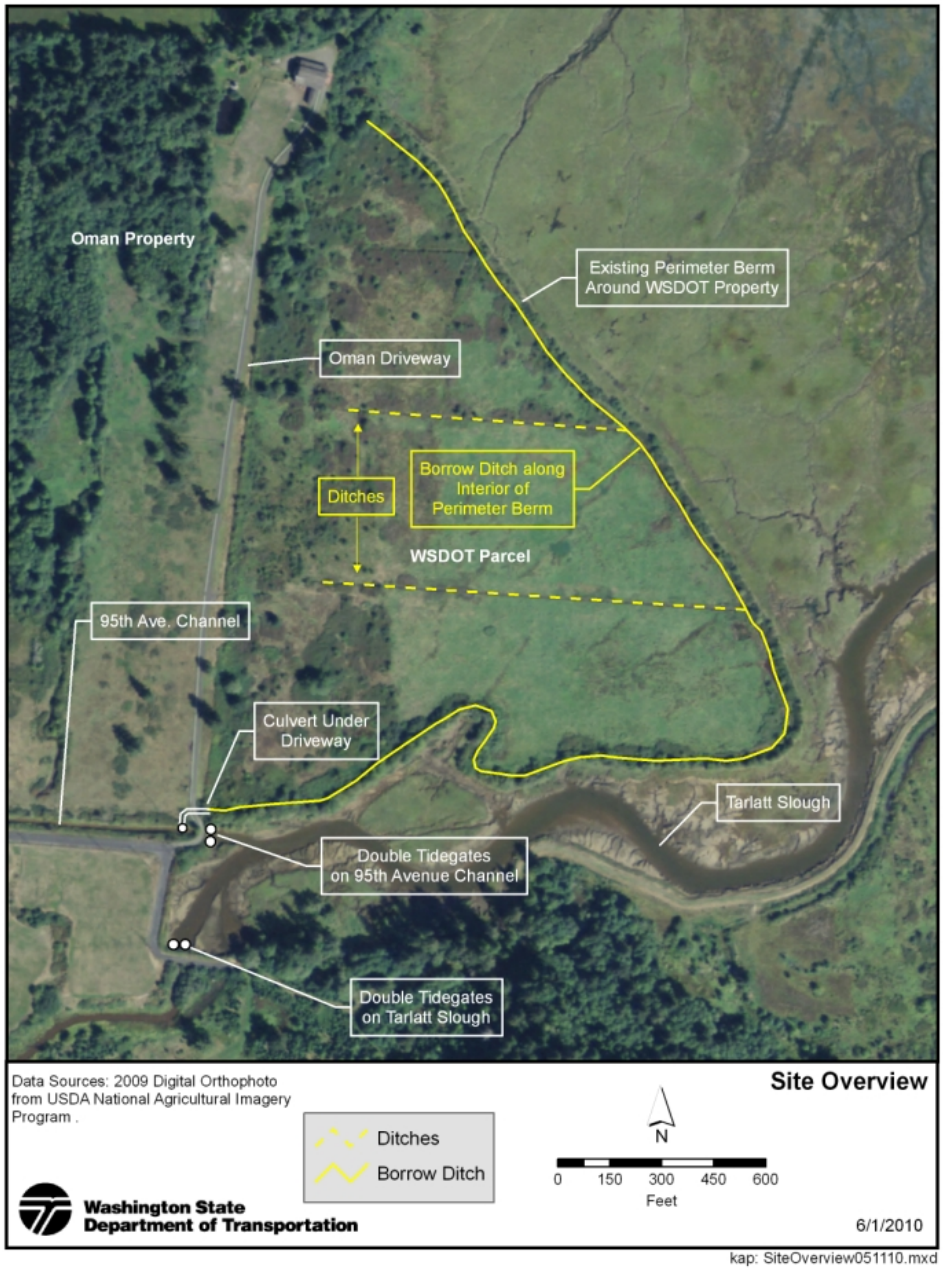

Figure 3. Overview of Site Features

4.3 Wetlands

Wetlands described in this report were assessed within the area east of the adjacent property driveway and the perimeter berm shown in Figure 3. Areas on the outside of the perimeter berm are estuarine wetlands associated with Tarlatt Slough and Willapa Bay.

Delineation data was collected at sampling points that are representative of conditions along the

western edge of the site. This data is recorded on wetland determination data forms (Appendix D).

No upland data points were evaluated along the perimeter berm. The wetland boundary along both sides of the berm perimeter was located based on elevation and vegetation characteristics. Land adjacent to the perimeter berm below 10.5' NAVD was determined to be wetland based on uniform conditions across the site.

The delineation determined that 47.13 acres of Category III wetland are present at the site. The wetland boundary is identified in Figure 4.

The site is classified as freshwater palustrine emergent habitat according to the *Classification of Wetlands and Deepwater Habitats of the United States*, U. S. Fish and Wildlife Service. Emergent vegetation across the site is made up of wetland adapted grasses, rushes, sedges and herbaceous plants. There are also smaller areas of freshwater palustrine scrub-shrub habitat intermixed with the emergent habitat. Plants within these scrub-shrub patches are dominated by Nootka rose, red elderberry, Hooker's willow and Pacific crabapple. Himalayan Blackberry and Nootka rose form dense thickets along the western edges of the property in particular where elevations rise. Pacific crabapple and Hookers willow dominate the vegetation along most of the perimeter berm also. Plants identified in the study area are listed in Appendix B-1.

There are trees scattered throughout the site and in particular where higher elevations exist along parts of the western and northern property edges. Tree species include red alder, Sitka spruce and cascara buckthorn.

The wetland was rated using the *Ecology 2004 Rating System for Western Washington wetlands, Version 2 updated July 2006*. According to this system the wetland's hydrogeomorphic class is depressional with an unrestricted outlet. Using this rating system it is a Category III wetland and scored a total of 48 points, including 6 points for hydrologic functions, 12 points for water quality functions and 30 points for general habitat functions. The wetland rating sheets are located in Appendix E.

<u>Soils</u>

Soils across the low elevations of the site are Ocosta silty clay loam. This soil type is a very poorly drained soil that developed on floodplains and deltas along coastal bays. Ocosta soils developed in alluvium deposited in coastal bays. Drainage in this soil type has been altered by ditching, tiling and pumping. The typical vegetation across these soils is sedges and grasses (*Soil Survey of Grays Harbor, Pacific County and Wahkiakum County*, 1986).

The soils of a small strip of land along the West side of the site and the adjacent private driveway are identified as Netarts fine sand in the soil survey. Netarts fine sands are well drained soils that developed on stabilized dunes.

There is also a small area of Palix silt loam, 30 to 65 percent slope in the Northwest corner of the property. This well drained soil formed in colluvium derived from siltstone. Appendix B-3 contains a map showing the distribution of these soil types on the site.

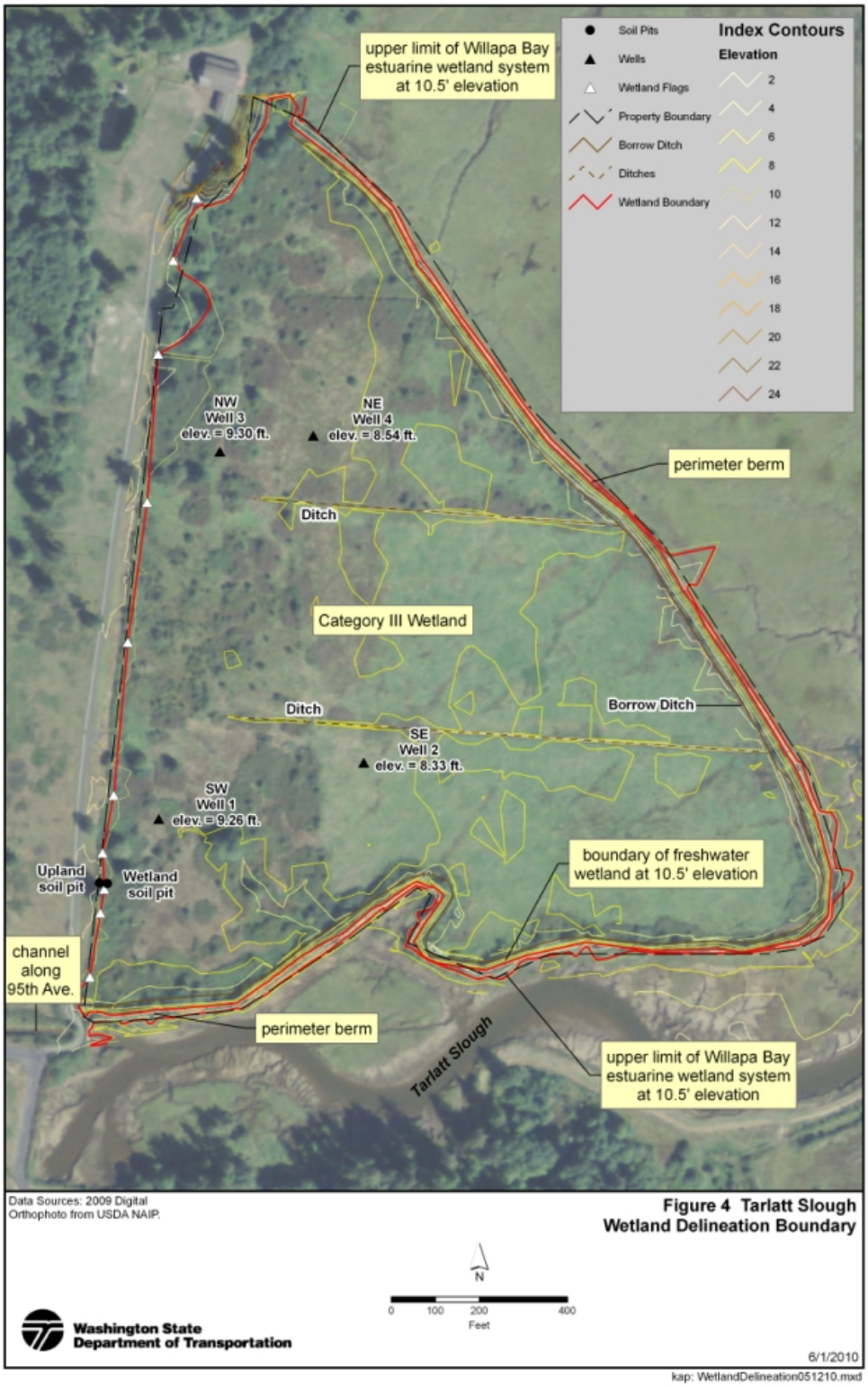

Figure 4. Wetland Delineation Boundary

Precipitation

Precipitation data is presented in Appendix F. Average precipitation in the vicinity of the Tarlatt Slough Restoration Site is approximately 81.19 inches per year (NRCS 2002). The water year in Washington extends from October 1 through the following September 30. The relevant water year was October 2008 through September 2009 when field work was conducted. Total precipitation for the water year was 55.49 inches which was below the 30-year average (Appendix F).

This annual precipitation total was 31.8 % below the average annual precipitation for the preceding three complete decades (years 1971 - 2000) and is thus considered to be below the normal range of precipitation for this location. Based on this information, normal hydrologic conditions were not present prior to field work.

Groundwater Data

Groundwater monitoring devices provide additional information about hydrologic conditions at the site. Groundwater data collected for the project is presented in Appendix F. Four shallow groundwater monitoring devices were installed at locations shown in Figure 4. Data collected between February 1st and April 4th of 2007, shows the ground water table at three of the well locations (NW, NE, SE) was within 12 inches of the surface for the entire period (See Figures F-1, F-2 and F-4 Appendix F). The fourth well is more variable but still shows groundwater elevations at that location to be within 12 inches of the surface on 10 days between March 1 and April 4th 2007 (See Figure F-3 Appendix F).

This duration of groundwater presence within Ocosta silty loam soils, supports the conclusion that the hydrology criteria for jurisdictional wetlands is met within this site.

Chapter 5. Mitigation Site Credit Proposal

5.1 Introduction

WSDOT is proposing to re-establish and hydrologically rehabilitate 48.58 acres of wetlands and associated tidal channel network at the Tarlatt Slough Mitigation site. This restoration project is being developed to offset future unavoidable impacts to wetland resources associated with WSDOT projects in the Willapa Bay area. The following credit proposal provides details of the proposed mitigation value and the basis from which the proposed mitigation values were developed for the site.

5.2 Benefits of the Project

The removal of the berm and restoration of the property is expected to result in the following functional improvements in this ecosystem:

1. Full restoration of tidal processes reconnecting the 49.26 acre site to Tarlatt Slough and the Willapa Bay estuarine ecosystem.

2. Rehabilitation of 47.13 acres of wetlands on the site from Category III wetlands of atypical HGM class, to Category I tidal fringe estuarine wetlands connected to the Willapa Bay estuarine ecosystem. (5.45 acres of rehabilitated wetland are within proposed regulatory buffer that will generate no mitigation credit).
3. Restoration of approximately 13,700 linear feet of associated historic tidal channels with direct connections to Willapa Bay and Tarlatt Slough.
4. Re-establishment of 1.45 acre of estuarine wetlands will be accomplished by removal of fill associated with the perimeter berm.
5. Rehabilitation of ecological processes that act across the site and the adjacent estuary by re-establishing the historic tidal channel network and tidal regime, and restoring the historic marsh plain elevation to approximately 4,250 linear feet of perimeter borrow ditch and 2,100 linear feet of East-West drainage ditches.

5.3 Estimate of Mitigation Value

The following estimate of mitigation value of the Tarlatt Slough site is calculated to be consistent with ratios and guidance in *Wetland Mitigation in Washington State - Part 1: Agency Policies and Guidance***,** Department of Ecology, U.S. Army Corps of Engineers (Seattle District), U.S. Environmental Protection Agency (Region 10), (Ecology Publication #06-06-`011a). This guidance will be subsequently referred to as 'the 2006 Joint Guidance' in this document.

The ratios proposed in this document take into consideration the project's high likelihood of success, the restoration of the site to the HGM class appropriate for the landscape, and the relative value of this type of restoration to the ecosystem.

5.3.1 Factors that Support the Likelihood of Successful Restoration

1. The mitigation site will be constructed prior to project impacts. This will reduce temporal impacts to wetlands and aquatic resources by having established ecological functions at the mitigation site prior to project impacts.
2. The site was historically high salt marsh associated with Willapa Bay and the lower reaches of Tarlatt Slough. Construction of the existing perimeter berm blocked tidal hydrology of the site and converted the wetland to a category III freshwater system. These areas will be completely restored to full natural tidal influence.
3. The restoration design follows the pattern of the historic tidal channel network visible in aerial images.
4. Tidal channels on the outside of the perimeter berm were used to guide the shape and size of the restored tidal channel network and the location of reconnection points to the existing marsh plain. The previous channel locations are known, therefore, it is highly likely that natural conditions will return successfully.
5. The marsh plain outside of the perimeter berm has well established salt marsh vegetation at varying elevations. This provides a source of immediate recruitment from a diverse natural marsh community.
6. Subsidence has been limited on the site, which will provide appropriate elevations for the re-establishment of high and low salt marsh plants by natural recruitment.
7. *Spartina alterniflora* control has been effective and is an ongoing effort by USFWS in the

Willapa Bay area. This minimizes the potential for future *Spartina alterniflora* infestation and provides the benefit of a framework for control that is already in place.

5.3.2 Benefits of Restoration

1. Tidal channels have been identified as important habitat, refugia and foraging area for juvenile salmonids and other fish species.
2. The restoration of approximately 13,700 linear feet of tidal channels of varying sizes at the site will significantly increase this unique type of fish habitat.
3. Salt marsh conditions associated with the estuarine environment provide habitat for migratory waterfowl and other species that may utilize the marsh plain and associated tidal channels for foraging, nesting, loafing, and refuge.
4. The Tarlatt Slough Mitigation Site is adjacent to property owned by the USFWS. The USFWS is supportive of this restoration plan and is working with WSDOT to develop an agreement that can place the Tarlatt Slough Property under the USFWS refuge management for the long term. USFWS is planning a similar project adjacent to the Tarlatt Site, but on a larger scale, removing nearly 5 miles of perimeter berm to restore the area to estuarine wetland. Ultimately, the restoration of the USFWS property and Tarlatt Slough Mitigation Site will greatly enhance the ecological value of the area.

5.3.3 Proposed Ratios to Establish Mitigation Value

WSDOT anticipates that the mitigation value provided by the restoration activities will be used to offset unavoidable impacts for several programmed bridge replacement projects in tidal sections of WRIA 24.

<u>Regulatory Buffer</u>
In accordance with USACE and Ecology requirements, a regulatory offset buffer will be established along the western boundary of the site. The buffer area will primarily be restored tidal marsh, with a narrow upper fringe of woody, salt tolerant vegetation. A regulatory buffer will be applied to the west side of the property within which no mitigation credit will be generated. The site is located within an area of rural land use, with one parcel immediately to the west. Willapa Bay and Tarlatt Slough lie along the north, east and south sides and are protected within the Willapa Bay National Wildlife Refuge. No buffer will be required or established along areas adjacent to the refuge.

Impacts from adjacent land uses are limited to the adjacent property owner's use of the driveway along the west side of the parcel and the indirect effects of pasturing of horses within the fenced area to the west side of that private driveway. The driveway forms a physical barrier that prevents surface flows from moving directly from the adjacent pasture to the proposed mitigation site. This limits the relative impact that the pastured horses have on the site directly. Impacts associated with the private driveway are low because this is a single family private driveway with a low number of vehicle trips per day. For these reasons it is estimated that this area would be characterized as having a low to moderate level of adjacent land use activities that could impact the wetland mitigation site. The 2006 Joint Guidance identifies the buffer width needed

to protect the functions and values of Category I Estuarine wetlands with low or moderate adjacent land use intensities at 100 feet and 150 feet respectively. (See Appendix 8, Table 8C-7, 2006 Joint Guidance). WSDOT proposes that the regulatory buffer applied to this project be established at 125 feet in width. This will result in 5.45 acres of wetland and 0.68 acres of upland within the buffer along the West side of the property.

Proposed Mitigation Ratios

The Joint 2006 Guidance describes mitigation ratios that are starting points for consideration, and are initially based on the assumption that the impacted wetland and the mitigation wetlands are the same category. WSDOT proposes that mitigation ratios for Tarlatt Slough may appropriately be reduced for the following reasons:

- the likelihood that construction of the Tarlatt Mitigation site will happen in advance of impacts proposing to use it as mitigation
- the high likelihood of success of this type of restoration
- the relative ecological value of this restoration opportunity
- The current Category III degraded freshwater wetlands will be rehabilitated and restored to Category I estuarine wetlands.

The ratio determination will be based on successful progress in restoration of the site as documented in Monitoring Reports, as well as, the decreased temporal impacts from construction timing. The following table and discussion presents relevant details of wetland rehabilitation and re-establishment mitigation ratios as summarized from the 2006 Joint Guidance and adjusted ratios that WSDOT proposes as suitable for project specific mitigation needs based on reasons stated above.

