January 2018

ANCHOR QEA

Preliminary Design Report

Meadowdale Beach Park and Estuary Restoration Design

RCO No. 15-1056P

Prepared for Snohomish County Parks and Recreation
For submittal to State of Washington Recreation and Conservation Office

January 2018

Preliminary Design Report

Meadowdale Beach Park and Estuary Restoration Design

RCO No. 15-1056P

Prepared for
Snohomish County Parks and Recreation
6705 Puget Park Drive
Snohomish, Washington 98296

Prepared by
Anchor QEA, LLC
710 Olive Way, Suite 1900
Seattle, Washington 98101

With contributions from:
Hanson Professional Services, Inc. – Railroad Engineering
Shannon & Wilson, Inc. – Geotechnical Engineering

TABLE OF CONTENTS

1 Introduction 1

1.1 Site Description 1

1.2 Project Purpose, Goals, and Objectives 2

2 Existing Conditions 7

2.1 Site History 7

2.1.1 Railroad Embankment History 7

2.1.2 Cultural Resources Assessment 8

2.1.3 Phase 1 Environmental Site Phase 1 11

2.2 Surrounding Land Use 11

2.3 Existing Park Facilities 11

2.4 Existing Railroad and Culvert Features 12

2.4.1 Railroad Embankment 12

2.4.2 The Culvert Feature 12

2.5 Natural Resources 12

2.6 Site Geology 13

2.6.1 Geologic Hazards 14

2.6.2 Topography and Soils 14

2.6.3 Sediment Sources 19

2.7 Water Resources 30

2.7.1 Lund's Gulch Creek 30

2.7.2 Riparian Stream Buffer 37

2.8 Plant Communities 37

2.9 Fish and Wildlife Resources 38

2.10 Description of the Problem 40

2.10.1 Under-Sized Culvert 40

2.10.2 Estuary Impacts 40

2.10.3 Shoreline Armoring 41

2.10.4 Flooding 41

2.10.5 Public Access 42

2.10.6 Maintenance and Permitting Impacts 42

3 Preliminary Design Alternatives 44

3.1 Evaluation Criteria 44

3.2 Development of Alternatives 45

3.2.1 Alternatives Considered But Not Evaluated ... 45
3.2.2 Evaluation of Additional Alternatives ... 46
3.2.3 Alternatives Evaluated ... 47
3.3 Alternatives Comparison and Analysis ... 61
3.3.1 Fisheries and Habitat Evaluation ... 61
3.3.2 Hydraulic, Sediment, Coastal Processes and Sea Level Rise Analysis ... 62
3.3.3 Railroad Infrastructure Evaluation ... 66
3.3.4 Cultural Resources Evaluation ... 67
3.3.5 Phase 1 Environmental ... 68
3.3.6 Costs ... 68
3.3.7 Parks and Recreation, ADA Access, and Public Safety ... 68

4 Preferred Alternative ... 69
4.1 Rationale for Selection of Preferred Alternative ... 70
4.2 Rationale for Not Selecting Alternative Nos. 1 and 2 ... 70

5 Design Considerations and Preliminary Analyses ... 76
5.1 Remove Hard Armored Railroad Embankment Along Shoreline ... 76
5.1.1 Railroad Preliminary Design ... 76
5.1.2 Revisions to Railroad Bridge from Preferred Alternative ... 85
5.1.3 Constructability Analysis ... 85
5.1.4 Finalizing the Preliminary Design ... 87
5.2 Increase Channel Meander Width, Improve Sediment Delivery, and Dissipate Floodwaters ... 87
5.2.1 Increase Channel Meander ... 88
5.2.2 Sediment Delivery ... 88
5.2.3 Floodwater Dissipation ... 89
5.3 Restore Tidal Marsh Pocket Estuary ... 89
5.3.1 Groundwater Conditions ... 90
5.3.2 Subsurface Conditions ... 90
5.3.3 Estuary Area History and Conditions ... 99
5.3.4 Tidal and Freshwater Influences ... 99
5.3.5 Estuary Tidal Marsh Grading and Existing Wetland Avoidance ... 100
5.3.6 Estuary Substrates and Plantings ... 100
5.4 Enhance and Restore Nearshore and Stream Riparian Buffers and In-Stream Habitat ... 112
5.4.1 Wetland Delineation and Ratings ... 112
5.4.2 Stream Assessment and Habitat Restoration Measures ... 113

5.5 Cultural Resources 115
5.6 Park and Recreation Elements 116
5.6.1 Public Safety and ADA-Compliant Beach Access 117
5.6.2 Permitting and Habitat Restoration Considerations for Park Improvements 117
5.6.3 Enhance and Increase Environmental Education Opportunities 118
5.6.4 Utilities 118
5.6.5 Subsurface Conditions 119
5.6.6 Constructability of Park Elements 120

6 Permitting and Stakeholder Consultation 121

7 Preliminary Design Drawings 126

8 Construction Quantities and Preliminary Construction Cost Estimate (Opinion of Probable Construction Cost) 127

9 References 133

FIGURES

Figure 1 Vicinity Map 3
Figure 2 Project Site and Existing Park Features 5
Figure 3 1872 T-Sheet 9
Figure 4 Wetland and Stream Delineation Results 15
Figure 5 Geologic Hazards Existing Conditions 17
Figure 6 Site Reconnaissance Survey 21
Figure 7a Exploration Plan 23
Figure 7b Exploration Plan 25
Figure 7c Exploration Plan 27
Figure 8 Pocket Estuary with Stream Flowing Northward (2015) 35
Figure 9 Stream Cutting More Directly Westward (2016) 36
Figure 10 Photographs of Flooding 41
Figure 11 Plan View of Alternative 1 49
Figure 12 Section View of Proposed Opening for Alternative 1 51
Figure 13 Plan View of Alternative 2 53
Figure 14 Section View of Proposed Opening for Alternative 2 55
Figure 15 Plan View of Alternative 3 57
Figure 16 Section View of Proposed Opening for Alternative 3 59

Figure 17 Plan View of Preferred Alternative ... 71
Figure 18 Section View of Proposed Opening for Preferred Alternative ... 73
Figure 19 Illustrative Plan of Preliminary Design ... 77
Figure 20 Soil Boring Locations ... 83
Figure 21 Groundwater Monitoring Well Locations ... 91
Figure 22 Groundwater Elevations Over Time ... 93
Figure 23 Groundwater Salinity Over Time ... 95
Figure 24 GPR Survey ... 97
Figure 25 Log of Test Pit TP-1 ... 101
Figure 26 Log of Test Pit TP-2 ... 103
Figure 27 Log of Test Pit TP-3 ... 105
Figure 28 Log of Test Pit TP-B ... 107
Figure 29 Log of Test Pit TP-RE-1 ... 109

TABLES

Table 1 Geotechnical Assessment and Sediment Loading ... 31
Table 2 Lund's Gulch Creek Hydrology ... 33
Table 3 Existing Tidal Information at the Site ... 34
Table 4 Plant Communities and Species ... 37
Table 5 Aquatic, Bird, and Wildlife Species ... 40
Table 6 Evaluation Criteria for Conceptual Alternatives ... 44
Table 7 Proposed Alternatives: Railroad Bridge Opening Input Summary ... 62
Table 8 Bridge Layouts for Alternatives 1, 2, and 3 ... 67
Table 9 Cost Summary ... 68
Table 10 Subsurface Conditions ... 81
Table 11 Predicted Water Surface Elevations Just Upstream of Railroad Berm ... 89
Table 12 Backshore Beach Plants ... 100
Table 13 Wetland Plants ... 111
Table 14 Summary of Wetland Classes and Ratings Using Ecology 2014 Wetlands Rating Systems ... 112
Table 15 Riparian Plants ... 114
Table 16 Subsurface Conditions ... 120
Table 17 Anticipated Environmental Approvals and Permits ... 123
Table 18 Preliminary Design Cost Summary ... 127
Table 19 Detailed Construction Quantities and Opinion of Probable Construction Cost ... 129

APPENDICES

Appendix A-1	Preliminary Design Drawings: Habitat Restoration and Park Element
Appendix A-2	Preliminary Design Drawings: Railroad Bridge
Appendix B	Phase 1 Environmental Site Assessment
Appendix C	Memorandum: Eelgrass Survey of Meadowdale Beach Park
Appendix D	Wetland, Stream, and Marine Delineation
Appendix E	Memorandum: Geologically Hazardous Areas
Appendix F-1	Draft Geotechnical Report (June 6, 2017)
Appendix F-2	Geotechnical Evaluation: Test Pit Excavation Photos
Appendix G	Type Selection Report
Appendix H	Memorandum: Hydraulic Model Update
Appendix I	Lund's Gulch Creek Fish Habitat Assessment
Appendix J-1	Meeting Minutes and Materials: Community Public Meeting
Appendix J-2	Meeting Minutes and Materials: Organization/Agency Stakeholder Meeting
Appendix J-3	Meeting Minutes and Materials: Regulatory Agency and Tribal Staff Meeting
Appendix J-4	Meeting Minutes and Materials: BNSF Meeting

ABBREVIATIONS

ADA	Americans with Disabilities Act
APE	Area of Potential Effect
cfs	cubic feet per second
cy	cubic yards
DAHP	Washington Department of Archaeology and Historic Preservation
EA	each
ECDC	Edmonds Community Development Code
Ecology	Washington State Department of Ecology
ESA	Endangered Species Act
GHA	geologically hazardous area
GPR	ground-penetrating radar
H:V	horizontal to vertical
HPA	Hydraulic Project Approval
ICF	ICF International, Inc.
in/yr	inch per year
lf	linear feet
LiDAR	Light Detection and Ranging
LS	lump sum
MHHW	mean higher high water
MLLW	mean lower low water
MW	monitoring well
N/A	not applicable
NAVD88	North American Vertical Datum 1988
NMFS	National Marine Fisheries Service
OHWM	ordinary high water mark
PDS	Planning and Development Services
ppt	parts per thousand
SCC	Snohomish County Code
SEPA	State Environmental Policy Act
sf	square feet
Site	project site
SRFB	Salmon Funding and Recovery Board
TF	track feet
TKDA	Toltz, King, Duvall, Anderson, and Associates, Inc.
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resource Inventory Area

1 Introduction

This Preliminary Design Report is prepared for the Salmon Funding and Recovery Board (SRFB) in accordance with the Recreation and Conservation Office (RCO) project agreement No. 15-1056P for Preliminary Design of a major estuary restoration and park redevelopment project proposed by Snohomish County (County). The County initiated the project at Meadowdale Beach Park to address deficiencies resulting from a hard armored railroad embankment with an undersized culvert, which affects habitat, sediment transport, park user experience, and public safety. To address these deficiencies, the project's restoration design includes removing a portion of the embankment and the culvert and replacing it with a five-span railroad bridge, excavating fill material to restore a tidal-marsh pocket estuary, and enhancing nearshore and stream riparian buffers. While the project is focused on Endangered Species Act (ESA)-listed juvenile chinook, it would benefit multiple species.

1.1 Site Description

Meadowdale Beach County Park, located on the northern end of Brown's Bay (Figure 1) on Puget Sound, is owned by the County under custodianship of the County's Parks and Recreation department. The park consists of multiple parcels totaling 108 acres, and extends from the rim of Lund's Gulch, a deeply incised forested ravine down to the tidelands. The railroad embankment located within a 100-foot-wide railroad right-of-way parallels the shoreline and separates the tidelands from the park's lawn area at the bottom of the ravine. The address for the project is 15433 75th Place West, Edmonds, Washington. The project site (Site) encompasses approximately 10 acres of lower Lund's Gulch Creek, the lawn area, and tideland area (Figure 2). The majority of the park, including the tidelands, is located within unincorporated Snohomish County, but the most southwest parcel landward (east) of the railroad, totaling approximately 23 acres, is located entirely within the City of Edmonds.

The park is centered around Lund's Gulch Creek, a salmon-bearing perennial stream, located on the floor of the gulch. The creek drains to Puget Sound through a 6 foot-wide box culvert under BNSF Railway tracks. The lower creek and estuarine delta are habitat for multiple salmonid species, including juvenile Chinook salmon, which are listed as threatened under ESA, as well as coho and chum salmon, and cutthroat trout.

The County entered into an agreement in 1988 with BNSF for shared use of the culvert for the purpose of providing public beach access as a condition of the Washington State Interagency Committee for Outdoor Recreation, now RCO acquisition funding. To facilitate access, a boardwalk (first wooden, then recently replaced with steel grating) was installed above the approximately 2-foot-deep by 4-foot-wide channel within the 50-foot-long culvert. The culvert is significantly undersized for the creek, and during high flow conditions a wide portion of the lower park is flooded. High-flow events also commonly cause the deposition of sediment at the upstream end of the box culvert. This material restricts the movement of fish into and out of the creek. The sediment also

deposits on adjacent park recreational areas. In addition, the trapping of sediment in these areas degrades an important nearshore habitat-forming process.

1.2 Project Purpose, Goals, and Objectives

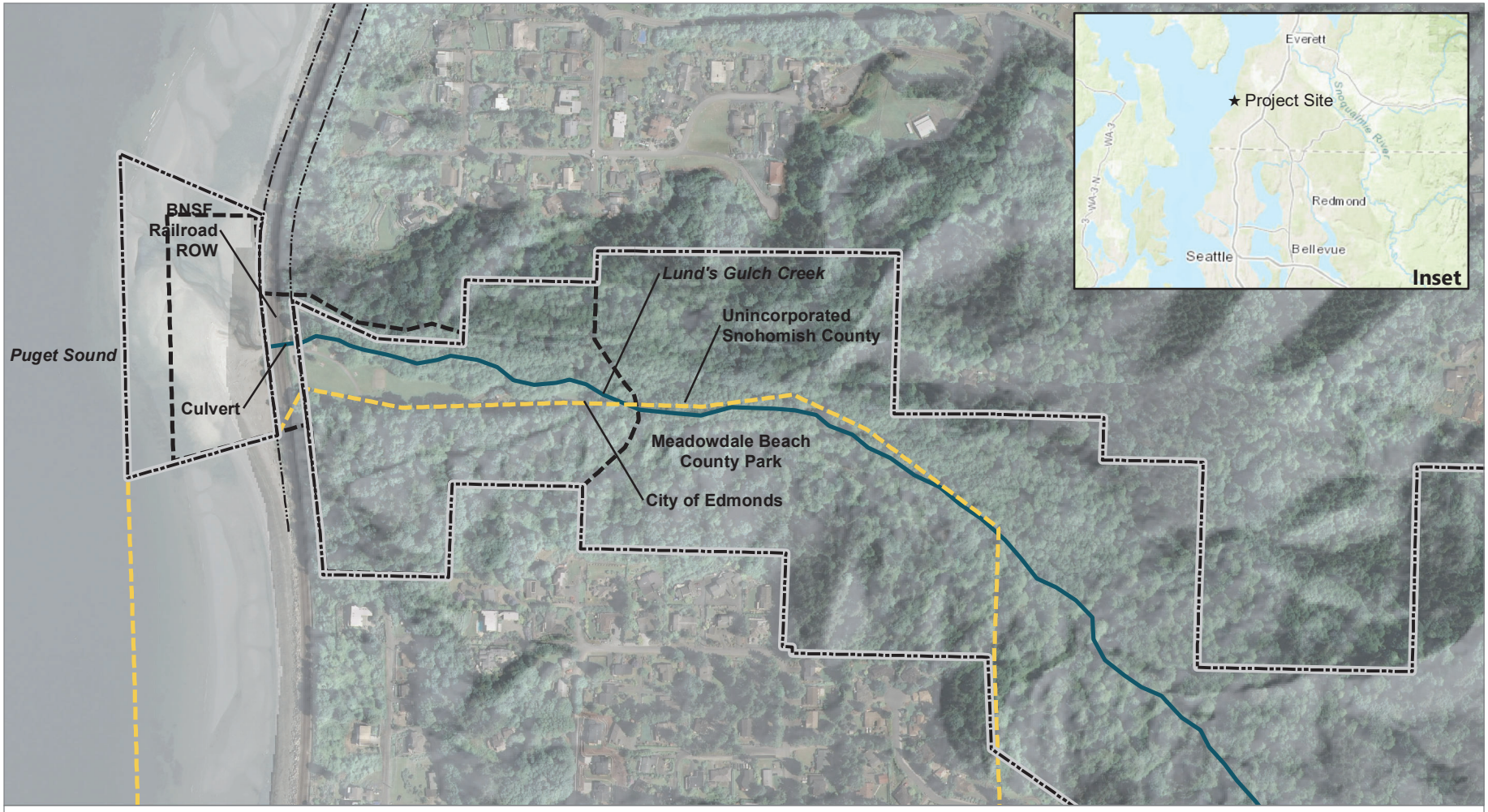
The overarching ecological goal of the project is to restore the estuary of Lund's Gulch Creek, including natural sediment and hydrologic processes in order to provide high-functioning, sustainable rearing habitat for non-natal juvenile Chinook (threatened), coho, and chum salmon; cutthroat trout; and other fish species within the park setting. Given the park setting and presence of a high-volume railroad line through the project, a complementary goal of the project is to provide the ecological restoration improvements such that compatible recreational uses, in particular improved access to the beach for park users, are also provided.

Specific project objectives outlined in the grant application and developed in the feasibility study/alternatives analysis to achieve the goals included the following:

- Remove approximately 130 linear feet (lf) of hard armored railroad embankment and the undersized (6-foot-wide) culvert
- Install a multi-span bridge with a 90-foot opening to dissipate flood waters, restore natural sediment transport processes, and allow the creek to meander dynamically over time, creating essential habitat
- Create approximately 1 acre of tidal estuary habitat
- Restore approximately 1 acre of nearshore and stream riparian buffers along shoreline and stream using native trees and shrubs
- Restore in-stream habitat conditions by placing large woody debris in the lower creek and restored estuary
- Address public safety (railroad crossing) and beach access issues associated with the undersized culvert, sediment, and flooding
- Provide Americans with Disabilities Act (ADA)-compliant and year-round access to the beach
- Enhance park user experience through provision of diverse natural habitats
- Enhance environmental education opportunities, including providing interpretive signage

This report describes the steps taken and technical decisions made during the preliminary design process to meet the stated objectives, and it describes and explains any modifications. The following elements are addressed herein:

- Existing and Historical Conditions
- Preliminary Design Alternatives
- Preferred Alternative
- Design Considerations and Preliminary Analysis
- Permitting and Stakeholder Consultation
- Preliminary Design Drawings
- Construction Quantities and Preliminary Construction Cost Estimate
- Appendices



LEGEND:

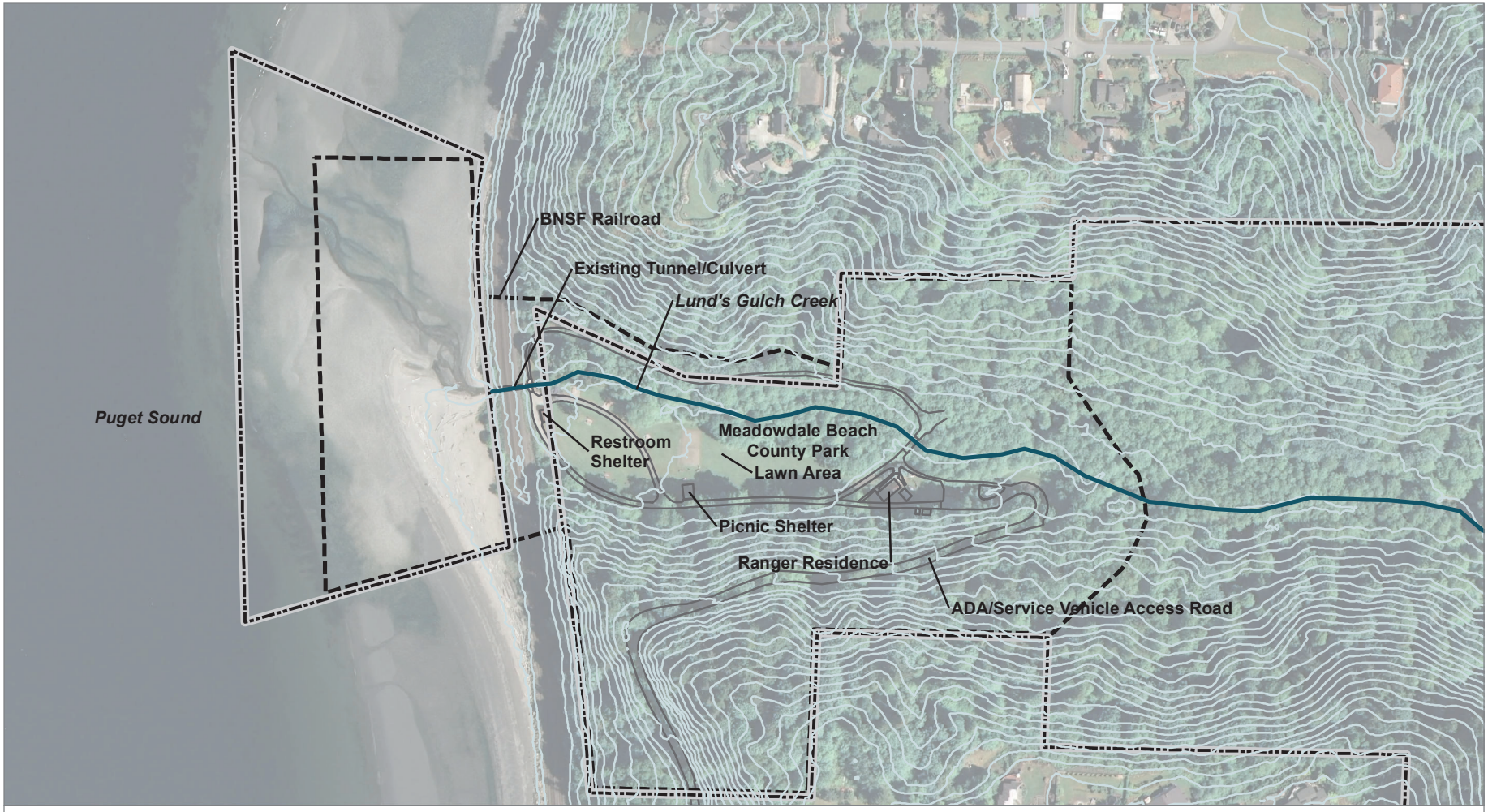
- Lund's Gulch Creek
- Park Boundary
- City/County Boundary
- Railroad Right-of-Way (ROW)
- Project Site

0 300
Feet

Publish Date: 2018/01/10, 4:19 PM | User: bsevertsen
Filepath: Q:\Jobs\SnohomishCounty_0723\MeadowdaleBeachPark\Maps\2017_12\Preliminary_Design_Report\Figure1_VicinityMap.mxd

ANCHOR QEA

Figure 1
Vicinity Map
Preliminary Design Report
Meadowdale Beach Park Recreation and Habitat Improvements Project



LEGEND:

- Lund's Gulch Creek
- Topographic Contour (10' Interval)
- Park Boundary
- Project Site

0 300
Feet

Publish Date: 2017/12/28, 4:49 PM | User: bsevertsen
Filepath: Q:\Jobs\SnohomishCounty_0723\MeadowdaleBeachPark\Maps\2017_12\Preliminary_Design_Report\Figure2_ExistingFeatures.mxd

ANCHOR QEA

Figure 2
Project Site and Existing Park Features
Preliminary Design Report
Meadowdale Beach Park Recreation and Habitat Improvements Project

2 Existing Conditions

This section discusses site conditions relevant to the project design, including site history, cultural resources, surrounding land use, existing facilities, railroad and culvert features, natural resources; and a detailed description of the existing problem to be addressed by this project. The existing site features are illustrated in Figure 2, and the topographic and boundary survey is included in the preliminary design drawings (Appendix A).

2.1 Site History

The project site once housed a natural saltmarsh, seen in the 1872 T-sheet (Figure 3), and was later homesteaded by John Lund in 1878 (Bruce Dees 1986; Snohomish County 2015); the railroad was constructed in the late 1800s. Lund's Gulch saw many subsequent landowners, was logged, and a fish hatchery was constructed at one point.

The property was eventually acquired by the Meadowdale Country Club in the early 1960s, and the lower portion of the site was intensively developed, including a club house, bath house, well, sports courts, lawn areas, and a pool. After repeated landslides, which damaged the access road, as well as other factors, the club closed in the mid-1960s, according to the 1969 property appraisal.

In 1971, Snohomish County Parks acquired the land with bond and grant funds for the purpose of developing a public park with beach access. The buildings, which had been badly vandalized, were demolished and removed, along with the remains of the clubhouse, which had been destroyed by fire. The public was allowed to drive into the park on the access road until its condition degraded due to unstable soils. The park was closed to the public in 1979, after which a wide range of unsanctioned activities occurred, including firearms use, motorcycle riding, and large parties (Bruce Dees 1986; Snohomish County 2015).

Planning and development of the park in its current configuration began in 1986, with the purpose of providing a passive recreation facility while preserving the site's natural resources and restoring a severely down-cut stream channel upstream of the current project area. The public process associated with the 1986 design process strongly supported the current hike-in only access for the public, supplemented by an ADA- and Ranger-only access road to the lower park area (Site). As part of the construction, the foundation remnants and other miscellaneous concrete were buried on site and the pool area was filled in.

2.1.1 Railroad Embankment History

The railway embankment was originally constructed in approximately 1891 by the Great Northern Railway (a predecessor of BNSF Railway) as a single-track alignment; the embankment was expanded to accommodate a second track starting in 1907 (Intlekofer 1989). Additional historical construction

documents provided by the Great Northern Railway Historical Society indicate that the second main line through the project area had been completed in 1907 and was constructed as a "slope wall," whereas segments north and south of the project area were constructed as "sea wall." A historical cross-section depicting sea wall construction includes large-diameter "face rock" along the outboard edge of the second main line for wave protection, and a timber bulkhead along the outboard edge of the original single track embankment (Intlekofer 1989), presumably for the same purpose, and presumably buried in-place.

No records were found in historical documents of the original embankment composition or of a trestle at the site, although trestles were commonly constructed for stream crossings during original railroad construction. Based on the historical documents, the railroad embankment does not appear to contain buried seawall structure (boulder-sized rock) or timber trestle.

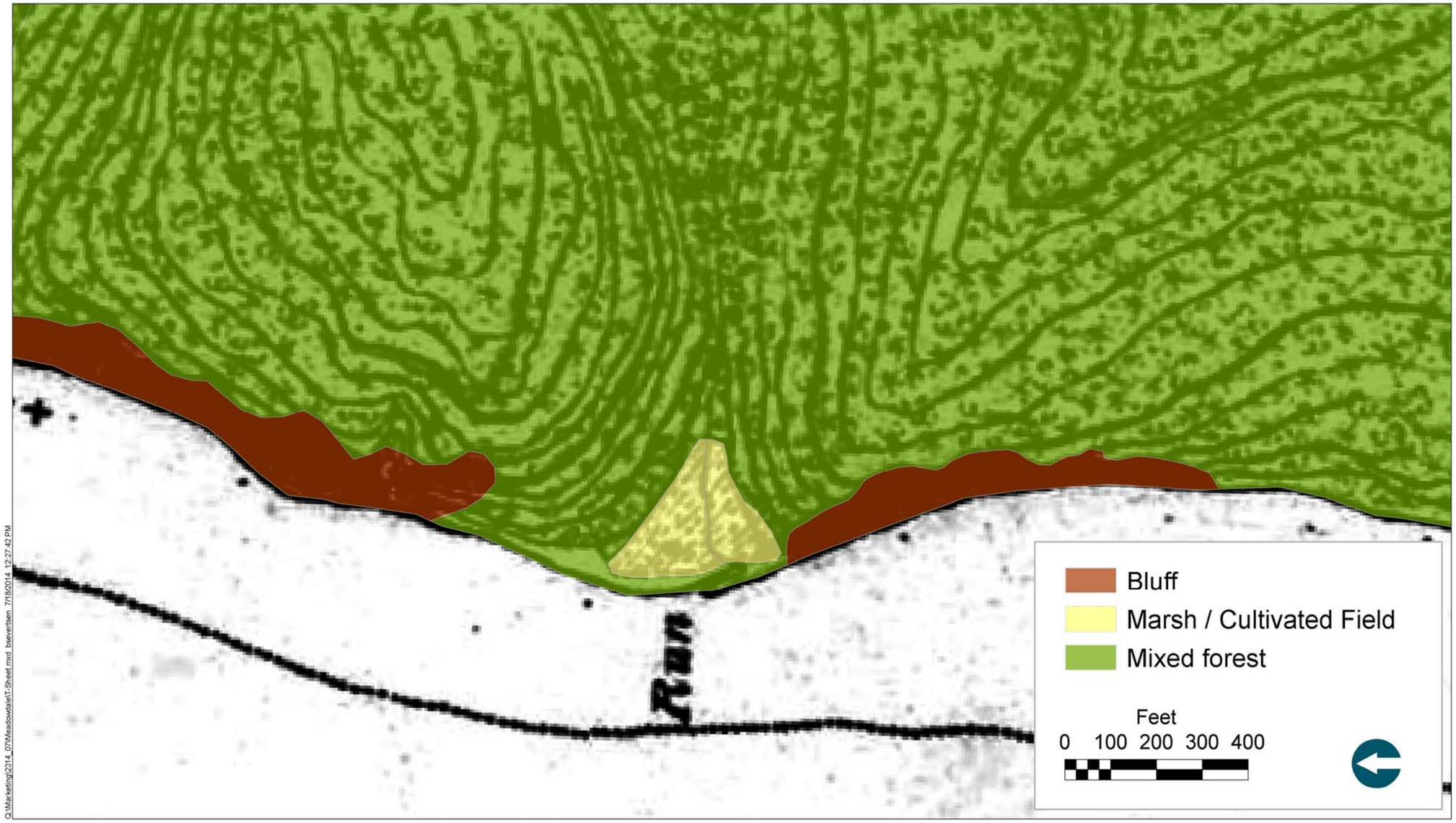
2.1.2 Cultural Resources Assessment

This section provides cultural resources information obtained prior to the design phase. Additional detail from the cultural resources study is provided in Section 5.5.

The park is located in a historically utilized and protected valley drained by Lund's Gulch Creek, with potential for both precontact- and historic-period archaeological deposits. The existing BNSF grade that is in the Area of Potential Effect (APE) was originally constructed in the late 19th century; during the 1940s, the current concrete culvert was constructed. There is one previously recorded shell midden site south of the project APE, which would not be impacted by the project but indicates the sensitivity of shorelines in this area for containing precontact midden deposits.

A number of historical activities have occurred at the park that could potentially contain archaeological deposits, including the early construction of the BNSF railroad, homesteading by the Lund family, and the Meadowdale Country Club. These historical activities may have disturbed any precontact or previous historic archaeological materials, but portions of earlier deposits can remain intact even in disturbed areas. Where Holocene sediments are present anywhere in the park, outside the limits of recent disturbance, archaeological potential should be considered moderate to high.

An Archaeological Screening Findings was prepared in 2013 for a culvert maintenance project; this was very site-specific to the actual maintenance action. The memo indicated there were no recorded sites relative to the location where maintenance would occur. This determination was based on contact with the Washington Department of Archaeology and Historic Preservation (DAHP). The literature review to assess the potential for cultural resources (archaeological, historical, and tribal sites) concluded that there were no recorded archaeological sites in the park, no cultural resource surveys were performed, nor historic structures or tribal traditional cultural properties recorded at the park; however, the tunnel may be older than 50 years, requiring further evaluation.



Filepath: I:\Projects\Snohomish County\Meadowdale Beach Park\Park and Habitat Design\Task 5.2 60% Design\Prelim Design Rpt\Figures\Figure3_1872_T-Sheet.docx

ANCHOR QEA

Figure 3
1872 T-Sheet
Preliminary Design Report
Meadowdale Beach Park and Estuary Restoration Design Project

2.1.3 Phase 1 Environmental Site Phase 1

A Phase 1 Environmental Site Assessment for the project area was conducted prior to the design phase (see Appendix B). The assessment revealed the presence of one Recognized Environmental Condition on the subject property: potential contaminants associated with the presence of railroad tracks on the subject property. This assessment revealed no Controlled Recognized Environmental Conditions in connection with the subject property and no Historical Recognized Environmental Conditions in connection with the subject property.

2.2 Surrounding Land Use

The park site is surrounded by single-family residential land uses, with zoned lots ranging from 12,000 to 20,000 square feet (sf). Upstream of the site, the City of Lynnwood has preserved upland forested property. Recently, through a Conservation Futures grant, Lynnwood acquired an additional 13 acres abutting the park, resulting in nearly 90 acres of conserved land adjacent to the park.

2.3 Existing Park Facilities

Meadowdale Beach Park is one of only three County-owned and operated parks that provides public beach access to Puget Sound. The park's natural forests, trail system, creek, and waterfront access are the main attractions and are popular with 50,000 to 70,000 annual visitors. Residents throughout the County, other nearby communities, and some from out of state utilize the park for daily exercise routines, walking, picnicking, beach-combing and bird and wildlife-watching. The park is used extensively for environmental education by local schools, Boy and Girl Scouts, and Edmonds Community College (Dailer 2015). The park is also an official Washington Water Trails campsite, providing beach camping to people using a non-motorized watercraft.

The park's main access for the public is a parking lot located off of 156th Street SW. Amenities in this upper portion of the park include a small playground, portable toilets, trailhead, and 30 parking stalls. A 1.25-mile earthen trail begins at the upper parking lot and follows Lund's Gulch Creek, terminating at a partially paved loop path in the lower ravine lawn area. This loop trail connects to the culvert, providing beach access under the BNSF railroad.

Additional facilities in the lower park include a sand volleyball court, picnic shelter, five uncovered picnic tables on concrete pads, a lawn area, pedestrian bridge, ADA-compliant parking, portable toilets, and a ranger residence.

2.4 Existing Railroad and Culvert Features

2.4.1 Railroad Embankment

The existing earthen railroad embankment parallels the beach, separating the County tidelands from the park lawn. The embankment is heavily armored with riprap and boulder-sized rock and is approximately 30 feet wide at the top and 60 feet wide at the base, with top of embankment approximately 8 feet above the adjacent foot-path. The embankment lies within the 100-foot BNSF-owned right-of-way. The embankment supports two tracks: Main 1 track (west track) and Main 2 track (east track). The corridor, a segment of the BNSF Scenic Subdivision (Line Segment 50, Milepost 21.8; Seattle to Wenatchee, Washington), has a high daily volume of freight, passenger, and commuter railroad traffic, which will likely increase over time. This line also serves Amtrak and Sound Transit passenger trains. Approximate daily train traffic through this location is summarized as follows:

- Amtrak: Six northbound and seven southbound trains (13 total)
- Sounder: Four northbound and four southbound trains (8 total)
- Freight: Forty trains going either direction (40 total)

2.4.2 The Culvert Feature

The existing concrete box culvert is located at the beginning of an approximately 4.5-degree curve in the railroad line. The culvert opening is 6 feet high by 6 feet wide and has an upstream invert elevation of 9.59 feet and a downstream invert elevation of 9.07 feet North American Vertical Datum of 1988 (NAVD88). The culvert must accommodate creek flows, sediment, and fish passage, and it provides the only public beach access. Year-round creek backwatering, high winter tides and stream flows, and sand and gravel deposition frequently render the culvert inaccessible. In addition, walkway grates are removed when sediments accumulate at the entrance, to facilitate fish passage. Without the grates installed, there is no suitable walking surface within the culvert for pedestrian beach access. Park users either traverse the creek bed (sometimes in knee-high water) or seek alternate routes to the beach, such as crossing the tracks, despite railroad right-of-way fencing and signs indicating the hazard and prohibiting trespassing.