Table 5-1 Mitigation Ratios from the 2006 Joint Guidance and Proposed Ratios for the Tarlatt Slough Mitigation Site

Category and Type of Wetland Impacts	Rehabilitation		Re-establishment	
	Ratio from 2006 Joint Guidance	Proposed Ratio	Ratio from 2006 Joint Guidance	Proposed Ratio
All Category III	4:1	2:1	2:1	1:1
Category II Estuarine	4:1 Rehab of an Estuarine wetland	2.5:1 Rehab of an Estuarine wetland	Case-by-case	2:1
All other Category II	6:1	3 :1	3:1	1.5 :1
Category I Forested	12:1	12:1	6:1	6:1
Category I based on scores	8:1	8:1	4:1	1:1
Category I Estuarine	6:1 rehab of an Estuarine wetland	4.5:1 rehab of an Estuarine wetland	Case by Case	4:1

Significant levels of functional lift will be accomplished with restoration of 13,700 linear feet of tidal channels and rehabilitation of hydrologic processes that act across the associated marsh plain. The restored tidal channels will immediately provide significant lift in hydrologic functioning at the site.

The restoration of the tidal channels, reconnection to the estuarine tidal channel network, and restoration of associated hydrologic processes will be achieved when construction is complete and the channels are functioning. Immediately after construction is complete the natural hydrologic processes will begin to operate across the site, and fish will have access to restored tidal channels. Marsh vegetation is expected to recruit naturally over time.

The final determination that part or all of Tarlatt Slough Mitigation site may be used to satisfy compensatory requirements for permitted impacts will be made by the respective regulatory agencies at the time permits are issued for future highway construction projects.

Proposed Mitigation Site Value and Availability

Contributing highway construction projects will impact primarily category 1 estuarine wetlands. Utilizing the ratios proposed in table 5-1 for category I Estuarine wetlands, WSDOT proposes an initial mitigation acreage availability or value of 9.62 acres to be generated by site restoration activities. In other words, the Tarlatt Slough mitigation site would provide mitigation for 9.62 acres of category 1 estuarine wetland impacts associated with WSDOT projects throughout the Willapa Bay ecosystem. If impacts to other categories of wetlands will occur, table 5-2 would be revised to include appropriate ratios from table 5-1. A reduction of ratios over time beyond the initial approved ratios is not proposed due to the type, quality, and function of the impacted wetland systems. No usage of available credit will occur during the 2010 calendar year.

Table 5-2. Estimated Mitigation Site Value and Availability for Category I Impacts

Mitigation Year	Mitigation Acreage Available	Proposed Ratio (from table 5-1)	Projected Category 1 Mitigation Value	Growing Season	Monitoring Year
2010	NA		Site constructed/As Built documentation	0	Year 0
2011	Advance Mitigation		Year 1	1	Year 1
Wetland Re-establishment	1.45 acres	1:1	1.45 acres		
Wetland Rehabilitation	41.68 acres	4.5:1	9.26 acres		
Total	43.13 acres		10.71 acres		

Based on these improvements to wetland functions and ecological processes, the proposed mitigation ratios will be appropriate for use at Year 1 following site construction and documentation of as-built conditions.

5.3.4 Proposed Site Value and Monitoring Timeline

WSDOT proposes to define the mitigation project age as described in Table 5-3. The site will be constructed in late summer or fall with revegetation of the upland and tidal fringe buffer area occurring during the first dormant planting season following construction.

Table 5-3. Calendar Year, Mitigation Year, Growing Season, and Monitoring Year

Calendar Year	Mitigation Year	Growing Season	Monitoring Year
2010	Site constructed/As Built documentation	0	Year 0
2011	Year 1	1	Year 1
2012	Year 2	2	Year 2
2013	Year 3	3	Year 3
2014	Year 4	4	Year 4
2015	Year 5	5	Year 5
2016	Year 6	6	Year 6
2017	Year 7	7	Year 7
2018	Year 8	8	Year 8
2019	Year 9	9	Year 9
2020	Year 10	10	Year 10

WSDOT SW Region Environmental Services Office will establish a tracking ledger that will clearly show the value and area of the site used and the area remaining after each use of the Tarlatt Mitigation site.

5.3.5 Estimates of Project Impacts

Table 5-4 Estimated Project Impacts in WRIA 24		
Project Name	**Est. Area of Impacts**	**Wetland Category and Type**
SR 105 North River Bridge Replacement 4/1/12 ad	1.0-1.5 acres	Cat I E2EM1N
SR 105 Smith Creek Bridge Replacement 4/1/12 ad	1.0-1.5 acres	Cat I E2EM1P
US 101 Middle Nemah Bridge Replacement 4/1/12 ad	0.5-1.0 acres	Cat I E2EM1P
US 101 Bone River Bridge Replacement 2/1/12 ad	0.15-0.5 acres	Cat I E2EM1N
SR 6 Willapa River Bridge Replacement 1/5/13 ad	0.5-1.5 acres	Cat II PEM1Y

A project specific mitigation plan will be developed to address project impacts and the suitability of Tarlatt Slough as a mitigation site. The mitigation value and area needed for each project will be proposed in the respective project specific mitigation plan using ratios contained in Table 5-1. A current mitigation site ledger will be included in the project specific mitigation plans.

5.3.6 Tracking Mitigation Value

The following details identify general process expectations for use and tracking of Tarlatt Mitigation Site mitigation value.

1. Proposed ratios for use of Tarlatt Mitigation Site value will be included in mitigation plans submitted for projects.
2. Each subsequent use of Tarlatt mitigation value will be documented in the Tarlatt Slough tracking ledger.
3. Copies of all permits, monitoring reports and correspondence related to compliance with permit conditions shall be kept in the Tarlatt Slough Mitigation Site project files.
4. Copies of permits authorizing use of Tarlatt Mitigation Site mitigation value for WSDOT project use and any correspondence required to document the agreed use of Tarlatt Mitigation Site mitigation value and use of that value shall be kept in the Tarlatt Slough Mitigation Site project files.

Chapter 6. Mitigation Goals, Objectives and Performance Standards

WSDOT uses goals and objectives to guide mitigation design and construction. Goals describe the overall intent of mitigation efforts; objectives describe individual components of the mitigation site in detail. Performance measures and standards are the benchmarks that define success for each objective and direct adaptive management. These measures and standards describe specific on-site characteristics that indicate whether the mitigation site meets an objective. They also guide the management of the mitigation site with intermediate benchmarks. Performance standards are used to evaluate compliance with regulatory permits during the monitoring period. Contingency plans describe what actions can be taken to correct site deficiencies.

WSDOT uses the adaptive management process to improve mitigation success. Adaptive management is a process through which changes to mitigation activities, maintenance procedures, or monitoring protocols are developed based on the successes or failures in other mitigation projects. These changes are then incorporated into the current mitigation projects. Information from ongoing monitoring further directs subsequent site management activities. WSDOT will monitor the site for up to 10 years and perform maintenance, as necessary, to achieve the mitigation performance standards. As part of the adaptive management process, corrections may be necessary if the site develops in ways that were not anticipated during design and permitting of the project. These corrections may require coordination with regulators, and in some cases require negotiation to revise performance standards.

6.1 Goals

The goal for Tarlatt Slough Mitigation site is to re-establish tidal channels and associated tidal marsh throughout the 49.26 acre site. Re-establishment of tidal channels and rehabilitation of degraded wetlands will restore ecological processes across this estuarine ecosystem.

6.2 Objectives

The objectives for restoring ecological processes and rehabilitating wetlands at the Tarlatt Slough Mitigation Site are the following:

1. Restore and rehabilitate approximately 43.13 acres of tidal marsh wetland and associated ecological structure and function.
2. Rehabilitate and improve hydrologic and water quality functions, and restore tidal connectivity with Willapa Bay by removing the existing perimeter berm.
3. Rehabilitate degraded wetlands within the historic tidal marsh by filling agricultural drainage ditches and re-establishing the historic tidal channel network to re-establish natural flow of tidal waters across this portion of the flood plain.
4. Re-establish aquatic habitat suitable for the natural recruitment and recolonization of associated salt marsh vegetation throughout the site.
5. Enhance buffers site by establishing dense native woody vegetation within upland areas along the western property boundary.

6.3 Performance Standards

The performance standards described below provide benchmarks for measuring the progress of goals and objectives for the mitigation site. Mitigation activities are intended to meet these performance standards within a specified time frame. The performance standards are based on function characteristics described in *Method for Assessing Wetland Functions* (Hruby et al. 1999). These function-based performance standards measure structural attributes that provide a reasonable indication of wetland functions. Methods to monitor each performance standard are described in general terms.

Objective 1: Restore and rehabilitate approximately 48.58 acres of tidal marsh wetland (which includes 5.45 acres of wetland buffer) associated ecological structure and function at the Tarlatt Slough Mitigation Site.

Performance Standards	*Monitoring Methods*
1A. Interim Performance Measure *Wetlands will be delineated at monitoring year 5 to assess the aerial extent of tidal marsh.*	*Conduct wetland delineation using current USACE methodology, the Washington State Wetland Delineation Manual (WDOE, 1997), and applicable supplements at year 5.*
1B. Success Standard *(final year of monitoring)* *At monitoring year 10, the wetland area will be delineated to demonstrate that the mitigation site contains approximately 43.13 acres of total wetland in compliance with the estimated acreages.*	*Conduct wetland delineation using current methods at year 10 to provide documentation of wetland acreage and make visual observations of Cowardin vegetation classes.*

Contingency: This project will convert existing freshwater wetland back to tidal wetland. The extents of wetland will not change, therefore no contingency is proposed.

Objective 2: Rehabilitate hydrologic functions and restore tidal connectivity with Willapa Bay by removing the existing perimeter berm at the Tarlatt Slough Mitigation Site.

Performance Standards	*Monitoring Methods*
2A. Interim Performance Measure *Complete hydrologic connection with the existing tidal elevations and cycles will be restored*	*As-built grading plans and photographic documentation will be submitted within year 1.*
2B. Interim Performance Measure *(all years)* *Natural tidal cycles will occur across the restored tidal wetland.*	*Conduct photo documentation at various predicted high tide events at least twice per year (1x each summer and winter) to document the extent of tidal inundation.*
2C. Success Standard *(final year of monitoring)* *At monitoring year 10, the wetland will be delineated using current methods and visual documentation provided to assure that the site contains a minimum of 43.13 acres of tidal*	*Conduct wetland delineation using current USACE methodology, the Washington State Wetland Delineation Manual (WDOE, 1997), and applicable supplements at year 10 to provide documentation of wetland acreage and hydrology.*

wetland.	

Contingency: This project will completely remove an existing berm structure that has eliminated tidal influence over the site. Once the berm is removed, WSDOT anticipates that natural tidal function will be fully restored to the current MHHW line and tidal cycle. Removal of the berm will eliminate the only barrier to full tidal function, therefore no contingency is proposed.

Objective 3: Rehabilitate degraded wetland within the historic tidal marsh by filling agricultural drainage ditches and re-establishing a minimum of 13,000 feet of the historic tidal channel network across the Tarlatt Slough Mitigation Site.

Performance Standards	*Monitoring Methods*
3A. Interim Performance Measure *The site will be graded consistent with the grading plan and tidal channel excavation plan including the filling of over 200 feet of agricultural ditches and over 4,000 feet of borrow ditch, and restoring a minimum of 13,000 linear feet of historic tidal channels.*	*As-built grading plans and photographic documentation will be submitted within monitoring year 1. Establish permanent photo documentation points at the confluence of key channels.*
3B. Success Standard *(all years)* *During all monitoring years, visually assess channel development.*	*Use established photo points to record and assess natural channel processes and development.*
3C. Success Standard *(year 5)* *At monitoring year 5, the restored tidal channel network will be surveyed to assess channel development.*	*Conduct a survey of the restored tidal channel network using GPS. Using GIS mapping tools, the GPS survey will be compared with the as-built condition map to assess channel development.*
3D. Success Standard *(final year of monitoring)* *At monitoring year 10, the restored tidal channel network will be surveyed to assess channel development.*	*Conduct a survey of the restored tidal channel network using GPS. Using GIS mapping tools, the GPS survey will be compared with the as-built condition map to assess channel development.*

Contingency: Initial excavation work will fill agricultural ditches and restore the extensive tidal channel network. Once a natural tidal pattern is restored, WSDOT fully anticipates that tidal channel network will continue to develop depending on natural forces and flow patterns, and may diverge from the as-built condition over time. No contingency is proposed.

Objective 4: Re-establish aquatic habitat suitable for the natural recruitment and recolonization of associated salt marsh vegetation throughout the Tarlatt Slough Mitigation Site.

Performance Standards	*Monitoring Methods*
4A. Success Standard *(all years)* *During the growing season, visually assess vegetation recolonization and establishment*	*Establish permanent photo documentation points to record and assess vegetation recolonization and establishment across the site.*
4B. Success Standard *(year 5)* *At monitoring year 5, vegetation will be surveyed to assess plant community development.*	*Conduct a survey of major plant community boundaries using GPS. Using GIS mapping tools, the GPS survey will be compared with the as-built condition map to assess plant community development against marsh plain elevations. The survey will include species composition and aerial cover using current vegetation sampling methods.*
4C. Success Standard *(final year of monitoring)* *At monitoring year 10, vegetation will be surveyed to assess plant community development.*	*Conduct a survey of major plant community boundaries using GPS. Using GIS mapping tools, the GPS survey will be compared with the as-built condition map to assess plant community development against marsh plain elevations. The survey will include species composition and aerial cover using current vegetation sampling methods.*

Contingency: If natural recruitment and recolonization of native salt marsh vegetation has not occurred within five years in areas capable of supporting wetland vegetation, planting of native salt marsh vegetation suitable for marsh plain elevation and tidal conditions may take place.

Objective 5: Enhance buffers at the Tarlatt Slough Mitigation Site by establishing dense native woody vegetation in upland areas along the western property boundary.

Performance Standards	*Monitoring Methods*
5A Success Standard *The buffer areas will be planted in accordance with the conceptual wetland planting plans, Appendix B.*	*As-built plans documenting that the mitigation sites have been planted according to the planting plan will be submitted within year 1.*
5B Success Standard *At monitoring year 1, there will be a minimum survival rate of 90% in area identified as Buffer areas.*	*Conduct major plant assessment of contract-installed vegetation (plant counts based on as-built plans).*
5C Success Standard *At monitoring year 3, 5, and 7, there will be a minimum density of native trees and/or shrubs in Buffer areas as follows:*	*Use current monitoring protocols (see Monitoring Plan) to determine density (number of living trees per acre) and species diversity in scrub shrub, forested, and buffer areas.*

Buffer: • *minimum density of 400 living native trees per acre* • *minimum density of 4,000 living native shrubs per acre* • *at least 2 species of native trees and 4 species of native shrubs will be present in the forested area. No single species will provide more 0% total aerial cover.*	
***5D. Success Standard** (final year monitoring)* *At monitoring year 10, there will be a minimum density of native trees and/or shrubs in Forested, Scrub Shrub, and Buffer areas as follows:* *Buffer:* • *minimum density of 300 living native trees per acre* • *minimum density of 3,000 living native shrubs per acre* • *At least 2 species of native trees and 4 species of native shrubs will be present in the forested area. No single species will provide more* 60% total aerial cover.	*Use current monitoring protocols (see Monitoring Plan) to determine density (number of living trees per acre) and species diversity in scrub shrub, forested, and buffer areas.*

Contingency: If the monitoring reports indicate insufficient establishment and/or plant survival, those areas not meeting current-year standard(s) will be replanted to bring them in compliance with the failing current-year standard(s).

Objective 6: Promote the development of native wetland plant communities by limiting the growth and spread of noxious and nuisance vegetation, including Spartina alterniflora.

Performance Standards	*Monitoring Methods*
6A. Performance Standard *Conduct a pre-construction survey of the existing extent of invasive vegetation including Spartina alterniflora, Purple loosetrife, and Iris pseudoacoris to establish a baseline for invasive species monitoring and management at years 1, 3, 5, 7, and 10.*	*Provide photographic and map (GPS or notations on plan sheets) documentation of existing stands of Spartina alterniflora, Purple loosetrife,and Iris pseudoacoris.*
6B. Performance Standard *In all monitoring years, invasive species noted in standard 6A will be documented and completely removed from the site.* *The aerial extent of Blackberry Species and Class A noxious weeds in the upland buffer will not exceed 15% of that area.*	*Observe and map (notations on plan sheets) locations of all species noted in standards 6A/6B as part of annual vegetation surveys using current monitoring techniques. For larger stands, GPS measurements of stand perimeters will be provided to measure the extent of change over time. Observations will form the basis of on-going site management and integrated vegetation management activities.*

Contingency: Implement a long-term integrated vegetation management plan to keep restored tidal areas free from the species noted in standard 6A, and to maintain the aerial extent of invasive species at or below the established thresholds in the upland buffer. Weed management activities may be conducted in all monitoring years.

Chapter 7. Monitoring

The monitoring objective for the mitigation areas is to achieve the prescribed standards unless WSDOT, in consultation with the regulatory agencies, establish replacement standards based on circumstances and conditions observed at the mitigation site.

A monitoring plan will be developed that addresses the success standards listed in this plan. The site will be monitored in years 1, 3, 5, 7, and 10 by the WSDOT Wetland Mitigation Monitoring Program to evaluate compliance with performance standards, formal monitoring. In formal monitoring years, years 1, 3, 5, 7, and 10, reports of the formal monitoring will be prepared and submitted both to the Corps of Engineers and Ecology. Additional monitoring will occur in intervening non-report years in order to inform and guide site development activities, informal monitoring. Successful mitigation will be measured by attainment of the performance standards described in the mitigation plan.

The Wetland Mitigation Monitoring Program uses objective-based monitoring to document the condition of WSDOT's wetland mitigation sites. Monitoring protocols are selected based on objectives specified in the mitigation plan, and evaluation of current site conditions. Quantitative data collection techniques presently in use are based on standard ecological and biostatistical methods described in Bonham (1989), Elzinga et al. (1998), Krebs (1999), Zar (1999), and other sources. The Wetland Program's current monitoring methods include the key concepts of objective-based monitoring, adaptive management, and statistical rigor. Quantitative monitoring methods employed involve sample size analyses and may include the point-line, point-frame, quadrat, and line-intercept methods as defined by the works cited above.

Formal and informal monitoring of the mitigation site will occur over the 10-year monitoring period. Table 7 lists the monitoring schedule for the mitigation site. Successful mitigation will be measured by attainment of the performance standards described in this mitigation plan document. Monitoring and establishment/contingency activities will cease as soon as all success standards have been attained.

Table 7-1 Monitoring Schedule

Monitoring Year	*Type of Monitoring*	
	Formal	*Informal*
1	Yes	quarterly site visits
2	No	quarterly site visits
3	Yes	quarterly site visits
4	No	quarterly site visits
5	Yes	quarterly site visits
7	Yes	quarterly site visits
10	Yes	quarterly site visits

Monitoring reports will be submitted to the following agencies:

Table 7-2 Regulatory Agency Contacts

Agency	**Contact**
U. S. Army Corps of Engineers Seattle District Regulatory Branch	Sandi Manning,
U. S. Fish and Wildlife Service	Charlie Stenvall
Washington State Department of Ecology	Rick Mraz
Washington State Department of Fish and Wildlife	Bill Rehe
Pacific County	Mike Stevens

Chapter 8. Contingency Plan

WSDOT anticipates that the mitigation goals will be accomplished with construction of the project as on the site construction plans. Removal of the existing perimeter berm, filling of the borrow ditch and associated drainage ditches, and restoration of the tidal channel network will fully restore tidal connectivity and function. The existing soils were historically inundated by saltwater tide, and it is fully expected that native salt marsh plants will recolonize the site at proper elevations within the monitoring period. Contingency actions, however, may be needed to correct major unforeseen problems not addressed by the performance standards and specific, automatic contingency plans. Automatic contingency measures (typical site management and establishment protocols) will be implemented as necessary to meet performance measures and standards.

Major contingency revisions typically require coordination with and approval from the permitting agencies and input from multiple disciplines to analyze emerging issues and develop workable solutions. Major contingencies typically include failed hydrology, failure to develop hydric soils, continued major plant mortality, and failure of the site to achieve the specified mitigation acreage. Soil and hydrology issues are not anticipated with this site given its landscape position and proposed mitigation action.

Not all site conditions can be anticipated, as such, the contingencies discussed do not represent an exhaustive list of potential problems or remedies.

Chapter 9. Site Management during Active Restoration

WSDOT (or its designated representatives) will manage the site annually for the first 10 years or until the site has achieved mitigation acceptance. Mitigation acceptance is when the regulatory agencies who issue permits with regulatory requirements concur that the Tarlatt Slough site has achieved the performance standards and complied with all permit conditions. Site management activities may include but are not limited to vegetation management (weed control in buffers, noxious weed control throughout site including Spartina alterniflora control), mulching, fertilizing, supplemental watering, plant replacement, protection from herbivores, and maintaining access, repairing damage from vandals, correcting erosion or sedimentation problems, or litter pickup.

Chapter 10. Long Term Management Strategy

The Tarlatt Slough site is located within the acquisition boundaries of the South Unit of the Willapa Bay Wildlife Refuge WSDOT and USFWS are in negotiations to transfer ownership of the Tarlatt Slough property to USFWS. This plan would entail the USFWS to provide the long term management of the site consistent with the mission of the wildlife refuge.

WSDOT plans to transfer the long term management responsibilities to the USFWS. Transfer of the ownership of the parcel may occur prior to final mitigation site acceptance and close out. If ownership is transferred to USFW Willapa Bay Refuge prior to mitigation acceptance, WSDOT will retain rights to actively manage, monitor and otherwise facilitate the site restoration until the performance standards and permit requirements have been satisfied as a condition of that transfer.

If the agreement with the Wildlife Refuge cannot for any reason be completed, WSDOT will retain that responsibility until an appropriate entity (conservation group or other) can be designated to provide long term management. Details of the long term management plan will be submitted to the agencies when finalized.

References

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Appendix A — Methods and Tools

Table A-1. Methods and tools used to prepare the report.

Parameter	Method or Tool	Website	Reference
Wetland Delineation	Washington State Wetland Delineation Manual	http://www.ecy.wa.gov/biblio/9694.html	**Ecology**. 1997. Washington state wetland identification and delineation manual. Publication #96-94. Washington Department of Ecology, Olympia, WA.
	Arid West Interim Regional Supplement	http://www.usace.army.mil/cw/cecwo/reg/inte_aridwest_sup.pdf	Website
Wetland Classification	USFWS / Cowardin Classification System	http://www.fws.gov/nwi/Pubs_Reports/Class_Manual/class_titlepg.htm	**Cowardin**, L. M., V. Carter, F. C. Golet, E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. Government Printing Office, Washington, D.C.
	Hydrogeomorphic Classification (HGM) System	http://el.erdc.usace.army.mil/wetlands/pdfs/wrpde4.pdf	**Brinson**, M. M. (1993). "A hydrogeomorphic classification for wetlands," Technical Report WRP-DE-4, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
Wetland Rating	Washington State Wetland Rating System	**Western Washington:** http://www.ecy.wa.gov/biblio/0406025.html	**Hruby**. 2004. Washington State wetland rating system for western Washington –as Revised July 2006. Publication # 04-06-025.
Wetland Indicator Status	Northwest (Region 9) (Reed, 1988) and Northwest (Region 9) Supplement (Reed et al., 1993)	http://www.fws.gov/nwi/bha/list88.html	**Reed**, P.B. Jr. 1988. National list of plant species that occur in wetlands: Washington. Biological Report NERC-88/18.47 for National Wetlands Inventory, Washington, D.C. **Reed**, P.B. Jr. 1993. Northwest supplement (Region 9) species with a change in indicator status or added to the Northwest 1988 list, wetland plants of the state of Washington 1988. U.S. Department of Interior Fish and Wildlife Service WELUT - 88 (26.9), Washington, D.C.
Plant Names	USDA Plant Database	http://plants.usda.gov/	Website (see Appendix A)
Soils Data	Soil Survey	**Web Soil Survey:** http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx **Soil Data Mart:** http://soildatamart.nrcs.usda.gov/	Website

Appendix B — Background Information

This Appendix includes the following figures and information:

B-1 Plant Species Observed in the Study Area

B-2 USGS Topographic Map

B-3 Soil Survey Map and Soil Codes

B-4 Wetland Inventory

B-5 Historical Aerials

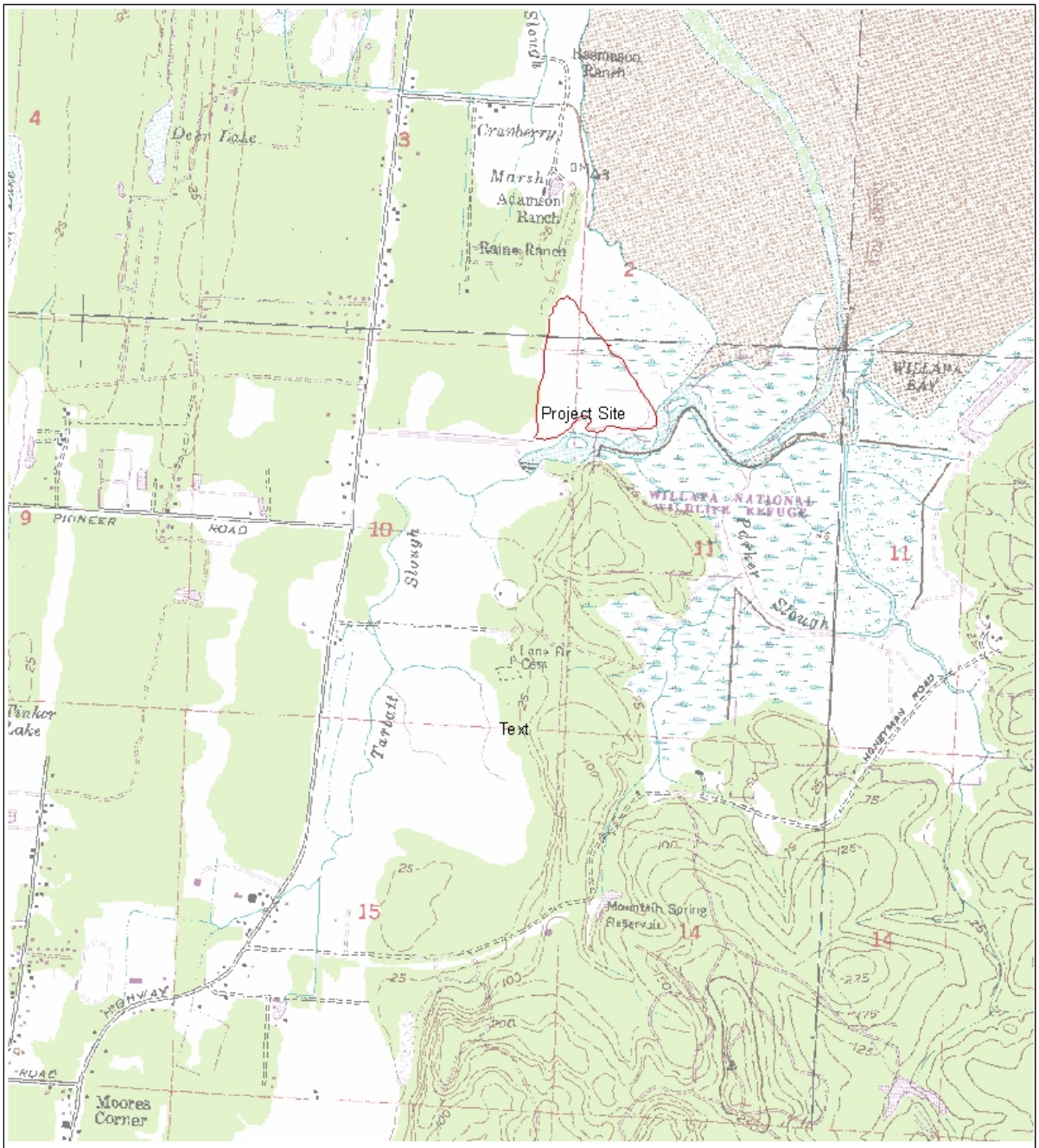
B-6 NOAA Endangered and Threatened Species List

B-7 USFWS Endangered and Threatened Species List

Appendix B-1 Plant Species Observed in the Study Area

Scientific Name	Common Name	Wetland Indicator Status
Grasses and Forbs		
Holcus lanatus	common velvetgrass	FAC
Dactylis glomerata	orchard grass	FACU
Agrostis gigantea	redtop	FAC
Phalaris arundinacea	reed canarygrass	FACW
Lotus corniculatus	bird's-foot trefoil	FAC
Ranunculus repens	creeping buttercup	FACW
Rumex crispus	curly dock	FAC+
Juncus arcticus ssp. *littoralis*	mountain rush	OBL
Argentina anserina	silverweed cinquefoil	OBL
Juncus effusus	soft rush	FACW
Typha latifolia	broadleaf cattail	OBL
Aster subspicatus	Douglas' aster	FACW
Vines and Ferns		
Rubus armeniacus	Himalayan blackberry	FACU
Polystichum munitum	western swordfern	FACU
Rubus ursinus	trailing blackberry	FACU
Shrubs		
Rosa nutkana	Nootka rose	FAC
Sambucus racemosa	red elderberry	FACU
Salix hookeriana	Hooker's willow	FACW-
Malus fusca	Pacific crabapple	FACW
Trees		
Picea sitchensis	Sitka spruce	FAC
Alnus rubra	red alder	FAC
Salix lucida ssp. *lasiandra*	Pacific willow	FACW+
Frangula purshiana	cascara buckthorn	FAC-

Appendix B-2 USGS Topographic Map



Appendix D 2 Tarlatt Slough Topographic Map

USGS 1:24,000

project site outlined in red

0 0.25 0.5 1 Miles

N

Appendix B-3 Soil Survey Map and Soil Codes

Custom Soil Resource Report
Soil Map

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:4,530 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 10N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Grays Harbor County Area, Pacific and Wahkiakum Counties, Washington
Survey Area Data: Version 8, Sep 22, 2009

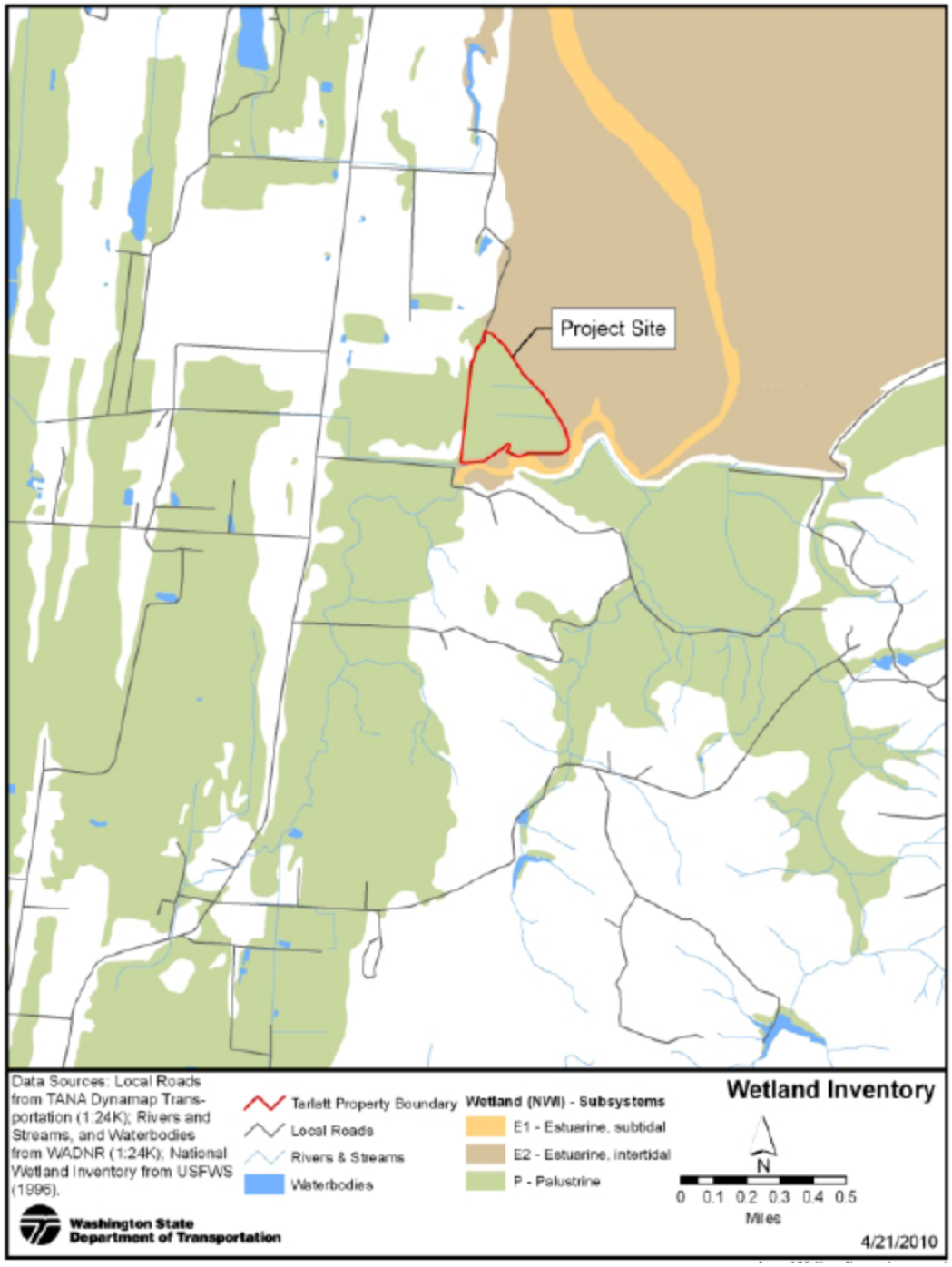
Date(s) aerial images were photographed: 6/24/2006