2.5 Natural Resources

The project is located in the Cedar-Sammamish Basin Water Resource Inventory Area (WRIA) 8 (Ecology 2016). Hydrologic characteristics in the project area are influenced by regional groundwater, direct precipitation, surface water runoff, Lund's Gulch Creek, and Puget Sound. Vegetation within the project area includes a variety of native, non-native, and ornamental trees, shrub, grass, and herbaceous species associated with upland, wetland, and riparian habitat. The marine environment also includes patches of native eelgrass (*Zostera marina*), described in Appendix C. The stream,

marine shoreline, and eight wetlands have been delineated on the site (Figure 4 and Appendix D), and groundwater monitoring indicates a high water table with low salinity readings. Further detail on these surveys and monitoring is provided in Section 5.4.

2.6 Site Geology

The general consensus in published geologic literature is that the Puget Sound region was subjected to six or more glaciations. Each glaciation deposited new sediment and partially eroded previous sediments. During the intervening periods when glacial ice was not present, normal stream processes, wave action, weathering, and landsliding eroded and reworked some of the glacially derived sediment, further complicating the geologic setting.

Lund's Gulch was initially carved by glacial meltwater after ice from the most recent glaciation retreated and the land was uncovered (Applied Geotechnology 1986). Lund's Gulch Creek incises through glacial and non-glacial soils from uplands of greater than 300 feet elevation as it flows to Puget Sound. The upper mile of Lund's Gulch is deeply incised with several smaller gullies, drainages, and seeps flowing into the creek channel. A tributary from the north joins Lund's Gulch Creek within the park.

Based on geologic maps of the area (Washington State Department of Natural Resources 2011; Minard 1982; Smith 1976), and on conditions observed during project subsurface explorations, the stratigraphy of Lund's Gulch has been interpreted to consist of the following geologic units:

- **Holocene Fill, Hf:** Loose to medium dense, or soft to stiff, imported soil and manmade materials or otherwise modified land.
- **Holocene Alluvium/Colluvium, Ha/Hc:** Loose to dense, intermixed fluvial sediments and landslide deposits.
- **Quaternary Vashon Recessional Outwash, Qvro:** Medium dense, glacial fluvial sediments deposited during recession or ablation of the last ice sheet.
- **Quaternary Vashon Till, Qvt:** Very dense diamicts
- **Quaternary Vashon Advanced Outwash / Quaternary Vashon Esperance Sand, Qva/Qe:** Very dense, glacial fluvial, advance outwash.
- **Quaternary Whidbey Formation / Quaternary Pre-Vashon Fluvial Deposits, Qw/Qpnf:** Very dense, non-glacial, fluvial, generally poorly graded fine to medium sand with fine gravel interbedded with silt and clay.
- **Quaternary Double Bluff Drift / Quaternary Pre-Vashon Glacial Till, Qdb/Qpgt:** Very dense, stratified glacial sediments, consisting of till, outwash, and glaciolacustrine deposits.

2.6.1 Geologic Hazards

Both the Snohomish County Code (SCC) and Edmonds Community Development Code (ECDC) define Geologically Hazardous Areas (GHAs), and the subcategory of Landslide Hazard Areas, and specify classification criteria and mitigation requirements for development within classified areas. The project area was evaluated during the design phase via an analysis of Light Detection and Ranging (LiDAR) data, site reconnaissance, and analysis of the information and site classifications based on regulatory geologic hazard definitions. Most of the site is defined as a Landslide Hazard Area (SCC 30.91L.040; ECDC 23.80), which defines GHAs as areas having the following elements:

- Slopes taller than 10 feet
- Areas of historical and active landslides
- Areas with slopes steeper than 33% (SCC) or 40% (ECDC)
- Slopes that intersect geologic contacts between relatively permeable sediment overlying relatively impermeable sediment
- Slopes that contain springs and groundwater seeps

The park and stream areas further qualify as GHA because of the following:

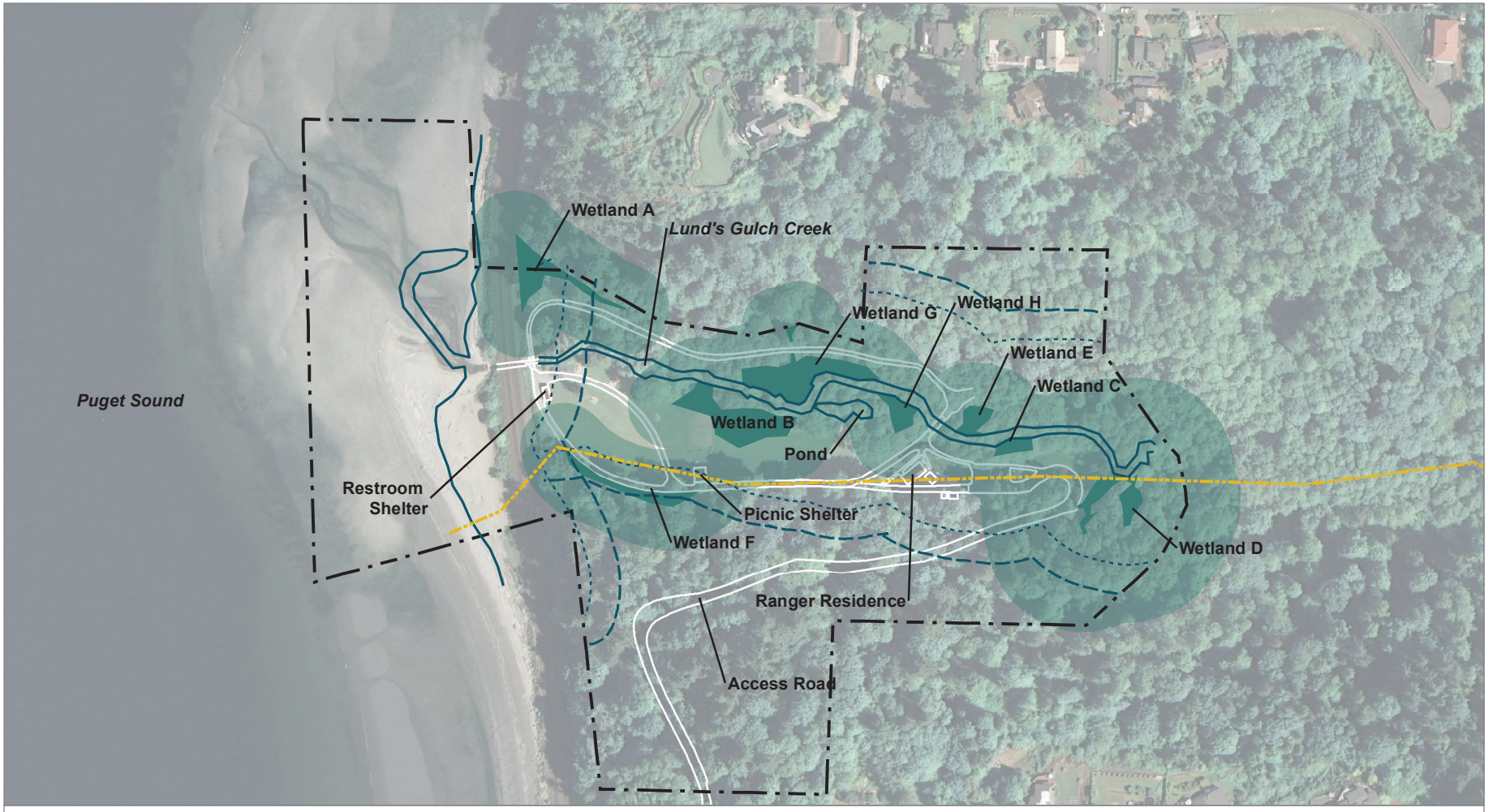
- They are in a canyon and an active alluvial fan, susceptible to inundation by debris flows or catastrophic flooding
- They are entirely encompassed within the boundaries, defined as twice the height of the steep slope, measured from the toe of slope

The GHA map is included as Figure 5 Further detail regarding the geologic hazards on the site is provided in a Draft Geologic Hazard Area Memo (Appendix E).

2.6.2 Topography and Soils

Topographic relief within the park is approximately 450 feet between the access road entrance (terminus of 162nd Place SW) and the Puget Sound shoreline. Slope angles vary throughout Lund's Gulch, with localized areas of near-vertical bluffs and nearly horizontal creek banks. The majority of the slopes along the north and south valley walls are 3 Horizontal to 1 Vertical (3H:1V) or steeper; however, the valley bottom near the creek is relatively flat.

Subsurface conditions based on geologic mapping by Minard (1982), previous studies by others, and subsurface explorations revealed the following geologic units and subsurface conditions:



LEGEND:

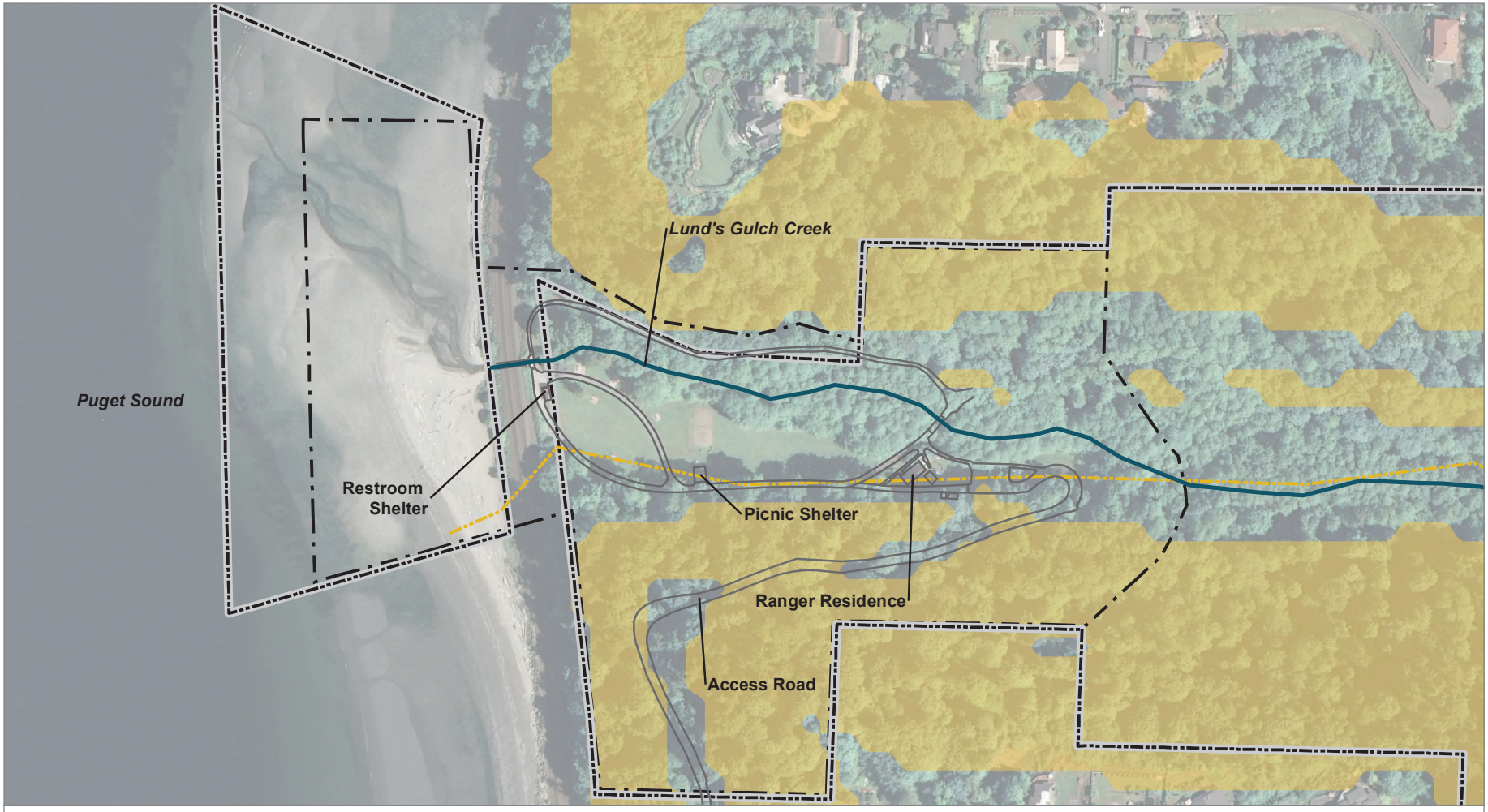
- OHWM
- OHWM Buffer
- Shoreline Zone
- Wetland
- Wetland Buffer
- Project Site
- Edmonds City Limits

0 300
Feet

Publish Date: 2017/12/26, 4:36 PM | User: bsevertsen
Filepath: Q:\Jobs\SnohomishCounty_0723\MeadowdaleBeachPark\Maps\2017_12\Preliminary_Design_Report\Figure3_wetland-stream.mxd

ANCHOR QEA

Figure 4
Wetland and Stream Delineation Results
Preliminary Design Report
Meadowdale Beach Park Recreation and Habitat Improvements Project



LEGEND:

- Slope > 33%
- Lund's Gulch Creek
- Project Site
- Edmonds City Limits

0 300
Feet

Publish Date: 2017/12/26, 4:45 PM | User: bsevertsen
Filepath: Q:\Jobs\SnohomishCounty_0723\MeadowdaleBeachPark\Maps\2017_12\Preliminary_Design_Report\FigureX_GeoHazard.mxd

ANCHOR QEA

Figure 5
Geologic Hazards Existing Conditions
Preliminary Design Report
Meadowdale Beach Park Recreation and Habitat Improvements Project

- **Fill (Hf):** Fill represents imported soil and other materials or otherwise modified land. This fill is similar to the native material, but less dense and likely associated with road and shoulder fill. Within select areas the fill consists of loose to medium dense silt; silty sand; and sand with gravel, organics, wood, and glass refuse in the upper 4.5 feet. Other areas included gravel to silty gravel with sand and cobbles in fill to about 6 feet deep.
- **Alluvium/Colluvium (Ha/Hc):** Alluvium and Colluvium is composed of sand and gravel with silt and clay pockets. These units are typically designated together and reflect a complex depositional environment – sediments deposited by landslides of the valley walls (colluvium) were intermixed with alluvium and reworked by streams in the valley bottom.
- **Whidbey Formation (Qpnf and Qpnl):** The Whidbey Formation represents sediment deposited on the land surface between glacial periods. These sediments were overridden by at least glacial advances and consolidated to a very dense or hard state. The Qpnf component of the Whidbey Formation represents sediments deposited in a fluvial environment and generally consists of very dense, fine silty sand with a few silt interbeds. Qpnf also contains trace gravel, silt and sand seams, and organics and fines are nonplastic to low plasticity. The Qpnl component of the Whidbey Formation represents sediments deposited in a lake environment. Qpnl consists of hard silt to sandy silt, with sand laminations. Fines in Qpnl have low plasticity or are nonplastic.

2.6.3 Sediment Sources

2.6.3.1 Sediment Sources and Delivery Evaluation

Shannon & Wilson geologists performed a site reconnaissance in December 2014. Topographic field maps with 10-foot contours and hillshade images generated from LiDAR (2005) were assessed prior to the field visit, to look for landscape-scale features that were potential sources of sediment to the creek. Landscape-scale features from the field maps included areas with bowl and arcuate shapes or headscarps, slumped and hummocky landscapes, and debris fans and colluvium mounds.

On December 4, 2014, geologists met with resident Park Ranger Doug Dailer, who has lived on site since 1992, and described site historical landslide occurrences, as included in the discussion below. This visit was followed by a 2-day field reconnaissance, walking the length of Lund's Gulch, and identifying, characterizing, and quantifying sediment sources and delivery mechanisms. In the field, geologists walked the length of Lund's Gulch from the mouth near the coastline of the Puget Sound to the upper reaches, just east of where 56th Avenue West would intersect with Lund's Gulch (Figure 6). At this projected intersection: 1) the creek valley becomes less incised, with a broader bottom; 2) slopes are more gently inclined; 3) mature, straight conifers dominate the forested landscape; and 4) sediment input contributing to the sediment load of the creek is relatively low, compared to the creek system as a whole.

Each location visited in the field was given an identification number (Location ID), plotted as points on field maps, recorded on a Global Positioning System, and photographed. Notes were recorded for each location and included the following:

- **Sediment Delivery Source:** Visual assessment of whether or not sediment appeared to be delivered to Lund's Gulch Creek.
- **Sediment Delivery Mechanism:** Categorization of event-driven or incremental input and sediment delivery type.
- **Estimated dimensions and/or volumes of sediment delivery and rate** (if incremental).

The Site and Exploration Plans (Figures 7a through 7c) show all of the locations visited at the site. Table 1 of Appendix F-1 lists notes recorded for only the locations that appeared to be contributing sediment to Lund's Gulch Creek.

2.6.3.2 Sediment Loading Evaluation

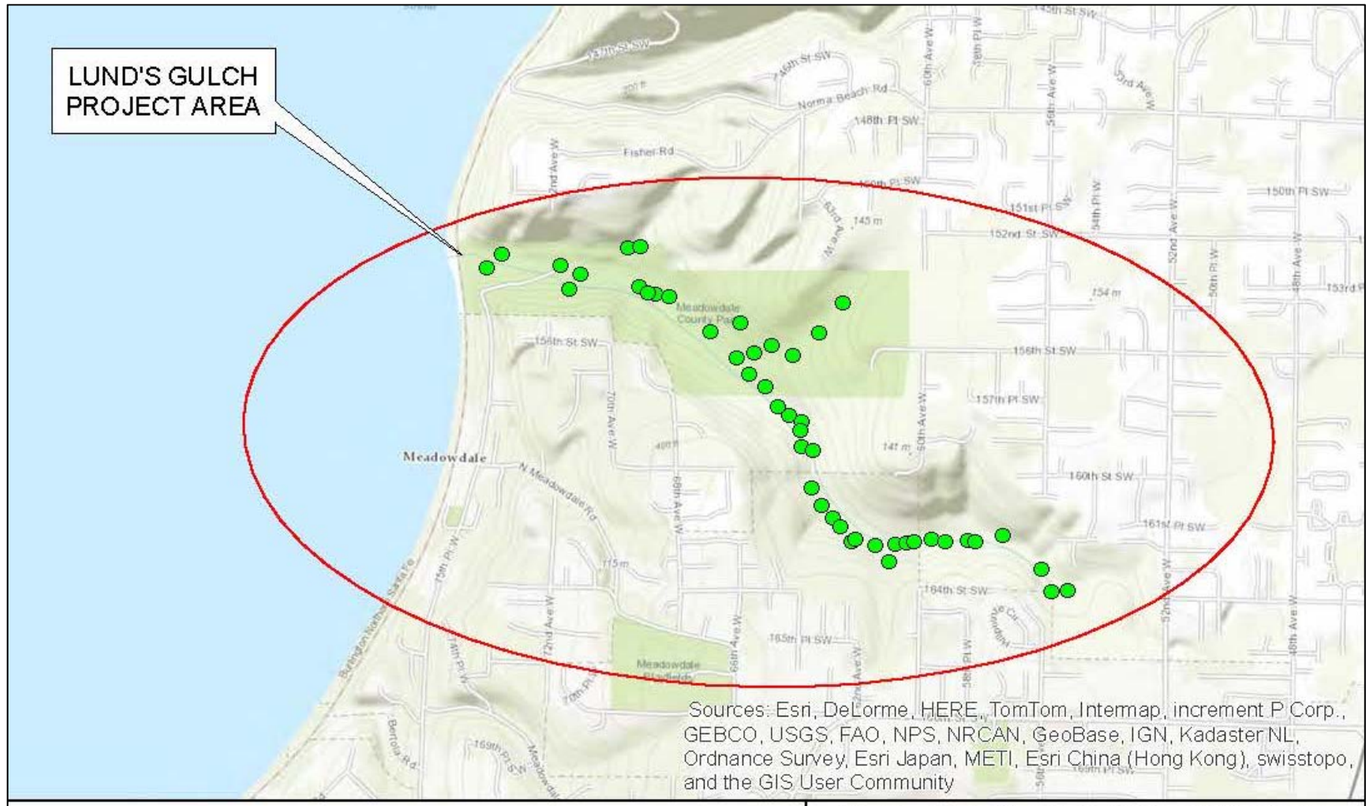
Sediment loading in a creek system takes into account the sediment delivery and the sediment storage. The goal for this project was to evaluate the locations and characteristics of sediment sources and processes that contribute sediment to the creek but does not evaluate the sediment transport within the creek.

The topography and stratigraphy of Lund's Gulch make it prone to sediment input into the creek and out to the delta. Steep-sided banks in the upper two-thirds of Lund's Gulch provide opportunity for entrainment of sediment by creep movement of landslide deposits from the valley walls and by high-water/high-flow erosion of the exposed creek banks. Additionally, discrete landslides of various sizes periodically directly deliver masses of sediment and debris.

2.6.3.3 Sediment Delivery Source

Some locations explored during the field reconnaissance did not appear to have contributed sediment to Lund's Gulch Creek. Once on site, some of the landscape-scale features identified during the desk study appeared to be inactive. For other locations, it appeared that a landslide had occurred, but the debris runout had not reached as far as the creek and contributed to the creek's sediment load. Some parts of these older landslide deposits could re-mobilize and eventually reach the creek, but they have not been taken into account.

Sediment source activity (or relative activity) is also an important area of note. Our approximate record of sediment sources and contribution includes a 17-year history of known landslides dating back to 1996, vegetation characteristics of slowly moving colluvial slopes, and bare earth or scarps in proximity to the creek.



Note: The points represent all of the locations visited in Meadowdale Beach Park and Lund's Gulch and show the extent of the area covered during the geologic reconnaissance in December 2014. See Figure 2 for more detail.

N
W E
S

0 ½ 1
Scale in Miles

Meadowdale Beach Park Feasibility Study
Geotechnical Assessment & Sediment Loading
Snohomish County, Washington

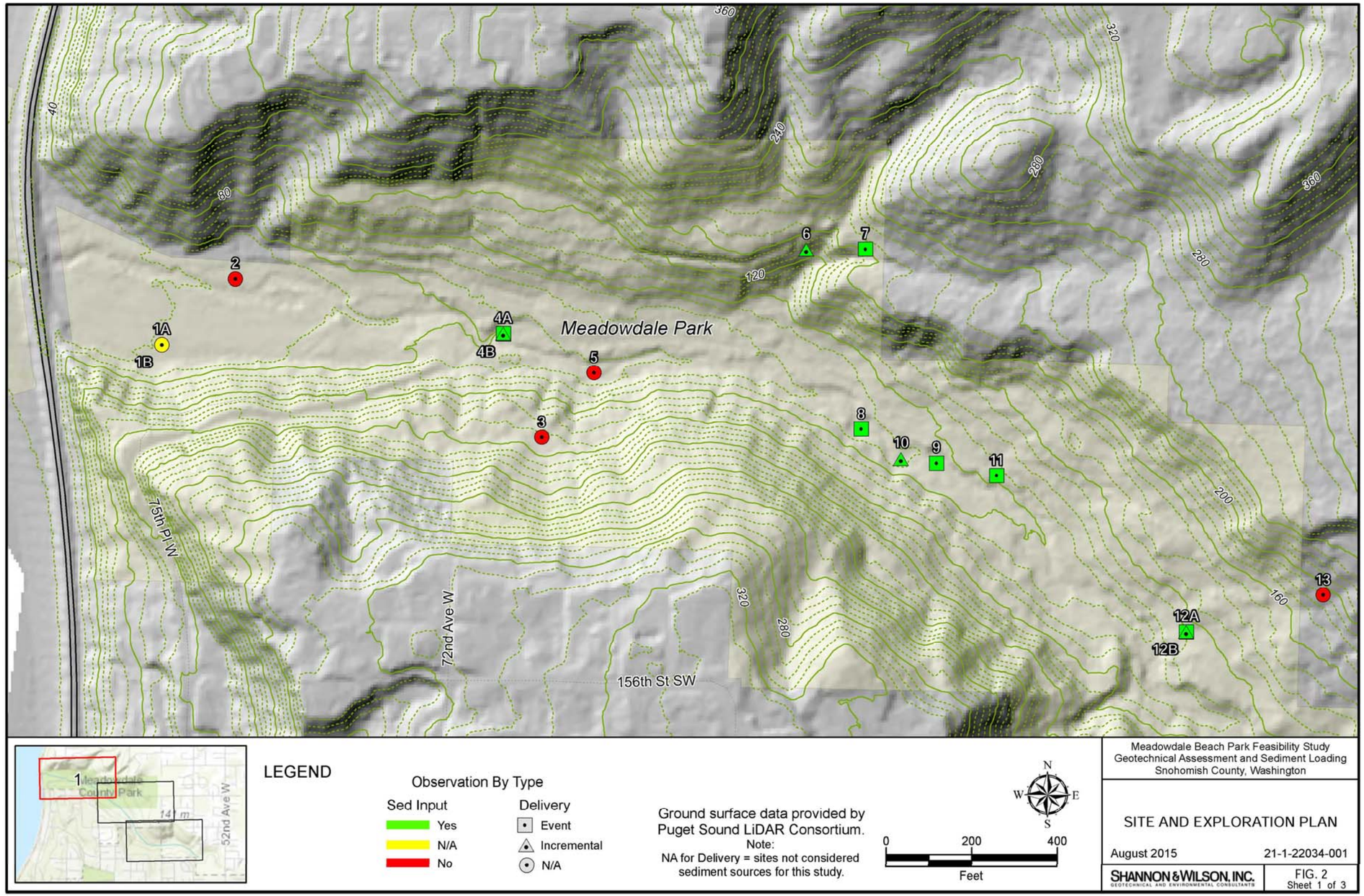
VICINITY MAP

August 2015 21-1-22034-001

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 1

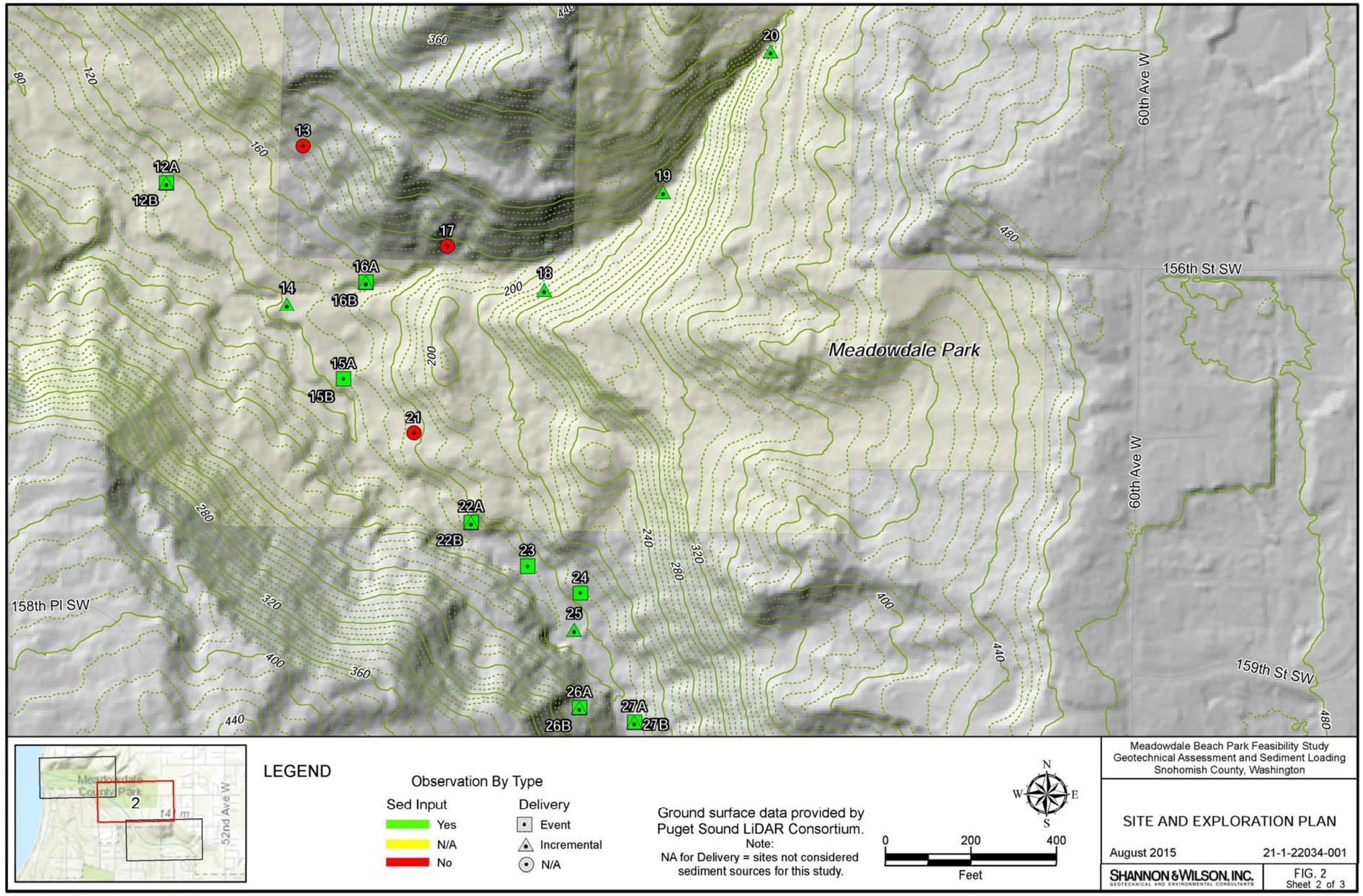
Filepath: I:\Projects\Snohomish County\Meadowdale Beach Park\Park and Habitat Design\Task 5.2 60% Design\Prelim Design Rpt\Figures\Figure6_Site Reconnaissance Survey.docx



Filepath: I:\Projects\Snohomish County\Meadowdale Beach Park\Park and Habitat Design\Task 5.2 60% Design\Prelim Design Rpt\Figures\Figure7-1_Exploration Plans.docx

ANCHOR QEA

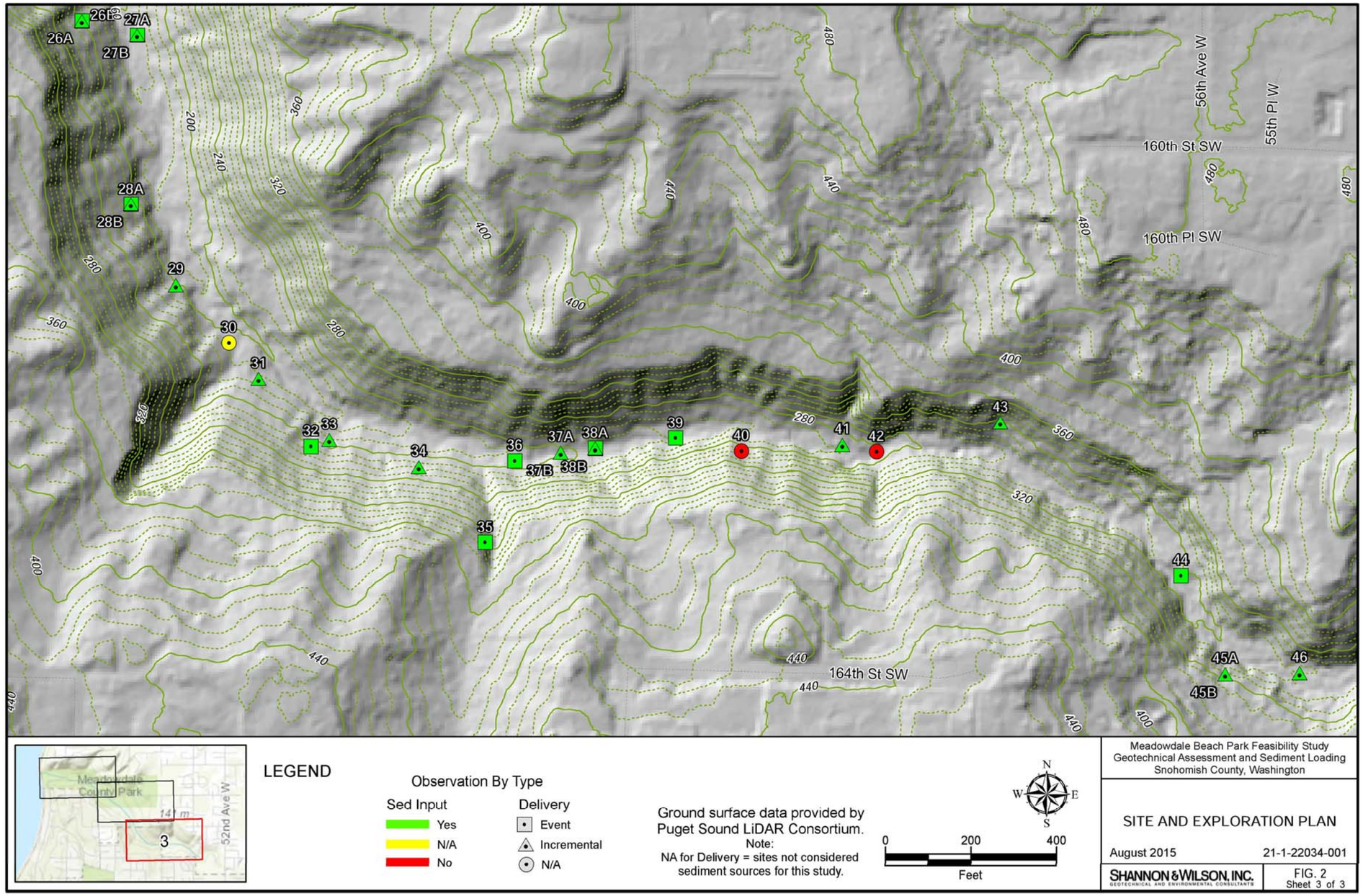
Figure 7a
Exploration Plan
Preliminary Design Report
Meadowdale Beach Park and Estuary Restoration Design Project



Filepath: I:\Projects\Snohomish County\Meadowdale Beach Park\Park and Habitat Design\Task 5.2 60% Design\Prelim Design Rpt\Figures\Figure7-2_Exploration Plans.docx

ANCHOR QEA

Figure 7b
Exploration Plan
Preliminary Design Report
Meadowdale Beach Park and Estuary Restoration Design Project



Filepath: I:\Projects\Snohomish County\Meadowdale Beach Park\Park and Habitat Design\Task 5.2 60% Design\Prelim Design Rpt\Figures\Figure7-3_Exploration Plans.docx

ANCHOR QEA

Figure 7c
Exploration Plan
Preliminary Design Report
Meadowdale Beach Park and Estuary Restoration Design Project

2.6.3.4 Sediment Delivery Mechanisms

Episodic Events: 10-year (estimated), event-driven landslides that can be deep-seated or shallow-rapid surficial slides, causing immediate sediment delivery to the creek, which can potentially temporarily block creek flow. This type of sediment delivery was associated with locations based on recent major winter storm events (the winters of 1996–97 and 2007–08) and a recent event that had occurred within a month of the field reconnaissance in November 2014. The most recent event had impacted the park and required drainage work and trail maintenance, similar to events that had occurred in the winters of 1996–97 and 2007–08, according to Park Ranger Doug Dailer (2014). The characteristics of these known landslide locations, such as morphology and vegetation growth, were used as a proxy for other locations upstream with similar observed characteristics.