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

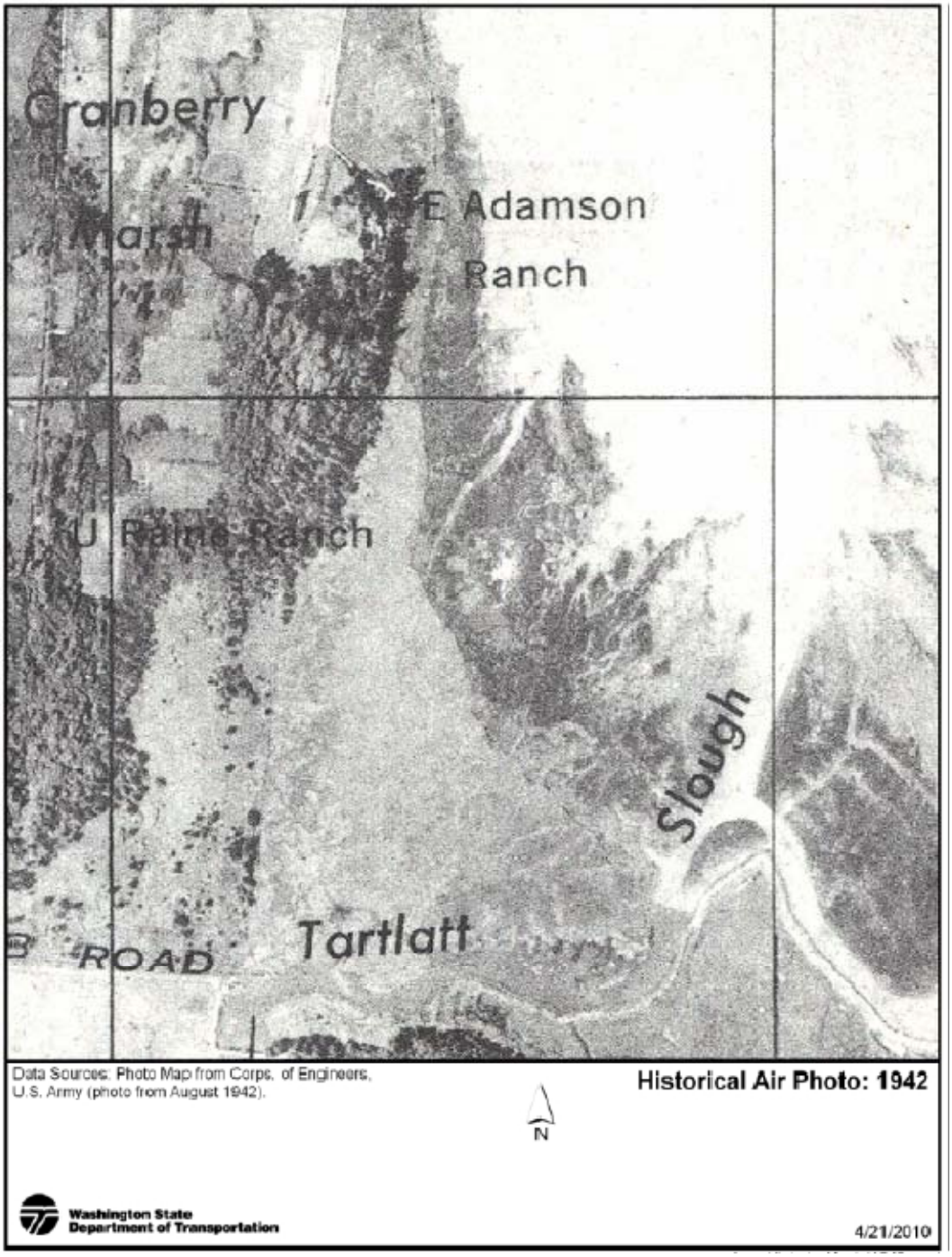
Map Unit Legend

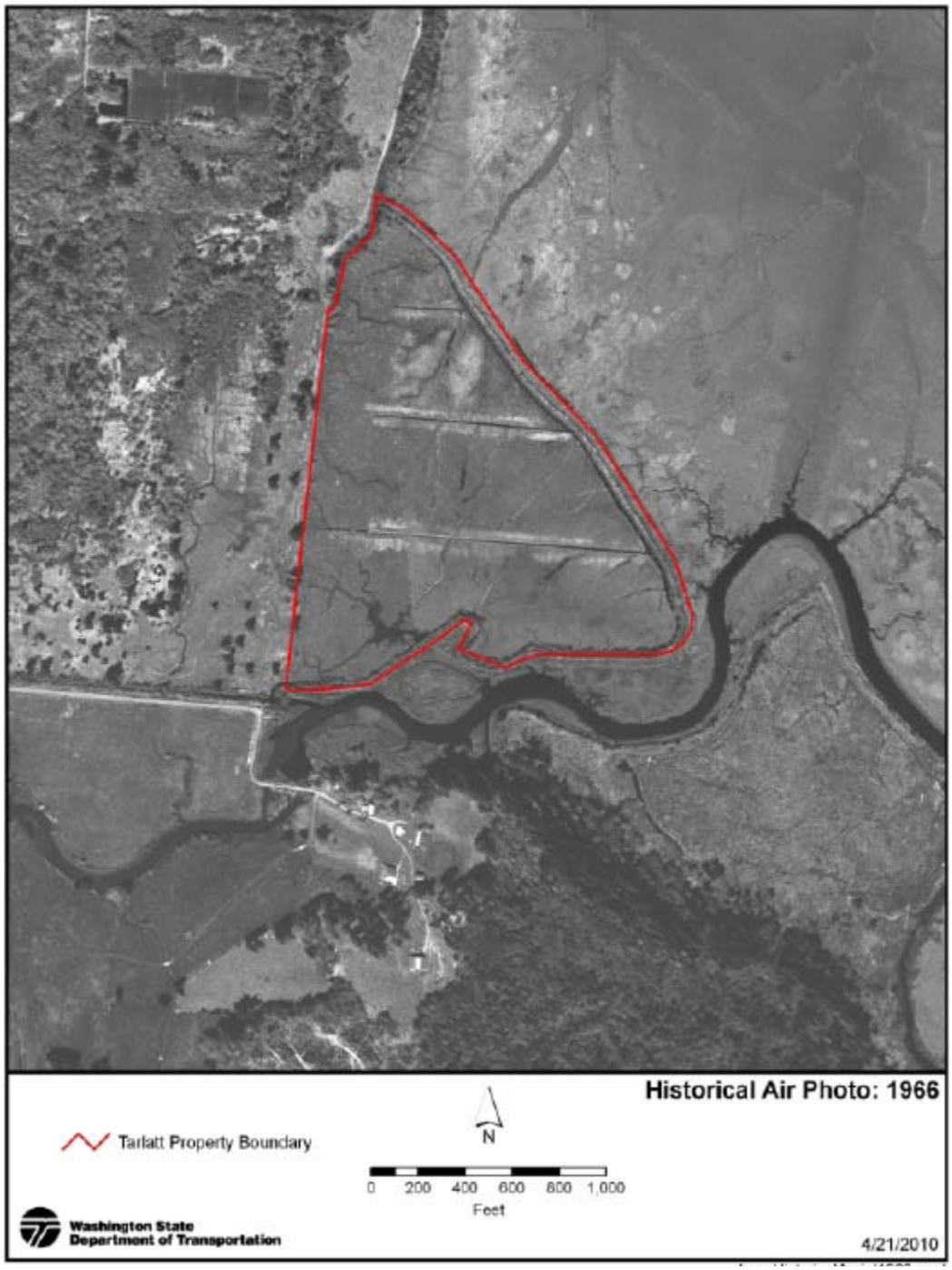
Grays Harbor County Area, Pacific and Wahkiakum Counties, Washington (WA627)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
92	Netarts fine sand, 3 to 12 percent slopes	4.5	7.2%
104	Ocosta silty clay loam	54.3	85.9%
112	Palix silt loam, 30 to 65 percent slopes	0.3	0.4%
162	Yaquina loamy fine sand	0.0	0.0%
Subtotals for Soil Survey Area		**59.1**	**93.6%**
Totals for Area of Interest		**63.1**	**100.0%**

Appendix B4 Wetland Inventory Map



Appendix B-5 Historical Aerial Photographs

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Tarlatt Property Boundary
N
0 200 400 600 800 1,000
Feet
Washington State
Department of Transportation
4/21/2010

Data Source: 2009 Digital
Orthophoto from USDA NAIP
Air Photo: 2009
N
Tarlatt Property Boundary
0 200 400 600 800 1,000
Feet
Washington State
Department of Transportation
4/21/2010

Appendix B-6 NOAA Endangered and Threatened Species List

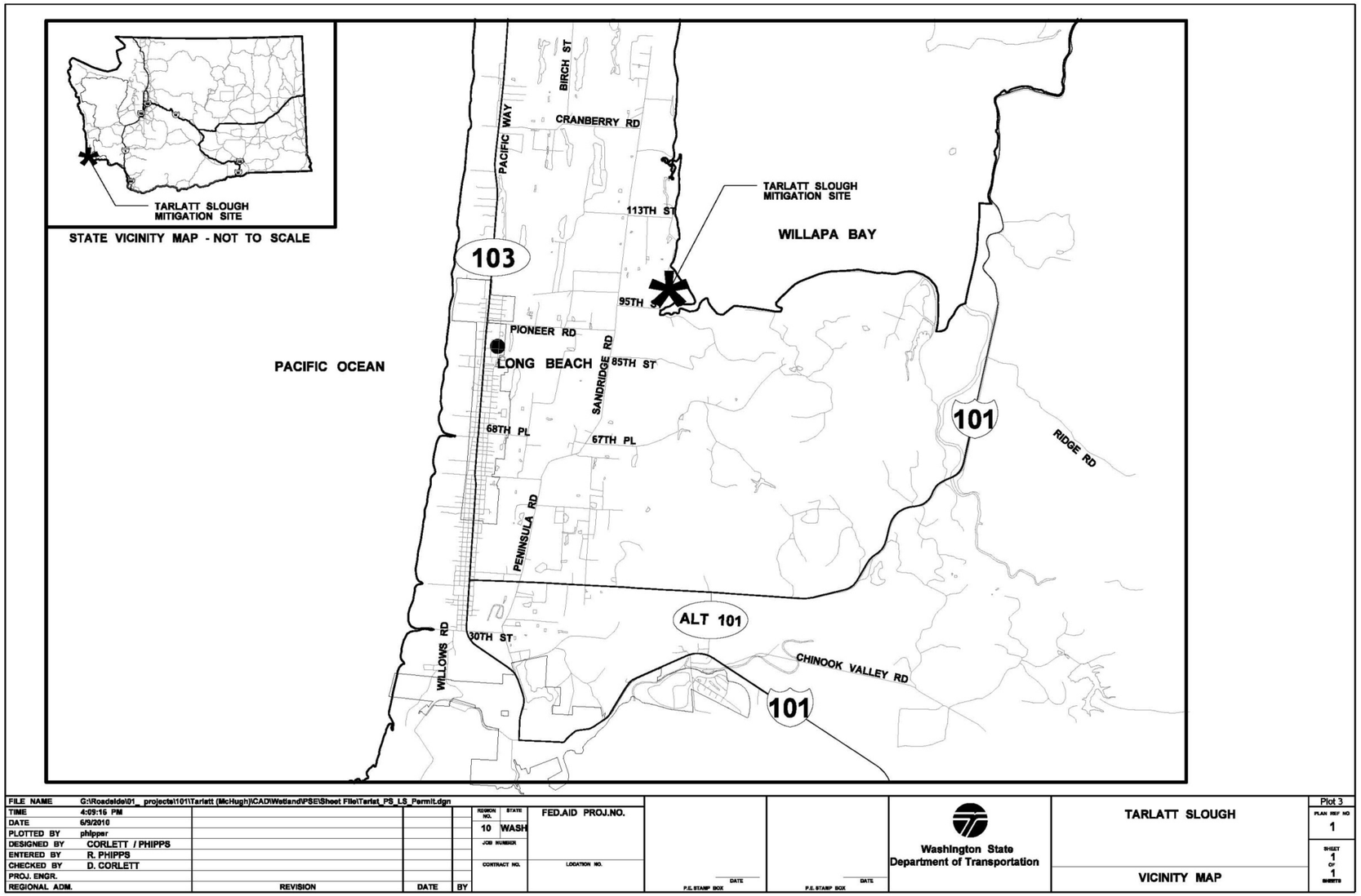
Listed species identified in the Biological Assessment for the Tarlatt Slough Mitigation Site dated April 2010.

- Southern distinct population segment(DPS) for North American Green Sturgeon (*Acipenser medirostris*)
- Southern DPS Pacific Eulachon (*Thaleichthys pacificus*)

Appendix B-7 USFWS Endangered and Threatened Species List

Listed species addressed in the ESA Section 7 Consultation for the Tarlatt Slough Mitigation Site dated 4-5-2010.

- Bull Trout (*Salvelinus confluentus*)
- Marbled Murrelet (*Brachyramphus marmoratus*)
- Snowy Plover (*Charadrius alexandrinus nivosus*)
- Streaked Horned Lark (*Eremophila alpestris strigata*)


TARLATT SLOUGH
MITIGATION SITE
STATE VICINITY MAP - NOT TO SCALE
PACIFIC WAY
BIRCH ST
CRANBERRY RD
113TH ST
TARLATT SLOUGH
MITIGATION SITE
WILLAPA BAY
103
95TH ST
PIONEER RD
PACIFIC OCEAN
LONG BEACH
85TH ST
SANDRIDGE RD
101
RIDGE RD
68TH PL
67TH PL
PENINSULA RD
ALT 101
30TH ST
WILLOWS RD
CHINOOK VALLEY RD
101
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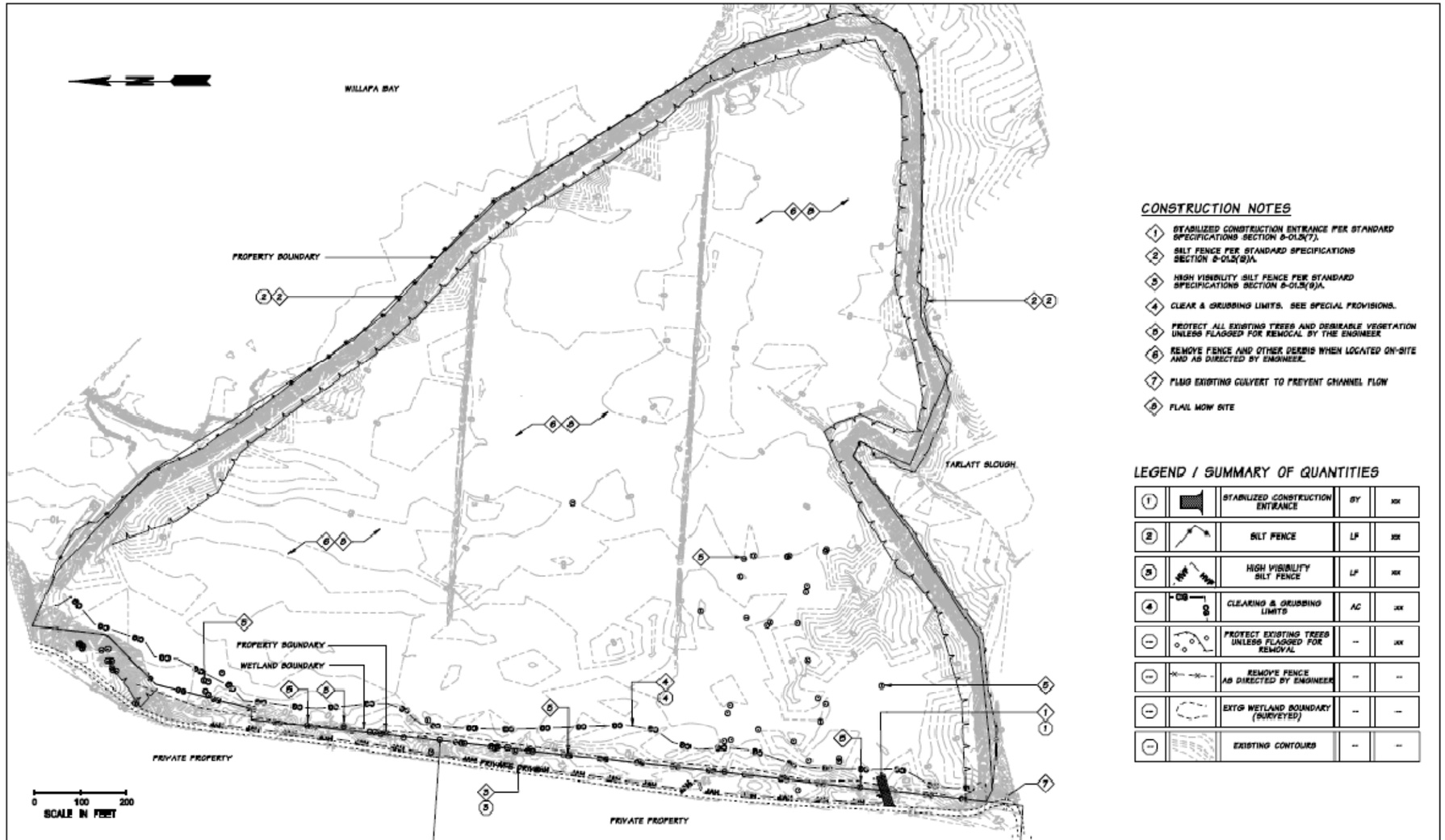
ENTERED BY R. PHIPPS
CHECKED BY D. CORLETT
PROJ. ENGR.
REGIONAL ADM.
REVISION
DATE
BY
REGION NO. 10
STATE WASH
FED.AID PROJ.NO.
JOB NUMBER
CONTRACT NO.
LOCATION NO.
P.E. STAMP BOX
DATE
Washington State
Department of Transportation
TARLATT SLOUGH
VICINITY MAP
Plot 3
PLAN REF NO 1
SHEET 1 OF 1 SHEETS



CONSTRUCTION NOTES

1. STABILIZED CONSTRUCTION ENTRANCE PER STANDARD SPECIFICATIONS SECTION 8-01.3(7).
2. SILT FENCE PER STANDARD SPECIFICATIONS SECTION 8-01.3(8)A.
3. HIGH VISIBILITY SILT FENCE PER STANDARD SPECIFICATIONS SECTION 8-01.3(8)A.
4. CLEAR & GRUBBING LIMITS. SEE SPECIAL PROVISIONS.
5. PROTECT ALL EXISTING TREES AND DESIRABLE VEGETATION UNLESS FLAGGED FOR REMOCAL BY THE ENGINEER
6. REMOVE FENCE AND OTHER DEBRIS WHEN LOCATED ON-SITE AND AS DIRECTED BY ENGINEER.
7. PLUG EXISTING CULVERT TO PREVENT CHANNEL FLOW
8. FLAIL MOW SITE

LEGEND / SUMMARY OF QUANTITIES

1	STABILIZED CONSTRUCTION ENTRANCE	SY	xx
2	SILT FENCE	LF	xx
3	HIGH VISIBILITY SILT FENCE	LF	xx
4	CLEARING & GRUBBING LIMITS	AC	xx
—	PROTECT EXISTING TREES UNLESS FLAGGED FOR REMOVAL	--	xx
—	REMOVE FENCE AS DIRECTED BY ENGINEER	--	--
—	EXTG WETLAND BOUNDARY (SURVEYED)	--	--
—	EXISTING CONTOURS	--	--

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DESIGNED BY	CORLETT / PHIPPS					
ENTERED BY	R. PHIPPS					
CHECKED BY	D. CORLETT					
PROJ. ENGR.	XXXX					
REGIONAL ADM.	XXXX	REVISION	DATE	BY		

REGION NO. 10 STATE WASH FEDAID PROJ.NO.

JOB NUMBER XXXX

CONTRACT NO. XXXX LOCATION NO.

PLAN/PROP SOC DESIGN

PLAN/PROP SOC DATE

Washington State Department of Transportation

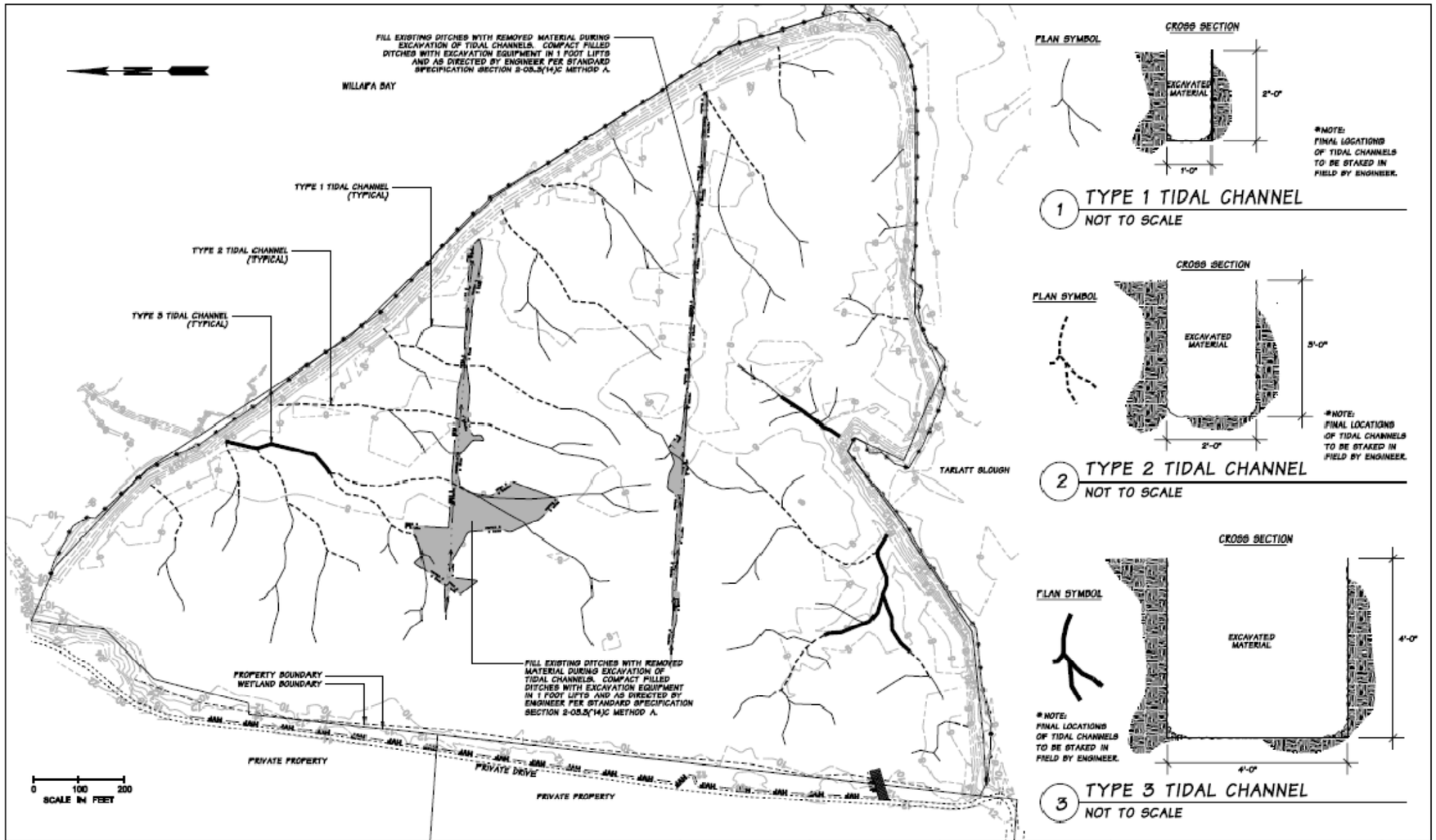
TARLATT SLOUGH

STAGE 1 - SITE PREP & TESC PLAN

Plot 2

PLAN SHEET NO. WL2

SHEET 2 OF 5 SHEETS



1 TYPE 1 TIDAL CHANNEL
NOT TO SCALE

2 TYPE 2 TIDAL CHANNEL
NOT TO SCALE

3 TYPE 3 TIDAL CHANNEL
NOT TO SCALE

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DESIGNED BY	CORLETT / PHIPPS						
ENTERED BY	R. PHIPPS						
CHECKED BY	D. CORLETT						
PROJ. ENGR.	XXXX						
REGIONAL ADM.	XXXX	REVISION	DATE	BY			

REGION NO.	STATE	FED.AID PROJ.NO.
10	WASH	
JOB NUMBER XXXX		
CONTRACT NO. XXXX		LOCATION NO.

Washington State Department of Transportation

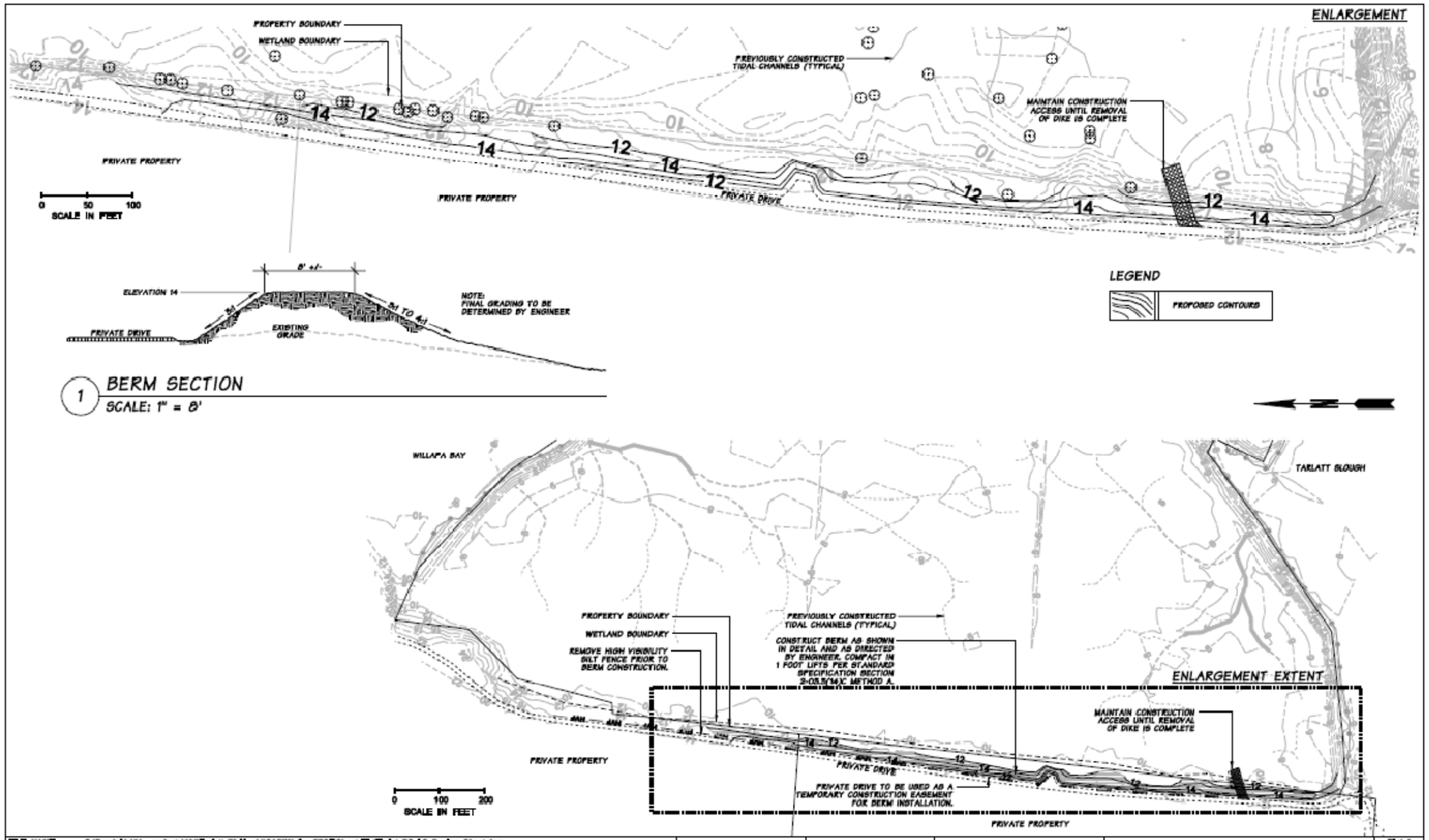
TARLATT SLOUGH

STAGE 2 - TIDAL CHANNEL EXCAVATION

Plot 3

PLAN SHEET NO. WL3

SHEET 3 of 6



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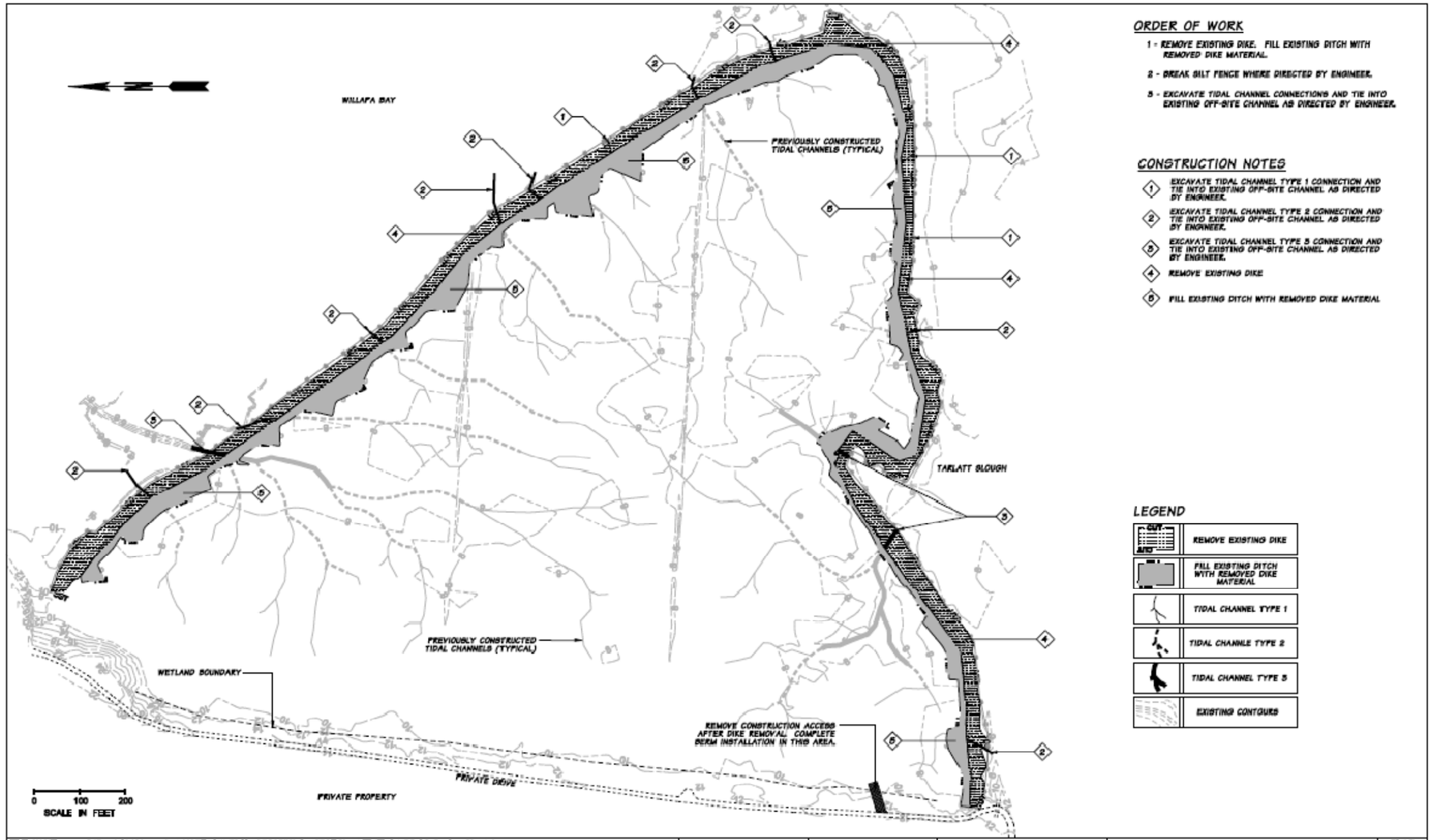
DATE	3/24/2010				10 WASH				
PLOTTED BY	pfipper				JOB NUMBER				
DESIGNED BY	CORLETT / PHIPPS				XXXX				
ENTERED BY	R. PHIPPS				CONTRACT NO.	LOCATION NO.			SHEET 4 of 5
CHECKED BY	D. CORLETT				XXXX				
PROJ. ENGR.	XXXX								
REGIONAL ADM.	XXXX	REVISION	DATE	BY				STAGE 3 - BERM CONSTRUCTION	

Washington State Department of Transportation



ORDER OF WORK

1 - REMOVE EXISTING DIKE. FILL EXISTING DITCH WITH REMOVED DIKE MATERIAL.

2 - BREAK SILT FENCE WHERE DIRECTED BY ENGINEER.

3 - EXCAVATE TIDAL CHANNEL CONNECTIONS AND TIE INTO EXISTING OFF-SITE CHANNEL AS DIRECTED BY ENGINEER.

CONSTRUCTION NOTES

1. EXCAVATE TIDAL CHANNEL TYPE 1 CONNECTION AND TIE INTO EXISTING OFF-SITE CHANNEL AS DIRECTED BY ENGINEER.
2. EXCAVATE TIDAL CHANNEL TYPE 2 CONNECTION AND TIE INTO EXISTING OFF-SITE CHANNEL AS DIRECTED BY ENGINEER.
3. EXCAVATE TIDAL CHANNEL TYPE 3 CONNECTION AND TIE INTO EXISTING OFF-SITE CHANNEL AS DIRECTED BY ENGINEER.
4. REMOVE EXISTING DIKE
5. FILL EXISTING DITCH WITH REMOVED DIKE MATERIAL

LEGEND

- CUT / FILL — REMOVE EXISTING DIKE
- FILL EXISTING DITCH WITH REMOVED DIKE MATERIAL
- TIDAL CHANNEL TYPE 1
- TIDAL CHANNLE TYPE 2
- TIDAL CHANNEL TYPE 3
- EXISTING CONTOURS

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DESIGNED BY	CORLETT / PHIPPS						
ENTERED BY	R. PHIPPS						
CHECKED BY	D. CORLETT						
PROJ. ENGR.	XXXX						
REGIONAL ADM.	XXXX	REVISION	DATE	BY			

REGION NO. 10 — STATE WASH — FEDAID PROJ.NO.

JOB NUMBER XXXX

CONTRACT NO. XXXX — LOCATION NO.

DATE — FILE-TEMP SIZE — DATE — FILE-REPRO SIZE

Washington State Department of Transportation

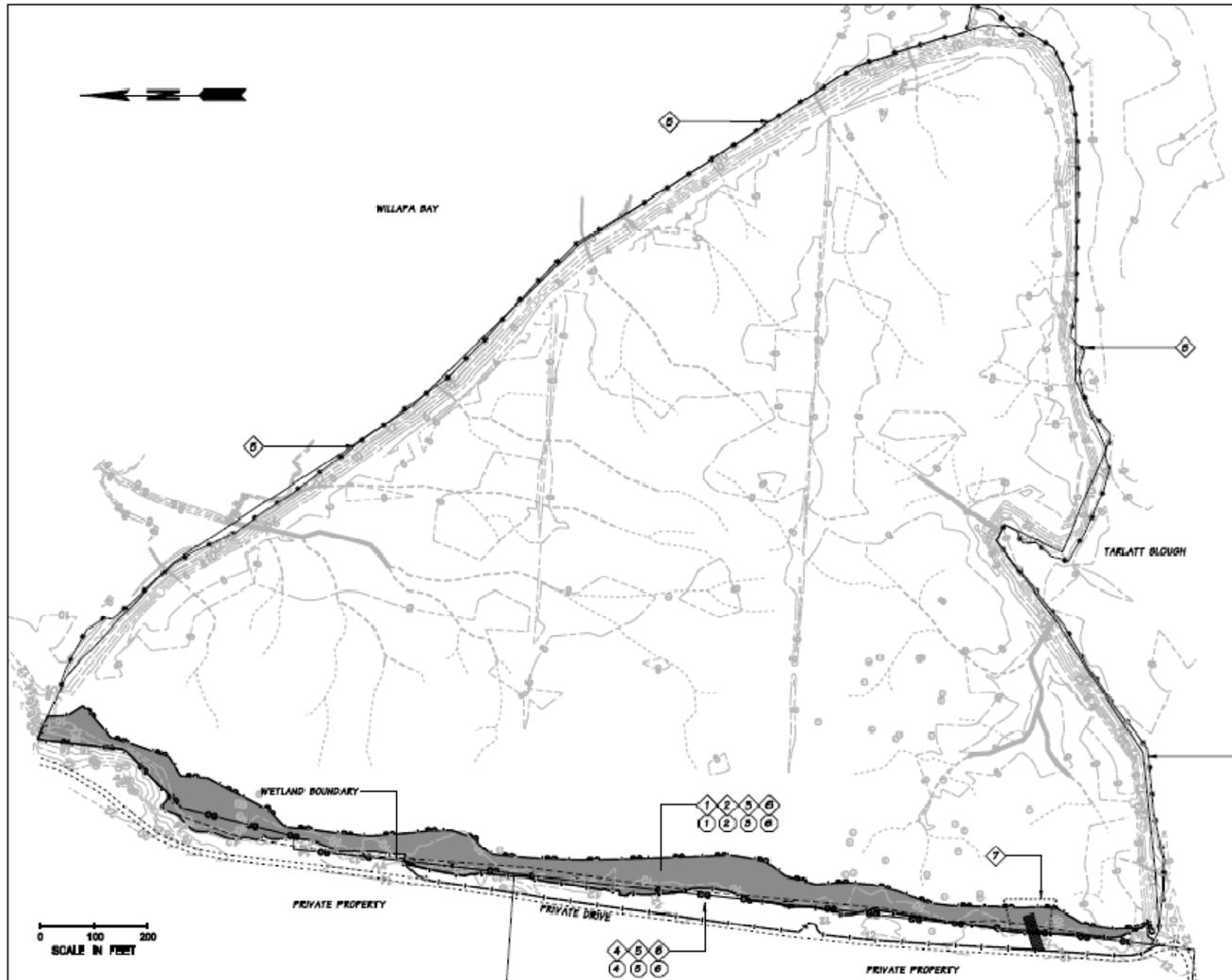
TARLATT SLOUGH

STAGE 4 - DIKE REMOVAL

Plot 5

PLAN SHT NO WLS

SHEET 5 OF 6 SHEETS



CONSTRUCTION NOTES

1. SOIL PREPARATION AREA FOLLOWING SELECTIVE CLEARING AND GRUBBING. SEE SPECIAL PROVISION 8-02.3(6) SOIL PREPARATION AREAS.
2. 3-INCH COMPOST BLANKET, TILLED IN
3. SEED, FERTILIZER, AND MULCH
4. 6-INCH TOPSOIL C OR 3-INCH COMPOST BLANKET
5. REMOVE SILT FENCE
6. EXTEND SURFACE TREATMENT TO BACK OF BERM OR AS STAKED BY THE ENGINEER
7. PRIOR TO COMPOST PLACEMENT, RESTORE SURFACE CONTOURS AND ELIMINATE AREAS OF COMPACTION PER SECTION 8-02.3(5).

SOIL PREPARATION - QUANTITIES THIS SHEET

#	ITEM	UNIT	TOTAL
1	SOIL PREPARATION AREA	ACRE	--
2	COMPOST BLANKET	C.Y.	
3	SEEDING, FERTILIZING, AND MULCHING: SEED MIX - WETLAND	ACRE	--
4	6-INCH TOPSOIL C OR 3-INCH COMPOST BLANKET	C.Y. OR S.F.	-- OR --

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DESIGNED BY	CORLETT / PHIPPS
ENTERED BY	R. PHIPPS
CHECKED BY	D. CORLETT
PROJ. ENGR.	XXXX
REGIONAL ADM.	XXXX

REVISION | DATE | BY

REGION NO. 10 | STATE WASH | FED.AID PROJ.NO.

JOB NUMBER XXXX

CONTRACT NO. XXXX | LOCATION NO.

Washington State Department of Transportation

TARLATT SLOUGH

STAGE 5 - RESTORATION

Plot 6

PLAN SHEET NO. WL5

SHEET 6 OF 6 SHEETS

Appendix D —Wetland Delineation Data Forms

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project Site: Tarlatt Slough Restoration Site City/County: Pacific Sampling Date: 9/22/2009
Applicant/Owner: Washington State Department of Transportation State: WA Sampling Point: UP2
Investigator(s): Gretchen Lux , Brad Archbold Section, Township, Range:
Landform (hillslope, terrace, etc.): Local relief (concave, convex, none): Slope (%):
Subregion (LRR): LRR A Lat: Long: Datum:
Soil Map Unit Name: On edge of Netarts Fine Sand/ Ocosta Silty Clay Loam NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, Or Hydrology ☐, significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐
Are Vegetation ☐, Soil ☐, Or Hydrology ☒, naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒	No ☐			
Hydric Soil Present?	Yes ☐	No ☒	**Is the Sampling Area within a Wetland?**	**Yes** ☐	**No** ☒
Wetland Hydrology Present?	Yes ☐	No ☒			

Remarks:

VEGETATION – Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum (Plot Size: 1 m²)			
5.			
6.			
7.			
8.			
9.			
		= Total Cover	
Herb Stratum (Plot Size: 1 m²)			
10. Lotus corniculatus	40	Y	FAC
11. Ranunculus repens	20	Y	FACW
12. Juncus effusus	10	N	FACW
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
Woody Vine Stratum (Plot Size:)			
1. Rubus armeniacus	60	Y	FACU
2.			
		= Total Cover	
% Bare Ground in Herb Stratum			

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	**2**	(A)
Total Number of Dominant Species Across All Strata:	**3**	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	**66%**	(A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

x Dominance Test is >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Wetland Non-Vascular Plants[1]

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ☒ **No** ☐

Remarks:

Project Site: Tarlatt Slough Restoration Site

SOIL

Sampling Point: SPU-2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(Inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10 YR 4/2	100					silty loam	No redox concentrations present

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? Yes ☐ No ☒

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stresses Plants (D1) **(LRR A)**
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) **(LRR A)**
- ☐ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? Yes ☐ No ☒

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: Shallow groundwater well data collected within wetland February 1 to April 3, 2007 identify shallow ground water table, see Figure XX
Remarks: No surface hydrology was visible at time of delineation. Not water was present in pits.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project Site:	Tarlatt Slough Restoration Site	City/County:	Pacific	Sampling Date:	9/22/2009
Applicant/Owner:	Washington State Department of Transportation		State: WA	Sampling Point:	WP2
Investigator(s):	Gretchen Lux , Brad Archbold	Section, Township, Range:			
Landform (hillslope, terrace, etc.):		Local relief (concave, convex, none):		Slope (%):	
Subregion (LRR):	LRR A	Lat:	Long:	Datum:	
Soil Map Unit Name:			NWI classification:		

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)

Are Vegetation ☐, Soil ☐, Or Hydrology ☐, significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐

Are Vegetation ☐, Soil ☐, Or Hydrology ☒, naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒	No ☐		
Hydric Soil Present?	Yes ☒	No ☐	**Is the Sampling Area within a Wetland?**	**Yes ☒ No ☐**
Wetland Hydrology Present?	Yes ☐	No ☒		

Remarks: Hydrology of this system is driven largely by seasonal high groundwater tables. Shallow ground water data collected in early growing season provides evidence of wetland hydrology. Lack of hydrology indicators at time of this site visit is usual condition for this wetland given the time of year and the unusually dry year.