Incremental Slope Creep: Slow movement of colluvial slopes toward the creek under the force of gravity. Studies by Saunders and Young (1983) empirically estimated annual volume of rock and sediment movement downslope by land sliding activity in similar geologic settings. Their studies assessed landslide scars to estimate their age, their approximate return interval, and their size. The empirically derived high and low estimates of colluvium entrained from downslope movement were 0.5 and 0.1 inch per year, respectively. By applying these rates of slope movement, our experience assessing slope instability, and inclinometer readings, we estimated rates of slope movement for those slopes exhibiting incremental slope creep in the project area. The estimated rates ranged from 1 inch per year (relatively fast movement), 0.5 inch per year, 0.3 inch per year (average movement), 0.25 inch per year, to 0.1 inch per year (relatively slow movement).

2.6.3.5 Sediment Delivery Types

Several different sediment delivery types were recognized in the field and noted for each location. Often these types of delivery mechanism overlapped or were combined, but the end result is the same: sediment was delivered to the creek. The categories are listed as follows:

- **Bank Erosion:** High water conditions that cause episodic and/or incremental entrainment of the exposed soil.
- **Toe of Slumps:** Colluvium collected in piles or mounds from previously slumped earth move slowly toward the creek or evacuate in one event to become entrained in the creek.
- **Debris Slides and Debris Avalanches:** These slides often include swaths of earth and trees as the soil mantle on steep slopes is mobilized downslope. These slides are often caused by saturation from heavy rains. In Lund's Gulch, thick colluvium over low permeable glacial till or glaciolacustrine deposits are prone to this type of landsliding. This mechanism is often associated with event-driven sediment delivery.
- **Debris Flow and Shallow Rapid Slides:** Typically, the top few inches of soil are mobilized as the ground becomes saturated and the slide behaves more like a viscous fluid as it moves downslope. This mechanism is often associated with event-driven sediment delivery.

2.6.3.6 Estimated Dimensions and Annual Sediment Input

Dimensions of sediment sources were estimated to quantify sediment delivery to the creek. For event-driven sediment delivery, the dimensions of the sediment source mass were estimated from scarps and/or debris mounds. The estimated volume at these sites were summed and divided by the 17-year evaluation period to provide an annual input. For incremental sediment delivery, the length and height dimensions were estimated and calculated with the estimated rates for annual volume input. For total estimated sediment input to Lund's Gulch, the event-driven and incremental calculations for annual volume were summed, for a total annual input estimated in this study is 82 cubic yards (cy). The results of these calculations are shown in Table 1.

The results presented in Table 1 indicate that most of the sediment delivery to the Lund's Gulch Creek is derived from discrete events during major winter storms. About seven times more sediment is delivered to the creek by discrete landslide events (approximately 72 cy) than by incremental creek side erosion (approximately 10 cy) on an average annual basis. Furthermore, the 21 mapped discrete events that likely occurred during three significant storms in the 17-year study period are estimated to have delivered an average of about 400 cy for each storm. The largest single event observed was about 267 cy, at location 12A.

Given the widespread instability of the slopes in Lund's Gulch and the quantities of colluvium on the margins of the creek, it is unlikely that the rate of sediment delivery will decrease during a typical design life of 50 to 100 years. It should be noted that the estimated sediment load is based on a 17-year evaluation period. Actual experienced sediment loads and may be periodically higher or lower than observed.

2.7 Water Resources

2.7.1 Lund's Gulch Creek

The park includes the lower reach of Lund's Gulch Creek, which flows through the park for approximately 4,000 feet at a relatively constant steep grade (3%) until its confluence with Puget Sound, near the existing culvert under the railroad berm. The creek is influenced by upland flows, incoming sediment loads, and tidal inundation at the mouth of the creek, as discussed in the following sub-sections.

2.7.1.1 Creek Hydrology

Hydrology in Lund's Gulch Creek was taken from the *Puget Sound Tributaries Drainage Needs Report* (Snohomish County 2002). Additional high flows were used in the analysis in order to take into account uncertainties in predicted hydrology modeling and uncertainties in performance of upstream stormwater control systems. An upper bound for hydrology identified for the creek was taken from pervious hydrology developed for the Lund's Gulch Basin in 1989 (Snohomish County 1989). Hydrology developed for Lund's Gulch Creek is provided in Table 2.

Table 1
Geotechnical Assessment and Sediment Loading

Location ID	Sediment Input	Delivery Type	Dimensions Length (feet)	Width (feet)	Height (feet)	Rate (in/yr)	Discrete Event Volume (cy)	Bank Erosion Annual Input (feet^3)	Bank Erosion Annual Input (cy)
4A	Yes	Bank erosion	24	6	6	event	32.0		
4B	Yes	Bank erosion	24	–	6	0.1 in/yr		1.2	0.04
6	Yes	Toe of slumps/bank erosion	30	–	8	0.3 in/yr		6.0	0.22
7	Yes	Toe of slumps/bank erosion	40	20	2	event	59.3		
8	Yes	Bank erosion	75	6	4	event	66.7		
9	Yes	Bank erosion - 2007	60	6	6	event	80.0		
10	Yes	Toe of slumps/bank erosion	30	–	6	1/4 in/yr		3.8	0.14
11	Yes	Bank erosion - 1996	12	6	8	event	21.3		
12A	Yes	Bank erosion - 2007	15	24	20	event	266.7		
12B	Yes	Bank erosion	50	–	8	0.3 in/yr		10.0	0.37
14	Yes	Bank erosion	80	–	8	1/2 in/yr		26.9	0.99
15A	Yes	Bank erosion - 2007	40	8	15	event	177.8		
15B	Yes	Bank erosion	12	9	4	event	16.0		
16A	Yes	Bank erosion - 2014	10	1	7	event	2.6		
16B	Yes	Bank erosion	10	–	7	0.1 in/yr		0.6	0.02
18	Yes	Bank erosion	10	–	3	0.1 in/yr		0.2	0.01
19	Yes	Toe of slumps	25	–	4	1/2 in/yr		4.2	0.16
20	Yes	Toe of slumps/bank erosion	200	–	8	1 in/yr		132.8	4.91
22A	Yes	Debris slides/debris avalanches	50	9	3	event	50.0		
22B	Yes	Toe of slumps/bank erosion	100	–	3	0.3 in/yr		7.5	0.28
23	Yes	Toe of slumps/bank erosion	50	6	5	event	55.6		
24	Yes	Toe of slumps/bank erosion	75	12	3	event	30.0		

Location ID	Sediment Input	Delivery Type	Dimensions Length (feet)	Width (feet)	Height (feet)	Rate (in/yr)	Discrete Event Volume (cy)	Bank Erosion Annual Input (feet^3)	Bank Erosion Annual Input (cy)
25	Yes	Debris flow from shallow rapid/bank erosion	20	–	6	1 in/yr		10.0	0.37
26A	Yes	Debris slides/debris avalanches	30	20	3	event	66.7		
26B	Yes	Toe of slumps/bank erosion	75	–	2	0.1 in/yr		1.2	0.05
27A	Yes	Debris slides/debris avalanches	30	2	10	event	10.0		
27B	Yes	Bank erosion	30	–	4	1 in/yr		10.0	0.37
28A	Yes	Debris slides/debris avalanches	40	15	4	event	88.9		
28B	Yes	Bank erosion	100	–	2	0.3 in/yr		5.0	0.19
29	Yes	Toe of slumps/bank erosion	20	–	2	1/4 in/yr		0.8	0.03
31	Yes	Toe of slumps/bank erosion	30	–	7	1/4 in/yr		4.4	0.16
32	Yes	Debris slides/debris avalanches	10	1.5	2	event	1.1		
33	Yes	Toe of slumps/bank erosion	25	–	1	1 in/yr		2.1	0.08
34	Yes	Debris slides/debris avalanches/bank erosion	60	–	6	0.1 in/yr		3.0	0.11
35	Yes	Debris slides/debris avalanches	50	10	1	event	18.5		
36	Yes	Debris slides/debris avalanches	60	50	3	event	5.0		
37A	Yes	Debris slides/debris avalanches/bank erosion	20	–	3	0.3 in/yr		1.5	0.06
37B	Yes	Debris slides/debris avalanches/bank erosion	30	–	3	0.3 in/yr		2.3	0.08
38A	Yes	Debris slides/debris avalanches/bank erosion	40	40	2	event	118.5		
38B	Yes	Toe of slumps/bank erosion	40	–	2	0.3 in/yr		2.0	0.07
39	Yes	Debris slides/debris avalanches/bank erosion	75	4	3	event	33.3		
41	Yes	Toe of slumps/bank erosion	30	–	10	1 in/yr		24.9	0.92

Location ID	Sediment Input	Delivery Type	Dimensions Length (feet)	Width (feet)	Height (feet)	Rate (in/yr)	Discrete Event Volume (cy)	Bank Erosion Annual Input (feet^3)	Bank Erosion Annual Input (cy)
43	Yes	Bank erosion	30	–	3	0.1 in/yr		0.7	0.03
44	Yes	Debris slides/debris avalanches/bank erosion	40	20	1	event	29.6		
45A	Yes	Bank erosion	50	–	4	0.1 in/yr		1.7	0.06
45B	Yes	Bank erosion	20	–	4	0.1 in/yr		0.7	0.02
46	Yes	Bank erosion	20	–	2	0.1 in/yr		0.3	0.01
						Total Delivery	**1,230**	270	**10**
						Number of Years in Event-driven History	**17**		
						Annual Average Sediment Delivery	**72**		**10**
						Total Annual Average Sediment Delivery	**82**	**cy**	

Table 2
Lund's Gulch Creek Hydrology

Peak Flow Event	Discharge (cfs)
2-year[a]	57
10-year[a]	89
25-year[a]	106
100-year[a]	135
Additional High Flows[b]	200
	300
	400
	550

Notes:

a. Source: Snohomish County 2002
b. See Appendix B of the Feasibility Study (Anchor QEA 2016)

As part of the Meadowdale Beach Park Feasibility Study, a 1-dimensional hydraulic model (HEC-RAS; Brunner 2010a, 2010b) was developed and used to estimate existing hydraulic conditions in Lund's Gulch Creek. The model was used to evaluate water surface elevations and potential bed shear stresses in the creek for flows ranging from 135 cubic feet per second (cfs; 100-year) to 400 cfs. Model results illustrate that the existing culvert causes the creek to backwater at higher flows, which reduces the bed shear stress just upstream of the culvert location. This causes sediment deposition just upstream of the culvert, as has been observed.

2.7.1.2 Creek Delta and Marine Shoreline

The mouth of the creek is influenced by the tide where it meets Puget Sound. The tidally influenced portion of the creek extends from just upstream of the existing culvert, through the culvert, and out onto the existing delta/marine shoreline. Existing tidal information is provided in Table 3. The constriction of flows through the culvert results in focused high-velocity flows ("firehose effect") at the culvert outlet and out onto the delta and beach. Currently, this firehose effect has moved beach material and formed a straight westward channel to Puget Sound, thus bisecting the natural spit and protected sub-estuary to the north (Figures 8 and 9).

Table 3
Existing Tidal Information at the Site

Datum	Elevation (feet)	
	NAVD88[a]	MLLW[b] 2015
Highest Astronomical Tide	10.5	12.5
Mean Higher High Water	9.0	11.0
Mean High Water	8.1	10.1
Mean Sea Level	4.4	6.4
Mean Low Water	0.7	2.7
NAVD88[a]	0	2.0
Mean Lower Low Water	-2.0	0

Notes:

a. Tidal datums and conversions between MLLW and NAVD88 datum at the site taken from the National Oceanic and Atmospheric Administration VDatum (http://vdatum.noaa.gov/).
b. To convert to elevations relative to MLLW (2015), add 2.0 feet to elevations in NAVD88 datum.

Figure 8
Pocket Estuary with Stream Flowing Northward (2015)

Figure 9
Stream Cutting More Directly Westward (2016)

The marine ordinary high water mark (OHWM) delineation within the project area included a 1,440-foot reach of shoreline, bisected by Lund's Gulch Creek and featuring a large tributary delta. The protective buffer width for the marine waters within the project area is 150 feet. The northerly net shore drift contributes to a sand spit formation that forms a small protected sub-estuary, like a pocket estuary, when the estuary channel turns to the north after flowing out of the culvert under the railroad. Semi-protected pocket estuaries are habitat types known to be utilized by higher densities of juvenile Chinook than other nearshore habitats (Beamer et al. 2006).

2.7.2 Riparian Stream Buffer

The lowermost 300 feet of Lund's Gulch Creek is confined by rock (approximately 210 feet) and logs parallel to the bank, which partially limit overhanging vegetation within the stream riparian buffer. Outside of this lowermost reach, the vegetated riparian buffer comprises upland and wetland habitat, and includes mostly native woody and emergent wetland species (described in the following section). The riparian buffer ranges in width from 5 feet at the lowermost edge, between 15 and 50 feet within the central reach of the project, and up to 70 feet at the uppermost reach of the Site. The tree species in the riparian stream buffer are dominated by native deciduous species, dominated by red alder (*Alnus rubra*), followed by big leaf maple (*Acer macrophylum*) and black cottonwood (*Populous trichocarpa*). A smaller proportion of the riparian buffer trees are non-native deciduous, and native and non-native conifers. An effort to plant native conifers in this segment of the stream riparian occurred in the last 10 to 20 years, and these trees are generally 10 to 15 feet tall, healthy, and currently functioning as an understory canopy component. Upstream of the Site and the Ranger Residence area, the riparian buffer expands substantially and is dominated by native second-growth deciduous and coniferous trees.

2.8 Plant Communities

Existing plant communities within the site include those associated with the ravine slopes, creek and marine riparian areas, and recreation lawn. In general, the ravine slopes and the majority of riparian areas are dominated by native species, while the lawn area and upland species adjacent to the lawn include some ornamental trees and shrubs. Representative species recorded are provided in Table 4.

Table 4
Plant Communities and Species

Scientific Name	Common Name	Wetland Status
Trees		
Acer macrophylum	Big-leaf maple	FACU
Alnus rubra	Red alder	FAC
Crataegus douglasii	Douglas hawthorne	FAC
Fraxinus latifolia	Oregon ash	FACW
Picea sitchensis	Sitka spruce	FAC
Populus balsamifera var. trichocarpa	Black cottonwood	FAC
Pseudotsuga menziesii	Douglas fir	FACU
Salix lucida. ssp. *lasiandra*	Pacific willow	FACW
Salix scouleriana	Scouler's willow	FACW
Thuja plicata	Western red cedar	FAC
Tsuga heterophylla	Western hemlock	FACU

Scientific Name	Common Name	Wetland Status
Shrubs and Groundcovers		
Acer circinatum	Vine maple	FAC
Cornus sericea	Red-osier dogwood	FACW
Corylus cornuta	Beaked hazelnut	FACU
Hedera helix[a]	English ivy	FACU
Ilex aquifolium[a]	Holly	FACU
Mahonia nervosa	Low Oregon grape	FACU
Oemleria cerasiformis	Indian plum	FACU
Rhododendron occidentale	Western azalea	FAC
Ribes lacustre	Prickly currant	FAC
Rubus armeniacus	Himalayan blackberry	FAC
Rubus parviflorus	Western thimbleberry	FACU
Rubus spectabilis	Salmonberry	FAC
Rubus ursinus	Trailing blackberry	FACU
Sambucus racemosa	Red elderberry	FACU
Grass, Ferns, and Herbaceous		
Athyrium filix-femina	Lady fern	FAC
Equisetum arvense	Field horsetail	FAC
Geranium robertianum	Stinky bob	FACU
Grass spp.	Mowed Grass	FACU
Juncus effusus	Soft rush	FACW
Phalaris arundinacea[a]	Reed canarygrass	FACW
Plantago lanceolata	English plantain	FACU
Polystichum munitum	Sword fern	FACU
Pteridium aquilinum	Bracken fern	FACU
Ranunculus repens	Creeping buttercup	FAC
Taraxacum officinale	Common dandelion	FACU
Tolmiea menziesii	Piggyback plant	FAC
Trifolium pratense	Red clover	FACU
Urtica dioica	Stinging nettle	FAC

Notes:

a. Washington State Noxious Weed (Class C)

2.9 Fish and Wildlife Resources

Several species of salmonids utilize Lund's Gulch Creek, including Chinook, coho, and chum salmon, steelhead, and sea-run cutthroat trout. Salmon spawning ground surveys document coho and chum salmon spawning each year. Salmon return data collected by community volunteers since 1997

indicate that in some years, more than 100 adult coho or chum would return to the creek; however, most recently the numbers have been lower (Uusitalo 2015). The last time spawner surveys reported more than 100 coho adults returned was 2001, as annual counts from 2002 to 2012 ranged between 2 and approximately 35. Chum adults numbers have been higher, with more than 100 chum adults observed in 2007, while annual counts from 2008 to 2012 ranged between 10 and approximately 75. Coho and chum spawning occurs in the lower portions of the creek, and in years when higher numbers of adults return, the spawning occurs over a larger portion of the creek.

In addition to any fry produced by adult coho and chum salmon spawning in the creek, hatchery origin fry have been released into the creek for many years (Uusitalo 2015). Approximately 10,000 chum fry (Chico Creek origin from Suquamish Tribe) and 1,000 coho fry (Wallace River origin from Washington Department of Fish & Wildlife [WDFW]) are released in the spring each year by a retired school teacher who has been releasing fish in the creek since the 1980s (Uusitalo 2015).

Sea-run cutthroat trout also spawn and rear in the Lund's Gulch Creek system. Pfeifer (1979) documented sea-run cutthroat trout throughout Lund's Gulch Creek, including headwater areas outside of the park.

Only two separate observations of steelhead adults have been reported, and both were for only one adult. Pfeifer (1979) referenced Don Hendricks' (WDFW) observation of a single steelhead adult in Lund's Gulch Creek, presumably in the late 1970s. More recently, Tom Murdoch, of the Adopt A Stream Foundation, reported seeing one steelhead adult relatively high in the system (Murdoch 2015).

Juvenile Chinook, coho, and chum salmon were documented in the lower 650 feet of the creek in a study by Beamer et al. (2013). Because the creek does not provide habitat for Chinook spawning, the presence of juvenile Chinook salmon indicates that the fish originated in other river systems, outmigrated to Puget Sound, and, during their movements and rearing along the marine nearshore, moved back into the available freshwater habitat associated with Lund's Gulch Creek.

Other fish species documented in the creek are starry flounder and sculpins (Pfeifer 1979; Adopt A Stream Foundation 2013). Starry flounder are entering the lower creek from the Puget Sound shoreline. Sculpin distributions in the creek are generally restricted to the lower reaches of Lund's Gulch Creek due to partial barriers inadvertently created by vertical drops downstream of log structures installed for restoration (Lantz et al. 2014).

The park site includes a resident ranger, who with park users have observed additional aquatic, bird, and wildlife species on site, as listed in Table 5.

Table 5
Aquatic, Bird, and Wildlife Species

Category	Species
Marine nearshore species	Plankton, anemones, crustaceans, snails, gunnels, nudibranchs, worms, shrimp, juvenile salmon, sculpin, flounder, perch, sand lance, pipe fish, jellyfish, isopods, amphipods, clams, mussels, oysters, geoduck, river otters, and harbor seals sea lions
Birds	Osprey, eagle, kingfisher, crow, gulls, mergansers, loons, heron, red tail hawk, Merlin, cooper hawk, finch band tail pigeon, mallard golden eye widgeon, warblers, wrens, robins, thrushes, flickers, woodpeckers
Upland species	Long tail weasel, alligator lizard, garter snake, tree frog, bats, owls, coyote, deer, raccoon, opossum, rabbit, muskrat, Douglas squirrels

2.10 Description of the Problem

2.10.1 Under-Sized Culvert

The 6-foot-wide culvert at the railroad crossing at the mouth of Lund's Gulch Creek causes flooding in the park during high flows and sediment deposition at the upstream end of the culvert, restricts the establishment of a fully functioning estuary, and restricts fish movements into and out of the stream. In addition to these hydraulic and ecological impacts, the railroad crossing affects park user access to the beach and public safety through the railroad right-of-way.

2.10.2 Estuary Impacts

The current conditions do not allow for a natural estuary to establish upstream of the railroad embankment, although the elevations and creek size are sufficient to support one. Instead of supporting a wider creek delta and estuarine area, the creek is narrowly constricted to flow through the concrete channel of the box culvert. This constriction also affects the estuary conditions waterward of the culvert, as the firehose effect caused by the creek constriction during high flows carves out a straight channel to the west, which bypasses high-functioning sub-estuary habitat to the north that dries out when the creek flows due west. A natural saltmarsh existed at the creek mouth prior to the construction of the railroad and subsequent land uses. The existing railroad berm and culvert opening, as well as past fill placement east of the railroad berm for upland uses, have eliminated most of the natural transition between freshwater and saltwater pocket-estuary habitat beneficial for juvenile salmonids (see Appendix E, Fisheries and Habitat Evaluation of Anchor QEA 2016). The culvert confines the creek to an artificially horizontally and vertically narrow corridor under the railroad berm, and an additional connected concrete channel extends for another 20 feet upstream. Past fill placement for a variety of upland uses during the 20th century cover the majority of the Lund's Gulch Creek ravine bottom for approximately 700 lf upstream of the railroad berm. The historical tidal marsh extended approximately 300 lf upstream of the berm. The current conditions do

not allow for a pocket estuary to establish upstream of the railroad embankment, although the creek was historically capable of supporting one. These altered estuary conditions also degrade habitat for salmon, including juvenile ESA-listed Puget Sound Chinook salmon that have been documented to use the lower 600 lf of the creek for rearing (Beamer et al. 2013).

2.10.3 Shoreline Armoring

The project is located along a segment of Puget Sound nearshore between Seattle and Everett that is also impacted by the presence of a railroad along the entire shoreline. The railroad acts as a nearly continuous barrier to natural sediment supply processes (see Appendix E, Fisheries and Habitat Evaluation of Anchor QEA 2016). The Lund's Gulch Creek mouth in the park is one of the few opportunities between Seattle and Everett where watershed and land use conditions are suitable for restoring pocket estuary habitat and natural sediment transport processes.

2.10.4 Flooding

Flooding incidents have increased steadily over the last 20 years. The park lawn, portable restroom enclosure, and volleyball court and picnic areas east of the railroad embankment can be inundated with floodwaters during back-to-back or high-intensity storm events (Figure 10). Fish can become stranded in the lawn areas as the water recedes; public beach access is impacted, resulting in public safety issues; and silt enters the creek from bank and lawn erosion. Higher flow events are accommodated for most of the entire reach of the creek until the creek reaches the culvert, where fill placement, armoring, and the concrete channel force the creek into an artificial 6-foot opening. The narrowing of the creek initially creates a "firehose effect" until backwatering results in the creek overtopping banks. As a result, the lower reach encounters bed scour, which is problematic for fish resources in the creek. Instead of allowing for a wider creek delta and pocket estuary, this area is currently the narrowest part of the creek because of fill placement, armoring, the concrete channel, and the culvert, exacerbating flood risk in this location.

Figure 10
Photographs of Flooding

Land side of culvert, at restroom enclosure

High tide on beach side of culvert

2.10.5 Public Access

To address public access to the beach when the park opened in the late 1980s, the culvert was retrofitted with a wooden deck over the creek. Later, when sediment accumulated in this vertically constrained channel, a grated steel deck was installed instead. This grated deck is generally removed during the winter to facilitate increased sediment loads and fish passage, leaving only an 18-inch-wide concrete ledge or the creek channel bottom for beach access through the tunnel.

Access to the beach is impacted by changing sediment deposition and scour patterns on the beach side of the culvert that have, at times, created backwatering at the grated decking. This backwatering has further increased the risk that park visitors, who are not prepared to wade through the creek, will instead cross over the fenced railroad berm (a trespass on the railroad right-of-way) to access the beach. The train speeds, train frequency, and horizontal curves on this heavily used double-track main railway line create extreme danger for park visitors who choose to illegally trespass. The current grated path with periodic submersion also has a low clearance and does not comply with the 80-inch vertical clearance guideline (Department of Justice 2010).

2.10.6 Maintenance and Permitting Impacts

Development within the Lund's Gulch Creek drainage basin, along with more frequent and intense storm events, have increased the need for maintenance activities associated with the culvert due to the accumulation of gravels within the culvert under the grating and at the tunnel entrance, blocking fish passage and flooding portions of the park. The initial maintenance action that does not require permits is the removal of the pedestrian grates, which increases the likelihood of trespass across the railroad. Also, while removing the grates assists some with fish passage issues, fish become endangered from foot traffic and still can become stranded landward of the embankment during flooding. For several years maintenance was performed under the County Hydraulic Project Approval (HPA) permit process, subject to all the conditions therein, and involved removing gravels within the culvert only and hauling the gravels off site. In 2013, this type of maintenance no longer sufficed, as gravels on the beach had accreted near the exit of the tunnel, resulting in a beach elevation higher than the bottom of the culvert, which resulted in continued flooding of the park lawn area. Sediment accretion waterward of the culvert mouth is attributed to the creek backwatering and pedestrian safety issues described above. The northward littoral drift along this portion of shoreline, combined with creek sediment deposits waterward of the culvert, had led to formation of a beach berm/spit that forces the creek to turn sharply north upon exiting the culvert. As described above, in 2016 this spit and sub-estuary formation process was interrupted by high flows, causing a firehose effect and severing the spit. Although these sediments within the culvert caused maintenance issues within the park, the spit and delta formation processes beyond the culvert perform the important function of providing a pocket estuary. Removal of gravels upstream and within the culvert and placing them out on the beach to restore downstream creek flow occurred under emergency permit action in

2013, but was required to be retro-actively permitted. While permits were being sought, gravels quickly accumulated, requiring the grates to be removed shortly after they were re-installed. Permits included U.S. Army Corps of Engineers (USACE) NWP3 and NWP27, Shoreline Substantial Development Permit, Shoreline Conditional Use Permit, HPA, Flood Hazard, and County Land Disturbing Activity permit. By the time these permits were approved, conditions on the beach, predominantly vegetation and topography, had naturally altered to such a degree that implementing any maintenance would have been more detrimental to the environment. The decision was made to not perform any gravel removal or maintenance at that time, but to review conditions the following year under the existing permits. The following year's beach condition still would require too much disturbance to perform maintenance and re-install the grates. The tunnel remained without a suitable walking surface, and the grates were not re-installed for 3 years, until an intense storm event in late 2016 cleared all the gravels within the culvert and scoured the beach all the way to Puget Sound, blowing out the 4-foot-high beach berm/spit. The grates have remained in place since, but they will need to be removed when the next event deposits sufficient gravel upstream of the grates. Maintenance actions such as these described are not sustainable from an operations, permitting, or ecological perspective.

3 Preliminary Design Alternatives

The County conducted a feasibility study between fall 2014 and spring 2016 to develop alternatives and then ultimately select a preferred alternative to address the multiple issues surrounding the culvert and embankment. The following section summarizes the steps involved and describes the alternatives evaluated.

3.1 Evaluation Criteria

Evaluation criteria were established prior to developing any alternative. The Evaluation Criteria in Table 6 resulted from multiple meetings with the County, public, and project stakeholders.

Table 6
Evaluation Criteria for Conceptual Alternatives

Category	Criteria
Habitat Restoration	• Quantity and Diversity of Nearshore Habitat Waterward of Railroad Crossing • Juvenile Salmon Fish Passage Conditions into Lower Creek • Size of Transition Zone between Saline and Freshwater Habitats • Quality of Lund's Gulch Creek Habitat • Quantity and Quality of Riparian Vegetation along Stream and Nearshore • Quality of Freshwater Wetland • Habitat Connectivity for Non-Fish Species • Conversion of Lawn area to Habitat • Increase opportunities for Current and Future Environmental based User Groups
Sediment Transport and Coastal Processes	• Sediment Transport Capacity of Opening, for Creek Sediment Loads • Potential for Channel Migration and Meandering • Shoreline Wave and Erosion Affecting Park and Railroad • Sediment Transport Distribution on Delta
Sustainability	• Sea Level Rise
Public Safety	• Beach Access Across BNSF Right-of-Way
Parks and Recreation	• Pedestrian / ADA Access and Circulation • Balance Public Access Opportunities with Habitat Protection • Conversion of Lawn Areas to Habitat • Facility Relocation • Operations and Maintenance • Ability to Provide Suitable Use Areas for Current and Anticipated Programs and User Groups, including Education Uses • Views
BNSF Coordination	• Consistent with Railroad Engineering Standards • Constructible within BNSF Work Windows • Meets BNSF Operations and Maintenance Standards
Support for Project	• Stakeholders (Community, Organizations, Tribes) • Permitting Agencies
Funding Opportunities	• Probability to Obtain Grants • Additional Fundraising and Partnership Opportunities
Cost	• Costs/Benefit Considerations

3.2 Development of Alternatives

Seven initial concepts for alternatives were developed after receiving input from stakeholders and presented to the County in January 2015. Additionally, two alternatives were developed and presented to the County in 2016, following selection of the preferred alternative due to the initial cost evaluation of the preferred alternative. Of the initial seven, four were not considered for various reasons, as discussed below, and the two alternatives developed post-preferred alternative selection were also determined to not meet project objectives or were less feasible so also were not evaluated, for the reasons given below. Three final conceptual alternatives were selected for further evaluation, and are described in full at the conclusion of this section.

3.2.1 Alternatives Considered But Not Evaluated

A small set of alternatives were considered in the feasibility stage but not fully evaluated due to infeasibility of implementation due to cost and/or constructability. These include:

- **Full restoration alternative:** The full restoration alternative would include construction of a 400-foot-wide railroad bridge to remove the railroad embankment along the entire length of the park fronting Puget Sound. This alternative was considered too expensive to be feasible at this location and would not receive support from BNSF. In addition, based on the results of the hydraulic analysis, this expansive opening was deemed not necessary to restore more natural flow and sediment transport conditions in the creek, as well as provide fish passage into creek.
- **Additional box culverts:** This alternative included installing multiple box culverts to accommodate the creek and using the existing culvert for pedestrian access. This alternative was not considered because it would require an open cut in the existing tracks/embankment to construct, as well as an approximate 24-hour work window to complete. Based on conversations with BNSF, this option was considered to be high risk and potentially infeasible, based on the open-cut construction method (which BNSF does not prefer) and given limited BNSF work windows allowed along this stretch of the line, which are estimated between 2 and 3 hours (previously estimated between 3 and 6 hours).
- **Larger bridge opening for creek with existing culvert for pedestrians:** This alternative was similar to one of the evaluated alternatives but included a larger bridge opening. This was not evaluated because it was deemed redundant by choosing an option with a large bridge that could accommodate the creek and pedestrians, along with keeping the existing deficient non-ADA-compliant culvert.
- **Pedestrian overpass with smaller bridge opening for Creek:** This alternative was not initially evaluated, due the reasons provided in Section 3.2.2 for the overpass only options, and because of dual costs for a bridge and an overpass.

3.2.2 Evaluation of Additional Alternatives

Following completion of the Feasibility Study, and based on the initial opinion of cost for the Preferred Alternative and associated input from stakeholders and the public, two additional alternatives were evaluated: a pedestrian overpass and tunnel construction options. The results of the additional evaluations are summarized in an addendum to the feasibility Study (Anchor QEA 2016a); a summary is provided as follows:

- **Pedestrian overpass only option:** This alternative was initially not evaluated, as it would not address fish passage, sediment delivery, flooding, or maintenance issues and may not even resolve pedestrian safety issues regarding beach access due to the length of the ramp and inconvenience of access. However, due to the public access goals for the project (and original opinion of cost for the preferred bridge alternative), this alternative was revisited in the report addendum. Due to BNSF's railroad horizontal and vertical clearance requirements, the overpass structure would be very tall, relatively long, and would either require elevator towers (Option A) or a significant ramp system (Option B) to allow ADA-compliant access to the beach for pedestrians. For Option A, the construction and maintenance of two elevator towers would be cost prohibitive. For Option B, the path of travel to the beach using the ramps system would be significant, and pedestrians would likely still go over the tracks to access the beach. This option would also carry a significant construction cost. Further, the pedestrian overpass by itself would not address many of the project goals, such as habitat and sediment delivery/maintenance issues. The cost of a combined bridge and overpass to address all the issues was not evaluated because it would be significantly more costly than any other alternative considered, without necessarily increasing any of the benefits for the reasons described above.
- **Tunnel options:** Jacking standard metal culverts through the railroad berm was initially determined to be infeasible due to risk of causing movement of the tracks during the process and the potential for large debris within the railroad berm. However, as part of the report addendum, this construction method was reconsidered and further examined as a matter of fiscal responsibility. Two potential concepts were considered for constructing a tunnel (or tunnels) under the railroad tracks to provide ADA-compliant pedestrian access and increased conveyance for the creek under the railroad tracks. Constructing these tunnels would involve jacking sections of a 12-foot-diameter smooth steel pipe through the railroad embankment. This concept would require excavation of the tunnel section to its final embedment depth prior to installation, but the pipe could be pushed through the embankment in smaller sections, adding on additional sections as progress was made through the embankment. Option A included the use of a single 12-foot-diameter smooth steel pipe constructed to the north of the existing culvert; the existing culvert would be separated from the creek and used for pedestrian access only. Option B included the use of three 12-foot-diameter smooth steel

pipes constructed to the north of the existing culvert for the creek; the existing culvert would be separated from the creek and used for pedestrian access only. These options were discarded because, in using the existing culvert, neither would improve public safety or provide an ADA-compliant route for pedestrians to the beach. Secondly, Option A would not restore the natural full-bank width of the creek (though it would increase it from existing conditions); Option B would provide a full-bank width but split between three separate tunnels. It would also require the creek to be re-routed to the north of its current alignment in order to retain the existing culvert for use by pedestrians. Both options would have limited capacity for sediment deposition and would be vulnerable to impacts from sea level rise, due to the limited clearance available from the proposed channel bed elevation and the top of the tunnel. Additionally, these options neither provided cost savings from the preferred bridge alternative nor eliminated the work-window constraints.

3.2.3 Alternatives Evaluated

For the three final conceptual alternatives that moved forward for evaluation, the following design criteria were considered during the design process:

- Preliminary hydraulic evaluation, which was used to determine opening sizes
- Balancing habitat restoration and recreational uses
- Providing ADA-compliant beach access
- BNSF structure standards
- Anticipated coordination requirements with BNSF during construction

3.2.3.1 Alternative 1: Three-Span Bridge, Combined Creek and Pedestrian Access Route

This alternative, shown in Figures 11 and 12, consists of a three-span bridge with a 30-foot clear center span, and two 25-foot abutment spans centered on the location of the current tunnel and creek outlet alignment. The south abutment span would provide a 10-foot-wide path for pedestrian access to the beach. The pedestrian access path would be set to an elevation approximately 1.2 feet above current mean higher high water (MHHW) and would provide 80 inches of vertical clearance (meeting ADA requirements) from the path to the overhead bridge span.

A portion of the lawn area (16,100 sf) would be converted to stream, marsh, and riparian habitat, and another 35,900 sf of habitat area would be restored by enhancing riparian vegetation and in-stream structures, for a total restored habitat area of 52,000 sf. In addition, 7,650 sf of existing habitat would be enhanced upstream of the existing pedestrian footbridge across Lund's Gulch Creek by installing in-stream structures consisting of large woody debris, and by enhancing existing riparian vegetation. The loop path north of the proposed marsh would be truncated, in order to avoid habitat fragmentation, and three picnic viewpoints would be established at the new path terminus. A new pedestrian bridge would be installed across the restored stream channel downstream of the existing

pedestrian bridge. Drainage of the remaining lawn areas north of the existing volleyball court would be improved by a combination of subsurface drainage and regrading. This alternative would provide the minimum bridge opening necessary for projected creek flows identified by the hydraulic analysis, and it represents the least change in terms of lawn area conversion and other recreation-related changes to the lower park.

3.2.3.2 Alternative 2: Existing Tunnel and Three-Span Bridge to the North, Separated Creek and Pedestrian Access Routes

Alternative 2, shown in Figure 13 and Figure 14, consists of a three-span bridge with a 40-foot clear center span, and two 25-foot abutment spans that would be located north of the current culvert location and creek outlet alignment. This would require re-alignment of the lower portion of the creek to accommodate the new location for the outlet. The existing culvert would be separated from the creek channel alignment and modified for pedestrian access only, with similar overhead clearance as currently exists on site. The pedestrian access path would be set to an elevation of approximately 10 feet NAVD88, which would be similar to its current elevation at the upstream end of the existing walkway. This configuration would not meet the 80-inch vertical clearance ADA requirement. Standing water could cover the path at tidal elevations higher than 10 feet NAVD88, which would be both a safety and ADA-compliance issue. All of the lawn area (30,600 sf) would be converted to stream, marsh, and riparian habitat, and another 31,000 sf of habitat area would be restored by enhancing riparian vegetation and in-stream structures, for a total restored habitat area of 61,600 sf. In addition, 9,300 sf of existing habitat would be enhanced upstream of the existing pedestrian footbridge across Lund's Gulch Creek by installing in-stream structures consisting of large woody debris, and by enhancing existing riparian vegetation.

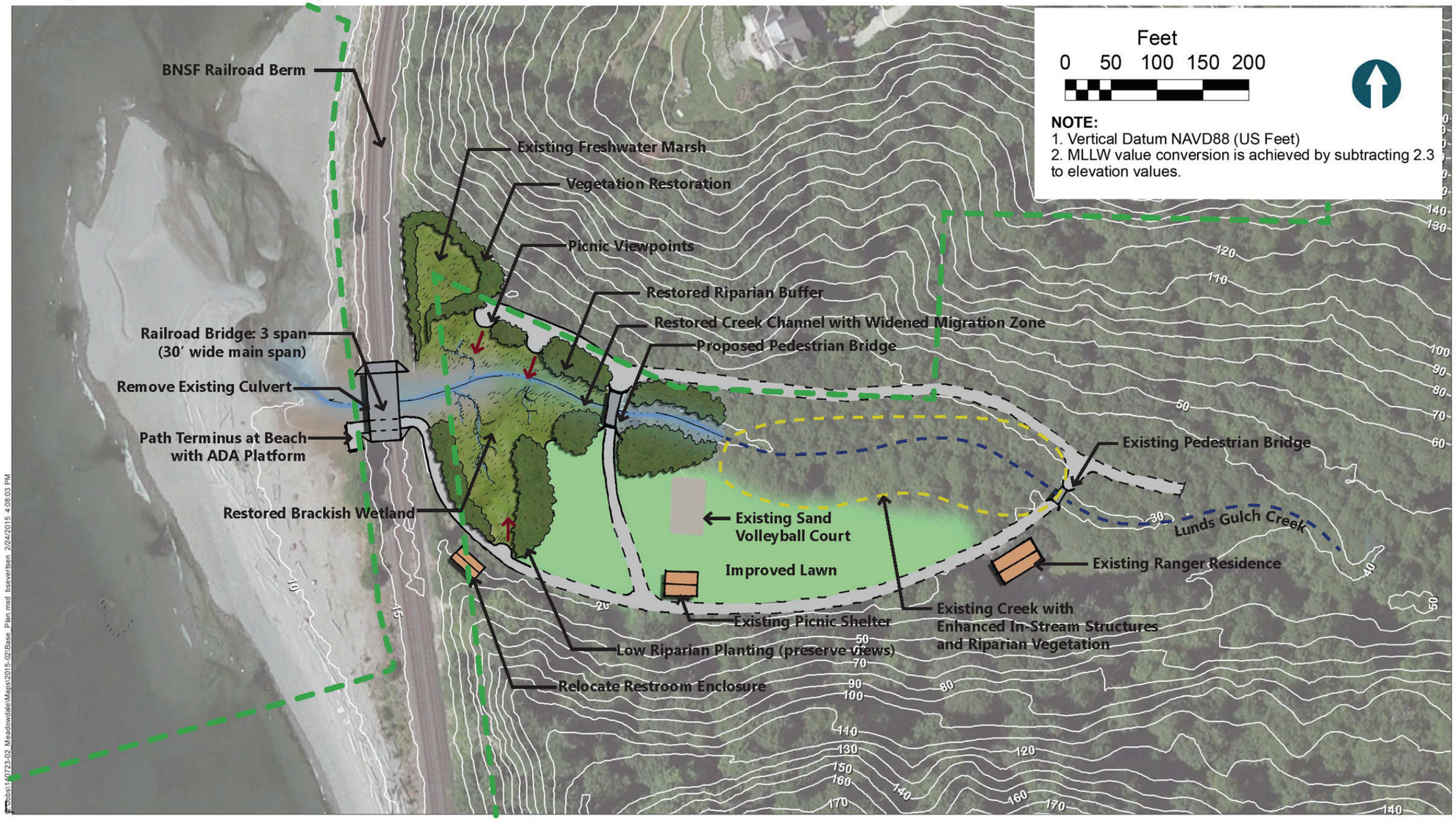
A new pedestrian bridge would be installed across the restored stream channel downstream of the existing pedestrian bridge. The northern path would be terminated just north of the proposed pedestrian bridge. A widened path section at the new terminus would accommodate a picnic viewpoint. Drainage of the remaining upper lawn area would be improved. Alternative 2 represents a midway between Alternatives 1 and 3, in terms of bridge size and extent of habitat restoration in the lower creek, as well as changes to the lawn area and recreation in the lower park.

3.2.3.3 Alternative 3: Four-Span Bridge, Combined Creek and Pedestrian Access Route

Alternative 3, illustrated in Figures 15 and 16, consists of a four-span bridge with two 40-foot clear center spans, and two 25-foot abutment spans centered on the location of the current culvert and creek outlet alignment. The south abutment span would provide a 10-foot-wide path for pedestrian access to the beach. The pedestrian access path would be set to an elevation approximately 1.9 feet above MHHW and would provide 6 feet of vertical clearance from the path to the overhead bridge span, which is less than the 80-inch minimum required for ADA vertical clearance.

MEADOWDALE BEACH COUNTY PARK FEASIBILITY STUDY

Exhibits were prepared by Anchor QEA, LLC for Snohomish County for the "Conceptual Alternatives Discussion Meeting" on February 26, 2015.
Renderings were revised on 3/9/2015 based on County feedback.



Alternative 1: Three Span Bridge, Combined Creek and Pedestrian Access Route, 50% of Lower Lawn Converted to Habitat

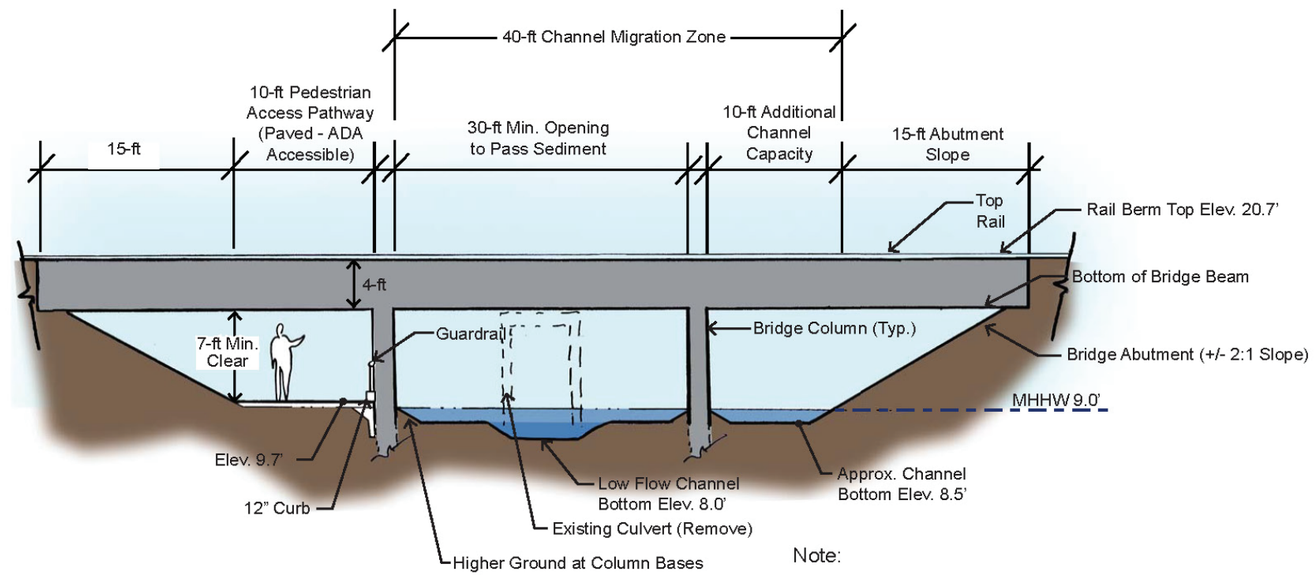
Filepath: C:\Users\hadomeit\Desktop\deleteme\Figure11_PlanViewOfAlt1.docx

ANCHOR QEA

Figure 11
Plan View of Alternative 1
Preliminary Design Report
Meadowdale Beach Park and Estuary Restoration Design Project

MEADOWDALE BEACH COUNTY PARK FEASIBILITY STUDY

Exhibits were prepared by Anchor QEA, LLC for Snohomish County for the "Conceptual Alternatives Discussion Meeting" on February 26, 2015.
Renderings were revised on 3/9/2015 based on County feedback.



Elevation Looking West

Note:

1. The vertical datum is NAVD 88.
2. Channel elevations shown are conceptual, and will be verified or modified based on the results of the final hydraulic modeling study being completed as part of this work.

Alternative 1: Three Span Bridge, Combined Creek and Pedestrian Access Route, 50% of Lower Lawn Converted to Habitat

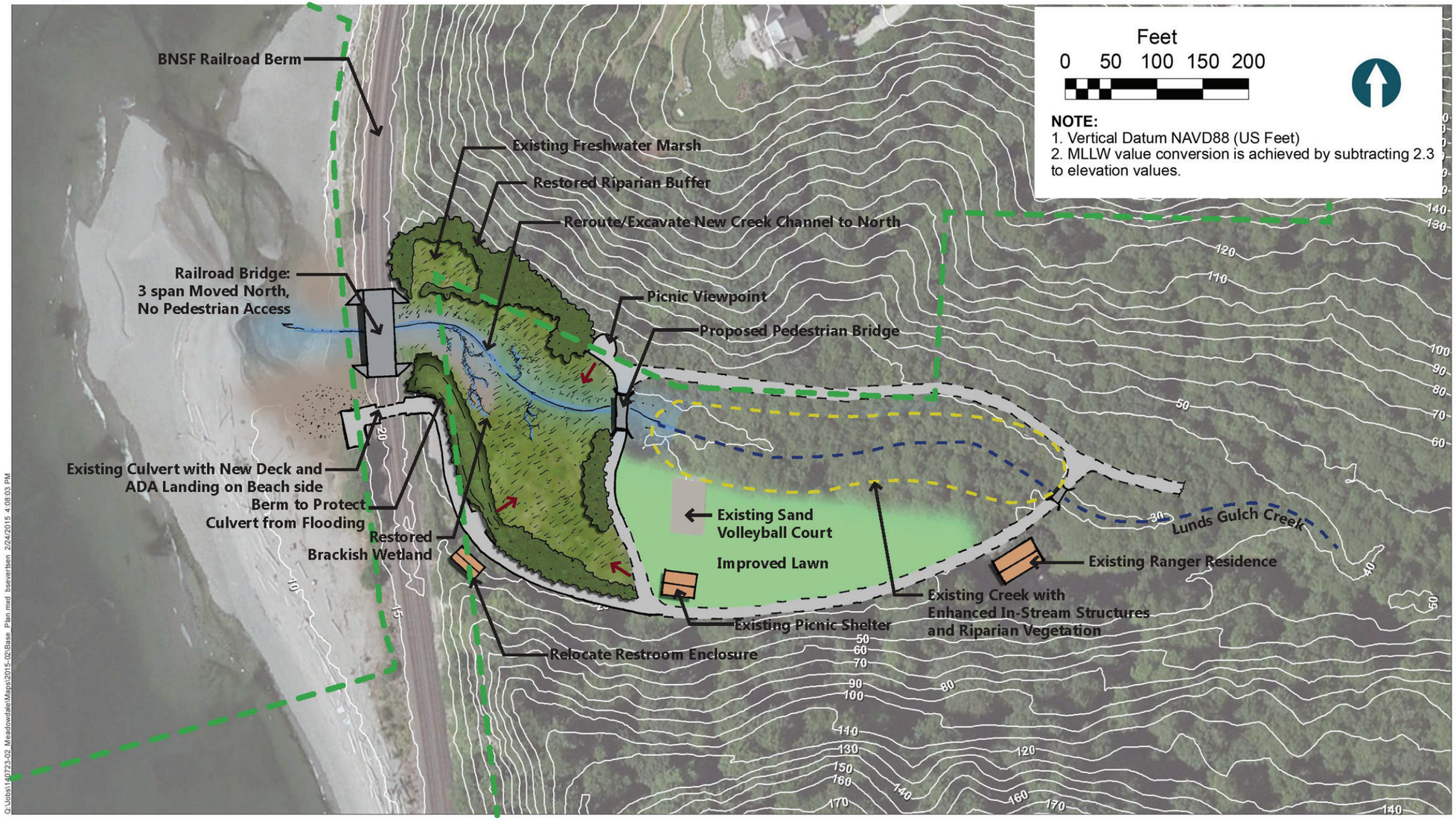
Filepath: C:\Users\hadomeit\Desktop\deleteme\Figure12_SectionViewOfProposedOpeningForAlt1.docx

ANCHOR QEA

Figure 12
Section View of Proposed Opening for Alternative 1
Preliminary Design Report
Meadowdale Beach Park and Estuary Restoration Design Project

MEADOWDALE BEACH COUNTY PARK FEASIBILITY STUDY

Exhibits were prepared by Anchor QEA, LLC for Snohomish County for the "Conceptual Alternatives Discussion Meeting" on February 26, 2015.
Renderings were revised on 3/9/2015 based on County feedback.



Alternative 2: Existing Tunnel and Three Span Bridge, Separated Creek and Pedestrian Access Routes, 100% of Lower Lawn Converted to Habitat

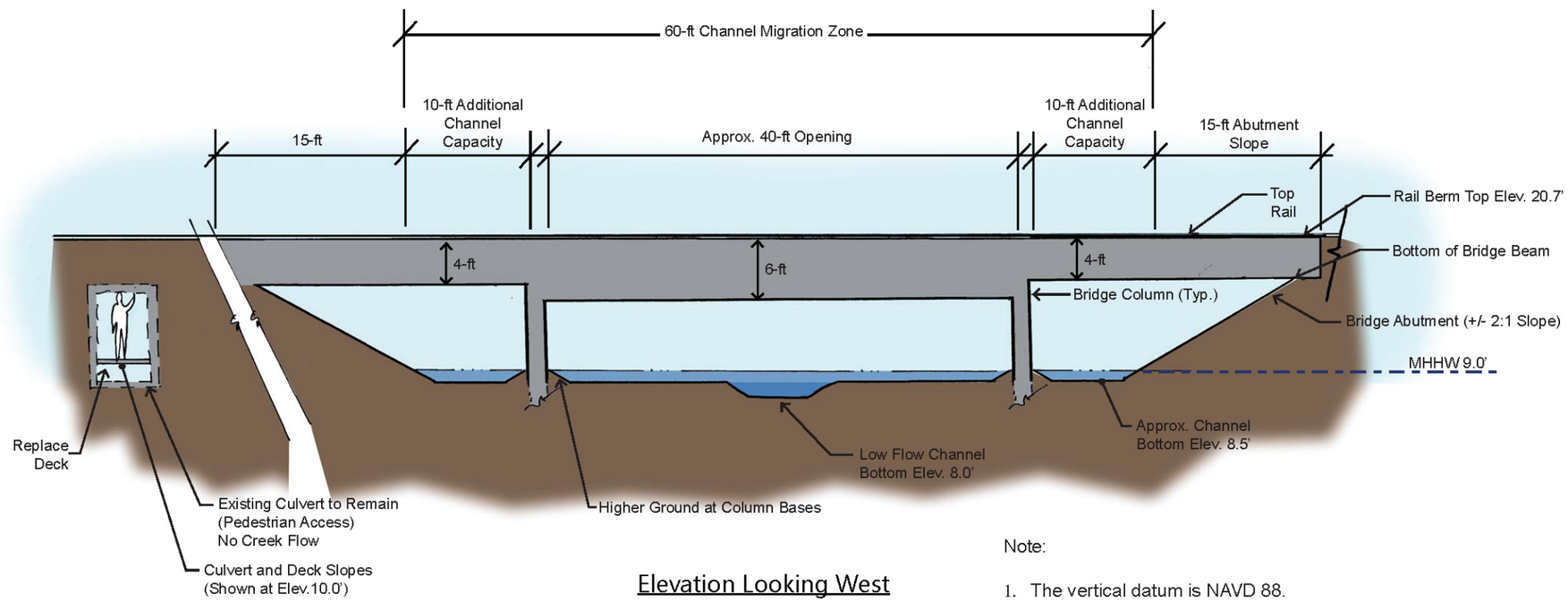
Filepath: C:\Users\hadomeit\Desktop\deleteme\Figure13_PlanViewOfAlt2.docx

ANCHOR QEA

Figure 13
Plan View of Alternative 2
Preliminary Design Report
Meadowdale Beach Park and Estuary Restoration Design Project

MEADOWDALE BEACH COUNTY PARK FEASIBILITY STUDY

Exhibits were prepared by Anchor QEA, LLC for Snohomish County for the "Conceptual Alternatives Discussion Meeting" on February 26, 2015.
Renderings were revised on 3/9/2015 based on County feedback.



Elevation Looking West

Note:

1. The vertical datum is NAVD 88.
2. Channel elevations shown are conceptual, and will be verified or modified based on the results of the final hydraulic modeling study being completed as part of this work.

Alternative 2: Existing Tunnel and Three Span Bridge, Separated Creek and Pedestrian Access Routes, 100% of Lower Lawn Converted to Habitat

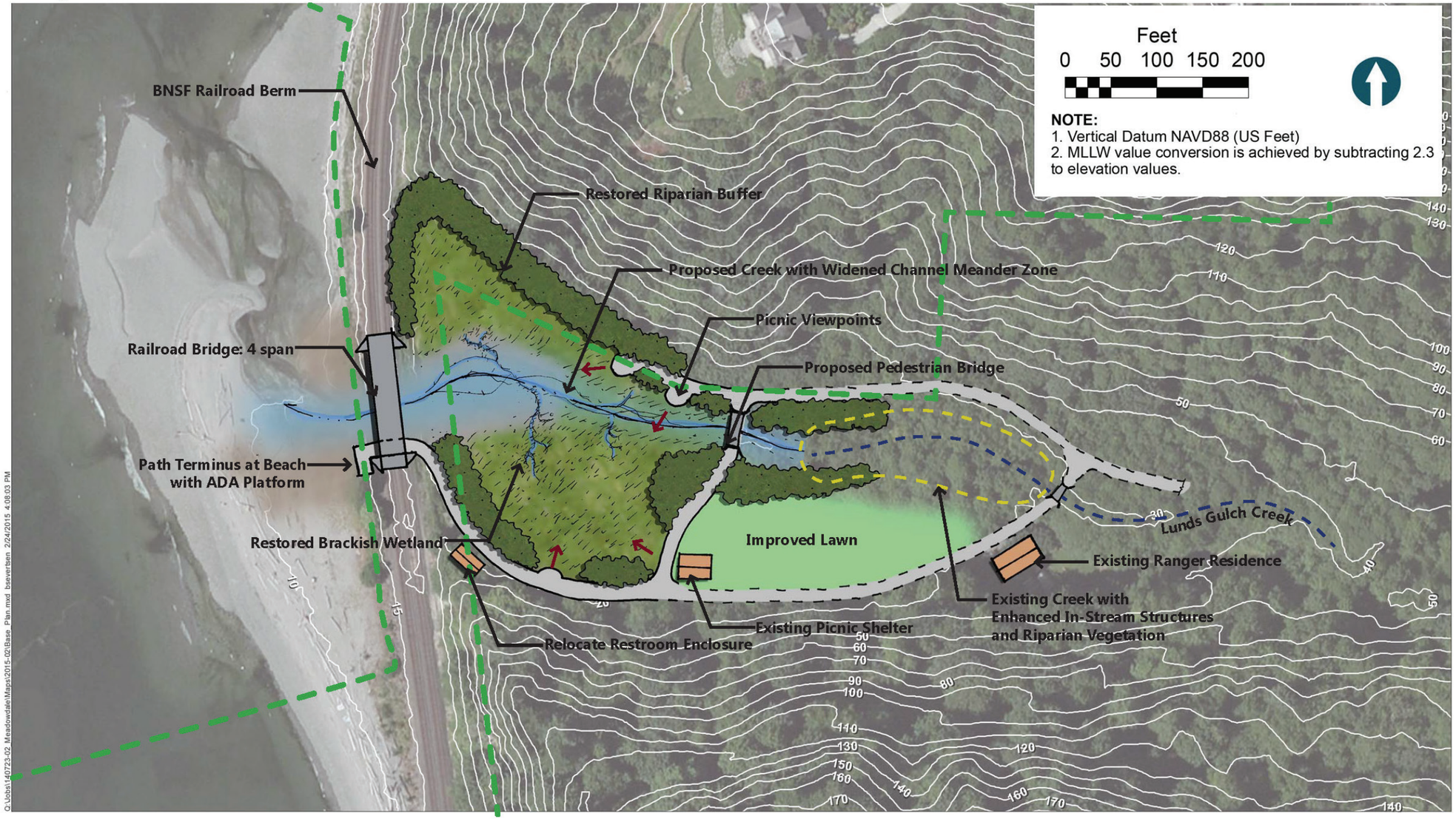
Filepath: C:\Users\hadomeit\Desktop\deleteme\Figure14_SectionViewOfProposedOpeningForAlt2.docx

ANCHOR QEA

Figure 14
Section View of Proposed Opening for Alternative 2
Preliminary Design Report
Meadowdale Beach Park and Estuary Restoration Design Project

MEADOWDALE BEACH COUNTY PARK FEASIBILITY STUDY

Exhibits were prepared by Anchor QEA, LLC for Snohomish County for the "Conceptual Alternatives Discussion Meeting" on February 26, 2015.
Renderings were revised on 3/9/2015 based on County feedback.



Alternative 3: Four Span Bridge, Combined Creek and Pedestrian Access Route, 100% of Lower Lawn and 30% Upper Lawn Converted to Habitat

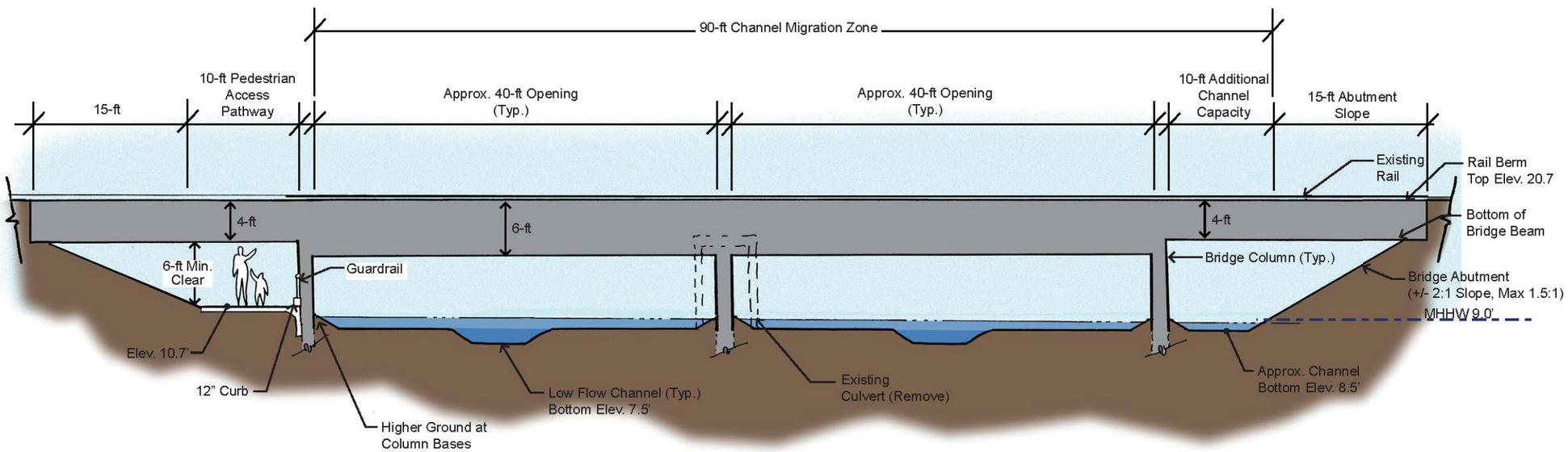
Filepath: C:\Users\hadomeit\Desktop\deleteme\Figure15_PlanViewOfAlt3.docx

ANCHOR QEA

Figure 15
Plan View of Alternative 3
Preliminary Design Report
Meadowdale Beach Park and Estuary Restoration Design Project

MEADOWDALE BEACH COUNTY PARK FEASIBILITY STUDY

Exhibits were prepared by Anchor QEA, LLC for Snohomish County for the "Conceptual Alternatives Discussion Meeting" on February 26, 2015.
Renderings were revised on 3/9/2015 based on County feedback.



Elevation Looking West

Note:

1. The vertical datum is NAVD 88.
2. Channel elevations shown are conceptual, and will be verified or modified based on the results of the final hydraulic modeling study being completed as part of this work.

Alternative 3: Four Span Bridge, Combined Creek and Pedestrian Access Route, 100% of Lower Lawn and 30% Upper Lawn Converted to Habitat

Filepath: C:\Users\hadomeit\Desktop\deleteme\Figure16_SectionViewOfProposedOpeningForAlt3.docx

ANCHOR QEA

Figure 16
Section View of Proposed Opening for Alternative 3
Preliminary Design Report
Meadowdale Beach Park and Estuary Restoration Design Project

The majority of the lawn area (42,850 sf) would be converted to stream, marsh, and riparian habitat, with another 58,150 sf of habitat area restored by enhancing riparian vegetation and in-stream structures, for a total restored habitat area of 101,000 sf. In addition, 7,200 sf of existing habitat would be enhanced upstream of the existing pedestrian footbridge across Lund's Gulch Creek by installing in-stream structures consisting of large woody debris, and by enhancing existing riparian vegetation.

A new pedestrian bridge would be installed across the restored stream channel downstream of the existing pedestrian bridge. The path connecting the picnic shelter to the northern path would be partially re-aligned, and the loop path north of the proposed marsh would be truncated in order to avoid habitat fragmentation. Two picnic viewpoints would be established at the new path terminus. Drainage of remaining lawn areas would be improved, and the volleyball court would be converted to lawn area. Alternative 3 represents the largest bridge span and, of the three alternatives presented, would provide the most conversion of lawn to natural habitat in the lower park.

3.3 Alternatives Comparison and Analysis

Each of the three conceptual alternatives was evaluated against the project evaluation criteria (Table 6), in addition to constructability issues associated with cultural resources and environmental assessment studies. This series of studies included the following:

- Fisheries and Habitat Evaluation
- Hydraulic, Sediment, Coastal Process, and Sea Level Rise Analysis
- Railroad Infrastructure Evaluation
- Cultural Resources Evaluation
- Phase 1 Environmental Evaluation
- Cost
- Parks and Recreation ADA-Compliant Access and Public Safety Evaluation

The following sections summarize the results of each of the studies conducted as part of the feasibility analysis.

3.3.1 Fisheries and Habitat Evaluation

All three alternatives entail restoring the Lund's Gulch Creek connection to Puget Sound by constructing a railroad bridge that would alleviate the current flooding and sediment impoundment problems due to the significantly undersized culvert. Each alternative also includes restoration of the upper estuary (transition zone), lower creek, and riparian corridor. As a result, all three alternatives would significantly improve habitat conditions in Lund's Gulch Creek, its estuary, and the nearshore.

The differences in the benefits for ecological restoration and fish habitat are primarily related to the size of the bridge opening and the size of the restored transition zone. Habitat benefits would be greater in magnitude and more certain with a wider bridge opening and a larger transition zone. Alternative 3 (Figures 15 and 16), as the alternative with the widest bridge opening and the largest transition zone, would provide the greatest benefits for the habitat criteria evaluated and would best restore stream, estuarine, and nearshore processes in the project area. The width of the bridge opening and the large transitions zone included in Alternative 3 would provide the highest degree of certainty that there would be sufficient area for the restored habitats to naturally evolve and adapt to changing conditions over time, such as increased tidal inundation resulting from sea level rise. Alternative 3 would provide the greatest resilience for the park to adapt to changes associated with sea level rise and a changing climate.

Overall, the project provides a meaningful opportunity to restore habitats and ecosystem processes. In addition to providing significant habitat benefits, restoration in park settings offers exceptional opportunities to educate people on the natural resources of the park, the purposes of individual habitat components, and the importance of self-sustaining designs.

3.3.2 Hydraulic, Sediment, Coastal Processes and Sea Level Rise Analysis

The three proposed alternatives were evaluated to determine their ability to allow for natural creek flow and sediment transport potential at high flows, impacts to coastal processes on the beach and delta, and sustainability due to predicted sea level rise scenarios. This section provides an overview of in-depth analyses that were conducted as part of the Feasibility Study (see Appendices B and H of Anchor QEA 2016).

The hydraulic model used to evaluate the minimum railroad bridge opening size for the project site (as described above) was used to inform the analysis. Table 7 summarizes the geometry of the railroad bridge opening and the elevation of the proposed new pedestrian walkway used in the model for each of the proposed alternatives.

Table 7
Proposed Alternatives: Railroad Bridge Opening Input Summary

Proposed Condition[a]	High Flow Channel Width (feet)	Number of Piers	Elevation of Pedestrian Walkway Under Bridge (feet NAVD88)[c]
Alternative 1	50[b]	2	10.4
Alternative 2	60	2	10.0 (Separated Access, influenced by tidal elevations only)
Alternative 3	100[b]	3	11.1

Notes:

a. See Figures 11 through 16 for plan and section views of proposed alternatives.
An additional 10 feet of high-flow channel width is assumed, to include the flooded pedestrian walkway.
Mean higher high water elevation is 9.0 feet NAVD88; annual maximum tide is 10.7 feet NAVD88.

3.3.2.1 Inundation of Proposed Pedestrian Walkway

Inundation of the proposed pedestrian walkway was evaluated based on tidal elevations for all alternatives and a combination of tidal elevations and higher flows in Lund's Gulch Creek for Alternatives 1 and 3. Alternative 2 would utilize the existing culvert for pedestrian access but separates it completely from the creek flow; thus, it would only be vulnerable to tidal inundation from Puget Sound. The elevations of the pedestrian walkway under the proposed railroad bridge for Alternatives 1, 2, and 3 are provided in Table 7. The elevation of the walkway for Alternative 1 maximized overhead clearance for pedestrians, while the elevation of the walkway for Alternative 3 maximized sustainability due to sea level rise.

Model results suggest that the existing culvert's pedestrian walkway is currently inundated by more than 1 foot during a 100-year discharge at MHHW and would continue to inundate as sea levels rise. Results show that Alternative 1 would maintain freeboard during a 100-year event under current conditions, but would be inundated slightly at annual maximum tide. By 2050, inundation during a 100-year event at the annual maximum tide would increase to approximately three-quarters of a foot in depth. Alternative 3 would maintain freeboard during a 100-year event at MHHW under current conditions and the annual maximum tide for every scenario modeled through the year 2050. By the year 2100, all proposed alternatives would begin to become inundated by the tide alone at MHHW (regardless of creek discharge) and would be significantly inundated (a minimum of 1 foot) at annual maximum tide (regardless of creek discharge).

3.3.2.2 Sediment Transport Potential Through the Proposed Opening

The sediment transport capacity of the proposed alternatives was evaluated using computed bed shear stresses from the hydraulic modeling. The primary locations of concern for this analysis were at the entrances and outlets of existing or proposed structures (i.e., culvert, bridge). The 2-, 10-, and 25-year events were used in the analysis.

At the 2-year flow, the wider opening proposed for all three alternatives would allow sediment from the creek to accrete within the new opening as the estuary expands upstream of the railroad berm once the constriction at the mouth of the creek is removed. At higher (10- and 25-year) flows, the sediment transport potential in the creek would be increased, compared to existing conditions with the culvert in place. This indicates improved sediment transport capacity through this reach for all proposed alternatives; however, a larger opening would more likely result in a dynamic channel through the opening because it would provide more room for the channel to meander in response to sediment loads and high-flow events in the creek.

3.3.2.3 Impacts to Coastal Processes

Impacts to existing coastal processes were evaluated for each of the proposed alternatives, specifically, potential for channel migration, sediment transport and distribution on the delta, and wave impacts inside the park (landward of the existing railroad berm).

3.3.2.3.1 Potential for Channel Migration

Alternative 1 would increase the width of the channel at the mouth from 6 feet (existing culvert) to 40 feet, providing a larger area for the creek to migrate. Based on results of the Feasibility Study (see Appendix B, Hydrology and Hydraulics Evaluation, of Anchor QEA 2016), sediment load from Lund's Gulch Creek would accumulate just upstream and within the new opening, as well as downstream of the opening on the delta. At higher flows, the accumulated sediment within the creek mouth would be mobilized in the flow and transported farther out onto the delta. This ongoing process of sediment accumulation and transport would allow for more complexity in the channel alignment at the mouth, including the potential for multiple or braided channels to form. The flow paths, size, and number of channels formed at the mouth would be dynamic over time and dependent on recent sediment supply and deposition from upstream, tides, and storm waves from Puget Sound.

Alternative 2 would increase the width of the channel at the mouth from 6 feet (existing culvert) to 50 feet. The impacts on channel migration potential for this alternative would be in line with those for Alternative 1; however, the creek would be re-aligned to the north of its current (and historical) alignment as part of this alternative. This would require additional modifications to the creek farther upstream than for Alternative 1, in order to develop a sustainable new alignment for the channel at the creek mouth, and the creek could potentially migrate back to the original location.

Alternative 3 would increase the width of the channel at the mouth from 6 feet (existing culvert) to 90 feet, providing a significantly larger area for the creek to migrate. The impacts on channel migration potential for this alternative would also be in line with those for Alternative 1; however, the significantly larger opening (compared to Alternatives 1 and 2) for the creek would provide opportunity for significantly more complex channel formation at the delta, mouth, and upstream of the bridge.