VEGETATION – Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum (Plot Size: 1 m²)			
5.			
6.			
7.			
8.			
9.			
		= Total Cover	
Herb Stratum (Plot Size: 1 m²)			
10. Ranunculus repens	90	Y	FACW
11. Lotus corniculatus	50	Y	FAC
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
Woody Vine Stratum (Plot Size:)			
1. Rubus armeniacus	50	Y	FACU
2.			
		= Total Cover	
% Bare Ground in Herb Stratum			

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	66%	(A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x1 =
FACW species	x2 =
FAC species	x3 =
FACU species	x4 =
UPL species	x5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

x Dominance Test is >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Wetland Non-Vascular Plants[1]

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ☒ No ☐

Remarks:

Project Site: Tarlatt Slough Restoration Site

SOIL

Sampling Point: WP-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (Moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10 YR 4/2	85					silty loam	
4-12+	10YR 5/1	75	10YR 5/8	many	C	M	Silty loam	Many prominent redox concentrations

[1]Type: C= Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soils Present? Yes ☒ No ☐

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stresses Plants (D1) **(LRR A)**
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) **(LRR A)**
- ☐ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes	☐	No	☒	Depth (inches):
Water Table Present?	Yes	☐	No	☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes	☐	No	☒	Depth (inches):

Wetland Hydrology Present? Yes ☐ No ☒

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
Shallow groundwater well data collected within wetland February 1 to April 3, 2007 identify shallow ground water table, see Figure XX

Remarks:	No surface hydrology was visible at time of delineation. Not water was present in pits. Recent weather patterns have been warmer and drier than usual, resulting in lack of visible hydrology. Hydrology in lower contours of wetland enclosed by perimeter dike is presumed to be driven by proximity of shallow groundwater to surface elevations. Along western property edge the land contour slopes from elevations of approximately 12 feet down to approximately 9 foot elevation over a short distance. The interior of the site is a flat to gradually sloping area that varies in elevations from 9.5 to 8 feet. The wetland hydrology near the western property boundary is influenced by lateral groundwater discharge along face of the slope in some places.

Appendix E — Wetland Rating Forms

Figure E-1 Wetland Rating Boundary

WETLAND RATING FORM – WESTERN WASHINGTON

Version 2 – Updated July 2006 to increase accuracy and reproducibility among users

Updated Oct. 2008 with the new WDFW definitions for priority habitats

Name of wetland (if known): Tarlatt Slough Restoration Project Date of site visit: 9/22/2009, 10/6/2009

Rated by: Gretchen Lux Trained by Ecology? Yes **X** No_____ Date of training:_____

SEC: **02,03,10,11** TWNSHP: **10N** RNGE: **11W**

Map of wetland unit: Figure 4 Estimated size 55 acres

SUMMARY OF RATING

Category based on FUNCTIONS provided by wetland: I_____ II __X__ III_____ IV_____

Category I =	Score > 70	Score : Water Quality Functions	12
Category II =	Score 51 - 69	Score for Hydrologic Functions	6
Category III =	Score 30 –50	Score for Habitat Functions	30
Category IV =	Score < 30	TOTAL Score for Functions	48

Category based on SPECIAL CHARACTERISTCS of Wetland I_____ II_____ Does not apply X

Final Category (choose the "highest" category from above") **Category III**

Summary of basic information about the wetland unit.

Wetland Unit has Special Characteristics		Wetland HGM Class used for Rating	
Estuarine		**Depressional**	x
Natural Heritage Wetland		**Riverine**	
Bog		**Lake-fringe**	
Mature Forest		**Slope**	
Old Growth Forest		**Flats**	
Coastal Lagoon		**Freshwater Tidal**	
Interdunal			
None of the above	x	Check if unit has multiple HGM classes present	x

Does the wetland being rated meet any of the criteria below? If you answer YES to any of the questions below you will need to protect the wetland according to the regulations regarding the special characteristics found in the wetland.

Check List for Wetlands that Need Additional Protection (in addition to the protection recommended for its category)	**YES**	**NO**
SP1. *Has the wetland unit been documented as a habitat for any Federally listed Threatened or Endangered* ***animal or plant*** *species (T/E species)?*For the purposes of this rating system, "documented" means the wetland is on the appropriate state or federal database.		?
SP2. *Has the wetland unit been documented as habitat for any State listed Threatened or Endangered* ***animal*** *species?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state database. Note: Wetlands with State listed plant species are categorized as Category 1 Natural Heritage Wetlands (see p. 19 of data form).		?
SP3. *Does the wetland unit contain individuals of Priority species listed by the WDFW for the state?*		?
SP4. *Does the wetland unit have a local significance in addition to its functions?* For example, the wetland has been identified in the Shoreline Master Program, the Critical Areas Ordinance, or in a local management plan as having special significance.		X

To complete the next part of the data sheet you will need to determine the Hydrogeomorphic Class of the wetland being rated.

The hydrogeomorphic classification groups wetlands in to those that function in similar ways. This simplifies the questions needed to answer how well the wetland functions. The Hydrogeomorphic Class of a wetland can be determined using the key below. See p. 24 for more detailed instructions on classifying wetlands.

Classification of Vegetated Wetlands for Western Washington

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides (i.e. except during floods)?

   NO – go to 2 **YES** – the wetland class is **Tidal Fringe**

   If yes, is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

   YES – Freshwater Tidal Fringe (Estuarine) **NO – Saltwater Tidal Fringe**

   *If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is a Saltwater Tidal Fringe it is rated as an **Estuarine** wetland.* Wetlands that were call estuarine in the first and second editions of the rating system are called Salt Water Tidal Fringe in the Hydrogeomorphic Classification. Estuarine wetlands were categorized separately in the earlier editions, and this separation is being kept in this revision. To maintain consistency between editions, the term "Estuarine" wetland is kept. Please note, however, that the characteristics that define Category I and II estuarine wetlands have changed (see p. _____).

2. The entire wetland unit is flat and precipitation is only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.

   NO – go to 3 **YES** – The wetland class is **Flats**

   If your wetland can be classified as a "Flats" wetland, use the form for **Depressional** wetlands.

3. Does the entire wetland meet both of the following criteria?

   _____ The vegetated part of the wetland is on the shores of a body of permanent open water (without any vegetation on the surface) where at least 20 acres (8ha) in size;

   _____ At least 30% of the open water area is deeper than 6.6 (2 m)?

   NO – go to 4 **YES** – The wetland class is **Lake-fringe (Lacustrine Fringe)**

4. Does the entire wetland meet all of the following criteria?

   _____ The wetland is on a slope *(slope can be very gradual).*

   _____ The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks.

   _____ The water leaves the wetland **without being impounded**?
   NOTE: *Surface water does not pond in these types of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 foot deep).*

   NO – go to 5 **YES** – The wetland class is **Slope**

5. Does the entire wetland meet all of the following criteria?

   _____ The unit is in a valley or stream channel where it gets inundated by overbank flooding from that stream or river.

   _____ The overbank flooding occurs at least once every two years.
   NOTE: *The riverine unit can contain depressions that are filled with water when the river is not flooding..*

   NO – go to 6 **YES** – The wetland class is **Riverine**

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time of the year. This means that any outlet, if present is higher than the interior of the wetland.

NO – go to 7 **YES** – The wetland class is **Depressional**

7. Is the entire wetland located in a very flat area with no obvious depression and no overbank flooding. The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched, but has no obvious natural outlet.

No – go to 8 YES – The wetland class is Depressional

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM classes. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within your wetland. NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the class listed in column 2 is less than 10% of the unit, classify the wetland using the class that represents more than 90% of the total area.

HGM Classes within the wetland unit being rated	*HGM Class to Use in Rating*
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake-fringe	Lake-fringe
Depressional + Riverine along stream within boundary	Depressional
Depressional + Lake-fringe	Depressional
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE under wetlands with special characteristics

If you are unable still to determine which of the above criteria apply to your wetland, or you have more than 2 HGM classes within a wetland boundary, classify the wetland as **Depressional** for the rating.

D	Depressional and Flat Wetlands	Points
	WATER QUALITY FUNCTIONS – Indicators that wetland functions to improve water quality.	(only 1 score per box)
D 1	**Does the wetland have the <u>potential</u> to improve water quality?**	*(see p.38)*
	D 1.1 Characteristics of surface water flows out of the wetland: • Unit is a depression with no surface water leaving it (no outlet) ..... points = 3 • Unit has an intermittently flowing, OR highly constricted, permanently flowing outlet..... points = 2 • Unit has an unconstricted, or slightly constricted, surface outlet (*permanently flowing*)..... points = 1 • Unit is a "flat" depression (Q.7 on key), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch ..... points = 1 *(If ditch is not permanently flowing treat unit as "intermittently flowing")* **Provide photo or drawing**	**Figure ___** **1**
	D 1.2 The soil 2 inches below the surface (or duff layer) is clay or organic (*use NRCS definitions*) YES points = 4 NO points = 0	0
	D 1.3 Characteristics of persistent vegetation (emergent, shrub, and/or forest Cowardin class): • Wetland has persistent, ungrazed vegetation > = 95% of area ..... points = 5 • Wetland has persistent, ungrazed vegetation > = 1/2 of area ..... points = 3 • Wetland has persistent, ungrazed vegetation > = 1/10 of area ..... points = 1 • Wetland has persistent, ungrazed vegetation < 1/10 of area ..... points = 0 **Map of Cowardin vegetation classes**	**Figure ___** **5**
	D 1.4 Characteristics of seasonal ponding or inundation: *This is the area of the wetland that is ponded for at least 2 months, but dries out sometime during the year. Do not count the area that is permanently ponded. Estimate area as the average condition 5 out of 10 years.* • Area seasonally ponded is > 1/2 total area of wetland..... points = 4 • Area seasonally ponded is > 1/4 total area of wetland..... points = 2 • Area seasonally ponded is < 1/4 total area of wetland..... points = 0 **Map of Hydroperiods**	**Figure ___** **0**
	Total for D 1 *Add the points in the boxes above*	6
D 2	**Does the wetland have the <u>opportunity</u> to improve water quality?** Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland? *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* ____ Grazing in the wetland or within 150 ft ____ Untreated stormwater discharges to wetland ____ Tilled fields or orchards within 150 ft. of wetland ____ A stream or culvert discharges into wetland that drains developed areas, residential areas, farmed fields, roads, or clear-cut logging ____ Residential, urban areas, golf courses are within 150 ft. of wetland ____ Wetland is fed by groundwater high in phosphorus or nitrogen ____ Other _____ YES multiplier is 2 NO multiplier is 1	*(see p. 44)* Multiplier X 2
◆	**<u>TOTAL</u> – Water Quality Functions** Multiply the score from D1 by D2; then ***add score to table on p. 1***	12
	HYDROLOGIC FUNCTIONS – Indicators that wetland unit functions to reduce flooding and stream degradation.	
D 3	**Does the wetland have the <u>potential</u> to reduce flooding and erosion?**	*(see p.46)*
	D 3.1 Characteristics of surface water flows out of the wetland unit • Unit is a depression with no surface water leaving it (no outlet) ..... points = 4 • Unit has an intermittently flowing, OR highly constricted permanently flowing outlet..... points = 2 • Unit is a "flat" depression (Q.7 on key) or in the Flats class, with permanent surface	0

	outflow **and no obvious natural outlet** and/or outlet is a man-made ditch ..... points = 1 *(If ditch is not permanently flowing treat unit as "intermittently flowing")* • Unit has an unconstricted, or slightly constricted, surface outlet *(permanently flowing)*..... points = 0	
	D 3.2 Depth of storage during wet periods. *Estimate the height of ponding above the bottom of the outlet. For units with no outlet measure from the surface of permanent water or deepest part (if dry).* • Marks of ponding are 3 ft. or more above the surface or bottom of the outlet..... points = 7 • The wetland is a "headwater" wetland..... points = 5 • Marks of ponding between 2 ft. to < 3 ft. from surface or bottom of outlet ..... points = 5 • Marks are at least 0.5 ft. to < 2 ft. from surface or bottom of outlet ..... points = 3 • Wetland is flat (yes to Q.2 or Q.7 on key)but has small depressions on the surface that trap water. points = 1 • Marks of ponding less than 0.5 ft ..... points = 0	3
	D 3.3 Contribution of wetland unit to storage in the watershed: *Estimate the ratio of the area of upstream basin contributing surface water to the wetland to the area of the wetland unit itself.* • The area of the basin is less than 10 times the area of unit..... points = 5 • The area of the basin is 10 to 100 times the area of the unit..... points = 3 • The area of the basin is more than 100 times the area of the unit ..... points = 0 • Entire unit is in the FLATS class..... points = 5	3
	Total for D 3 *Add the points in the boxes above*	6
D 4	**Does the wetland have the <u>opportunity</u> to reduce flooding and erosion?** Answer YES if the unit is in a location in the watershed where the flood storage, or reduction in water velocity, it provides helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows. Answer NO if the water coming into the wetland is controlled by a structure such as flood gate, tide gate, flap valve, reservoir etc. OR you estimate that more than 90% of the water in the wetland is from groundwater in areas where damaging groundwater flooding does not occur. *Note which of the following indicators of opportunity apply.* ____ Wetland is in a headwater of a river or stream that has flooding problems. ____ Wetland drains to a river or stream that has flooding problems ____ Wetland has no outlet and impounds surface runoff water that might otherwise flow into a river or stream that has flooding problems ____ Other _____ YES multiplier is 2 NO multiplier is 1	*(see p. 49)* Multiplier X 1
◆	**<u>TOTAL</u> – Hydrologic Functions** Multiply the score from D3 by D4; then ***add score to table on p. 1***	6

Comments:

R	Riverine and Freshwater Tidal Fringe Wetlands	Points
	WATER QUALITY FUNCTIONS – Indicators that wetland functions to improve water quality.	(only 1 score per box)
R 1	**Does the wetland have the <u>potential</u> to improve water quality?** *(see p.52)*	
	R 1.1 Area of surface depressions within the riverine wetland that can trap sediments during a flooding event: • Depressions cover > 3/4 area of wetland.....points = 8 • Depressions cover > 1/2 area of wetland.....points = 4 **(If depressions > 1/2 of area of unit draw polygons on aerial photo or map)** • Depressions present but cover < 1/2 area of wetland.....points = 2 • No depressions present.....points = 0	**Figure ___**
	R 1.2 Characteristics of the vegetation in the unit (areas with >90% cover at person height): • Trees or shrubs > 2/3 area of the unit .....points = 8 • Trees or shrubs > 1/3 area of the wetland .....points = 6 • Ungrazed, herbaceous plants > 2/3 area of unit.....points = 6 • Ungrazed herbaceous plants > 1/3 area of unit.....points = 3 • Trees, shrubs, and ungrazed herbaceous < 1/3 area of unit.....points = 0 **Aerial photo or map showing polygons of different vegetation types**	**Figure ___**
	Add the points in the boxes above	
R 2	**Does the wetland have the <u>opportunity</u> to improve water quality?** Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland. *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* ____ Grazing in the wetland or within 150 ft ____ Untreated stormwater discharges to wetland ____ Tilled fields or orchards within 150 ft. of wetland ____ A stream or culvert discharges into wetland that drains developed areas, residential areas, farmed fields, roads, or clear-cut logging ____ Residential, urban areas, golf courses are within 150 ft. of wetland ____ The river or stream linked to the wetland has a contributing basin where human activities have raised levels of sediment, toxic compounds or nutrients in the river water above standards for water quality. ____ Other _____ YES multiplier is 2 NO multiplier is 1	*(see p. 53)* Multiplier _____
◆	**<u>TOTAL</u> – Water Quality Functions** Multiply the score from R1 by R2; then ***add score to table on p. 1***	
	HYDROLOGIC FUNCTIONS – Indicators that wetland functions to reduce flooding and stream erosion.	
R 3	**Does the wetland have the <u>potential</u> to reduce flooding and erosion?**	*(see p.54)*
	R 3.1 Characteristics of the overbank storage the wetland provides: *Estimate the average width of the wetland perpendicular to the direction of the flow and the width of the stream or river channel (distance between banks). Calculate the ratio: (average width of unit) / (average width of stream between banks).* • If the ratio is more than 20 .....points = 9 • If the ratio is between 10 – 20 .....points = 6 • If the ratio is 5- <10 .....points = 4 • If the ratio is 1- <5 .....points = 2 • If the ratio is < 1 .....points = 1 **Aerial photo or map showing average widths**	**Figure ___**
	R 3.2 Characteristics of vegetation that slow down water velocities during floods: *Treat large woody debris as "forest or shrub". Choose the points appropriate for the best description. (polygons need to have >90% cover at person height NOT Cowardin classes):* • Forest or shrub for > 1/3 area OR herbaceous plants > 2/3 area .....points = 7	**Figure ___**

	• Forest or shrub for > 1/10 area OR herbaceous plants > 1/3 area .....points = 4 • Vegetation does not meet above criteria .....points = 0 **Aerial photo or map showing polygons of different vegetation types**	
	Add the points in the boxes above	
R 4	**Does the wetland have the <u>opportunity</u> to reduce flooding and erosion?** Answer YES if the wetland is in a location in the watershed where the flood storage, or reduction in water velocity, it provides helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows. *Note which of the following conditions apply.* ____ There are human structures and activities downstream (roads, buildings, bridges, farms) that can be damaged by flooding. ____ There are natural resources downstream (e.g. salmon redds) that can be damaged by flooding ____ Other _____ *(Answer NO if the major source of water to the wetland is controlled by a reservoir or the wetland is tidal fringe along the sides of a dike)* YES multiplier is 2 NO multiplier is 1	*(see p.57)* Multiplier _____
◆	**<u>TOTAL</u> – Hydrologic Functions** Multiply the score from R3 by R4; then ***add score to table on p. 1***	