3.3.2.3.2 Sediment Transport and Distribution on the Delta

As part of the Meadowdale Beach Park Feasibility Study), Shannon & Wilson conducted a geotechnical feasibility study to evaluate alternatives for mitigating sediment buildup at the existing culvert and for achieving design objectives for improving pedestrian beach access. The feasibility study included a sediment-loading evaluation to estimate the annual sediment volume entering Lund's Gulch Creek. At present, much of the sediment load is impounded upstream of the existing culvert and removed from the system in order to maintain pedestrian access to the beach. Sediment that can be transported though the culvert is deposited on the delta within a narrow reach downstream of the culvert. The wider opening proposed for Alternative 1 would allow sediment to be deposited

within a wider area at the mouth, but upstream and within the opening and downstream on the delta. The changes to sediment transport patterns would allow the delta to grow inland (as well as waterward) and would likely extend upstream of the new opening into the park area. In addition, lack of directed flow out of the culvert during high-flow events may alter the creek migration patterns on the delta. The energy from high flows in the creek would be distributed over a greater area, and it would likely require a larger flow to breach the berm on the delta and create a straight channel. The location and orientation of the berm on the beach may also change as sediment is deposited in different areas of the delta, as opposed to primarily in front of the existing culvert. Depending on the frequency and timing of large rainfall events and larger wind-wave events, the delta is likely to go through periods of growth and erosion, oscillating around an average shoreline location.

Alternative 2 would have similar impacts to sediment transport and deposition on the delta as Alternative 1. The main difference is that the creek outlet would be moved north of its current (and historical) condition. The sediment depositional area on the delta would therefore be moved to the north, and the delta would likely go through a transition phase following construction of Alternative 2. Sediment on the southern portion of the delta may begin to erode due to lack of replenishment from upstream and the net littoral drift to the north. The northern portion of the delta would expand as sediment is deposited directly in that area from upstream creek flow. The net littoral drift to the north may also move the extent of the delta farther to the north than its current extent. Over time, the entire delta would likely shift somewhat to the north.

Alternative 3 would have similar impacts to sediment transport and deposition on the delta as for Alternative 1. As with potential for channel migration, the much larger opening would provide opportunity for sediment distribution and transport over a much larger area than either Alternatives 1 or 2. This growth of the delta upstream of the opening would most likely be larger (across channel) than for the other alternatives. In addition, sediment deposited in some areas of the mouth may have a higher retention time in the opening compared to Alternatives 1 and 2 because this opening is much larger than is required for efficient sediment transport at high flows. It is possible that over time, sediment deposited during a high-flow event would remain outside the influence of the creek channel long enough to become vegetated. This could result in permanent filling in of portions of the creek mouth if the entire width of the creek migration zone under Alternative 3 were not required to support creek hydraulics.

3.3.2.3.3 Potential for Wave Impacts Inside the Park

Storm waves from Puget Sound move sediment on the outer portions of the delta, forming berms at or near the MHHW line. These berms act as natural wave breaks for storm waves, thus protecting the backshore areas of the delta from erosion due to direct wave impact. Alternative 1 would allow for continued formation of these berms and may be beneficial to berm formation, due to increased sediment load reaching the nearshore area. In addition, the elevations of the backshore area of the

delta are at or above MHHW elevation (including the current channel thalweg). Sediment deposition within the opening and out onto the delta would be expected to keep elevations in these areas above MHHW. Therefore, the wider opening that would be constructed as part of Alternative 1 would not be expected to increase potential for wave impacts inside the park. Alternative 2 would behave similarly to Alternative 1 in terms of storm wave impacts. Alternative 2 would not be expected to increase potential for wave impacts inside the park. Alternative 3 would behave similarly to Alternatives 1 and 2 in terms of storm wave impacts; however, if sediment was retained within the opening for longer periods of time (or indefinitely) than the other alternatives, there would likely be less sediment being transported out on the delta. This could result in decreased berm formation and subsequent increase in impacts to backshore areas of the delta from direct wave impact, but that energy would likely be attenuated by the larger estuary.

3.3.2.4 Projected Sea Level Rise Effects

The elevations of the backshore area of the delta are approximately 1 to 3 feet above current MHHW. Elevations of low-lying areas just upstream of the opening are approximately 3.5 to 4 feet above current MHHW (2015). For mid-range sea level rise predictions for 2030 (0.2 foot), no significant changes to coastal processes or creek function are expected. By 2050, the increase in sea levels is predicted to be just over 0.5 foot, which would result in increased flooding in the park area during higher tides and some landward movement of the shoreline of the delta. The delta could potentially expand into the park through and upstream of the opening in order to retain backshore beach area. In 2100, mid-range sea levels are expected to be 2 feet higher than the present. This would have a significant impact to the delta because much of the existing delta would be submerged at higher tides. Flooding in the lower reaches of the park near the mouth would likely be severe; the pocket estuary area inside the park for all alternatives would become larger by 2100, and the recreational area within the park and on the beach would be significantly depleted. It is possible that continued sediment loads from Lund's Gulch Creek could build up the mouth upstream of the opening, and a pocket beach area would then form within the mouth and lower reaches of the park. However, this assumes sediment loads would remain the same or increase in the future.

3.3.3 Railroad Infrastructure Evaluation

Toltz, King, Duvall, Anderson, and Associates (TKDA), the County's railroad consultant during the Feasibility Study, conducted a structural evaluation of the railroad infrastructure for each conceptual alternative. Table 8 summarizes the three bridge layouts for each alternative.

Table 8
Bridge Layouts for Alternatives 1, 2, and 3

Alternative	Bridge Layout	Main Span	First/Last Spans
		Structure depth (top of tie to low chord)	**Structure depth (top of tie to low chord)**
Alternative 1	Three-span bridge with 30-foot main span, combined creek and pedestrian access route	30-inch double cell box beams	20-inch concrete slab beams
		45 inches	35 inches
Alternative 2	Three-span bridge with 40-foot main span with separate creek and pedestrian access (in existing tunnel) route	36-inch single cell box beams	20-inch concrete slab beams
		51 inches	35 inches
Alternative 3	Four-span bridge with two 40-foot main spans, combined creek and pedestrian access route	36-inch single cell box beams	20-inch concrete slab beams
		51 inches	35 inches

The bridges proposed for all three alternatives met BNSF standards at the time of submittal and would be subject to the same constraints on construction access and requirements for BNSF coordination.

TKDA held preliminary discussions regarding the proposed bridge with BNSF Railway staff to determine their design requirements and possible flexibility in applying these design guidelines. This discussion resulted in two comments that impact the design, as follows:

- Windows for interrupting railroad traffic would be limited to a maximum of 2 to 3 hours
- 20-foot tracks centers are required at the bridge

Alternative 3, with the largest structure would, require the most time to construct, especially given the short work windows available. Alternative 1 has similar benefits to Alternative 3 but would require slightly less time to construct given the size of the proposed bridge. Alternative 2 is similar to Alternative 1 but it also retains the existing culvert tunnel for a separate pedestrian access route. This pedestrian route would retain the same issues (standing water and sediment) and therefore would have more maintenance and operation issues compared to the other two alternatives.

3.3.4 Cultural Resources Evaluation

All three alternatives include demolition or modification to two existing structures: the restroom enclosure and the tunnel. In general, the three alternatives have very similar footprints of ground disturbance. Alternative 3 has the greatest area of deep ground disturbance, because there are more pilings than the smaller bridge spans, and it should be considered the alternative with the greatest potential to impact archaeological resources. It is followed by Alternative 2, then Alternative 1, which has the least potential to affect cultural resources.

3.3.5 Phase 1 Environmental

One recognized environmental condition, related to the railroad berm, was identified by the Phase 1 Environmental Site Assessment, developed by Shannon & Wilson. This translates to the greatest potential environmental cleanup risk and associated costs for Alternative 3 and the lowest risk for Alternative 1.

3.3.6 Costs

Conceptual opinions of probable costs were developed for each of the three conceptual alternatives (Anchor QEA 2016) and are summarized in Table 9. These costs are appropriate for comparison of relative cost between the three proposed alternatives, but do not include costs associated with delays due to issues related to BNSF coordination (e.g., work windows being taken away during construction), construction management, monitoring, insurance and indemnification, railroad involvement during design and construction, and facility maintenance and ownership requirements. In addition, these costs do not reflect additional mobilization or other costs associated with constructability issues, tax or one percent for the arts requirement.

Table 9
Cost Summary

Criterion	Alternative		
	1	2	3
Temporary Facilities	$ 53,000	$ 58,000	$ 63,000
Demolition and Clearing	$ 62,000	$ 80,000	$ 95,000
Earthwork	$ 117,000	$ 151,000	$ 197,000
Railroad Bridge	$ 3,181,000	$ 3,391,000	$ 4,091,000
Recreation Items	$ 264,000	$ 259,000	$ 267,000
Planting, Irrigation, and Large Woody Material	$ 218,000	$ 278,000	$ 373,000
Mobilization, Contingencies, and Sales Tax	$ 2,154,000	$ 2,332,000	$ 2,813,000
Opinion of Probable Construction Cost (rounded)	**$ 6,050,000**	**$ 6,550,000**	**$ 7,900,000**

3.3.7 Parks and Recreation, ADA Access, and Public Safety

It is important to note that Meadowdale Beach Park is a hike-in park, and visitors come primarily to experience natural fish and wildlife habitat, including the beach, forested ravine, and creek. The three alternatives would provide differing levels of safety, beach access improvements, and recreational opportunities. They would also reduce maintenance requirements and associated costs to differing degrees, but all of them would improve conveyance of stream flows and sediment through appropriately sized openings. Accommodating these processes would restore habitat for salmon, but also convert varying amounts of the lower park area, specifically to lawn area, and to fish and wildlife habitat, shrinking the associated lawn-dependent uses.

4 Preferred Alternative

Alternative 3 was chosen as the draft preferred alternative; it consists a 130-foot-wide, four-span bridge, with the largest restored pocket estuary and associated riparian and wetland habitat. This conclusion was reached through a collaborative process with the County, consultant team, agency/organization stakeholders, and the community. Meetings were held with agency/organization stakeholders and community stakeholders in 2015 to review the conceptual alternatives and the results of the studies, and make final recommendations (see Appendix A of Anchor QEA 2016 for meeting summaries). In general, all of the agency and organization stakeholders, and the majority of community stakeholders, preferred Alternative 3.

Following this process, a final preferred alternative (Figures 17 and 18) was developed. This alternative included a 130-foot-wide, four-span bridge, conversion of approximately half of the lawn area to fish and wildlife habitat, significantly improved year-round beach access, and various other path and recreation facility improvements, as follows:

- **Railroad Bridge:** The existing culvert would be replaced with a four-span, 130-foot bridge centered on the location of the current culvert and creek outlet alignment.
- **Habitat Restoration:** The majority of the lawn area (42,850 sf) would be converted to pocket estuary and riparian habitat, with another 58,150 sf of upstream habitat area enhanced by installing in-stream structures consisting of large woody debris, and by enhancing existing riparian vegetation by planting more native conifers, for a total restored habitat area of 101,000 sf.
- **Recreation Facilities**
  - ***Beach Access:*** The pedestrian access path would be separated from the creek channel and located on the far south side under the railroad bridge. The path would provide the 80-inch minimum required for ADA-compliant vertical clearance.
  - ***Pedestrian Bridge:*** A new pedestrian bridge would be installed upstream of the pocket estuary across the restored stream channel downstream of the existing pedestrian bridge.
  - ***Restroom Enclosure:*** The enclosure would be located near the railroad right-of-way.
  - ***Paths:*** The path connecting the picnic shelter to the northern path would be partially re-aligned, and the loop path north of the proposed marsh would be truncated in order to avoid habitat fragmentation.
  - **Lawn Renovation:** Drainage of remaining lawn areas would be improved, and the volleyball court would be converted to lawn area.
  - **ADA Access:** ADA access would be extended throughout the park by constructing accessible walkways to the railroad bridge.
  - **Site Furnishings:** New benches, picnic tables, and other site furnishings would be provided to enhance the park and recreational facilities.

- **Picnic Viewpoints:** Two picnic viewpoints would be established at the new path terminus.

4.1 Rationale for Selection of Preferred Alternative

The preferred alternative was selected based on the evaluation criteria described in Section 3.1. In particular, habitat restoration including natural process (e.g. sediment and coastal) restoration, support of the project, public access and safety, and life-cycle cost and sustainability pointed the process towards selection and refinement of Alternative 3.

Alternative 3 provides full restoration of the natural creek bank-width, which in turn best supports the restoration of natural coastal and sediment processes. This alternative would provide the largest pocket estuary habitat, through excavation of upland fill and replacement of turf lawn with planted wetland habitat.

Importantly, this alternative was supported by all of the agency and organization stakeholders and the majority of public participants in meetings, who recognized that the park's main attraction is its natural habitat rather than its upland facilities. This alternative, through providing the greatest amount of habitat, also provides the most opportunity for environmental education programs and features.

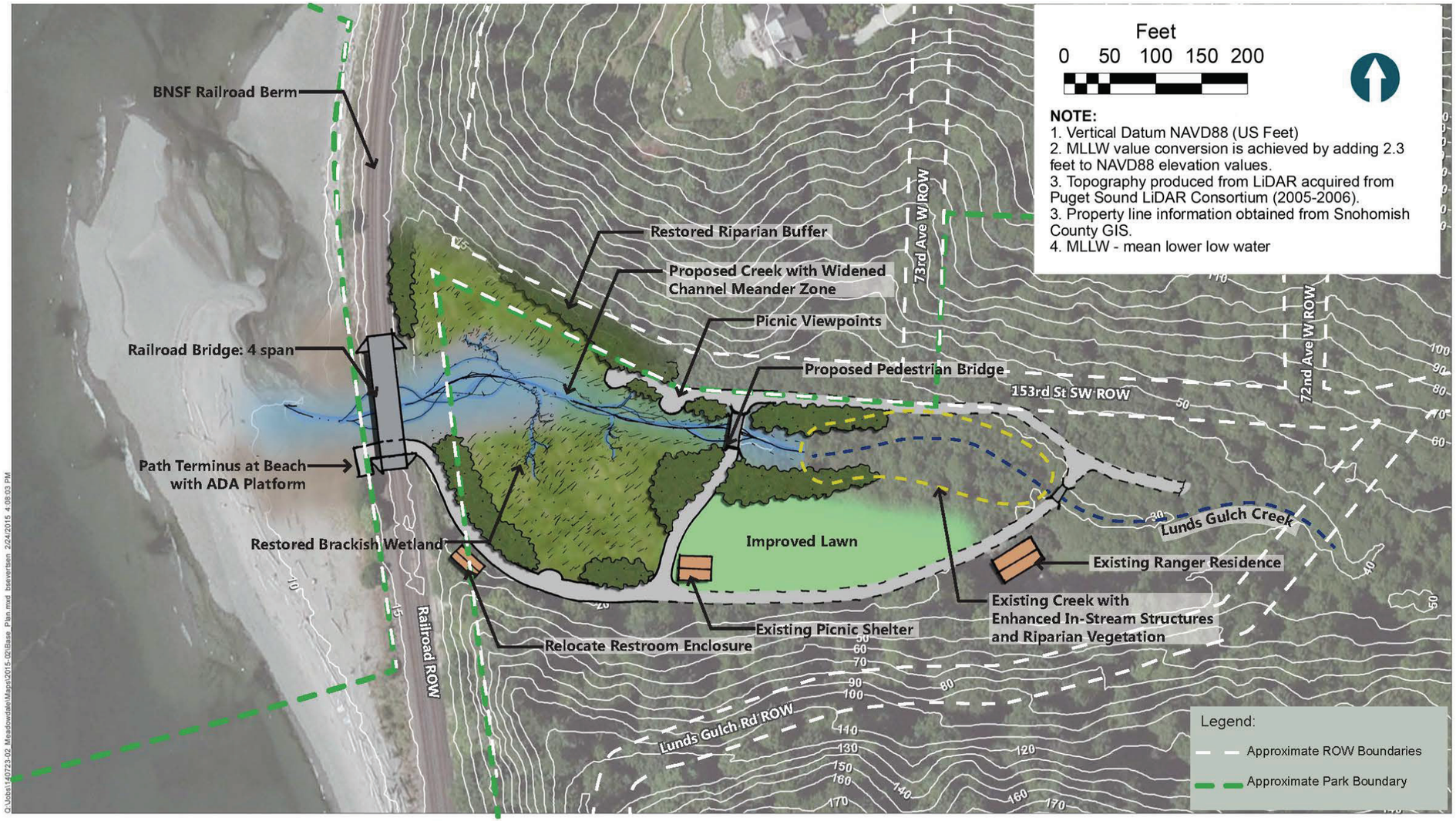
An additional benefit of Alternative 3 is its provision of improved beach access for park users. Alternative 3 would provide the best beach access, due to the size of the opening and the width of the path under the new railroad bridges. Additionally, with slight modifications related to vertical clearance under the bridge, Alternative 3 could provide an ADA-compliant route to the beach, providing equitable access to park facilities and meeting legal and funding requirements.

While initial construction costs for Alternative 3 are high, this alternative has the lowest lifecycle cost, by eliminating ongoing maintenance needs within sensitive aquatic environments. Additionally, restoring the soft shoreline estuary and maximizing the railroad berm opening would positively affect high-flow flood risks and provide the most resiliency against climate change effects.

4.2 Rationale for Not Selecting Alternative Nos. 1 and 2

Alternative No. 1. is a smaller-scale version of the preferred alternative. This alternative was not selected due to the desire to seek the best long-term solution, given the cost, size, coordination, permits, approvals, and agreements with a railroad agency. Repeating this process to enlarge the structure at a future date would add significant cost over the same project lifetime.

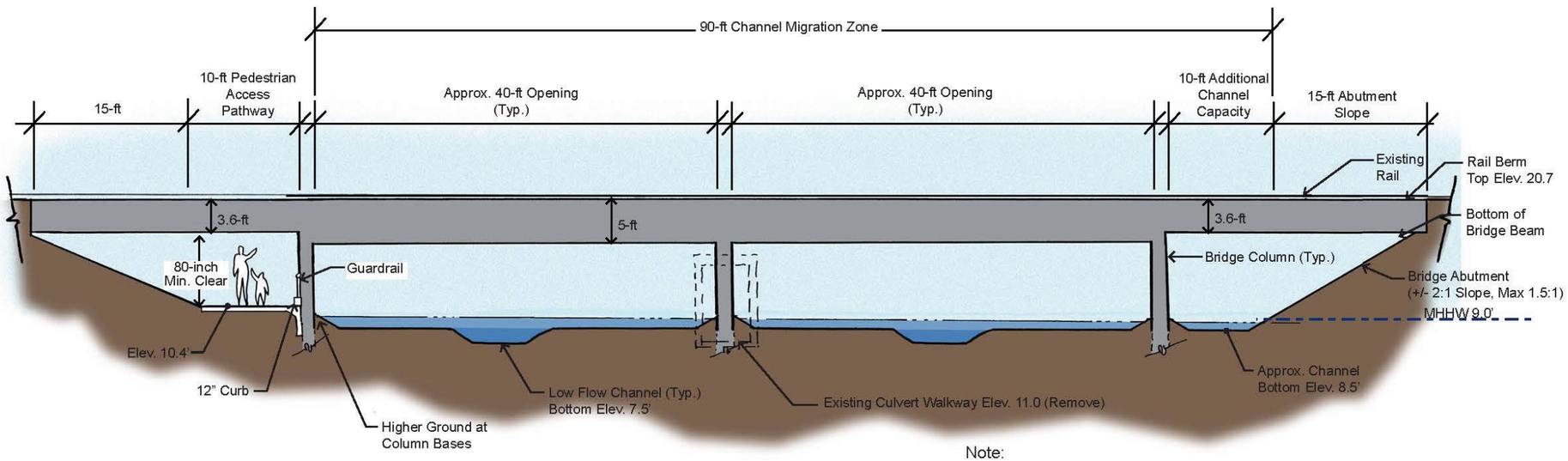
Alternative No. 2 was not selected primarily because it proposed to keep the existing tunnel, which is an aging structure and not ADA-compliant. In addition, the creek would require relocation, raising



Preferred Alternative: Four Span Bridge, Combined Creek and Pedestrian Access Route, 100% of Lower Lawn and 30% Upper Lawn Converted to Habitat

Filepath: C:\Users\hadomeit\Desktop\deleteme\Figure17_PlanViewOfPreferredAlt.docx

Figure 17
Plan View of Preferred Alternative
Preliminary Design Report
Meadowdale Beach Park and Estuary Restoration Design Project



Elevation Looking West

Note:

1. Vertical Datum NAVD88 (US Feet).
2. MLLW elevations can be obtained by adding 2.3 feet to NAVD88 elevation values.
3. Topography produced from LiDAR acquired from Puget Sound LiDAR Consortium (2005-2006)
4. Geometry of existing culvert taken from Puget Sound Tributaries Drainage Needs Report (Snohomish County, 2002)
5. MLLW - mean lower low water
6. MHHW - mean higher high water
7. Channel elevations shown are conceptual and may be modified based on results of hydraulic modeling or during project design.

Preferred Alternative: Four Span Bridge, Combined Creek and Pedestrian Access Route, 100% of Lower Lawn and 30% Upper Lawn Converted to Habitat

Filepath: C:\Users\hadomeit\Desktop\deleteme\Figure18_SectionViewOfProposedOpeningForPreferredAlt.docx

ANCHOR QEA

Figure 18
Section View of Proposed Opening for Preferred Alternative
Preliminary Design Report
Meadowdale Beach Park and Estuary Restoration Design Project

concerns that the creek may have the potential to migrate back to the current location, causing pedestrian access issues.

Finally, while both Alternatives No. 1 and 2 represent cost savings of $1 million to $2 million, the incidentals are presumed to be similar for all three alternatives. Therefore, given the above, these two alternatives were not selected.

5 Design Considerations and Preliminary Analyses

This section provides the design criteria that informed the preliminary design, and presents results of any analyses performed. This section also describes any revisions to the preferred alternative resulting from the preliminary design process, along with an explanation as to whether and how these revisions impact the stated objectives.

The content is organized to align with the targeted objectives for this project. Objectives 1 through 5 are specific to the overarching ecological goal of providing high-functioning, sustainable rearing habitat for non-natal juvenile Chinook (threatened), coho, and chum salmon; cutthroat trout; and other fish species within the park setting, and include the following:

1. Remove 130 lf of hard armored railroad embankment along the shoreline
2. Install a four-span railroad bridge with a 90-foot opening to enable creek meander, improve sediment delivery, and dissipate floodwaters
3. Restore approximately 1 acre of tidal marsh pocket estuary
4. Enhance and restore 1 acre of nearshore and steam riparian buffers along 1,050 feet of shoreline
5. Restore in-stream habitat conditions by placing large woody debris in the lower creek and restored estuary.

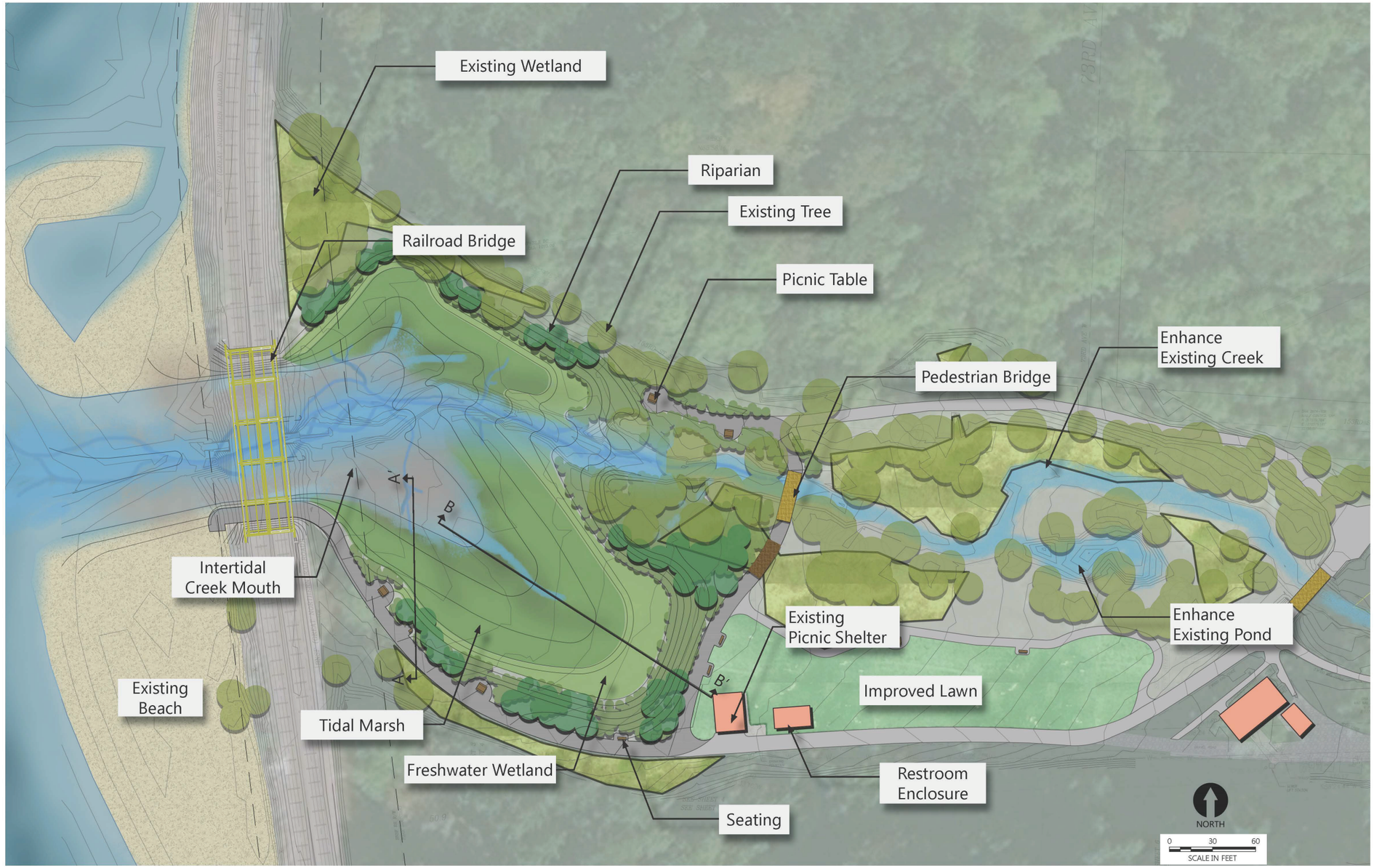
Specific design criteria under each of these five habitat restoration objectives are provided in Sections 5.1 through 5.4. Draft results of the cultural resources inventory are discussed in Section 5.5, including archaeological monitoring, which is provided to inform how subsurface conditions might impact this project. In addition, Section 5.6 contains a discussion regarding the additional objectives addressing park elements, as many of the design elements associated with these objectives are likely to contribute to the success of this project. An Illustrated Plan of the Preliminary Design is shown on Figure 19, the Preliminary Design drawings are referenced in Section 7 and shown in Appendix A, and construction costs are discussed in Section 8.

5.1 Remove Hard Armored Railroad Embankment Along Shoreline

This project objective included removal of 130 lf of rock armored railroad embankment paralleling the shoreline. As part of that removal, the undersized culvert will be removed. The preferred alternative included replacement of the embankment and culvert with a four-span bridge. The following describes the design criteria developed during preliminary design to meet this objective.

5.1.1 Railroad Preliminary Design

The preliminary design was informed by the following documents, which establish railroad engineering design criteria:



Filepath: C:\Users\hadomeit\Desktop\deleteme\Figure19_IllustrativePlanViewOfPrelimDesign.docx

ANCHOR QEA

Figure 19
Illustrative Plan View of Preliminary Design
Preliminary Design Report
Meadowdale Beach Park and Estuary Restoration Design Project

- BNSF comments on Conceptual Design
- Boundary and Topographic Survey
- Geotechnical Investigation (Vertical Borings)
- Geotechnical Investigation (Horizontal Borings)
- Geotechnical Investigation Historical Archive Research findings (see Section 2.1.2)
- American Railway Engineering and Maintenance-of-Way Manual for Railway Engineering
- BNSF Standard Bridge & Component Plans, dated June 1, 2016
- BNSF Standard Specifications
- 2012 BNSF Engineering Instructions for guidance on track design and geometry
- 2011 BNSF Project Design Drawing Standards for overall appearance of track and civil plans
- BNSF Engineering Structures CAD Standards Manual, dated January 1, 2016
- 2016 Union Pacific/BNSF Railway *Guidelines for Railroad Grade Separation Projects*
- Constructability Input from Railroad Bridge Contractor
- 2010 ADA Standards for Accessible Design

5.1.1.1 BNSF Comments on Conceptual Design

In May 2016, the County submitted conceptual (10%) plans representing the preferred alternative, as part of BNSF's required project submittal process; BNSF provided comments in September 2016. The BNSF directives establish project-specific railroad design criteria and are summarized as follows:

1. No changes to the horizontal track alignment of the existing track(s)
2. No changes to the vertical track alignment of the existing track(s)
3. BNSF will not change their current operational practices or sacrifice any current operational flexibility except for brief periods during construction under specific short-term circumstances, i.e., hours in length
4. No shoofly tracks of any speed at this location, due to constructability and impacts to operation

Using the above comments from BNSF as design criteria, the design team updated the 10% railroad bridge design while still achieving the project goals, as described here:

BNSF Comment 1: No changes to horizontal track geometry

BNSF's comment of maintaining existing track centers of approximately 14.8 feet complicates shoring design and construction between the two tracks. The complication is due to installing shoring so close to an existing live railroad track and reducing the access around the shoring area in which to work. The 20-foot track center was initially proposed because it is a current rail design standard, but BNSF, at their discretion, can "grandfather" current conditions, as warranted.

However, this update benefits the project in the following ways:

1. Reduces the railroad bridge footprint by shortening the bridge's overall width

2. Reduces the amount of new armored track embankment on the park side required north and south of the new bridge as it ties into the existing alignment
3. Increases area available for estuary restoration

Maintaining the existing track geometry through the proposed bridge location provides benefits to the project but complicates the bridge construction due to shoring between the two tracks. Further discussion of how the design team plans to address these difficulties is provided later in this report.

BNSF Comment 2: No changes to vertical track geometry

The only reason to propose a vertical track re-alignment would be to provide a higher pedestrian path elevation under the bridge while providing the ADA-required height clearance of 80 inches. The result is that the path elevation is fixed at 10.4 feet NAVD88). A discussion regarding the path elevation and sea level rise can be found in Section 5.6.1.

BNSF Comment 3: No changes to current operational practices

Current operational practices include posted timetable track speeds through the Meadowdale area, as follows: 45 miles per hour for freight trains and 50 miles per hour for passenger and commuter trains. These speeds cannot be reduced in any new track alignment. This comment requires the structure to be built under regular rail traffic, with short work windows. This comment did not affect the proposed design.

BNSF Comment 4: No shoofly tracks

Shoofly tracks are temporary tracks built adjacent to the existing structure to facilitate construction along existing rail lines; they are typically designed to accommodate existing speeds. A low-speed shoofly was initially proposed, because a standard shoofly would not work in this location due to site topography constraints. BNSF's comments regarding no shoofly tracks result in less impact to the park overall because the structure would need to be built on the park side, and in order to build the structure, additional encroachment landward of the shoofly would be warranted.

5.1.1.2 Boundary and Topographic Survey

Survey data collected in April 2017 identified or confirmed several considerations for the preliminary design. The survey included a top-of-rail survey of both BNSF main tracks through the project area, as well as a topographic survey of the track embankment. This survey data confirmed that track centers are less than 15 feet through the proposed bridge location. Also, the elevation difference between Main 1 and Main 2 was able to be quantified as approximately 6 inches, which results in Main 2 being the controlling track in the design of the bridge. The survey helped to more precisely locate track tangents, spirals, and curves as well as vertical curves and tangents, using the survey data and multiple linear regression tools in Bentley InRoads CAD package. The bridge will be in a curve for both tracks, and the design will need to account for train forces through this curve. The

survey also helped further refine proposed bridge elevation and its impact to the proposed pedestrian trail's vertical clearance under the bridge.

5.1.1.3 Geotechnical Input

A draft geotechnical report (Appendix F-1) was prepared to provide a summary of surveys and explorations, subsurface conditions, and engineering study results. These results informed the railroad bridge and tidal marsh pocket estuary (Sections 5.1 and 5.3) design.

For the draft geotechnical report, soil borings were drilled (Figure 20) to support the bridge design:

- Five borings along the existing access road (for construction equipment access)
- Two borings near the proposed railroad bridge abutments
- One horizontal boring into the railroad embankment fill

Subsurface Conditions derived from these borings are shown in Table 10.

Engineering analyses completed for the draft report include driven-pile axial capacity plots and recommended LPile parameters for designing railroad and pedestrian bridge foundations, lateral earth pressure analysis for designing temporary shoring, seismic analyses to provide seismic design parameters and liquefaction potential, and associated construction considerations. At the time the report was published, final design analyses were ongoing.

Table 10
Subsurface Conditions

Boring ID	Location	Subsurface condition
MB-1	Along existing access road	Asphalt road surface overlying interbedded dense to very dense sand and silt with beds between 6 inches and 17 feet thick
MB-2		Asphalt road surface overlying interbedded medium dense to dense sand and silt with beds between 2.5 and 17 feet thick
MB-3		Asphalt road surface overlying loose to medium dense silty sand fill to a depth of 12 feet, overlying interbedded dense sand and silt with beds between 2.5 and 34 feet thick
MB-4		Asphalt road surface overlying loose to medium dense poorly graded sand with silt fill to a depth of 7 feet, overlying interbedded dense sand and silt with beds between 6 inches and 14 feet thick
MB-5		Asphalt road surface overlying interbedded medium dense to very dense silty sand and poorly graded sand with silt to a depth of 33 feet, with beds between 1 and 13.5 feet thick
MB-6 through MB-7	East of existing railroad berm	Asphalt and gravel trail surface overlying very loose to soft, interbedded sandy silt, silt, silty sand with gravelly zones to a depth of 9.5 to 13 feet, overlying medium dense, poorly graded sand with silt and gravel to a depth of 24 to 28 feet, overlying dense to very dense, interbedded gravel, sand, silty sand to depths of 117 feet, overlying very dense silt with sand to a depth of 130 feet

Bridge Constructability

Bridge constructability was evaluated by drilling geotechnical borings near each abutment, conducting ground-penetrating radar (GPR) and electrical resistivity tomography along the top of the railroad embankment, and drilling a sub-horizontal boring into the embankment.

Bridge Foundations

Based on the subsurface conditions observed in the abutment borings and sub-horizontal embankment boring, we feel the anticipated steel HP 14X89 H-pile bridge foundation elements are constructable using impact pile hammer installation methods. We anticipate bridge piling will be driven through the existing embankment and into the underlying colluvium and alluvium, to depths approaching 120 feet below the existing walking path. Embankment soils observed during the sub-horizontal boring consisted of gravelly sand and sandy gravel, with no indications of wood piling, cobbles or boulders, consistent with reviewed historical embankment construction records.

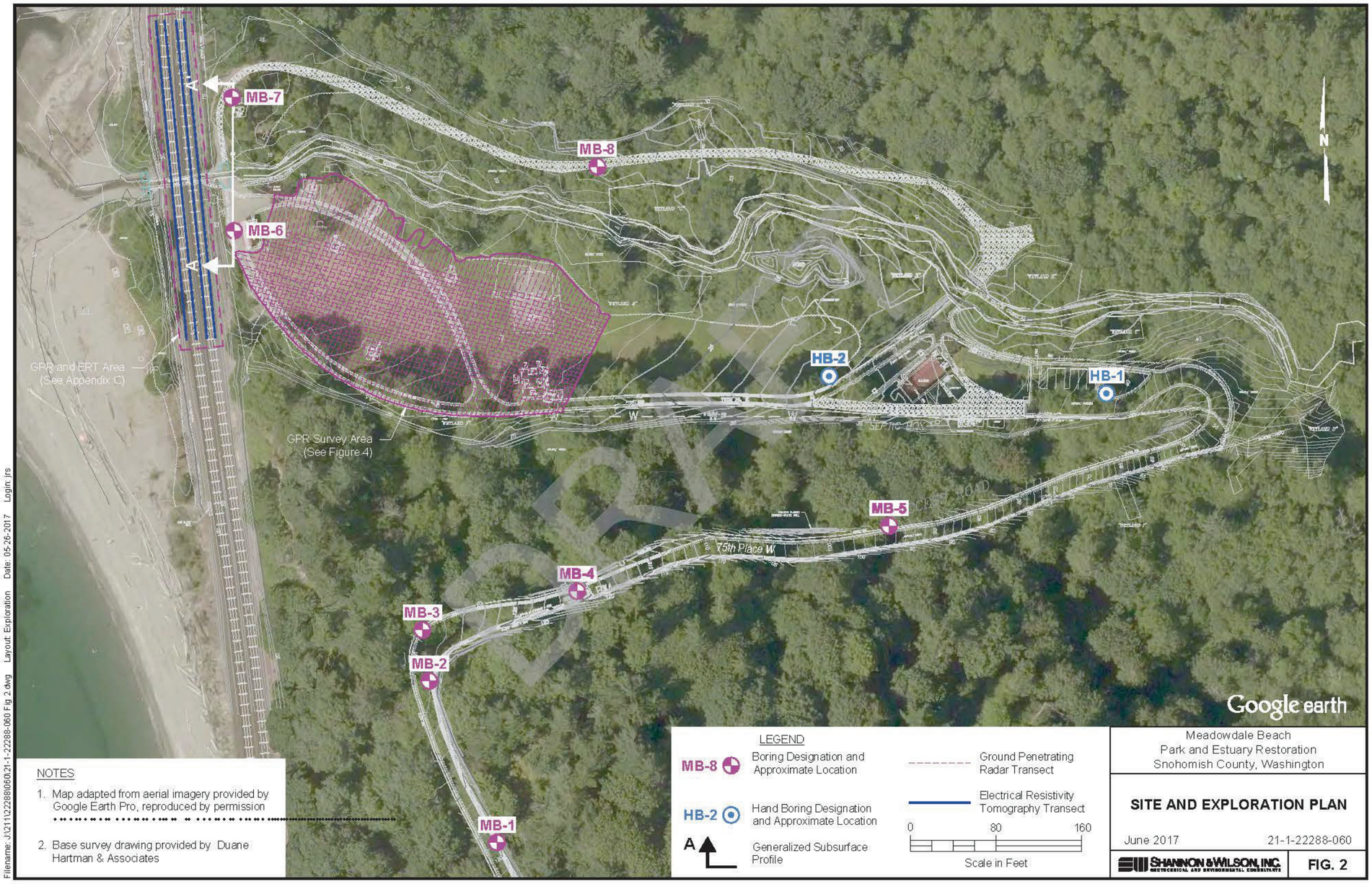
Bridge Construction Sequence and Temporary Shoring

To construct the bridge within the anticipated windows, construction will be sequenced to maintain live track conditions throughout construction, and the bridge will be constructed one track at a time. Once the first half is completed, traffic will be routed to the completed portion, and the second half of the bridge will be constructed. As such, temporary shoring will be installed between the tracks to allow excavation during construction of the first half of the bridge. Temporary shoring may be continuous sheetpile wall or driven H-piling with steel sheet lagging, depending on the contractor's preference. Based on observed soil conditions, we anticipate that either shoring method should be constructable. Advantages to using driven H-piling and steel sheet lagging include improved pile drivability, as H-piling are generally more robust and capable of penetrating hard ground, and decreased waste, as it is anticipated that piling would be cut off at a specified elevation below the finished ground elevation, rather than extracted.

5.1.1.4 Railway Bridge Standards

The proposed concrete ballast-deck railway bridge that will support the two main tracks was based on BNSF standard bridge plans and includes 17-inch-tall concrete curbs, concrete walkways, and steel handrail with kick angles to keep ballast from falling onto the pedestrian trail below.

The bridge foundations consist of driven steel H-piles that would be efficient to drive into the ground during short work windows determined by BNSF. The rest of the bridge uses BNSF standard precast concrete components that are economical, durable, and able to resist saltwater spray. These components and the proposed configuration will be known to railroad bridge contractors and have been proven to work for BNSF throughout their railroad network. The BNSF standard bridge components meet any applicable Federal Railroad Administration, American Railway Engineering and Maintenance-of-Way Association, or internal BNSF requirements.



Filepath: C:\Users\hadomeit\Desktop\deleteme\Figure20_SoilBoringLocations.docx

ANCHOR QEA

Figure 20
Soil Boring Locations
Preliminary Design Report
Meadowdale Beach Park and Estuary Restoration Design Project

5.1.2 Revisions to Railroad Bridge from Preferred Alternative

The preferred alternative provided a meander width within the two main 40-foot spans, as well as 10 feet of the northern abutment span, for a total width of 90 feet. In June 2016, BNSF updated their standard bridge plans, 2 months after the County submitted the conceptual plan to BNSF. The new standard bridge plans require deeper beam sections for the span lengths originally proposed at the time the preferred alternative was developed. This would reduce clearances under both the abutment and middle spans, affecting visibility, aesthetics, and trail vertical clearance. Therefore, the design team proposed an updated bridge design with shorter span lengths to reduce the beam depth. The main spans were shortened to 28 feet, and the number of main spans were increased from two to three, changing from a four- to a five-span bridge. These changes maintain the total channel meander width of approximately 90 feet, consisting of 84 feet under the main spans and an additional 6 feet within the northern abutment span. The overall top of bridge length changed to 128 feet, a slight reduction in length of 2 feet from the preferred alternative.

By shortening the span lengths and adding a span in the middle, beam depths were reduced from 36 to 30 inches, while the abutment spans' beam depths would remain at 20 inches, consistent with the preferred alternative. Shortening the bridge spans has the advantage of potentially enabling BNSF bridge crews to build the bridge using a rail-mounted crane. The preferred alternative with its fewer and longer spans would not be feasible for BNSF to construct because their equipment weight requirements limit them to installing spans up to 28 feet long. If BNSF drives the piles and builds the bridge, less temporary grading is needed, and it would likely be easier to permit. Using a rail-mounted crane also potentially decreases the size and cost of the temporary shoring. Decreasing the beam depth of the middle spans would provide a more open view of the beach looking under the bridge from the land side.

In addition, a gravity block wall under the southern abutment was utilized to accommodate the ADA-compliant vertical clearance of 80 inches for the pedestrian trail. However, this 80-inch clearance also resulted in lowering the pedestrian trail by approximately 7 inches from the preferred alternative, to 10.4-foot elevation NAVD88.

5.1.3 Constructability Analysis

5.1.3.1 Mobilization Ingress/Egress

This hike-in only park abutting Puget Sound with a limited-access, one-lane road affected by historical landslide activity poses a particular set of constructability challenges for construction equipment and material delivery. During the Addendum Phase of the Feasibility Study, a vetted railroad bridge contractor was consulted to discuss the construction feasibility of the additional alternatives considered, as well as the preferred alternative; to provide input on work windows; and to inform the conceptual cost estimate. In addition, part of that discussion focused on site access. At

that time three access points were discussed, including: 1) rail; 2) the ADA/limited-access road; and 3) marine access via barge. The rail line was the preferred method, but would require BNSF's approval. Based on comments at the initial meeting with BNSF, it was determined that this option had too much uncertainty at the feasibility stage of the project to be of relied upon. Marine access would require a temporary pier to be constructed on the beach, impacting intertidal habitat including eelgrass beds and adding challenges to permitting. The road presented potential weight and maneuverability limitation issues. Shannon & Wilson provided a preliminary assessment concluding that certain repairs and structural improvements to the limited-access road may be warranted, and that seasonal conditions may limit access. However, any improvements made to the limited-access road would represent a long-term investment into County infrastructure, versus the expenditures for the temporary facilities needed for marine access or payment to the railroad.

During the design phase, Shannon & Wilson was contracted to perform the geotechnical investigation on the road, determine whether the road could meet all the requirements necessary for the equipment, and engineer any stabilization measures necessary. The railroad bridge contractor was consulted again to provide more specific details, such as weights, widths, turning radii, slope limitations of the transport vehicles bringing in the crane, and the bridge components, if by road. The previous options of marine access and rail, along with adding air (helicopter) access, were also re-vetted, with more detail sought. The helicopter option was considered cost prohibitive, based on information obtained from one of the consultants experienced with helicopter deliveries; the contractor added that a lifting frame would need to be built for a sky crane helicopter, and noted that liability insurance would likely be very expensive. Rail access was still a good option but thought to still have a high level of uncertainty and could affect the timeline if BNSF pulled the option after all project permitting. The final direction by the County during preliminary design was to pursue and permit the road access option, but the rail option would continue to be a point of discussion with BNSF; ultimately, the selected contractor has the potential for recommending their own construction access method, which may require additional permitting.

The railroad bridge contractor indicated that a 100-ton, road-compatible lifting crane weighing 289,000 pounds when set up, along with the pre-cast bridge sub and super-structure and H-piles, must be mobilized and demobilized from the site. This crane would likely be mobilized using multiple pieces of equipment to the site, including a 123-foot-long low-boy, along with standard highway freight trucks (typically 40 to 48 feet long). Shannon & Wilson, the design team's geotechnical engineering consultant, is currently designing bank stabilization improvements along the limited-access road, to accommodate these loads. The equipment could have a potential grade restriction of 15%. The limited-access road has a section with some 16% grade segments that would require regrading to achieve the 15% maximum. The hairpin turn and narrow road width also present challenges to the low-boy; however, to address this limitation, the crane can be unloaded from the low-boy and "walked" down the road from the gate location.

5.1.3.2 Limited-Access Road Stability Improvements

Historical limited-access road fill prism failures, observed existing shoulder displacements, and anticipated construction traffic volumes and loading prompted analyses to evaluate limited-access road stability improvements. Five borings were advanced along the limited-access road, and stability analyses were completed to model road stability under construction traffic. Based on observed soil conditions and stability analysis results, we anticipate localized road damage and shoulder failures would likely develop under construction traffic. Measures for improving road fill stability in-situ, such as driven slope-reinforcement elements, will be included in the construction drawings and specifications.

5.1.3.3 Bridge Construction – Temporary Facilities

In addition to access, the railroad bridge contractor was consulted regarding potential means and methods specific to the bridge construction, based on the limited-access road and crane approach described above. A temporary embankment consisting of quarry spalls capped with crushed surfacing base course would likely be required on both the beach and lawn sides of the tracks. The embankment could be 30 feet wide at an elevation 8 feet below top of rail along the majority of the bridge. In addition, a 50- by 50-foot raised pad brought up to the rail elevation would be required south of the proposed bridge location. An additional 30 feet of laydown area extending water-ward and lawn-ward of the embankment would also be required for bridge components. The remaining lawn area where the estuary is proposed would also likely be needed for staging of equipment and materials. As stated previously, the selected contractor may have an alternate bridge construction temporary facilities plan, but this configuration is being used for the sake of construction cost estimating, permitting, and approvals from BNSF. Any variation may require additional permitting or approvals from BNSF. Lund's Gulch Creek will need to be diverted during bridge construction. The method currently proposed is multiple 36-inch-diameter corrugated metal pipe culverts.

5.1.4 Finalizing the Preliminary Design

Preliminary design drawings (Appendix A-2) were submitted to BNSF in August 2017 as part of the BNSF 30% submittal requirements, along with a Type Selection Report (Appendix G), which outlines the reasoning for the selection of the various design elements of the railroad bridge, including but not limited to the superstructure, substructure, and foundations. A review meeting with BNSF was held on December 5, 2017, to discuss their comments on this submittal; the results of this meeting are summarized in Section 6.

5.2 Increase Channel Meander Width, Improve Sediment Delivery, and Dissipate Floodwaters

This project objective included increasing the available meander width for Lund's Gulch Creek under the BNSF railroad from a confined 6-foot-wide box culvert to a 90-foot-wide opening. This opening

would also enable sand and gravel sediment from the creek to travel naturally through the restored and expanded pocket estuary and adjacent nearshore, as opposed to being obstructed by the existing grating and the narrow culvert opening. Finally, the proposed channel opening would eliminate backwatering of large storm events into the park, which frequently flooded the portable restroom enclosure, and would allow high tides to ebb and flow within the restored pocket estuary. The widened channel under the railroad would also address and reduce the frequency of firehose effect events that are detrimental to the natural beach berm/spit and pocket estuary formation on the waterward side of the BNSF right-of-way.

5.2.1 Increase Channel Meander

5.2.1.1 Updated Hydraulic Modeling

The 1-dimensional hydraulic model (HEC-RAS; Brunner 2010a, 2010b) developed for the Feasibility Study was updated in October 2016 to reflect new site survey data that were collected within the project extents (Appendix H) for the preliminary design process. The predicted water surface elevations from the original and updated models were compared, and no significant differences were identified. Therefore, recommendations for the minimum opening size (20-foot opening during flows up to 300 cfs, 30-foot opening for flows up to 400 cfs) developed as part of the Feasibility Study remain unchanged.

5.2.2 Sediment Delivery

The proposed grading within the lower channel would allow the creek to meander and naturally transport and distribute its sediment load over time. The weather conditions creating stream and tidal forces strong enough to cause natural adjustment of the channel in the estuary may occur as early as the first fall and winter following construction. Because construction is expected to end in the late summer, the preliminary design includes the establishment of a starter channel, utilizing salvaged streambed substrate, to direct flow through the estuary. The purpose of this channel is to provide sufficient depth and velocity conditions to allow adult salmon (i.e., coho, chum, and, possibly, stray Chinook) and cutthroat trout passage into the creek during the first fall season between the end of construction and the time when high-flow events may begin to naturally create a different channel through the restored pocket estuary. The concern is that without a channel, the stream may inadvertently provide water depths insufficient for adult salmon passage. The preliminary design channel is trained in its alignment using an approximately 1-foot-tall berm comprising streambed sediment and cobbles on either side of the channel. The expectation is that the normal storm events in the first or second wet season following construction would begin to rework the area. It is anticipated that the channel would adjust and continue to evolve over a period of years into different alignments, as is expected of a low-gradient creek mouth conveying relatively high sediment loads through a pocket estuary. Pocket estuary forming natural sediment delivery processes are designed

to be improved on the landward and waterward sides of the BNSF railroad. As stated above, the significantly widened channel and removal of the narrow culvert would substantially reduce the occurrence of firehose effect events that cut through the beach berm/spit and short circuit the pocket estuary formation on the waterward side of the railroad. Long-term shifts in sediment distribution are also anticipated due to sea level rise. The design provides a perimeter of relatively flat space that is currently 2 feet above the highest recorded tide for the estuary to shift landward before reaching steeper proposed slopes.

5.2.3 Floodwater Dissipation

As discussed in Section 2.10.4, the existing culvert causes flooding of the park due to backwatering of the creek by the culvert, which has limited flow capacity. The backwatering caused by the culvert itself is exacerbated by sediment deposition within and immediately upstream of the culvert at the railroad berm. Hydraulic modeling conducted as part of the Feasibility Study (Anchor QEA 2016a), modeled water surface elevations due to high creek flows upstream of the railroad embankment for existing conditions (culvert in place) and several bridge alternatives of varying widths. As shown in Table 11, predicted water surface elevations upstream of the railroad berm within the park are 2 to 4 feet higher for existing (with culvert) conditions than for all bridge options considered (bridge widths of 30 feet to 90 feet).

Table 11
Predicted Water Surface Elevations Just Upstream of Railroad Berm[a]

Creek flows (cfs)	Existing Conditions, with Culvert	All Bridge Options (opening size 30 to 90 feet)
135 (100-year flow)	12.8	10.8
200	14.2	11.0
300	15.8	11.2

Notes:

a. Water surface elevations developed in the Feasibility Study as part of the HEC-RAS modeling effort (see Appendix B, Anchor QEA [2016a]). All model simulations used MHHW elevation (9.0 feet NAVD88) as downstream boundary condition.

5.3 Restore Tidal Marsh Pocket Estuary

This project objective included restoring approximately 1 acre of high-functioning, sustainable rearing habitat for non-natal juvenile Chinook (threatened), coho, and chum salmon; cutthroat trout; and other fish species. The objective of approximately 1 acre of estuary habitat is met by the preliminary design, which includes 1.3 acres of estuary habitat. As mentioned in Section 2.1, the 1872 T-sheet for this site revealed landcover and topography supporting a pocket estuary protected by a beach berm/spit at the lower creek mouth, prior to construction of the railroad embankment. The beach berm/spit component of the pocket estuary has naturally re-established on the waterward side of the railroad, but the landward tidal marsh was filled in many decades ago. This landward

portion is the restored component, requiring excavation of former fill materials, mentioned here. However, as mentioned above, the removal of a narrow culvert with a 90-foot channel opening would also support natural sediment transport and delivery processes for the pocket estuary on the waterward side of the railroad. The combined benefits of the project create a larger pocket estuary spanning both sides of the railroad line, and improve nearshore natural sediment processes for eelgrass beds at the perimeter of the creek delta. This expanded pocket estuary would be much more resilient to sea level rise than current conditions.

5.3.1 Groundwater Conditions

Four piezometers were installed in the lawn area in October 2016 to monitor groundwater levels. This information was essential to better understand shallow groundwater and salinity conditions in areas proposed for pocket estuary marsh habitat. Data were recorded monthly at all four locations (Figure 21). Monitoring Well (MW)-01 readings indicated groundwater within 0.3 to 5 feet of the ground surface, depending on the season. MW-2 and MW-3 readings were between 0.9 and 5 feet, and MW-4 readings were between 2.8 and 7.5 feet of the ground surface (Figure 22).

Salinity readings indicated that the groundwater is well below the lower limit of estuarine conditions of 5 parts per thousand (ppt), with readings between 0.06 and 0.17 ppt (Figure 23).

These results indicate that while groundwater readings would support wetland creation throughout the site, excavation to allow for tidal influx is necessary to sustainably support the salinity requirements of an estuarine system important for juvenile salmon-rearing habitat.

5.3.2 Subsurface Conditions

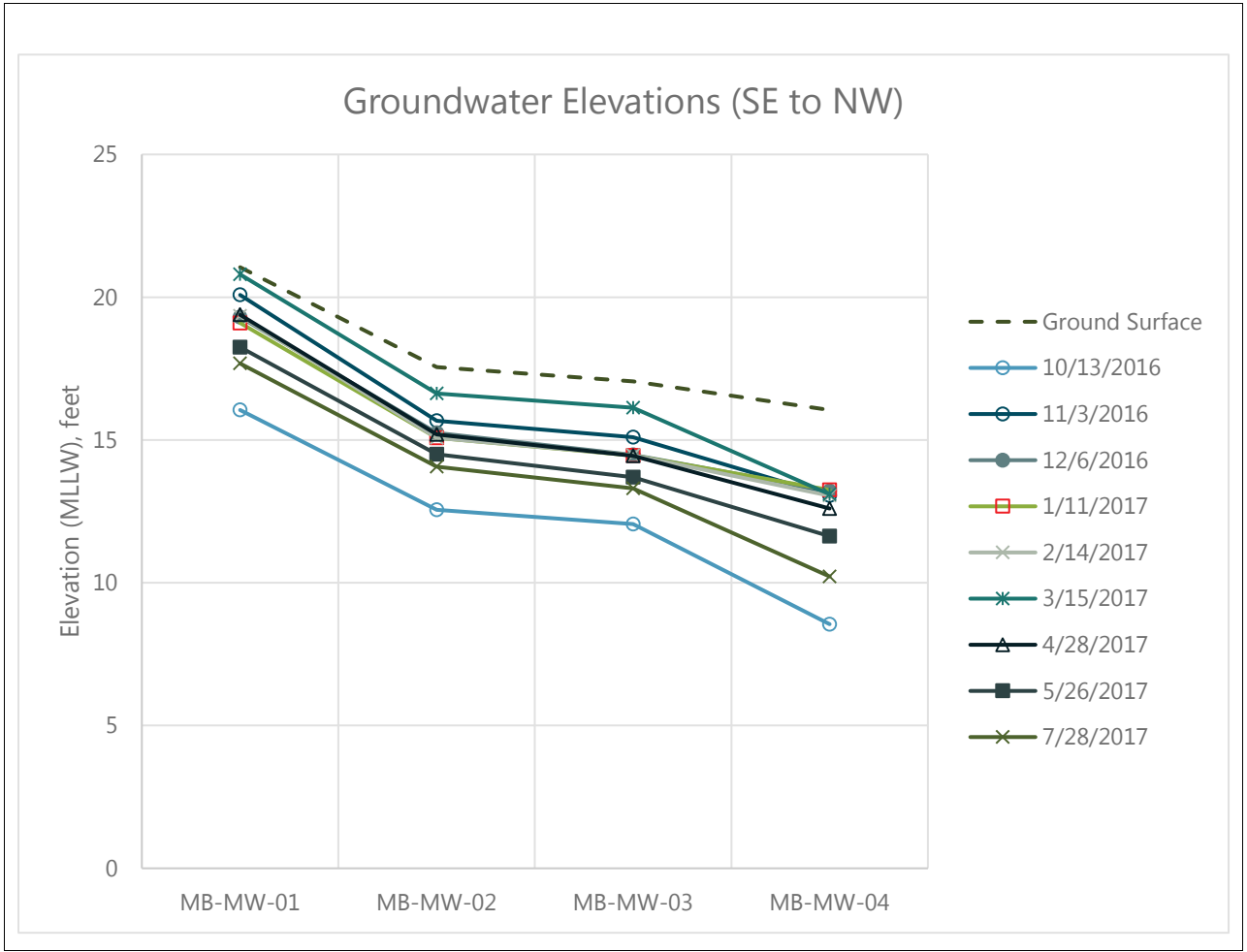
A number of historical activities have occurred at the park, and materials from these uses have in some instances been deposited on the site. In particular, the demolition of the Meadowdale Country Club included disposal and capping of construction debris within and in the vicinity of the club's former outdoor pool.

GPR surveys (Appendix F-1, Draft Geotechnical Report; F-2, Test Pit Photos; and Figure 24) were performed throughout the lawn area and the railroad embankment in 2016 and 2017. These surveys transmit and measure reflected electromagnetic pulses, to detect the presence of anomalous features, identifiable by sharp contrasts in density and other physical properties that would indicate a change of soil type or presence of a dense object, such as a boulder, concrete block, concrete slab, or steel beam, within less-dense subsurface soils. The GPR surveys detected numerous anomalous features, relatively evenly distributed throughout the lawn area, with several clusters of anomalies that may indicate remnant foundations and debris from historical structures. In general, a concentration of these features was shown north and west of the existing picnic shelter and asphalt walkway. Test pits were excavated in these areas and are described in Section 5.3.3.

Publish Date: 2017/12/28, 4:50 PM | User: bsevertsen
Filepath: Q:\Jobs\SnohomishCounty_0723\MeadowdaleBeachPark\Maps\2017_12\Preliminary_Design_Report\FigureX_MontiorWell.mxd

ANCHOR QEA

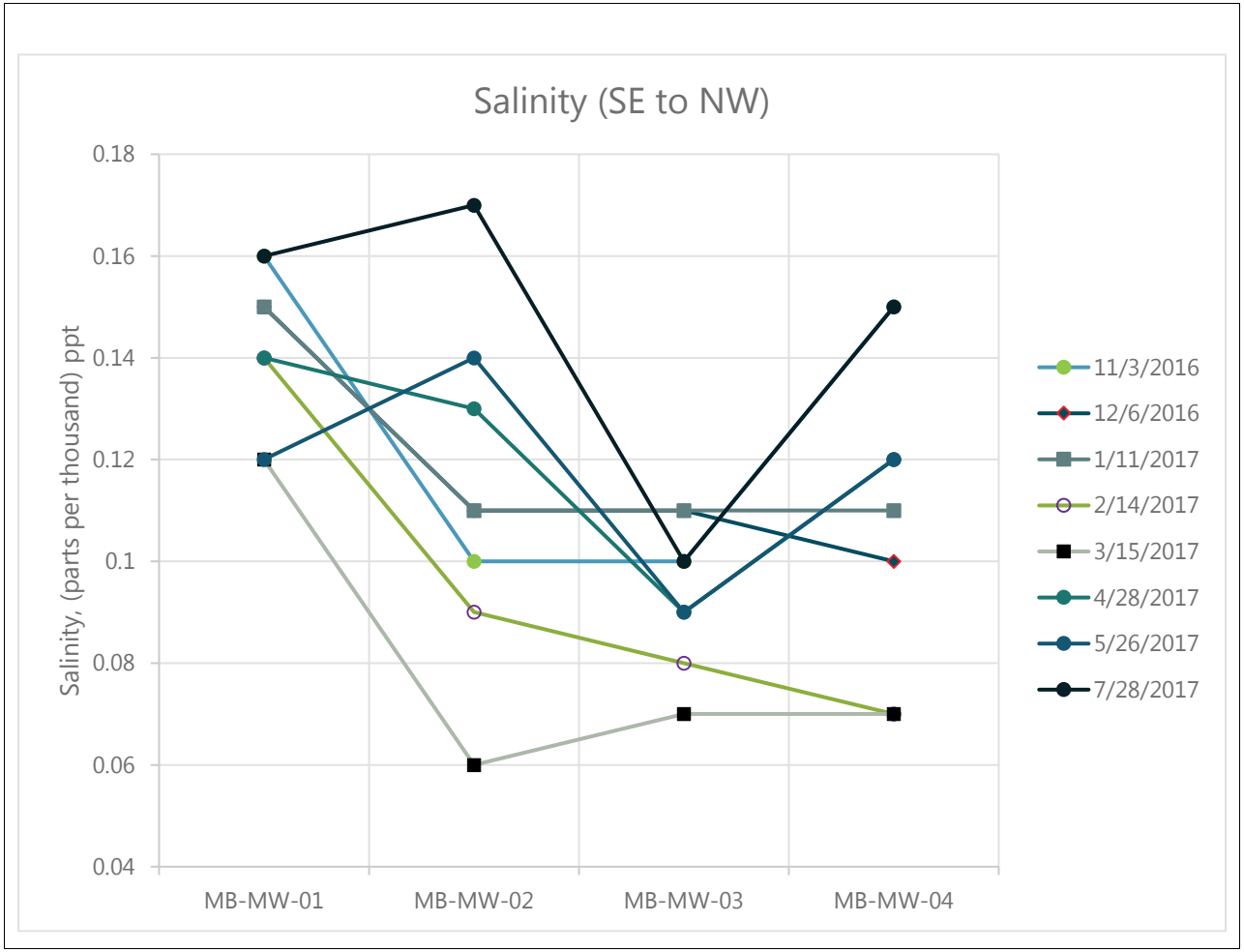
Figure 21
Groundwater Monitoring Well Locations
Preliminary Design Report
Meadowdale Beach Park Recreation and Habitat Improvements Project



Filepath: \\fuji\anchor\Projects\Snohomish County\Meadowdale Beach Park\Park and Habitat Design\Task 5.2 60% Design\Prelim Design Rpt\Figures\Figure22_GroundwaterElevsOverTime.docx

ANCHOR QEA

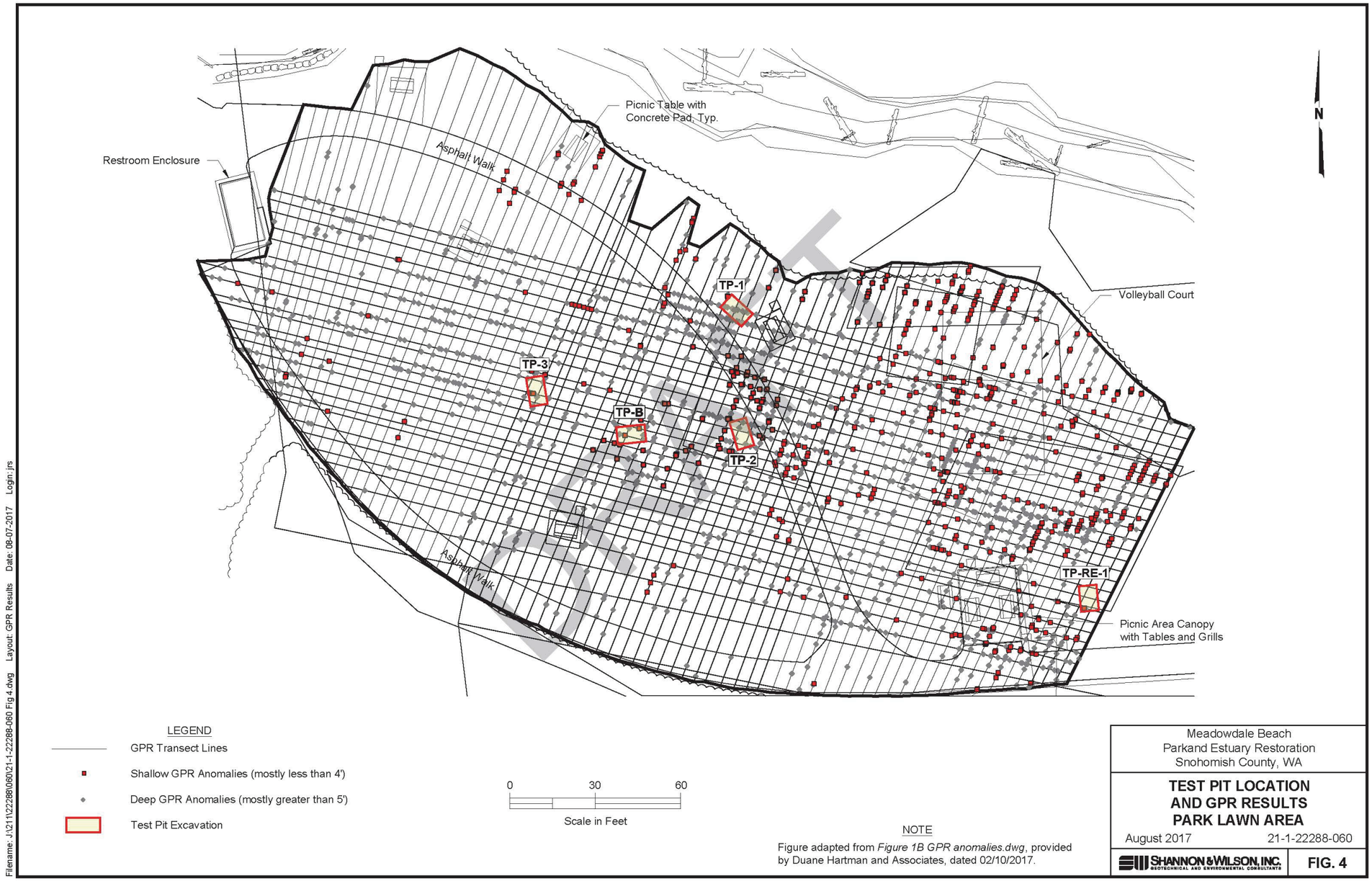
Figure 22
Groundwater Elevations Over Time
Preliminary Design Report
Meadowdale Beach Park and Estuary Restoration Design Project



Filepath: \\fuji\anchor\Projects\Snohomish County\Meadowdale Beach Park\Park and Habitat Design\Task 5.2 60% Design\Prelim Design Rpt\Figures\Figure23_GroundwaterSalinityOverTime.docx

ANCHOR QEA

Figure 23
Groundwater Salinity Over Time
Preliminary Design Report
Meadowdale Beach Park and Estuary Restoration Design Project



Filepath: \\fuji\anchor\Projects\Snohomish County\Meadowdale Beach Park\Park and Habitat Design\Task 5.2 60% Design\Prelim Design Rpt\Figures\Figure24_GPRsurvey.docx

ANCHOR QEA

Figure 24
GPR Survey
Preliminary Design Report
Meadowdale Beach Park and Estuary Restoration Design Project

5.3.3 Estuary Area History and Conditions

The remnant Meadowdale Country Club structures were believed to be within the proposed estuary restoration area. A geophysical survey using GPR methods and subsequent test pits was completed during preliminary design (see Figures 25 through 29). These methods were used to investigate whether anomalous features were present beneath the ground surface throughout the western portion of the existing lawn area where the estuary restoration is proposed. The GPR survey data were collected along linear transects oriented approximately parallel and perpendicular to the long axis of the lawn area. The GPR data indicated numerous anomalies distributed throughout the western lawn area, with an apparent concentration of anomalous features near the suspected location of the buried pool and country club structures, along the northern leg of the asphalt walkway through the grassy area and just north and west of the picnic area canopy.

Based on the GPR results and interpreted conditions, four test pits were excavated within areas of concentrated anomalous features, to investigate whether remnant structure debris was present; such debris was encountered in all four test pits. Three of the test pits contained concrete slabs at depths ranging from 4 to 9.5 feet below ground surface, with steel, concrete, brick, wood, and other manmade materials observed within the soil overlying the slabs.

Estuary restoration construction will encounter remnant debris and foundation elements, which will need to be properly disposed. If remnant foundation elements or slabs are present at the proposed finished cut elevation, estuary excavation may need to be deepened in localized areas to remove remnants, as necessary, to construct the finished surface as designed.

5.3.4 Tidal and Freshwater Influences

The replacement of the culvert with the bridge opening will connect a restored tidal marsh pocket estuary habitat with the existing beach-berm spit-protected pocket estuary waterward of the railroad. Currently, high flows through the culvert can focus high-velocity water into a direct westward channel to Puget Sound, bisecting the natural spit during high creek flows and cutting off the low-flow channel within the beach-side pocket estuary. The less-constrained opening of the bridge would significantly reduce flow velocities in the creek channel, thereby reducing the potential for the natural spit to be eroded during high-flow events in the creek and returning the delta to a more naturally functioning system.

The creation of the tidal marsh pocket estuary landward of the railroad bridge will bring high tides further into the park. Through excavation, the MHHW line moves between 90 and 150 feet landward of its current location at the upstream end of the culvert. The extreme high water moves farther landward and is of equal importance due to both subsurface salinity effects on marsh vegetation root systems and sea level rise.

5.3.5 Estuary Tidal Marsh Grading and Existing Wetland Avoidance

Three existing freshwater wetlands (described in Section 5.4.1) are adjacent to the proposed estuary tidal marsh restoration landward of the railroad. These freshwater wetlands are located to the north, south, and east of the tidal marsh restoration. In compliance with avoidance-and-minimization requirements of local, state, and federal environmental regulations, the design of the estuary tidal marsh avoids these wetlands; specifically, the wetlands are protected from dewatering and disruption by avoiding excavation/grading within 10 feet of the wetland boundary. Wetland avoidance and minimization of impacts for the preliminary design reduces the estuary restoration footprint from what is shown in the preferred alternative. The main freshwater input to the restored estuary tidal marsh is Lund's Gulch Creek and subsurface groundwater downgradient of the three existing freshwater wetlands.