Comments:

L	Lake-fringe Wetlands	Points
	WATER QUALITY FUNCTIONS – Indicators that the wetland unit functions to improve water quality.	(only 1 score per box)
L 1	**Does the wetland unit have the <u>potential</u> to improve water quality?** *(see p.59)*	
	L 1.1 Average width of vegetation along the lakeshore (use polygons of Cowardin classes): • Vegetation is more than 33 ft. (10m) wide ..... points = 6 • Vegetation is more than 16 ft.(5m) wide and < 33 ft ..... points = 3 • Vegetation is more than 6 ft. (2m) wide and < 16 ft ..... points = 1 • Vegetation is less than 6 ft. wide ..... points = 0 **Map of Cowardin classes with widths marked**	**Figure ___**
	L 1.2 Characteristics of the vegetation in the wetland: *Choose the appropriate description that results in the highest points, and do not include any open water in your estimate of coverage. The herbaceous plants can be either the dominant form or as an understory in a shrub or forest community. These are not Cowardin classes. Area of Cover is total cover in the unit, but it can be in patches. NOTE: Herbaceous does not include aquatic bed.* • Cover of herbaceous plants is > 90% of the vegetated area ..... points = 6 • Cover of herbaceous plants is > 2/3 of the vegetated area ..... points = 4 • Cover of herbaceous plants is > 1/3 of the vegetated area ..... points = 3 • Other vegetation that is not aquatic bed or herbaceous covers > 2/3 of the unit ..... points = 3 • Other vegetation that is not aquatic bed in > 1/3 vegetated area ..... points = 1 • Aquatic bed cover and open water > 2/3 of the unit ..... points = 0 **Map with polygons of different vegetation types**	**Figure ___**
	Add the points in the boxes above	
L 2	**Does the wetland have the <u>opportunity</u> to improve water quality?** Answer YES if you know or believe there are pollutants in the lake water, or polluted surface water flowing through the unit to the lake. *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* ____ Wetland is along the shores of a lake or reservoir that does not meet water quality standards ____ Grazing in the wetland or within 150 ft ____ Polluted water discharges to wetland along upland edge ____ Tilled fields or orchards within 150 ft. of wetland ____ Residential or urban areas are within 150 ft. of wetland ____ Parks with grassy areas that are maintained, ballfields, golf courses (all within 150 ft. of lake shore) ____ Power boats with gasoline or diesel engines use the lake ____ Other _____ YES multiplier is 2 NO multiplier is 1	*(see p.61)* Multiplier _____
◆	**<u>TOTAL</u> – Water Quality Functions** Multiply the score from L1 by L2; then ***add score to table on p. 1***	
	HYDROLOGIC FUNCTIONS – Indicators that wetland functions to reduce shoreline erosion.	
L 3	**Does the wetland have the <u>potential</u> to reduce shoreline erosion?**	*(see p.62)*
	L 3 Average width and characteristics of vegetation along the lakeshore *(do not include aquatic bed): (choose the highest scoring description that matches conditions in the wetland)* • 3/4 of distance is shrubs or forest at least 33 ft. (10m) wide ..... points = 6 • 3/4 of distance is shrubs or forest at least 6 ft. (2m) wide. ..... points = 4 • 1/4 of distance is shrubs or forest at least 33 ft. (10m) wide ..... points = 4 • Vegetation is at least 6 ft. (2m) wide (any type except aquatic bed) ..... points = 2 • Vegetation is less than 6 ft. (2m) wide (any type except aquatic bed) ..... points = 0 **Aerial photo or map with Cowardin vegetation classes**	**Figure ___**
	Record the points in the boxes above	
L 4	**Does the wetland have the <u>opportunity</u> to reduce erosion?**	*(see p. 64)*

	Are there features along the shore that will be impacted if the shoreline erodes? *Note which of the following conditions apply.* ____ There are human structures and activities along the upland edge of the wetland (buildings, fields) that can be damaged by erosion. ____ There are undisturbed natural resources along the upland edge of the wetland (e.g. mature forests, other wetlands) that can be damaged by shoreline erosion. ____ Other _____ YES multiplier is 2 NO multiplier is 1	Multiplier _____
◆	**<u>TOTAL</u> – Hydrologic Functions** Multiply the score from L3 by L4; then ***add score to table on p. 1***	

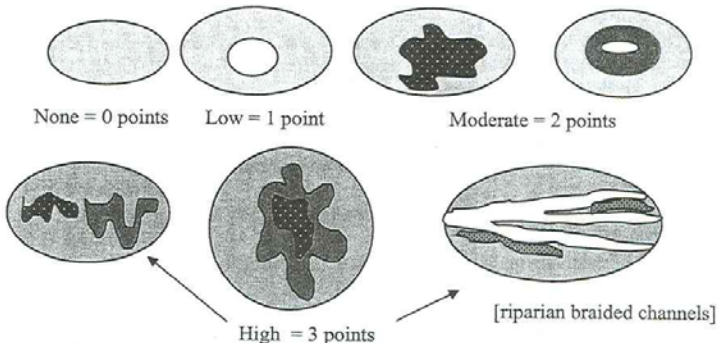
Comments:

S	Slope Wetlands	Points
	WATER QUALITY FUNCTIONS – Indicators that wetland functions to improve water quality.	(only 1 score per box)
S 1	**Does the wetland have the <u>potential</u> to improve water quality?**	*(see p.64)*
	S 1.1 Characteristics of average slope of unit: • Slope is 1% or less *(a 1% slope has a 1 ft. vertical drop in elevation for every 100 ft. horizontal distance)* ..... points = 3 • Slope is 1% - 2% ..... points = 2 • Slope is 2% - 5% ..... points = 1 • Slope is greater than 5% ..... points = 0	
	S 1.2 The soil 2 inches below the surface (or duff layer) is clay, organic *(Use NRCS definitions).* YES = 3 points NO = 0 points	
	S 1.3 Characteristics of the vegetation in the wetland that trap sediments and pollutants: *Choose the points appropriate for the description that best fits the vegetation in the wetland. Dense vegetation means you have trouble seeing the soil surface (>75% cover), and uncut means not grazed or mowed and plants are higher than 6 inches.* • Dense, uncut, herbaceous vegetation > 90% of the wetland area ..... points = 6 • Dense, uncut, herbaceous vegetation > 1/2 of area ..... points = 3 • Dense, woody, vegetation > 1/2 of area. ..... points = 2 • Dense, uncut, herbaceous vegetation > 1/4 of area ..... points = 1 • Does not meet any of the criteria above for vegetation ..... points = 0 **Aerial photo or map with vegetation polygons**	**Figure ___**
	Total for S 1 *Add the points in the boxes above*	
S 2	**Does the wetland have the <u>opportunity</u> to improve water quality?** Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland? *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* ____ Grazing in the wetland or within 150 ft ____ Untreated stormwater discharges to wetland ____ Tilled fields, logging, or orchards within 150 ft. of wetland ____ Residential, urban areas, or golf courses are within 150 ft. upslope of wetland ____ Other _____ YES multiplier is 2 NO multiplier is 1	*(see p. 67)* Multiplier _____
◆	**<u>TOTAL</u> – Water Quality Functions** Multiply the score from S1 by S2; then ***add score to table on p. 1***	
	HYDROLOGIC FUNCTIONS – Indicators that wetland functions to reduce flooding and stream erosion.	
S 3	**Does the wetland have the <u>potential</u> to reduce flooding and stream erosion?**	*(see p.68)*
	S 3.1 Characteristics of vegetation that reduce the velocity of surface flows during storms: *Choose the points appropriate for the description that best fits conditions in the wetland (stems of plants should be thick enough (usually > 1/8in), or dense enough to remain erect during surface flows).* • Dense, uncut, **rigid** vegetation covers > 90% of the area of the wetland ..... points = 6 • Dense, uncut, **rigid** vegetation> 1/2 area of wetland ..... points = 3 • Dense, uncut, **rigid** vegetation > 1/4 area. ..... points = 1 • More than 1/4 of area is grazed, mowed, tilled, or vegetation is not rigid ..... points = 0	
	S 3.2 Characteristics of slope wetland that holds back small amounts of flood flows. The slope has small surface depressions that can retain water over at least 10% of its area. YES = 2 points NO = 0 points	
	Add the points in the boxes above	

S 4	**Does the wetland have the <u>opportunity</u> to reduce flooding and erosion?** Is the wetland in a landscape position where the reduction in water velocity it provides helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows? *Note which of the following conditions apply.* ____ Wetland has surface runoff that drains to a river or stream that has flooding problems ____ Other _____ *(Answer NO if the major source of water is controlled by a reservoir (e.g. wetland is a seep that is on the downstream side of a dam)* YES multiplier is 2 NO multiplier is 1	*(see p. 70)* Multiplier _____
◆	**<u>TOTAL</u> – Hydrologic Functions** Multiply the score from S3 by S4; then ***add score to table on p. 1***	

Comments:

These questions apply to wetlands of all HGM classes.		**Points**
	HABITAT FUNCTIONS – Indicators that wetland functions to provide important habitat.	(only 1 score per box)
H 1	**Does the wetland have the <u>potential</u> to provide habitat for many species?**	
	H 1.1 <u>Vegetation structure</u> *(see P. 72)*: *Check the types of vegetation classes present (as defined by Cowardin) – Size threshold for each class is 1/4 acre or more than 10% of the area if unit is smaller than 2.5 acres.* ____ Aquatic Bed ____ Emergent plants ____ Scrub/shrub (areas where shrubs have > 30% cover) ____ Forested (areas where trees have > 30% cover) *If the unit has a forested class check if:* ____ The forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the forested polygon. *Add the number of vegetation types that qualify. If you have:* **Map of Cowardin vegetation classes** 4 structures or more ..... points = 4 3 structures ..... points = 2 2 structures ..... points = 1 1 structure..... points = 0	**Figure ___** **4**
	H 1.2 <u>Hydroperiods</u> *(see p.73)*: *Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or 1/4 acre to count (see text for descriptions of hydroperiods).* ____ Permanently flooded or inundated 4 or more types present points = 3 ____ Seasonally flooded or inundated 3 or more types present .....points = 2 ____ Occasionally flooded or inundated 2 types present .....points = 1 ____ Saturated only 1 type present .....points = 0 ____ Permanently flowing stream or river in, or adjacent to, the wetland ____ Seasonally flowing stream in, or adjacent to, the wetland ____ **Lake-fringe wetland ..... = 2 points** ____ **Freshwater tidal wetland ..... = 2 points** **Map of hydroperiods**	**Figure ___** **3**
	H 1.3 <u>Richness of Plant Species</u> *(see p. 75)*: Count the number of plant species in the wetland that cover at least 10 ft^2 *(different patches of the same species can be combined to meet the size threshold)* *You do not have to name the species. Do not include Eurasian Milfoil, reed canarygrass, purple loosestrife, Canadian Thistle.* If you counted: > 19 species..... points = 2 5 – 19 species ..... points = 1 List species below if you want to: < 5 species ..... points = 0 _____ _____ _____ _____	1
	H 1.4 Interspersion of Habitats *(see p. 76)*: Decided from the diagrams below whether interspersion between Cowardin vegetation (described in H1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, medium, low, or none.	

		Note: If you have 4 or more classes or 3 vegetation classes and open water, the rating is always "high". **Use map of Cowardin classes.**	**Figure ___** **3**
	H 1.5 <u>Special Habitat Features</u> *(see p. 77)*: *Check the habitat features that are present in the wetland. The number of checks is the number of points you put into the next column.* ____ Large, downed, woody debris within the wetland (> 4 in. diameter and 6 ft. long) ____ Standing snags (diameter at the bottom > 4 inches) in the wetland ____ Undercut banks are present for at least 6.6 ft. (2m) and/or overhanging vegetation extends at least 3.3 ft. (1m) over a stream (or ditch) in, or contiguous with the unit, for at least 33 ft. (10m) ____ Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet turned grey/brown)* ____ At least 1/4 acre of thin-stemmed persistent vegetation or woody branches are present in areas that are permanently or seasonally inundated *(structures for egg-laying by amphibians)* ____ Invasive plants cover less than 25% of the wetland area in each stratum of plants *NOTE: The 20% stated in early printings of the manual on page 78 is an error.*		4
	H 1 TOTAL Score – potential for providing habitat	*Add the points in the column above*	15

H 2	**Does the wetland have the <u>opportunity</u> to provide habitat for many species?**	(only 1 score per box)
	H 2.1 <u>Buffers</u> *(see P. 80)*: *Choose the description that best represents condition of buffer of wetland unit. The highest scoring criterion that applies to the wetland is to be used in the rating. See text for definition of "undisturbed".* ____ 100m (330 ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 95% of circumference. No structures are within the undisturbed part of buffer (relatively undisturbed also means no grazing, no landscaping, no daily human use)..... **points = 5** ____ 100m (330 ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 50% circumference ..... **points = 4** ____ 50m (170 ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 95% circumference ..... **points = 4** ____ 100m (330 ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 25% circumference ..... **points = 3** ____ 50m (170 ft) of relatively undisturbed vegetated areas, rocky areas, or open water for > 50% circumference..... **points = 3** **If buffer does not meet any of the criteria above:** ____ No paved areas (except paved trails) or buildings within 25m (80 ft) of wetland > 95% circumference. Light to moderate grazing or lawns are OK ..... **points = 2** ____ No paved areas of buildings within 50m of wetland for > 50% circumference. Light to moderate grazing or lawns are OK ..... **points = 2** ____ Heavy grazing in buffer ..... **points = 1** ____ Vegetated buffers are < 2m wide (6.6 ft) for more than 95% circumference (e.g. tilled fields, paving, basalt bedrock extend to edge of wetland) ..... **points = 0** ____ Buffer does not meet any of the criteria above..... **points = 1** **Arial photo showing buffers**	**Figure ___** **4**
	H 2.2 <u>Corridors and Connections</u> *(see p. 81)* H 2.2.1 Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 150 ft. wide, has at least a 30% cover of shrubs, forest or native undisturbed prairie, that connects to estuaries, other wetlands or undisturbed uplands that are at least 250 acres in size? *(Dams in riparian corridors, heavily used gravel roads, paved roads, are considered breaks in the corridor).* YES = **4 points** (go to H 2.3) NO = go to H 2.2.2 H. 2.2.2 Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 50 ft. wide, has at least 30% cover of shrubs or forest, and connects to estuaries, other wetlands or undisturbed uplands that are at least 25 acres in size? **OR a Lake-fringe** wetland, if it does not have an undisturbed corridor as in the question above? YES = **2 points** (go to H 2.3) NO = go to H 2.2.3 H. 2.2.3 Is the wetland: • Within 5 mi (8km) of a brackish or salt water estuary OR • Within 3 miles of a large field or pasture (> 40 acres) OR YES = 1 point • Within 1 mile of a lake greater than 20 acres? NO = 0 points	4

	H 2.3 Near or adjacent to other priority habitats listed by WDFW (see p. 82): *(see new and complete descriptions of WDFW priority habitats, and the counties in which they can be found, in the PHS report http://wdfw.wa.gov/hab/phslist.htm)* Which of the following priority habitats are within 330 ft. (100m) of the wetland unit? *NOTE: the connections do not have to be relatively undisturbed.* ____ **Aspen Stands:** Pure or mixed stands of aspen greater than 0.4 ha (1 acre). ____ **Biodiversity Areas and Corridors**: Areas of habitat that are relatively important to various species of native fish and wildlife (*full descriptions in WDFW PHS report p. 152*). ____ **Herbaceous Balds:** Variable size patches of grass and forbs on shallow soils over bedrock. ____ **Old-growth/Mature forests:** (Old-growth west of Cascade crest) Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 20 trees/ha (8 trees/acre) > 81 cm (32 in) dbh or > 200 years of age. **(**Mature forests) Stands with average diameters exceeding 53 cm (21 in) dbh; crown cover may be less that 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80 - 200 years old west of the Cascade crest. ____ **Oregon white Oak:** Woodlands Stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158*). ____ **Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other. ____ **Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161*). ____ **Instream:** The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources. ____ **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report: pp. 167-169 and glossary in Appendix A).* ____ **Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human. ____ **Cliffs:** Greater than 7.6 m (25 ft) high and occurring below 5000 ft. ____ **Talus:** Homogenous areas of rock rubble ranging in average size 0.15 - 2.0 m (0.5 - 6.5 ft), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs. ____ **Snags and Logs:** Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 51 cm (20 in) in western Washington and are > 2 m (6.5 ft) in height. Priority logs are > 30 cm (12 in) in diameter at the largest end, and > 6 m (20 ft) long. If wetland has **3 or more** priority habitats **= 4 points** If wetland has **2** priority habitats = **3 points** If wetland has **1** priority habitat **= 1 point** No habitats = 0 points Note: All vegetated wetlands are by definition a priority habitat but are not included in this list. Nearby wetlands are addressed in question H 2.4)	4
	H 2.4 Wetland Landscape: *Choose the **one** description of the landscape around the wetland that best fits (see p. 84)* • There are at least 3 other wetlands within 1/2 mile, and the connections between them are relatively undisturbed (light grazing between wetlands OK, as is lake shore with some boating, but connections should NOT be bisected by paved roads, fill, fields, or other development ..... points = 5 • The wetland is Lake-fringe on a lake with little disturbance and there are 3 other lake-fringe wetlands within 1/2 mile ..... points = 5 • There are at least 3 other wetlands within 1/2 mile, BUT the connections between them are disturbed. ..... points = 3 • The wetland fringe on a lake **with** disturbance and there are 3 other lake-fringe wetlands within 1/2 mile ..... points = 3 • There is at least 1 wetland within 1/2 mile ..... points = 2 • There are no wetlands within 1/2 mile ..... points = 0	3
	H 2 TOTAL Score – opportunity for providing habitat *Add the scores from H2.1, H2.2, H2.3, H2.4*	15
	TOTAL for H 1 from page 8	15

◆	**Total Score for Habitat Functions**	Add the points for H 1 and H 2; then ***record the result on p. 1***	30

Comments:

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Please determine if the wetland meets the attributes described below and circle the appropriate answers and Category.