The estuary tidal marsh restoration design maximizes the extent of the pocket estuary through proposed excavation of nearly 17,000 cy of material. Cuts range from 3 to nearly 8 feet within the boundary of the estuary restoration landward of the railroad (excluding the railroad berm removal for the railroad bridge). These cuts increase the estuarine transition area from fresh to saltwater for juvenile salmon (i.e., Chinook, coho, and chum), creating opportunities for natural habitat formation through channel migration in the estuary, and providing adequate space for sediment deposition and sea level rise adaptation, as described previously.

The design team considered using microtopography to lessen the cut volume, thereby protecting the existing lower creek channel and riparian trees within the restored estuary, but the approach was dismissed, in favor of long-term needs for sediment storage and delivery. These long-term benefits add resiliency to the restoration, outweighing any short-term riparian habitat benefits, and natural processes would, in time, create increased and more sustainable habitat diversity.

5.3.6 Estuary Substrates and Plantings

Materials within the pocket estuary include gravel/cobble streambed substrate, sand/gravel fish mix substrate, beach sand, topsoil for wetland plants, and backshore and wetland plants.

Backshore beach plantings are proposed waterward of the railroad berm and consist of species shown in Table 12. These plug plants will be installed in beach sand substrates.

Table 12
Backshore Beach Plants

Common Name	Scientific Name
Coastal sand verbena	*Abronia latifolia*
Sea thrift	*Armeria maritima*
Coastal Strawberry	*Fragaria chiloensis*
Puget Sound Gumweed	*Grindelia integrifolia*
Dunegrass	*Leymus mollis*

File: J:\211\22288\040\21-1-22288-040 TP-1.dwg Date: 08-02-2017 Author: jrs

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

LOG OF TEST PIT TP-1

JOB NO: 21-1-22288-040 DATE: 7/20/17 LOCATION: Meadowdale Beach Park

PROJECT: Meadowdale Beach Park and Estuary Restoration

	SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
1	Light brown, *Silty Sand with Gravel (SM);* moist; little fine gravel; fine to medium sand; low plasticity fines; few organics; scattered construction debris; wood debris at 1.0 foot below ground surface (b.g.s.). Concrete debris (8-inches in diameter) starting at 2 feet b.g.s. Holocene fill (Hf)	▽		S-1, S-2, S-3	0–4
2	Dark brown, *Poorly Graded Sand with Gravel (SP);* moist; little fine to coarse gravel; fine to medium sand; low plasticity fines; increasing frequency of construction debris (wood fragments, 6- to 9-inch diameter concrete rubble). Encountered intact concrete slab at 4.0 feet below ground surface. Holocene fill (Hf)			S-4, S-5, S-6	4–12

Sketch of East Pit Side — Surface Elevation — Horizontal Distance in Feet

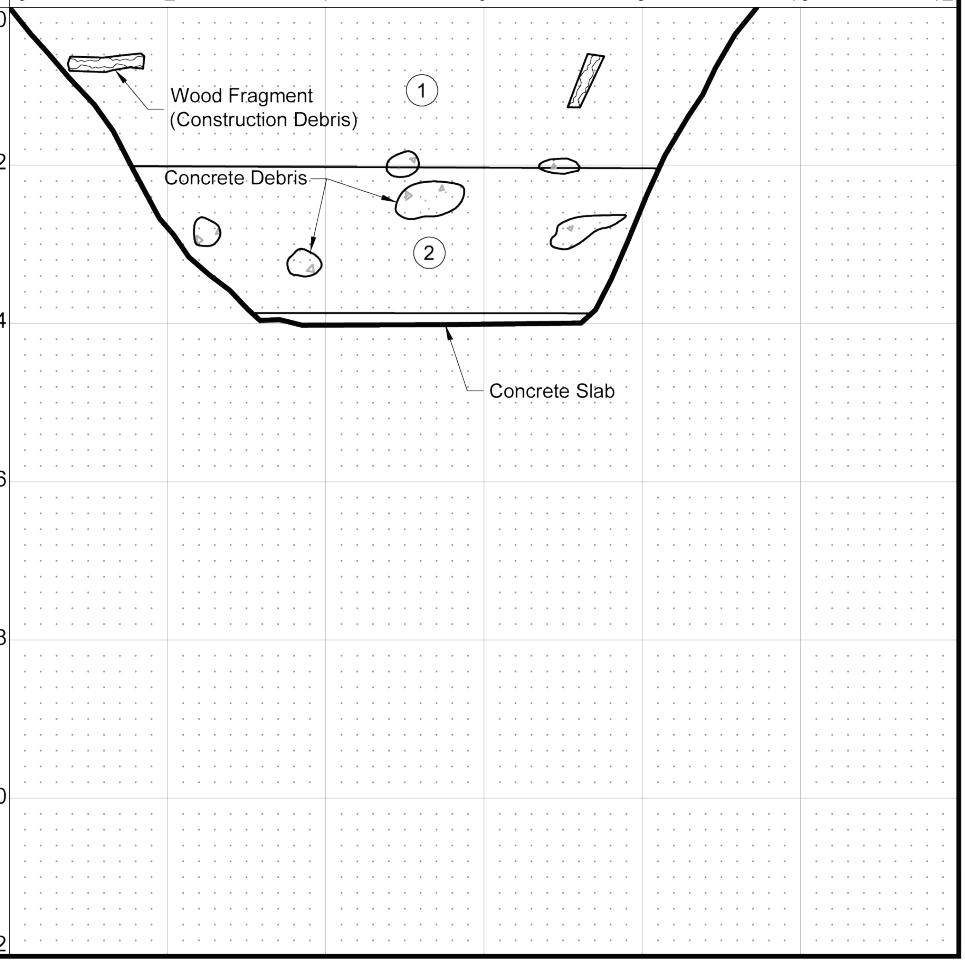


FIG. 1

Filepath: \\fuji\anchor\Projects\Snohomish County\Meadowdale Beach Park\Park and Habitat Design\Task 5.2 60% Design\Prelim Design Rpt\Figures\Figure25_Test Pit Log 1-5.docx

ANCHOR QEA

Figure 25
Log of Test Pit TP-1
Preliminary Design Report
Meadowdale Beach Park and Estuary Restoration Design Project

File: J:\211\22288\040\21-1-22288-040 TP-2.dwg Date: 08-04-2017 Author: jrs

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

LOG OF TEST PIT TP-2

JOB NO: 21-1-22288-040 DATE: 7/20/17 LOCATION: Meadowdale Beach Park

PROJECT: Meadowdale Beach Park and Estuary Restoration

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Light brown, *Silty Sand with Gravel (SM);* moist; little coarse to fine gravel; fine to medium sand; low plasticity fines; abundent construction debris below 1.0 foot ground surface (b.g.s.), including wood fragments, concrete rubble greater than 1-foot in diameter with rebar, and metal debris. Holocene fill (Hf)			S-1 S-2 S-3	0 2
(2) Gray, *Silty Sand with Gravel (SM);* moist; wet below 5 feet; few organics; little fine to coarse gravel; few cobbles; fine to medium sand; increasing frequency of construction debris (wood, concrete rubble - 3-inches to greater than 2-feet, and metal debris). Holocene fill (Hf)	▽		S-4 S-5	4 6 8 10 12

Sketch of East Pit Side Surface Elevation

Horizontal Distance in Feet

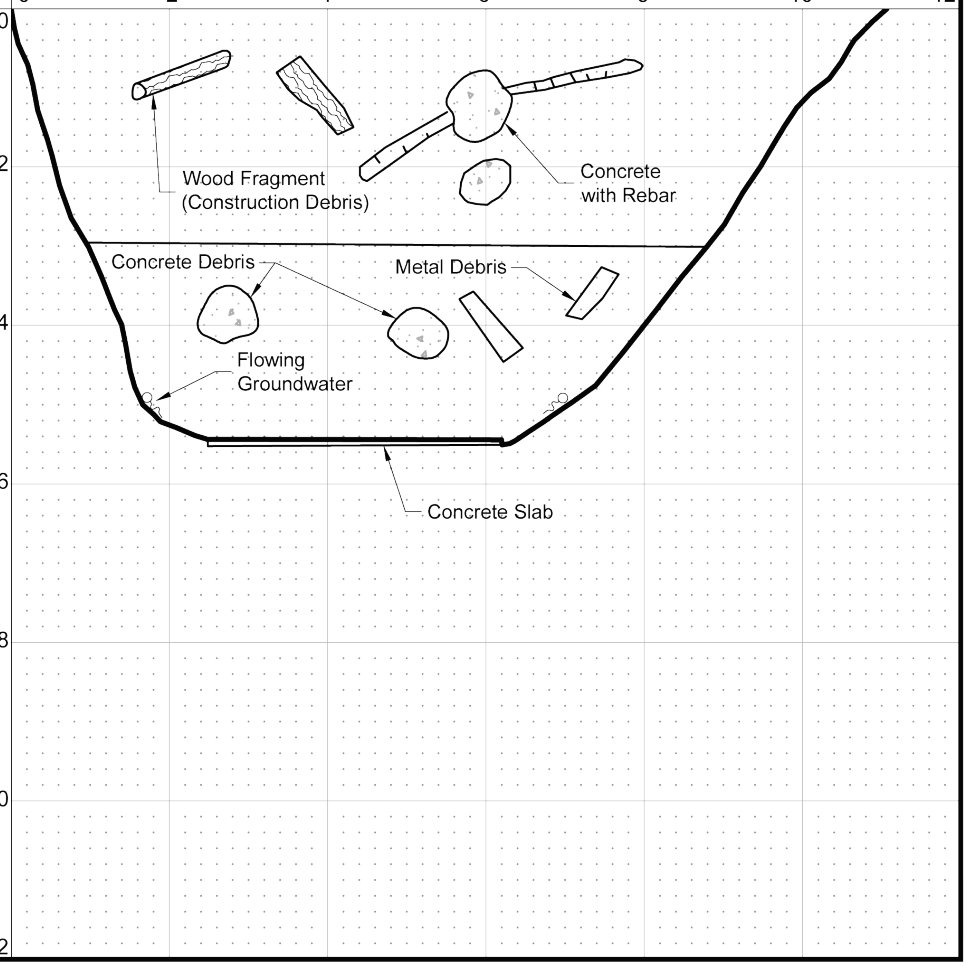


FIG. 1

Filepath: \\fuji\anchor\Projects\Snohomish County\Meadowdale Beach Park\Park and Habitat Design\Task 5.2 60% Design\Prelim Design Rpt\Figures\Figure26_Test Pit Log 2-5.docx

ANCHOR QEA

Figure 26
Log of Test Pit TP-2
Preliminary Design Report
Meadowdale Beach Park and Estuary Restoration Design Project

File: J:\211\22288\040\21-1-22288-040 TP-3.dwg Date: 08-04-2017 Author: jrs

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

LOG OF TEST PIT TP-3

JOB NO: 21-1-22288-040 DATE: 7/20/17 LOCATION: Meadowdale Beach Park

PROJECT: Meadowdale Beach Park and Estuary Restoration

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Light brown, Silty Sand with Gravel (SM); moist; little coarse to fine gravel; fine to medium sand; low plasticity fines; little construction debris (wood, concrete rubble - 3-inches to greater than 2-feet in diameter, and metal debris). Holocene fill (Hf)			S-1, S-2	0–4
(2) Gray, Silty Sand with Gravel (SM); moist; wet below 5 feet; few organics; little fine to coarse gravel; few cobbles; fine to medium sand; Increasing frequency of construction debris (concrete debris 6-inches to greater than 2-foot in diameter, wood debris, and metal debris). Holocene fill (Hf)	▽		S-3, S-4	4–12

Sketch of East Pit Side

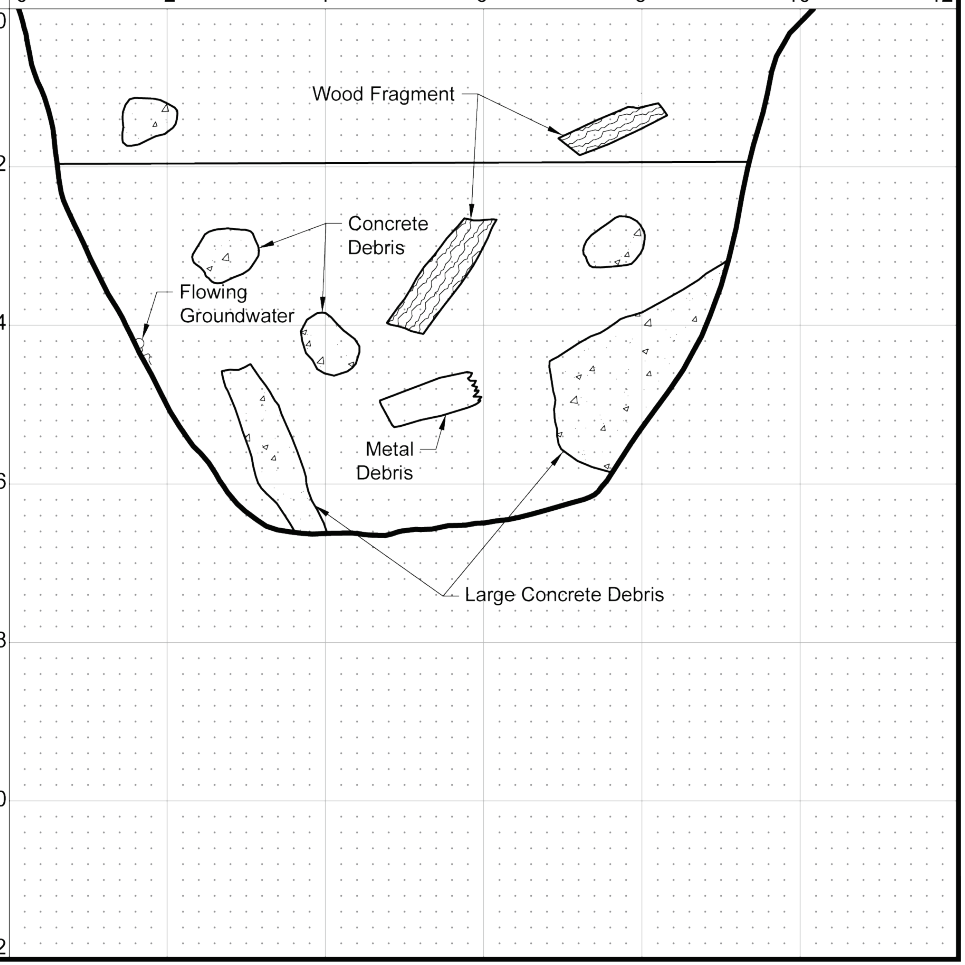


FIG. 1

Filepath: \\fuji\anchor\Projects\Snohomish County\Meadowdale Beach Park\Park and Habitat Design\Task 5.2 60% Design\Prelim Design Rpt\Figures\Figure27_Test Pit Log 3-5.docx

ANCHOR QEA

Figure 27
Log of Test Pit TP-3
Preliminary Design Report
Meadowdale Beach Park and Estuary Restoration Design Project

File: J:\211\22288\040\21-1-22288-040 TP-B.dwg Date: 08-02-2017 Author: jrs

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

LOG OF TEST PIT TP-B

JOB NO: 21-1-22288-040 DATE: 7/20/17 LOCATION: Meadowdale Beach Park

PROJECT: Meadowdale Beach Park and Estuary Restoration

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Light brown, Silty Sand with Gravel (SM); moist; little coarse to fine gravel; fine to medium sand; low plasticity fines; 1 foot below ground surface (b.g.s.) some construction debris (wood, concrete rubble - 3-inches to greater than 2-feet in diameter, and metal debris). Holocene fill (Hf)			S-1, S-2	0–4
(2) Gray, Silty Sand with Gravel (SM); moist; wet below 5 feet; few organics; little fine to coarse gravel; few cobbles; fine to medium sand; Increasing frequency of construction debris (wood fragments, concrete rubble with and without rebar less than 6-inches to greater than 1-foot in diameter, and metal debris). Holocene fill (Hf)	▽		S-3, S-4	4–12

Sketch of North Pit Side

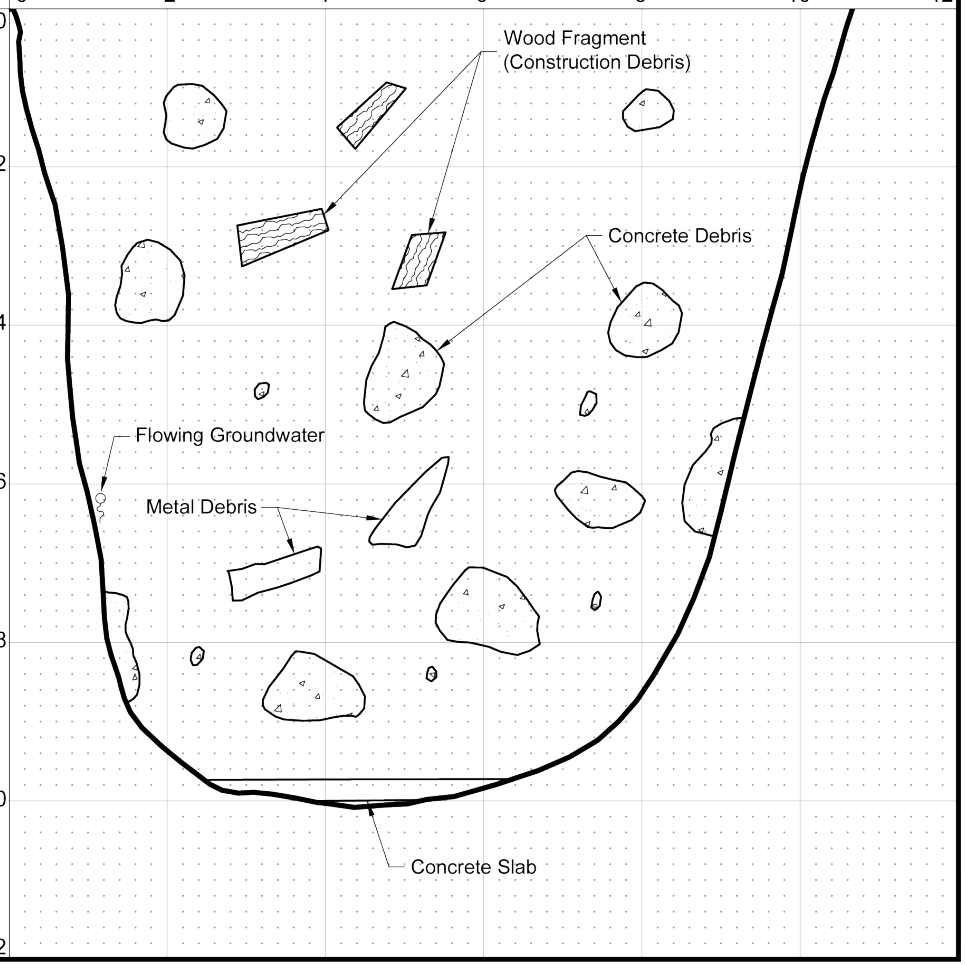


FIG. 1

Filepath: \\fuji\Anchor\Projects\Snohomish County\Meadowdale Beach Park\Park and Habitat Design\Task 5.2 60% Design\Prelim Design Rpt\Figures\Figure28_Test Pit Log 4-5.docx

ANCHOR QEA

Figure 28
Log of Test Pit TP-B
Preliminary Design Report
Meadowdale Beach Park and Estuary Restoration Design Project

File: J:\211\22288\040\21-1-22288-040 TP-RE-1.dwg Date: 08-02-2017 Author: jrs

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

LOG OF TEST PIT TP-RE-1

JOB NO: 21-1-22288-040 DATE: 7/20/17 LOCATION: Meadowdale

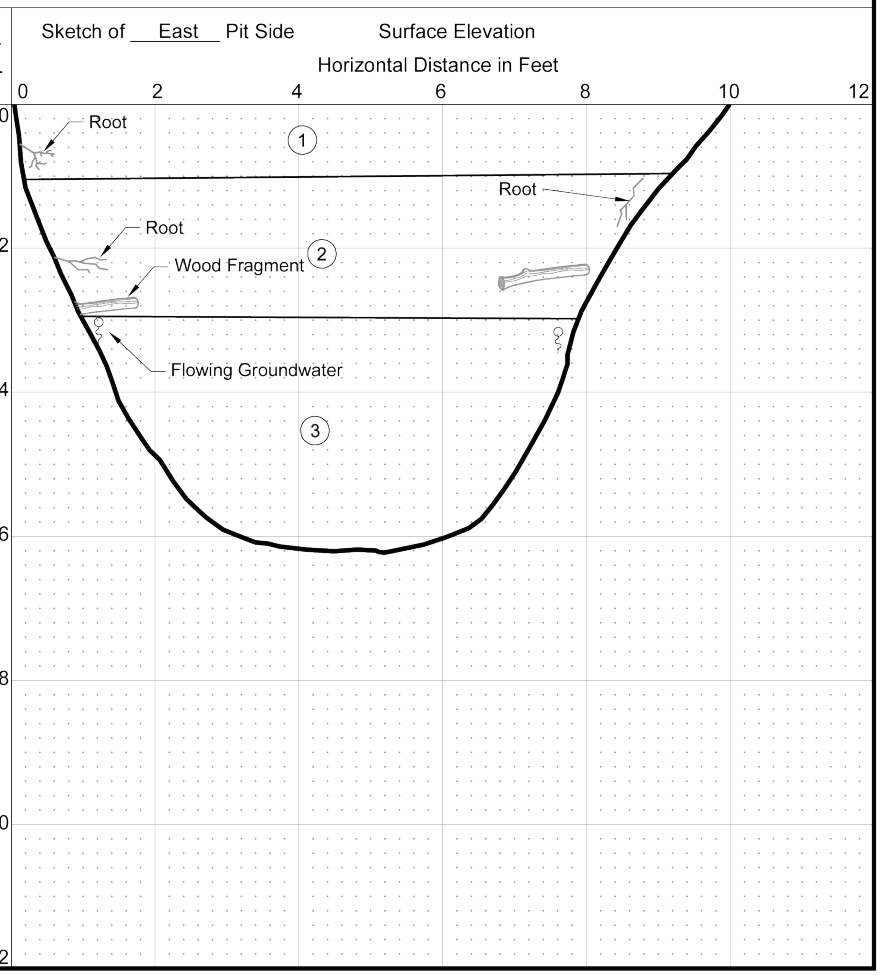
PROJECT: Meadowdale Beach Park

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Light brown, *Silty Sand with Gravel (SM);* moist; little fine gravel; fine to medium sand; low plasticity fines; few organics. Holocene fill (Hf)			S-1	0
(2) Gray, *Silty Sand with Gravel (SM);* moist; wet below 3 feet; little fine gravel; fine to medium sand; low plasticity fines; root fragments. Holocene Alluvium (Ha)/Holocene Colluvium (Hc)	▽		S-2, S-3, S-4	2, 4
(3) Gray, *Poorly Graded Sand (SP);* wet; fine to medium sand. Holocene Alluvium (Ha)/Holocene Colluvium (Hc)			S-5, S-6	6, 8, 10, 12

NOTES

1. T-probe penetration 3-6" at 1.0 foot below ground surface (b.g.s.)
2. T-probe penetration 8-12" at 3.0 foot b.g.s.
3. T-probe penetration >12" at 4.0 foot b.g.s.
4. T-probe penetration >12" at 5.0 foot b.g.s.

FIG. 1



Filepath: \\fuji\anchor\Projects\Snohomish County\Meadowdale Beach Park\Park and Habitat Design\Task 5.2 60% Design\Prelim Design Rpt\Figures\Figure29_Test Pit Log 5-5.docx

ANCHOR QEA

Figure 29
Log of Test Pit TP-RE-1
Preliminary Design Report
Meadowdale Beach Park and Estuary Restoration Design Project

The pocket estuary tidal marsh landward of the railroad bridge will host emergent tidal and freshwater wetland species, shown in Table 13. Emergent wetland areas would primarily be at gentle slopes of between 15 and 50H:1V, and at elevations between Mean High Water and Extreme High Water, with a fringe that is at the base of steeper, riparian slopes and above current extreme high tidal elevations, to provide a sea level rise buffer for habitat migration. Topsoils in the tidal and freshwater wetland areas would be intentionally fine grained, including a mix of compost and loam to better retain soil moisture.

Table 13
Wetland Plants

Category	Common Name	Scientific Name
Freshwater Wetland Trees	Black Hawthorn	*Crataegus douglasii*
	Hooker Willow	*Salix hookeriana*
	Scouler Willow	*Salix scouleriana*
Freshwater Wetland Shrubs	Redosier Dogwood	*Cornus sericea*
	Black Twinberry	*Lonicera involucrata*
	Salmonberry	*Rubus spectabilis*
Freshwater Wetland Emergents	Slough Sedge	*Carex obnupta*
	Darkthroat shooting star	*Dodecatheon pulchellum*
	Skunk Cabbage	*Lysichiton americanus*
	Small fruited Bulrush	*Scirpus microcarpus*
	Hardstem Bulrush	*Schoenoplectus acutus*
	American Three-square	*Scirpus americanus*
	Piggy-back plant	*Tolmiea menziesii*
High Tidal Marsh Emergents	Douglas Aster	*Aster subspicatus*
	Lyngby's Sedge	*Carex lyngbyei*
	Tufted Hairgrass	*Deschampsia cespitosa*
	Puget Sound Gumweed	*Grindelia integrifolia*
	Pacific Silverweed	*Potentilla anserina* ssp. *Pacifica*
	American Three-square	*Scirpus americanus*
	Henderson's Checker-bloom	*Sidalcea hendersonii*
Medium/Low Tidal Marsh Emergents	Lyngby's Sedge	*Carex lyngbyei*
	Sea Plantain	*Plantago maritima*
	Salt grass	*Distichlis spicata*
	Pacific Silverweed	*Potentilla anserina* ssp. *Pacifica*

5.4 Enhance and Restore Nearshore and Stream Riparian Buffers and In-Stream Habitat

5.4.1 Wetland Delineation and Ratings

As part of the preliminary design process, ecologists performed a wetland delineation and wetland rating analysis of wetland habitat within the project area in fall/winter 2016. Eight wetlands (Wetlands A, B, C, D, E, F, G, and H) were delineated (Figure 4) and rated. Table 14 lists the 2014 Washington State Department of Ecology (Ecology) and local (Snohomish County or City of Edmonds) hydrogeomorphic classification, wetland rating, and classification.

Table 14
Summary of Wetland Classes and Ratings Using Ecology 2014 Wetlands Rating Systems

Wetland	Area (acres)	Hydrogeomorphic Classification	2014[1] State Rating (Ecology)	Local Rating (Snohomish County)[2]	Local Rating (City of Edmonds)
Wetland A	0.13	Depressional	III	III	N/A
Wetland B	0.21	Slope and Riverine	II	II	N/A
Wetland C	0.03	Slope and Riverine	II	II	N/A
Wetland D	0.10	Slope	III	N/A	III
Wetland E	0.05	Depressional and Riverine	III	III	N/A
Wetland F	0.08	Slope	IV	N/A	IV
Wetland G	0.22	Depressional, Slope, and Riverine	III	III	N/A
Wetland H	0.05	Slope and Riverine	II	II	N/A

Notes:
1. Hruby, T., 2014. Washington State Wetlands Rating System for Western Washington: 2014 Update. Publication No. 14-06-029. Olympia, WA: Washington State Department of Ecology.
2. Snohomish County 2016. Snohomish County Code. Cited: November 12, 2016. Available at: http://www.codepublishing.com/wa/snohomishcounty/.

Required wetland buffers were identified according to the current SCC (Snohomish County 2016). Wetlands A, B, C, D, E, G, and H require 75-foot buffers for low-intensity land use because they are Category II or Category III wetlands with a habitat function score of 5 to 7. Wetland F requires a 25-foot buffer for low-intensity land use as a Category IV wetland. Wetlands D and F are located within the City of Edmonds. While the City of Edmonds code defers to the State Rating (Category III for Wetland D, and Category IV for Wetland F), the buffer widths are wider: 165 feet for Wetland D and 75 feet for Wetland F.

In compliance with avoidance-and-minimization requirements of local, state, and federal environmental regulations, the proposed habitat restoration avoids impacting these wetlands.

5.4.2 Stream Assessment and Habitat Restoration Measures

Lund's Gulch Creek (Figure 4) is associated with six of the eight wetlands, before flowing into Puget Sound through the railroad berm culvert. A 1,230-foot reach of Lund's Gulch Creek was delineated within the project area; a small ponded area (240-foot perimeter) associated with the creek was also delineated. The ponded area is located off the left bank of the creek, near Wetland H; it appears to have been an excavated feature and not a wetland. Lund's Gulch Creek meets the criteria of a Type F Water, perennial flow with fish habitat characteristics, and a protective buffer width of 150 feet.

The current condition of the Lund's Gulch Creek reduce the quantity and quality of habitat for salmon. Juvenile Chinook, coho, and chum were documented in the lower 650 feet of the creek in a study by Beamer et al. (2013). Because the creek does not provide habitat for Chinook spawning, this indicates that juvenile Chinook from other river systems migrate to and use the limited habitat available, much as they use small "pocket estuaries" in other Puget Sound locations (Beamer et al. 2006).

The proposed restoration in the creek focuses on converting a currently constrained lower reach into the upper estuary and adding large wood to improve habitat conditions and complexity throughout the remainder of the project area. These components of the design were identified as needs through a Stream Assessment (Appendix I) performed as part of the preliminary design process. The Stream Assessment expands upon and quantifies the deficiencies identified during the Feasibility Study.

The lowermost 300 feet of Lund's Gulch Creek is confined by rock (approximately 210 feet) and logs parallel to the bank. This bank armoring was installed with several small wood structures for habitat purposes in approximately 2001. The wood structures were installed using hand tools by an Adopt-A-Stream crew (Murdoch 2015). Currently, some of the in-stream log structures have been undercut by flows and are perched above the creek. These structures do not provide in-stream habitat across a full range of flows nor do they function to maintain stream grade through the lower creek. Instead, some of the existing wood structures appear to create partial barriers at some flows as flows go under and over the wood. The reach provides some pockets of gravel, some cover along the banks, and a series of small pools (19% of area). At the upstream end of this reach, the creek is unconstrained, and the absence of an established high-flow berm allows the creek to overtop its left bank and flood across the park lawn area. The proposed restoration would restore this reach by removing constraints to channel movement so the creek will re-meander as it enters the re-established upper estuary. Large wood will be included in the design.

In the next 500 feet upstream (i.e., from 300 to 800 feet from the culvert), the creek is wider and contains a series of riffles and pools. More wood structures were placed in this reach during the 2001 restoration, creating some pool habitat. The proposed restoration includes enhancing habitat in this reach by adding wood to the existing structures. The delineated freshwater pond feature in this area

would be further enhanced by placing salvaged streambed cobbles to provide shallow water habitat, placing large woody material for added structure, and planting the banks with riparian vegetation.

5.4.2.1 Riparian Restoration Soil Preparation, and Planting

Soil health, biodiversity, and careful consideration of planting layers (i.e., groundcover, understory, and canopy) are emphasized in the planting palette for riparian areas. Woody plantings would include a riparian fringe around the pocket estuary, as well as enhancing existing riparian areas with conifer interplanting along Lund's Gulch Creek within the project site. Proposed species for these two types of riparian planting are shown in Table 15. New riparian areas would have maximum slopes of 3H:1V, elevations well above extreme high tides (+14 feet NAVD88), and suitably amended soils consisting of a mix of compost and mineral sand. Native conifer trees are being emphasized in all riparian areas for long-term maximum riparian benefit. Temporary irrigation (2-year operation) would be included to support new riparian planting areas only.

Table 15
Riparian Plants

Category	Common Name	Scientific Name
Shade tolerant Riparian Conifer Trees-Interplanting	Sitka Spruce	*Picea sitchensis*
	Western Red Cedar	*Thuja Plicata*
	Western Hemlock	*Tsuga heterophylla*
Riparian Trees	Big-leaf Maple	*Acer macrophyllum*
	Red Alder	*Alnus rubra*
	Oregon Crabapple	*Malus fusca*
	Sitka Spruce	*Picea sitchensis*
	Shore Pine	*Pinus contorta var. "contorta"*
	Douglas-Fir	*Pseudotsuga menziesii*
	Hooker Willow	*Salix hookeriana*
	Scouler Willow	*Salix scouleriana*
	Western Hemlock	*Tsuga heterophylla*
	Western Red Cedar	*Thuja Plicata*
Riparian Shrubs	Vine Maple	*Acer circinatum*
	Saskatoon Serviceberry	*Amelanchier alnifolia*
	Redosier Dogwood	*Cornus sericea*
	Beaked Hazelnut	*Corylus cornuta*
	Oceanspray	*Holodiscus discolor*
	Tall Oregon Grape	*Mahonia aquifolium*
	Indian Plum	*Oemleria cerasiformis*
	Pacific Ninebark	*Physocarpus capitatus*

Category	Common Name	Scientific Name
	Nootka Rose	*Rosa nutkana*
	Thimbleberry	*Rubus parviflorus*
	Red Elderberry	*Sambucus racemosa*
	Common Snowberry	*Symphoricarpos albus*
Riparian Groundcovers	Vanilla-leaf	*Achlys triphylla*
	Wild Ginger	*Asarum caudatum*
	Salal	*Gaultheria shallon*
	Low Oregon Grape	*Mahonia nervosa*
	Swordfern	*Polystichum munitum*

5.4.2.2 Large Woody Material

As part of the preliminary design process, a meeting was held with a geomorphologist to assess the sites conditions and opportunities for using large woody materials in the design. The geomorphologist determined that all trees removed through the estuary creation process should be retained for reuse on site. While existing native trees were retained where possible, the estuary excavation limits and depths require the removal of at least 40 trees. All trees to be removed will be used as large woody materials (approximately 19 uncut logs with rootwads and 34 cut logs of rootwads or tree tops) or reinstalled as snag features (10 features) within riparian planting areas. Twelve of the largest woody debris pieces would be placed within the pocket estuary, with an additional 15 pieces placed near the bridge abutments; 22 medium-size pieces would be located within the existing stream channel, and 4 within the restored pond. These large wood features would provide additional habitat structure and complexity, providing pools and slow-water habitat that is supportive to juvenile salmonids. Eight snag features would be installed north of the existing creek channel and two snags installed south of the creek; all snags would be located within riparian habitat areas. Snag features were included in response to comments from the Snohomish Watershed Counsel requesting that these features be considered as habitat for cavity-nesting birds.

5.5 Cultural Resources

A desktop study was conducted during the Feasibility Study, with findings mentioned in Section 2. As part of the preliminary design process, ICF International (ICF) conducted a cultural resources inventory and archaeological monitoring of geotechnical activities performed during the preliminary design phase, within the limits of the APE. The cultural resources assessment is currently being finalized and will include results and technical recommendations. The draft results are as follows:

- The existing BNSF grade, alignment, and culvert are all older than 50 years and are being inventoried and evaluated as part of the cultural resources assessment.