	Wetland Type – *Check off any criteria that apply to the wetland. Circle the Category when the appropriate criteria are met.*	
SC1	**<u>Estuarine wetlands?</u>** *(see p.86)* Does the wetland unit meet the following criteria for Estuarine wetlands? ____ The dominant water regime is tidal, ____ Vegetated, and ____ With a salinity greater than 0.5 ppt. YES = Go to SC 1.1 NO X____	
	SC 1.1 Is the wetland unit within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? YES = Category I NO = go to SC 1.2	**Cat. 1**
	SC 1.2 Is the wetland at least 1 acre in size and meets at least two of the following conditions? YES = Category I NO = Category II ____ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. If the non-native *Spartina* spp,. are only species that cover more than 10% of the wetland, then the wetland should be given a dual rating (I/II). The area of Spartina would be rated a Category II while the relatively undisturbed upper marsh with native species would be a Category 1. Do not, however, exclude the area of Spartina in determining the size threshold of 1 acre. ____ At least 3/4 of the landward edge of the wetland has a 100 ft. buffer of shrub, forest, or un-grazed or un-mowed grassland ____ The wetland has at least 2 of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands.	**Cat. I** **Cat. II** **Dual Rating I/II**
SC2	**<u>Natural Heritage Wetlands</u>** *(see p. 87)* Natural Heritage wetlands have been identified by the Washington Natural Heritage Program/DNR as either high quality undisturbed wetlands or wetlands that support state Threatened, Endangered, or Sensitive plant species. SC 2.1 Is the wetland being rated in a Section/Township/Range that contains a natural heritage wetland? *(This question is used to screen out most sites before you need to contact WNHP/DNR.)* S/T/R information from Appendix D _____ or accessed from WNHP/DNR web site _____ YES _____ Contact WNHP/DNR (see p. 79) and go to SC 2.2 NO _____ SC 2.2 Has DNR identified the wetland as a high quality undisturbed wetland or as a site with state threatened or endangered plant species? YES = Category 1 NO _____ not a Heritage Wetland	**Cat I**
SC3	**<u>Bogs</u>** *(see p. 87)* Does the wetland **(or any part of the unit)** meet both the criteria for soils and vegetation in bogs? Use	**Cat. I**

the key below to identify if the wetland is a bog. ***If you answer yes you will still need to rate the wetland based on its function.***

1. Does the unit have organic soil horizons (i.e. layers of organic soil), either peats or mucks, that compose 16 inches or more of the first 32 inches of soil profile? (See Appendix B for a field key to identify organic soils)? YES = go to question 3 NO = go to question 2

2. Does the wetland have organic soils, either peats or mucks that are less than 16 inches deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on a lake or pond? YES = go to question 3 NO = is not a bog for purpose of rating

3. Does the unit have more than 70% cover of mosses at ground level, AND other plants, if present, consist of the "bog" species listed in Table 3 as a significant component of the vegetation (more than 30% of the total shrub and herbaceous cover consists of species in Table 3)?

   YES = Is a bog for purpose of rating NO = go to question 4

   NOTE: If you are uncertain about the extent of mosses in the understory you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16" deep. If the pH is less than 5.0 and the "bog" plant species in Table 3 are present, the wetland is a bog.

4. Is the unit forested (> 30% cover) with sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Englemann's spruce, or western white pine. WITH any of the species (or combination of species) on the bog species plant list in Table 3 as a significant component of the ground cover *(> 30% coverage of the total shrub/herbaceous cove*r)?

   YES = Category I NO = Is not a bog for purpose of rating

SC4	**<u>Forested Wetlands</u>** *(see p. 90)* Does the wetland have at least 1 acre of forest that meet one of these criteria for the Department of Fish and Wildlife's forests as priority habitats? *If you answer yes you will still need to rate the wetland based on its function.* ____ **Old-growth forests**: (west of Cascade Crest) Stands of at least two three species forming a multi-layered canopy with occasional small openings; with at least 8 trees/acre (20 trees/hectare) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 inches (81 cm or more). NOTE: The criterion for dbh is based on measurements for upland forests. Two-hundred year old trees in wetlands will often have a smaller dbh because their growth rates are often slower. The DFW criterion is and "OR" so old-growth forests do not necessarily have to have trees of this diameter. ____ **Mature forests**: (west of the Cascade Crest) Stands where the largest trees are 80 – 200 years old OR have an average diameters (dbh) exceeding 21 inches (53 cm); crown cover may be less than 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth. YES = Category I NO = X___ not a forested wetland with special characteristics	**Cat. I**
SC5	**<u>Wetlands in Coastal Lagoons</u>** *(see p. 91)* Does the wetland meet all of the following criteria of a wetland in a coastal lagoon? ____ The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks. ____ The lagoon in which the wetland is located contains surface water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom.)* YES = Go to SC 5.1 NO X____ not a wetland in a coastal lagoon SC 5.1 Does the wetland meet all of the following three conditions? ____ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing) and has less than 20% cover of invasive plant species (see list of invasive species on p. 74). ____ At least 3/4 of the landward edge of the wetland has a 100 ft. buffer of shrub, forest, or un-grazed or un-mowed grassland. ____ The wetland is larger than 1/10 acre (4350 square ft.) YES = Category I NO = Category II	**Cat. I** **Cat. II**
SC6	**<u>Interdunal Wetlands</u>** *(see p. 93)* Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? YES = Go to SC 6.1 NO X____ not an interdunal wetland for rating ***If you answer yes you will still need to rate the wetland based on its functions.*** In practical terms that means the following geographic areas: • Long Beach Peninsula -- lands west of SR 103 • Grayland-Westport -- lands west of SR 105 • Ocean Shores-Copalis – lands west of SR 115 and SR 109 SC 6.1 Is the wetland one acre or larger, or is it in a mosaic of wetlands that is one acre or larger? YES = Category II NO = go to SC 6.2 SC 6.2 Is the wetland between 0.1 and 1 acre, or is it in a mosaic of wetlands that is between 0.1 and 1 acre? YES = Category III	**Cat. II** **Cat. III**

◆	**Category of wetland based on Special Characteristics** *Choose the "highest" rating if wetland falls into several categories, and record on p. 1.* If you answered NO for all types enter "Not Applicable" on p. 1	

Appendix F — Precipitation and Groundwater Data

Monthly precipitation data for Long Beach Experimental Station, Washington.

Month	Precipitation (inches)				
	Recorded Totals [a]		1971-2000[b]		
			30% chance will have		
	2008	2009	Less than	More than	Average
January		10.75	7.85	13.87	11.61
February		3.71	7.10	11.71	9.91
March		7.65	6.88	10.50	9.02
April		4.15	4.51	7.04	6.02
May		0.09	2.84	4.63	3.92
June		0.68	2.07	3.56	2.99
July		0.05	0.97	2.06	1.69
August		0.38	0.95	2.18	1.79
September		0.78	1.41	4.01	3.29
October	4.89		3.95	8.22	6.76
November	11.05		8.87	13.81	11.82
December	11.31		9.31	14.44	12.37
2008-2009 Water Year	55.49		30 Year Annual Average		81.19

[a] NOAA Regional Climate Center
[b] NRCS http://www.wcc.nrcs.usda.gov/cgibin/getwetco.pl?state=wa

Table F-1 Comparison of Observed and Normal Precipitation

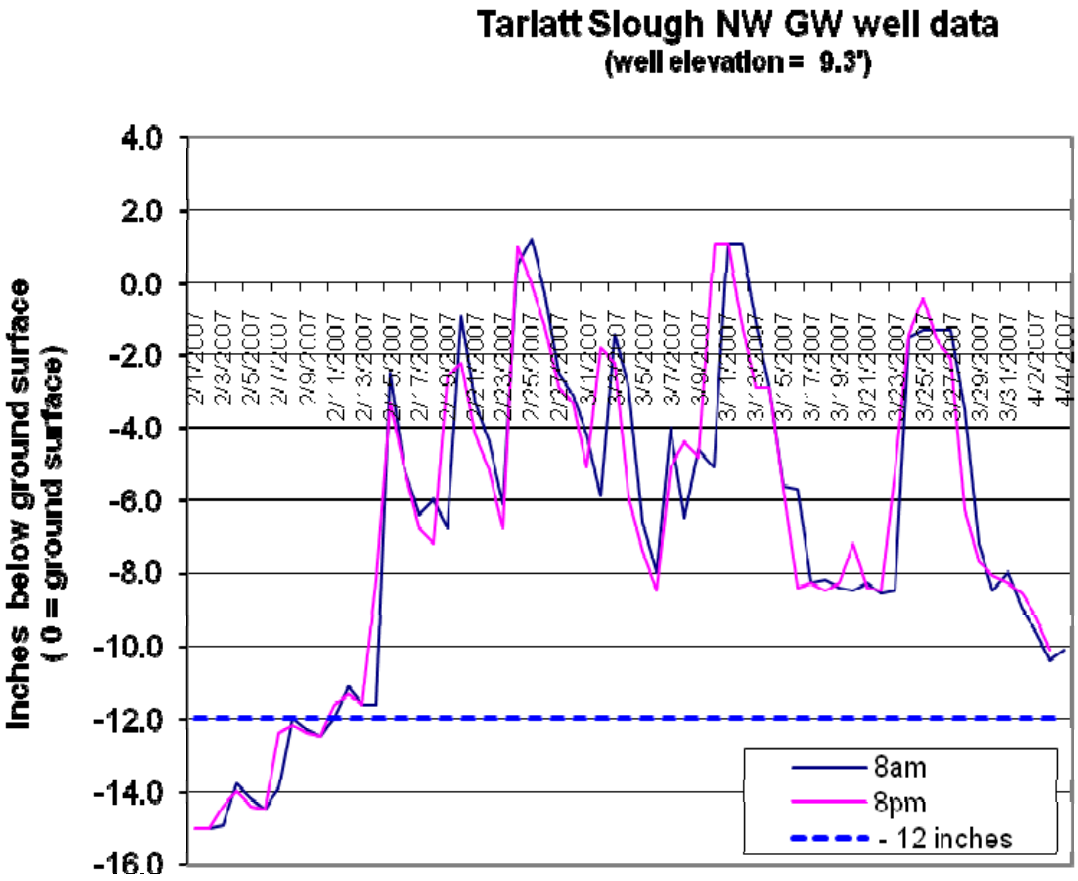


Figure F-1 NW Groundwater Well Data: 2/1/2007 – 4/4/2007

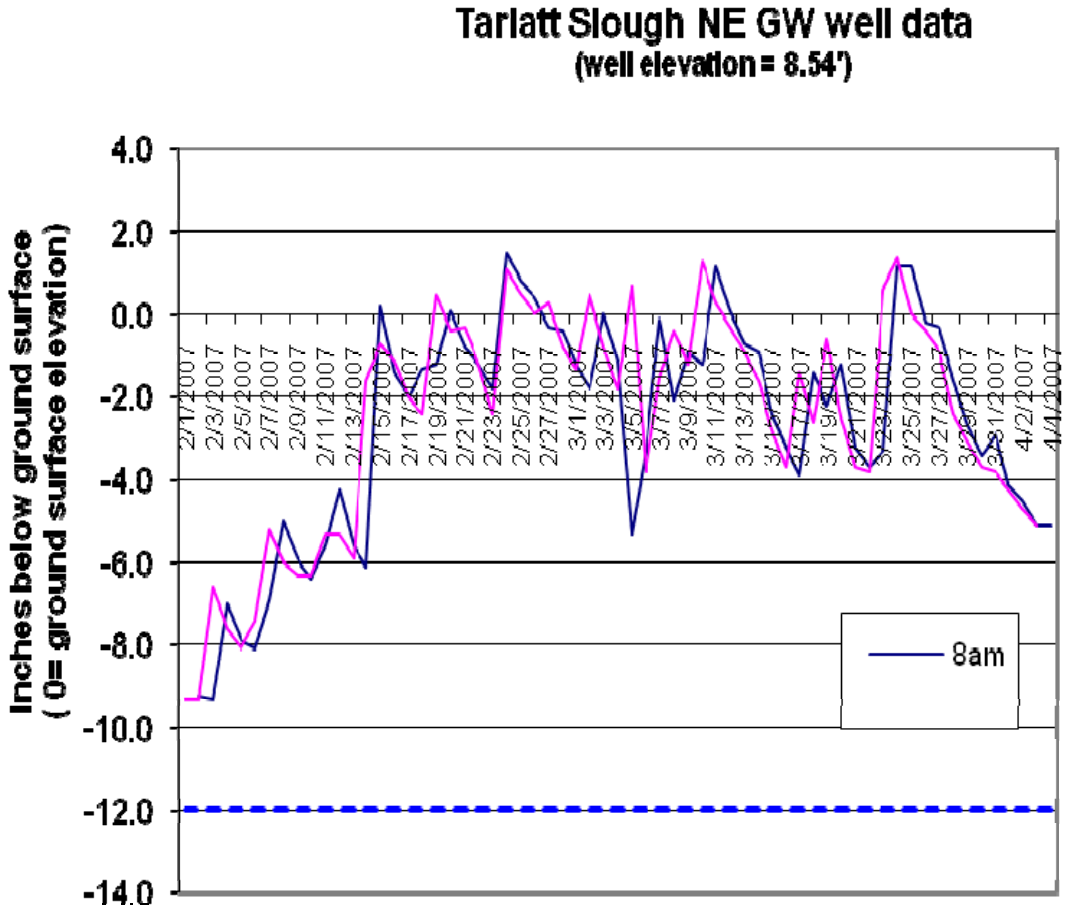


Figure F-2 NE Groundwater Well Data: 2/1/2007 – 4/4/2007

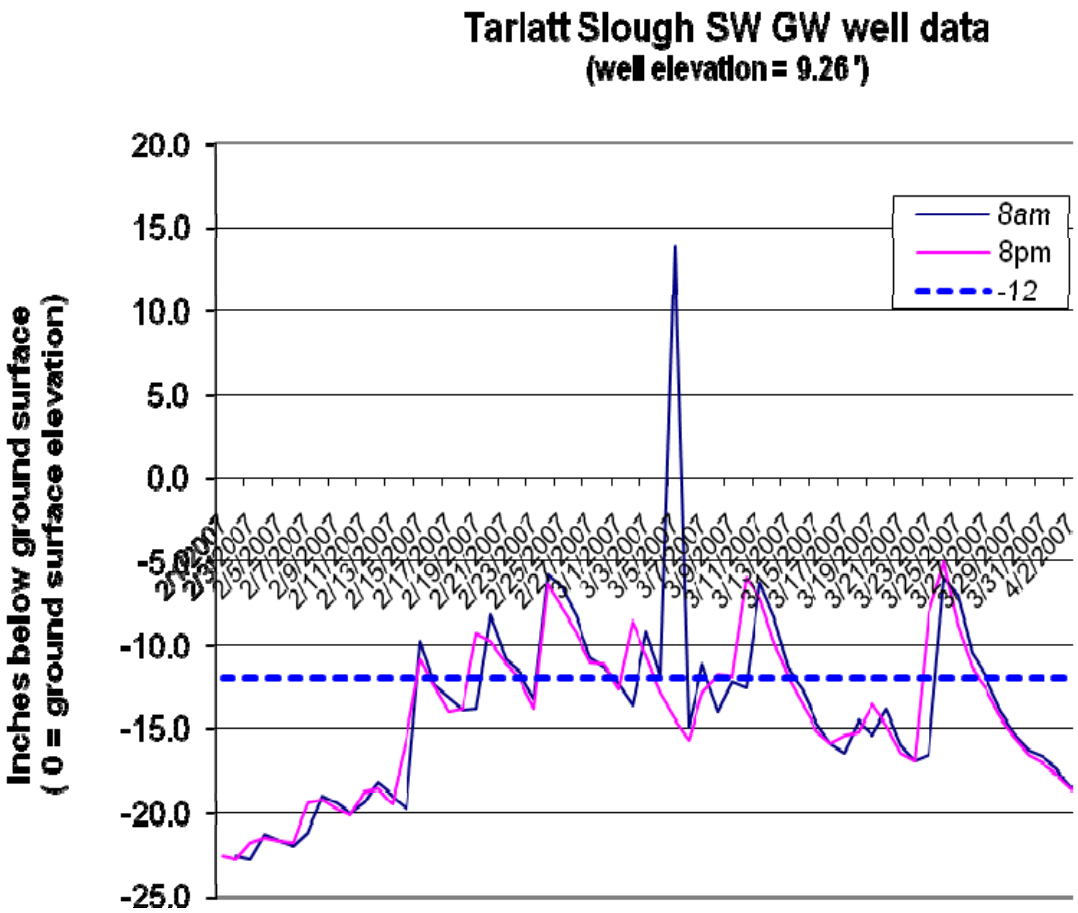


Figure F-3 SW Groundwater Well Data: 2/1/2007 – 4/4/2007

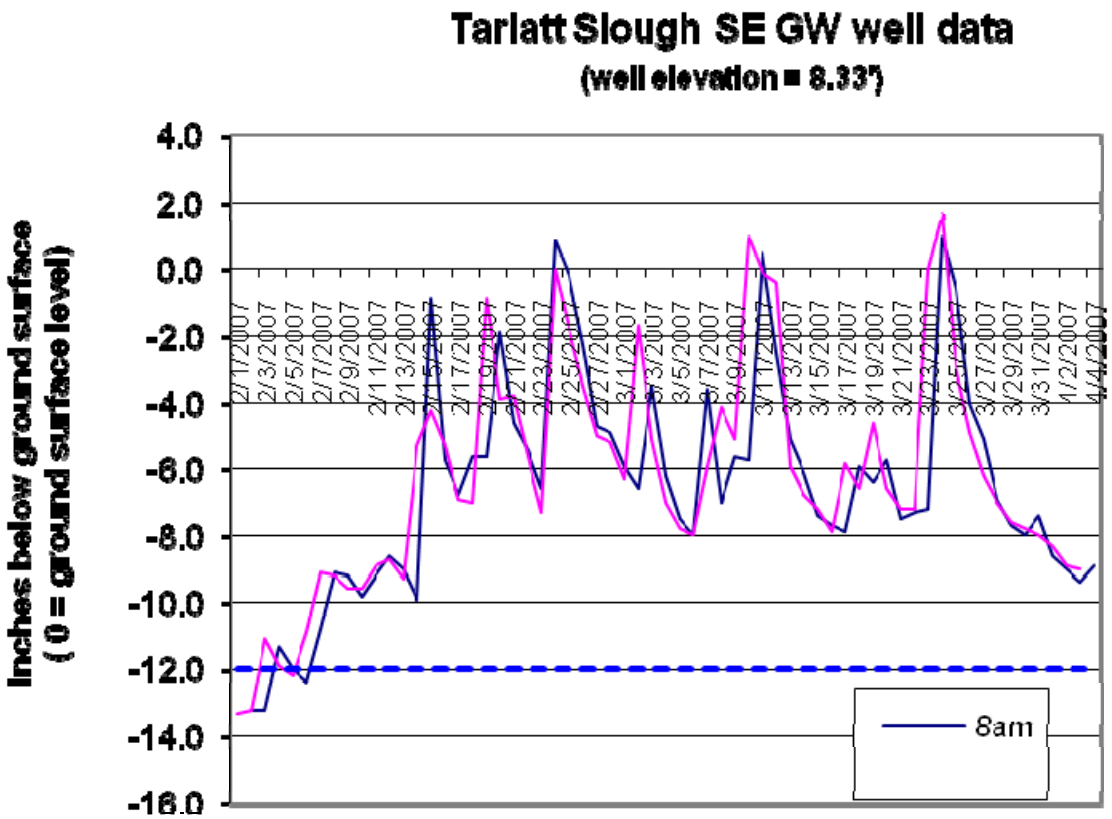


Figure F-4 SE Groundwater Well Data: 2/1/2007 – 4/4/2007