- During archaeological monitoring of geotechnical investigations performed for identifying GPR anomalies (see Section 5.3.2), ICF documented extensive demolition debris and partially intact portions of the pool and concrete slabs that are associated with facilities of the former Meadowdale Country Club. In addition, scattered historic debris, including nails, ceramic pool tiles, and brick fragments, were identified in shovel tests conducted in the APE. ICF is documenting these deposits as an historic-era archaeological site and will provide recommendations concerning the evaluation and construction monitoring options in the technical report.
- No precontact or early historic period resources were documented or identified during any of the geotechnical monitoring or archaeological investigations; however, portions of these resources could still be intact and deeply buried in the valley alluvial deposits or partially intact and displaced or disturbed by later development.
- The project will affect the existing BNSF grade alignment and culvert inventoried as part of the cultural resources assessment. The resource will be evaluated as part of the cultural resources technical report effort, and management recommendations will be provided to outline the NRHP eligibility recommendation and resulting level of effect anticipated by planned project activities.
- The project will affect portions of foundations, pool walls, and demolition debris associated with the Meadowdale Country Club resource identified during the cultural resources inventory. The resource will be evaluated in the cultural resources technical report, and management recommendations will be provided to outline the NRHP eligibility recommendation and resulting level of effect anticipated by planned project activities.

Archaeological monitoring will be recommended throughout construction for ground-disturbing activities planned for the breaching of the rail grade, the floodplain, beach, and areas identified during the GPR survey, which are expected to extend below the imported fill deposits overlying the existing park lawn areas.

5.6 Park and Recreation Elements

This restoration project is located at a heavily used county park. As noted, approximately 50,000 to 70,000 people visit the park annually. A major draw for visitors is the natural landscape, including the forested hike-in only access, the wildlife, and the beach. The park is also used for science-based programs focusing on water quality, marine plants and animals, as well as the creek ecology. Therefore, it is critical to capitalize and improve on the natural draws to the park and propose park and recreation improvements that align with the objective of providing sustainable rearing habitat for non-natal juvenile Chinook (threatened), coho, and chum salmon; cutthroat trout, and other fish species within the park setting.

5.6.1 Public Safety and ADA-Compliant Beach Access

The shared use of the culvert by humans, fish, and the creek is detrimental and not sustainable. Park visitors must walk in the creek through high water if the grates have been removed due to gravel accumulation and fish-passage issues. Alternately, visitors choose to trespass on the railroad, which not only has the potential for a fatality, but a train derailment that could result in ecological impacts. The project proposes to separate the pedestrian path from the creek located under the southern abutment span of the bridge. The path is proposed to be constructed of concrete and include a concrete curb and buried vinyl sheetpile wall underneath the bridge, to reduce undercutting over time. This path meets ADA requirements, including a minimum vertical clearance of 80 inches under the bridge, a clear width of 9.75 feet, and a nearly flat slope of 2%. The path will terminate on the beach side with a concrete pad that will provide space for seating on the beach side of the bridge.

A dedicated 10-foot-wide path along with the widened creek meander and estuary plantings is intended to significantly reduce or eliminate human impacts on rearing habitat. The creek would migrate over time within the opening, varying the proximity of the creek thalweg to the pedestrian route. Meeting the ADA-compliant vertical clearance was determined to be critical for the project, from both a legal and grant support perspective. However, this clearance results in a lower path elevation due to the fixed vertical height of the rail overhead, as compared to reduced (non-ADA-compliant) vertical clearance by raising the path to extend the duration that it would not be impacted by tides. The path elevation of 10.4 feet NAVD88 will be about 1 foot above MHHW, based on current sea levels. During king tides (annual maximum tide), the walkway will be inundated by a few inches of water, based on current sea levels. Therefore, during the highest tides, pedestrians will have to walk through a few inches of water to access the beach. In the future, based on sea level rise predictions for Puget Sound (NRC 2012), the walkway will start to be inundated at MHHW between 2050 and 2100. Inundation of the pathway during king tides will increase from a few inches today to about 0.5 feet over the walkway by 2030 and about 1.5 feet over the walkway by 2100.

5.6.2 Permitting and Habitat Restoration Considerations for Park Improvements

The majority of the lower park area contains several wetlands and Lund's Gulch Creek, their associated buffers, and the 150-foot marine shoreline buffer. The project not only removes the fill in the lawn area to restore the estuary, but will remove a portion of a paved trail adjacent to Wetland A. To address the need for a looped trail, a pedestrian bridge, which will provide viewing opportunities of salmon in the creek, will be constructed mid-way between the existing culvert and the existing pedestrian bridge. The bridge span over the creek was increased from 30 to 40 feet in the preliminary design phase, to accommodate high flows, wood transport, and channel migration, and to meet WDFW requirements. South of the new bridge the trail, a concrete pier-supported boardwalk, is proposed in an effort to limit fill within Wetland B. In addition, picnicking features have

been relocated out of the restored pocket estuary to the north edge of the existing lawn area to be preserved, and on the north side of the relocated creek crossing upstream of the estuary restoration.

Finally, the portable restroom enclosure, which can be inundated with flooding and is close to the creek, have been relocated farther upland, outside of both the delineated toe of slope wetland (Wetland F) and the BNSF right-of-way. This new location will be closer to the existing picnic shelter and farther from the restored pocket estuary and lower, widened creek channel.

5.6.3 Enhance and Increase Environmental Education Opportunities

As indicated in earlier sections, several user groups, kindergarten through college-age visit this park for science-based programs. The project is strongly supported by these groups. As part of the preliminary design process, an interpretive sign designer was consulted to develop signage supporting environmental education. Potential themes of the interpretive signs may include: geologic history, natural sediment flows, history of the park, purpose of the restoration project, and/or ethnographic themes of salmon species. Four interpretive signs will be located throughout the park: at the path terminus near the beach, along the southern edge of the estuary, near the new pedestrian bridge crossing the creek, and, potentially, in the eastern portion of the park.

5.6.4 Utilities

The topographic survey conducted as part of the preliminary design process included existing utilities. A description of these utilities and how this project affects each utility is summarized below:

Potable Water

Potable water service is provided by the City of Edmonds through a meter located near the gate on the east edge of the driveway to the parking area and ranger residence. A 2.5-inch PVC water service main extends down the driveway to the ranger residence and picnic shelter. A 1-inch PVC water service extends beyond the picnic shelter to a sink at the existing portable restroom enclosure. This line will be abandoned with a new service line outside of the tidal marsh estuary area to a foot-wash located landward of the beach access trail.

Sanitary Sewer

A small lift station and force main serves the ranger house. Wastewater is pumped through a 1.5-inch force main that extends from the buried septic tank near the ranger residence to a manhole in the City of Edmonds 75th Place West right-of-way near the gate at the limited-access road. Portable toilets are located in an enclosure just south of the stream and east of the BNSF railroad, within the proposed estuary area. This area is frequently inundated with floodwaters during heavy storm events. No alterations to the pumped system are proposed by the project, but the restroom enclosure will be moved from the current location to a location outside of the BNSF right-of-way and outside of all critical areas.

Power and Communications

Power and communications conduits extend into the site along the driveway. Power is available at the ranger residence, picnic shelter, and to a pole light located near the culvert entrance. This light will be removed under the proposed project, but one safety light, located east of the proposed railroad bridge and operable from the existing ranger house, would be included for use only when trespassing is suspected.

Stormwater

Existing stormwater facilities include a paved swale, in disrepair, along the south side of the limited-access road. The swale discharges runoff through Wetland D to Lund's Gulch Creek. Other constructed drainage facilities include a catch basin in the parking area with a storm drain that conveys untreated runoff to Lund's Gulch Creek, a few miscellaneous culverts that connect wetlands with the stream under pathways, and roof drain systems.

As part of the preliminary design process, a preliminary drainage report was prepared that addressed flow control and water quality treatment for the site. The entire access road is presumed to be disturbed during construction, and therefore the swale would be reconstructed as a lined facility with natural materials. Catch-basin inlets and storm drains would be added at the bottom of the roadway and parking area. Stormwater would then be conveyed to a wet biofiltration swale for treatment. The biofiltration swale would extend along the toe of the slope adjacent to the pathway near the picnic shelter and proposed portable restroom enclosure and piped under the path to a cobble-lined swale outletting at the OHWM.

Irrigation

There is currently no irrigation in the park. As stated in Section 5.4.2.1, temporary irrigation will be necessary to establish plantings within riparian planting areas. Irrigation improvements will include a separate meter and service line extending from the top of the limited-access road to the lower park. These lines are proposed to be abandoned following plant establishment (2 years).

5.6.5 Subsurface Conditions

For the Draft Geotechnical Report (Appendix F-1), the following soil borings (Figure 20) were drilled to support various park components of the design:

- One boring near the proposed pedestrian bridge at the creek
- Two shallow hand borings to support the stormwater infiltration design

Subsurface conditions derived from these borings are shown in Table 16.

Table 16
Subsurface Conditions

Boring ID	Location	Subsurface condition
MB-8	Near proposed pedestrian bridge	Gravel trail surface overlying very loose, silty sand to a depth of 7 feet, overlying soft to stiff lean clay with sand to a depth of 15 feet, overlying medium dense to dense, interbedded silty sand, sandy silt and silty clay to a depth of 26 feet
HB-1	Existing parking lot	Poorly graded gravel to a depth of 1.3 feet, overlying sandy silt/silty sand to a depth of 2 feet, overlying silty sand with trace gravel to a depth of 9.9 feet
HB-2	West of ranger residence	Grass and sod surface overlying silty gravel with sand and cobbles to a depth of 1 foot, overlying sandy silt with gravel to a depth of 2 feet, overlying silty sand with gravel and cobbles to a depth of 6 feet

5.6.6 Constructability of Park Elements

Constructability was evaluated by drilling a boring near the pedestrian bridge north abutment, excavating a test pit near the proposed restroom enclosure structure, and digging hand borings to evaluate infiltration potential for stormwater management design. The pedestrian bridge boring indicated that the bridge piling would bear in alluvium and colluvium, and drivability appears favorable using anticipated vibratory or impact hammer methods. The proposed restroom enclosure will bear in alluvium, requiring modest site preparation to reduce settlement potential. Infiltration was deemed infeasible due to persistent shallow groundwater and insufficient infiltration capacity at the proposed infiltration sites.

6 Permitting and Stakeholder Consultation

The feasibility study and preliminary design development stages included opportunities for the community, local organizations, municipalities, tribes, permitting agencies, and BNSF to provide input and comment. During the feasibility study, two meetings were held with agency/organization stakeholders to review evaluation criteria developed for the project, review proposed alternatives, and receive input into selection of the preferred alternative. Similarly, two community stakeholder meetings were held for the general public. Separate meetings were held with BNSF and appropriate permitting agencies to review the preferred conceptual design alternative for the project, to gain insight into their concerns, and outline future coordination efforts with each participating group (Anchor QEA 2016).

During preliminary design development, the following outreach and consultation was or will be performed:

- Critical Areas Review Site Meeting with Snohomish County Planning and Development Services (PDS; December 5, 2017)
- Community Meeting (June 21, 2017)
- Stakeholder Meeting (July 31, 2017)
- Briefing with Snohomish County Executive Team (August 1, 2017)
- Pre-application Materials submitted to County PDS (August 9, 2017)
- Pre-application Materials submitted to City of Edmonds Permitting and Development (August 11, 2017)
- Permitting Agency Meeting, held on site (August 28, 2017)
- 30% Design Submittal to BNSF (August 30, 2017)
- Development Review Committee meeting with City of Edmonds (September 7, 2017)
- Briefing to USACE through County WRDA process (September 27, 2017)
- Meeting with BNSF (December 5, 2017)
- Pre-Application Meeting with PDS (scheduled for January 4, 2018)

The Critical Areas Review Site meeting confirmed the final wetlands delineation and creek and marine OHWM to the satisfaction of County PDS. The community meeting was attended by approximately 40 individuals, who viewed a PowerPoint presentation and participated in question-and-answer sessions related to habitat, railroad, and park elements. There was general enthusiasm regarding the project moving forward at a reasonable pace. In response to a question regarding why a section of lawn was going to be retained in the upland area, rather than converted to estuary, three reasons were provided: 1) during the feasibility study the stakeholders requested that some lawn remain, as user groups do congregate and use the shelter, especially during summer; 2) the project is anticipated to encourage even more environmental outreach, and those groups need a location to gather; and 3) hydrology would not support the upper lawn area as estuary as well and would

require an even greater amount of earth removal. In response to a second question regarding whether or not the trees selected to be removed within the estuary footprint could be left as snags, the response clarified that the site grading plans won't lend to leaving stumps in place, but that all trees removed would be re-used on site for stream habitat improvement. The full list of questions, comments, and answers and meeting background materials are provided in Appendix J-1.

The organization/agency stakeholder meeting was attended by representatives from City of Lynnwood, City of Edmonds, WRIA 8, Tulalip Tribes, Sno-King Watershed, Snohomish County Marine Resources Committee, BNSF, Washington Utilities and Transportation Commission, County staff, and members of the consultant team. The same PowerPoint was presented and a question-and-answer session followed. The feedback was positive, with questions ranging from long-term maintenance needs, wood installation, and railroad bridge aesthetics, to better accommodating potential sea level rise. The BNSF project coordinator did not provide comments due to the railroad's project review and approval process, but he did respond to the question regarding sea level rise, indicating that the tracks could not be raised. The meeting agenda, attendance list, and questions and responses are included in Appendix J-2.

Outreach to regulatory agency staff and tribal staff prior to an on-site meeting included one-to-one contact with representatives from Snohomish County, City of Edmonds, USACE, WDFW, Ecology, the Suquamish Tribe, Tulalip Tribes, and the Stillaguamish Tribe. Most of these staff were familiar with the project and had toured the park previously during the feasibility study phase. A smaller subset from this group attended the on-site meeting and walked through the site, while reviewing the specific plans for the upland area, creek and riparian area, proposed estuary, new railroad bridge, and beach. The agency staff were positive about the ecological benefits from the project and provided feedback and direction regarding several features, including the following:

- Sizing and location of the proposed pedestrian bridge should avoid placement of footings in water and account for future (lateral) movement of the creek
- Construction staging and sequencing should align with applicable work windows for anadromous fish species as well as sand lance spawning
- Recommendations for design of temporary stream diversion during construction
- Recommendation to incorporate history of the site into interpretive features

A detailed meeting summary can be found in Appendix J-3. The anticipated environmental approvals and permits, based on feedback from these outreach and coordination efforts, are shown in Table 17. Submittal of permit applications is planned for early 2018.

Table 17
Anticipated Environmental Approvals and Permits

Approval or Permit	Agency	Trigger
Federal		
Clean Water Act Section 404 Permit/Rivers and Harbors Act Section 10 Permit	USACE	Discharge of dredged or fill material into waters of the United States, including adjacent special aquatic sites such as wetlands; work in or over navigable waters of the United States
National Environmental Policy Act Compliance	USACE	Projects with a federal nexus (i.e., led by a federal agency, receiving federal funding, located on federal lands, or requiring a federal permit)
Endangered Species Act Compliance	USACE in coordination with NMFS and USFWS	Project with federal nexus occurring in the vicinity of species listed under the Endangered Species Act
Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation	NMFS	Project with federal nexus that may affect Essential Fish Habitat
National Historic Preservation Act Section 106 Compliance	USACE in coordination with DAHP	Project with federal nexus that has the potential to affect cultural, archaeological, or historic properties
Rivers and Harbors Act Section 9	U.S. Coast Guard	Bridge over navigable waters; feedback from USCG on applicability of Bridge Permit is still pending.
State		
Clean Water Act Section 401 Water Quality Certification	Ecology in coordination with USACE	Projects associated with in-water work
Coastal Zone Management Consistency Determination	Ecology	Project with federal nexus within any of Washington's 15 coastal counties
Clean Water Act Section 402 National Pollutant Discharge Elimination System Construction Stormwater General Permit	Ecology	One acre or more of soil-disturbing activities with a discharge of stormwater to receiving water or storm drains that discharge into a receiving water
Hydraulic Project Approval	WDFW	Work that uses, diverts, obstructs, or changes the natural flow or bed of state waters
Safety Crossing Certification	Washington State Utilities and Transportation Commission	Railroad crossing changes
Local		
SEPA Determination	Snohomish County	Proposal that requires a local agency decision, projects affecting aquatic lands
Shoreline Substantial Development Permit	Snohomish County	Activities within Shoreline Management Act jurisdiction

Approval or Permit	Agency	Trigger
Flood Hazard Permit	Snohomish County	Project located in a Flood Hazard Area
Critical Areas Consistency Determination	Snohomish County	Activities that may affect Wetlands and Fish & Wildlife Conservation Areas, Geologically Hazardous Areas, and the Channel Migration Zone
Land Disturbing Activity Permit	Snohomish County	Volume, extent, and location of clearing and grading activities
Building permit	Snohomish County	Restroom enclosure
SEPA	City of Edmonds	Proposal that requires a local agency decision, projects affecting aquatic lands
Shoreline Substantial Development Permit	City of Edmonds	Activities within Shoreline Management Act jurisdiction
Critical Areas Consistency Determination	City of Edmonds	Activities that may affect ecologically sensitive or hazardous areas
Grading, Fill, and Excavation Permit	City of Edmonds	Grading, fill, stockpile of fill, and excavation work
Retaining Wall Permit	City of Edmonds	Retaining walls of any height located within the mapped Earth Subsidence Landslide Hazard Area of North Edmonds or within a designated Critical Area other than Erosion Hazard Area, or retaining walls greater than 4 feet in height
Railroad		
Railroad Right of Entry Agreement	BNSF	Working within Railroad right-of-way limits
Construction & Maintenance Agreement	BNSF	Any overhead or underpass structure impacting the Railroad

The Development Review Committee meeting with City of Edmonds included representatives from public works, building, planning, and parks departments. Key topics included drainage, mitigation for potential wetland impacts, and construction access/haul routes through the City of Edmonds. The haul route will be used to bring materials, including the crane and railroad bridge sections, as well as hauling the 17,000 cy of materials for creating the estuary. A follow-up meeting with the City on the haul route is pending, and a formal pre-application meeting will be scheduled following 60% design.

The USACE Snohomish County Lead was briefed about the project during a monthly County/USACE meeting and concurred with the proposed list of USACE permits and approvals likely needed. The JARPA and Biological Assessment are nearly complete, along with the Cultural Resource study, and will be submitted in early 2018. The agreement between Snohomish County and USACE is anticipated to provide a more streamlined approval process.

The purpose of the meeting with BNSF was to discuss the following:

- 30% review comments from their Structure and Operations Divisions
- Constructability and sequencing
- Anticipated construction schedule
- Additional design elements, including safety lighting, wood placement in the creek near bridge pier, and aesthetics
- BNSF's desired role in the permitting process
- Initial discussion on BNSF's Construction & Maintenance Agreement

The outcome of the meeting was very positive, with limited comments on the 30% submittal, which will be addressed in the 60% submittal; additionally, BNSF expressed interest in building the railroad bridge with their crews at County expense, rather than an outside contractor. BNSF will further vet this idea and provide a decision in January 2018. This could represent considerable savings for the project, as BNSF would have an advantage of procuring their own work windows and using a track-mounted drill rig for pile driving, which is more efficient than mobilizing and demobilizing equipment to accommodate train traffic. The Structures Review Comments and Meeting Minutes are included in Appendix J-4.

Finally, a Pre-Application meeting is scheduled with County PDS on January 4, 2018. The main issues to be addressed include coordination with City of Edmonds and the County regarding the State Environmental Policy Act review process, temporary embankment shoreline impacts, and County interest in the railroad approval process.

7 Preliminary Design Drawings

Preliminary design drawings are provided in Appendix A and will also be provided to RCO in AutoCAD format. The Habitat Restoration and Park Element plans, developed by Anchor QEA, are included in Appendix A-1, and the Railroad Bridge plans developed by Hanson Professional Services are included in Appendix A-2.

8 Construction Quantities and Preliminary Construction Cost Estimate (Opinion of Probable Construction Cost)

Table 18 summarizes the preliminary opinion of probable construction cost, and Table 19 provides detailed construction quantities and costs. The quantities and opinion of probable construction cost are based on the preliminary design of all project elements to date, including the railroad improvements, habitat restoration improvements, limited-access road improvements, and park and environmental education improvements. Some uncertainties exist regarding methods of construction access for the railroad bridge using BNSF tracks, the extent of underground buried debris in the estuary restoration area. This estimate does not include construction management and inspection by the County or BNSF, materials testing for quality control, or substantial indirect costs to be paid by the County to the railroad that will be later defined in the Easement and Operation and Maintenance Agreement.

Table 18
Preliminary Design Cost Summary

Item	Subtotal
Temporary Facilities	$ 113,680
Demolition and Clearing	$ 304,885
Earthwork	$ 683,398
Railroad Bridge	$ 4,299,291
Access Road Reinforcement	$ 340,200
Utilities	$ 88,000
CIP Concrete and Crushed Rock Site Work	$ 51,352
Asphalt Paving and Pavement Markings	$ 97,954
Large Wood and Stream Materials	$ 124,253
Restroom Enclosure	$ 129,644
Pedestrian Bridge	$ 178,892
Boardwalk	$ 31,938
Site Furnishings	$ 37,760
Irrigation	$ 115,191
Landscape Topsoil, Planting, and Seeding	$ 295,930
Subtotal	$ 6,892,369
Mobilization (15%)	$ 1,033,855
Design Contingency (10%)	$ 792,622
Construction Contingency (15%)	$ 1,307,827
Sales Tax (9.1%)	$ 912,427
Total Opinion of Probable Construction Cost (rounded)	**$ 10,940,000**

This page intentionally left blank.

Table 19

Detailed Construction Quantities and Opinion of Probable Construction Cost

		Item	Qty.	Unit	Unit Cost	Subtotal
1. Temporary Facilities						
	a.	Temporary construction fencing	84	LF	$ 10.00	$ 840
	b.	Temporary tree protection fencing	784	LF	$ 10.00	$ 7,840
	c.	Temporary erosion and sediment control	1	LS	$ 77,000.00	$ 77,000
	d.	Temporary Diversion and Control of Water	1	LS	$ 28,000.00	$ 28,000
Subtotal Temporary Facilities						**$ 113,680**
2. Demolition & Clearing						
	a.	Remove existing restroom enclosure	1	LS	$ 8,653.00	$ 8,653
	b.	Demo utilities	1	LS	$ 2,000.00	$ 2,000
	c.	Clear and grub site	78,130	SF	$ 0.20	$ 15,626
	d.	Sawcut existing asphalt paving	36	LF	$ 5.00	$ 180
	e.	Strip and stockpile 6" topsoil from all vegetated areas to be cleared and grubbed	1,447	CY	$ 20.00	$ 28,937
	f.	Selectively remove invasive, non-native vegetation	13,127	SF	$ 2.00	$ 26,254
	g.	Remove tree, salvage, and cut select pieces as large woody debris (LWD)	40	EA	$ 1,040.00	$ 41,600
	h.	Rotomill AC pavement and stockpile	11,809	SF	$ 1.00	$ 11,809
	i.	Remove subsurface debris	1,700	CY	$ 90.00	$ 153,000
	j.	Remove Rock Armoring (3.5-ft depth)	32	CY	$ 44.00	$ 1,415
	k.	Removed Crushed Rock Surfacing	3,352	SF	$ 0.60	$ 2,011
	l.	Remove Volleyball Court Surfacing, Stockpile and reuse at lawn	2,027	SF	$ 0.60	$ 1,216
	m.	Remove grill	6	EA	$ 168.00	$ 1,008
	n.	Dispose of excess cleared material	1	LS	$ 5,000.00	$ 5,000
	o.	Remove miscellaneous debris	1	LS	$ 5,000.00	$ 5,000
	p.	Remove picnic table	6	EA	$ 168.00	$ 1,008
	q.	Remove drinking fountain	1	EA	$ 168.00	$ 168
Subtotal Demolition & Clearing						**$ 304,885**
3. Earthwork						
	a.	Upland cut and fill	17,609	CY	$ 9.00	$ 158,479
	b.	Place and compact on-site stockpiled sandy soil	508	CY	$ 9.00	$ 4,572
	c.	Haul excess and unsuitable excavated material	15,454	CY	$ 33.00	$ 509,986
	d.	Trenching for utility trench	395	CY	$ 8.00	$ 3,162
	e.	Furnish, Place, and Compact Pipe Bedding for Utility Improvements	140	CY	$ 35.00	$ 4,903
	f.	Place and Compact Native Backfill for Utility Improvements	255	CY	$ 9.00	$ 2,296
Subtotal Earthwork						**$ 683,398**
4. Railroad Bridge (Hanson)						
	a.	Temporary embankment with quarry spalls	4,900	CY	$ 85.00	$ 416,500
	b.	Temporary embankment capping material (subballast)	240	CY	$ 55.00	$ 13,200
	c.	Remove temporary embankment	5,140	CY	$ 45.00	$ 231,300
	d.	Structural excavation	1,970	CY	$ 50.00	$ 98,500
	e.	Temporary soil retention system	4,354	SF	$ 500.00	$ 2,176,830
	f.	Furnish and drive steel H-pile (HP 14x89)	4,800	LF	$ 100.00	$ 480,000
	g.	Furnish and erect precast abutment cap	4	EA	$ 9,750.00	$ 39,000
	h.	Furnish and erect precast bent cap	8	EA	$ 6,300.00	$ 50,400
	i.	Furnish and erect precast beam (B20-2110)	8	EA	$ 10,480.00	$ 83,840
	j.	Furnish and erect precast beam (B30-2710)	12	EA	$ 13,360.00	$ 160,320
	k.	Furnish and erect precast wingwalls	4	EA	$ 1,500.00	$ 6,000
	l.	Demo existing box culvert	1	LS	$ 50,000.00	$ 50,000
	m.	Waterproofing	4,011	SF	$ 25.00	$ 100,267
	n.	Block wall	363	SF	$ 116.00	$ 42,119
	o.	Track removal/reinstallation (by BNSF)	336	TF	$ 1,000.00	$ 336,000
	p.	Install WSDOT Type 3 chain-link fence	242	LF	$ 45.00	$ 10,890
	q.	Remove chain-link fence	275	LF	$ 15.00	$ 4,125
Subtotal Railroad Bridge						**$ 4,299,291**
5. Access Road Reinforcement (Shannon & Wilson)						
	a.	Spiral Nail Reinforcement	8,100	SF	$ 42.00	$ 340,200
Subtotal Access Road						**$ 340,200**
6. Utilities						
	a.	Utility Locate and Protect	1	LS	$ 4,000.00	$ 4,000
	b.	Storm Drainage Improvements	1	LS	$ 57,000.00	$ 57,000
	c.	Stormwater Bio-filtration Swale	1	LS	$ 15,000.00	$ 15,000
	d.	Water Service Line Relocation	1	LS	$ 12,000.00	$ 12,000
Subtotal Utilities						**$ 88,000**

Table 18
Detailed Construction Quantities and Opinion of Probable Construction Cost

		Item	Qty.	Unit	Unit Cost	Subtotal
7. CIP Concrete and Crushed Rock Site Work						
	a.	Install concrete path and concrete pads	1,379	SF	$ 8.00	$ 11,032
	b.	Furnish and place crushed rock surfacing base course for concrete paving (2-inch)	8	CY	$ 42.00	$ 356
	c.	Furnish and place crushed rock for paths and viewpoints (6-inch)	62	CY	$ 35.00	$ 2,169
	d.	Standard sawcutting	1,379	LF	$ 4.00	$ 5,516
	e.	Install concrete seatwall and sheetpile cap	10	CY	$ 539.00	$ 5,138
	f.	Install 4-ft vinyl sheetpile wall	78	LF	$ 141.00	$ 10,998
	g.	Install concrete wheel stops in parking area	7	EA	$ 156.00	$ 1,092
	h.	Install concrete mowstrip	350	LF	$ 43.00	$ 15,050
Subtotal CIP Concrete and Crushed Rock Site Work						**$ 51,352**
8. Asphalt Paving and Pavement Markings						
	a.	Install HMA asphalt paving (access road and path)	454	TON	$ 136.00	$ 61,744
	b.	Install HMA asphalt paving at parking lot	85	TON	$ 136.00	$ 11,560
	c.	Install crushed surfacing top course (CSTC) access road	398	TON	$ 50.00	$ 19,900
	d.	Install crushed surfacing top course (CSTC) at parking lot	85	TON	$ 50.00	$ 4,250
	e.	Parking lot striping	1	LS	$ 500.00	$ 500
Subtotal Asphalt Paving and Pavement Markings						**$ 97,954**
9. Large Wood and Stream Materials						
	a.	Place salvaged on-site logs (uncut) with rootwads	19	EA	$ 322.00	$ 6,118
	b.	Place salvaged on-site stumps with rootwads and/or tree-tops in ravine channel	34	EA	$ 215.00	$ 7,310
	c.	Furnish and place streambed cobble	509	TON	$ 70.00	$ 35,630
	d.	Furnish and place beach sand (above OHWM)	1,671	TON	$ 45.00	$ 75,195
Subtotal Large Wood and Stream Materials						**$ 124,253**
10. Restroom Enclosure						
	a.	Architecture	1	LS	$ 129,644.00	$ 129,644
Subtotal Restroom Enclosure						**$ 129,644**
11. Pedestrian Bridge						
	a.	Furnish and install pedestrian bridge	1	LS	$ 121,892.00	$ 121,892
	b.	Pedestrian Bridge abutments	1		$ 50,000.00	$ 50,000
	c.	Concrete wing walls	1	LS	$ 7,000.00	$ 7,000
Subtotal Pedestrian Bridge						**$ 178,892**
12. Boardwalk						
	a.	Field-built diamond-pier supported boardwalk	44	LF	$ 589.50	$ 25,938
	b.	Boardwalk abutments and plinths	1	LS	$ 6,000.00	$ 6,000
Subtotal Boardwalk						**$ 31,938**
13. Site Furnishings						
	a.	Furnish and install benches and picnic tables	1	LS	$ 22,074.00	$ 22,074
	b.	Furnish and install footwash	1	EA	$ 4,980.00	$ 4,980
	c.	Furnish and install drinking fountain	1	EA	$ 10,530.00	$ 10,530
	d.	Furnish and install landscape boulder	1.6	TON	$ 110.30	$ 176
Subtotal Site Furnishings						**$ 37,760**
14. Irrigation (Riparian and lawn landward of RR Bridge)						
	a.	Irrigation system installed	1	LS	$ 86,040.75	$ 86,041
	b.	1-1/2" Water Meter	1	LS	$ 10,000.00	$ 10,000
	c.	RPBA Backflow Assembly with PRV	1	LS	$ 5,000.00	$ 5,000
	d.	Controller	1	LS	$ 12,500.00	$ 12,500
	e.	Quick Couplers	1	LS	$ 1,650.00	$ 1,650
Subtotal Irrigation						**$ 115,191**

Table 18

Detailed Construction Quantities and Opinion of Probable Construction Cost

		Item	Qty.	Unit	Unit Cost	Subtotal
15. Landscape Topsoil, Planting, and Seeding						
	a.	Place salvaged on-site topsoil for topsoil type 1 (6-in depth)	767	CY	$ 7.00	$ 5,368
	b.	Import and place topsoil type 2 (12-in depth in swale, 6-in depth elsewhere)	545	CY	$ 42.00	$ 22,873
	c.	Import and place salvaged sandy soil at lawn areas (depth varies)	508	CY	$ 7.00	$ 3,556
	d.	Place jute fabric in planting areas with 4:1 or steeper slope	2,032	SY	$ 8.00	$ 16,254
	e.	Place coir fabric in all emergent marsh areas	3,268	SY	$ 19.00	$ 62,084
	f.	Coniferous tree (5 gallon)	151	EA	$ 90.00	$ 13,590
	g.	Deciduous trees (5 gallon)	115	EA	$ 81.00	$ 9,315
	h.	Shrub (2 gallon)	717	EA	$ 35.00	$ 25,095
	i.	Groundcover (1 gallon, 2-ft O.C.)	620	EA	$ 18.00	$ 11,160
	j.	Emergent plug (10 cubic inch, 2-ft O.C.)	8,040	EA	$ 6.00	$ 48,240
	k.	Livestake (3' O.C.)	1,008	EA	$ 3.00	$ 3,024
	l.	Lawn hydroseed	16,763	SF	$ 0.40	$ 6,705
	m.	Mulch (3" depth)	235	CY	$ 42.00	$ 9,851
	n.	Furnish and install goose exclosure	29,408	SF	$ 2.00	$ 58,816
Subtotal Planting						**$ 295,930**
						$ 6,892,369
					Mobilization (15%)	**$ 1,033,855**
					Subtotal Construction + Mob.	**$ 7,926,224**
					Design Contingency (10%)	**$ 792,622**
					Subtotal Const.+ Mob.+ Conting.	**$ 8,718,846**
					Construction Contingency (15%)	**$ 1,307,827**
					Subtotal Const.+ Mob.+ Conting.	**$ 10,026,673**
					Sales Tax (9.1%)	**$ 912,427**
					Subtotal Const. + Mob + Conting. + Tax	**$ 10,939,101**
					Total Opinion of Probable Construction Cost	**$ 10,940,000**

All costs are in 2017 dollars. Construction bid escalation in subsequent years is not included.

In providing opinions of probable construction cost, the Client (Snohomish County Parks and Recreation) understands that the Consultant (Anchor QEA L.L.C.) has no control over the cost or availability of labor, equipment or materials, or over market condition or the Contractor's method of pricing, and the consultant's opinions of probable construction costs are made on the basis of the Consultant's professional judgment and experience. The Consultant makes no warranty, expressed or implied, that the bids or the negotiated cost of the Work will not vary from the Consultant's opinion of probable construction cost.

Other Non-Construction Costs Not Included: BNSF Railway Agreement Negotiation and Settlement Costs, Bidding, Construction Phase Project Management & Design Team Construction Support, Construction Inspection, and Permit Related Monitoring.

9 References

Adopt A Stream Foundation, 2013. Lund's Gulch Creek Rapid Assessment. Available at http://www.streamkeeper.org/aasf/Lunds_Gulch_Creek.html.

Anchor QEA, 2016. *Feasibility Report: Meadowdale Beach County Park Feasibility Study*. Prepared for Snohomish County. August 2015. Available at: http://bit.ly/2pXV8le

Anchor QEA, 2016a. Addendum: Feasibility Report *Feasibility Report: Meadowdale Beach County Park Feasibility Study*. Prepared for Snohomish County. April 2016. Available online at: http://bit.ly/2pXV8le

Applied Geotechnology, 1986. *Geotechnical Engineering Study, Meadowdale Beach Park, Snohomish County, Washington*. Prepared for Snohomish County Parks and Recreation. August 1986.

Beamer, E.M., W.T. Zackey, D. Marks, D. Teel, D. Kuligowski, and R. Henderson, 2013. *Juvenile Chinook Salmon Rearing in Small Non-Natal Streams Draining into the Whidbey Basin*. Skagit River System Cooperative. December 3, 2013. Available at: http://www.skagitcoop.org/documents/EB2752_Beamer%20et%20al_2013.pdf.

Bruce Dees (Bruce Dees & Associates), 1986. *Master Plan Report: Meadowdale Beach County Park*. September 1986.

Brunner, G.W., 2010a. *HEC-RAS River Analysis Systems User's Manual Version 4.1*. CDP 68. U.S. Army Corps of Engineers. Hydrologic Engineering Center. Davis, California.

Brunner, G.W., 2010b. *HEC-RAS River Analysis Systems Hydraulic Reference Manual*. CDP-69. U.S. Army Corps of Engineers. Hydrologic Engineering Center. Davis, California.

Department of Justice, 2010. 2010 ADA Standards for Accessible Design. Accessed October 6, 2015. Available at: http://www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards.pdf.

Dailer, Doug (Park Ranger, Snohomish County Parks and Recreation), 2015. Personal communication with Peter Hummel (Anchor QEA) during site visit on March 5, 2015.

Ecology (Washington State Department of Ecology), 2016. Environmental Information: Watersheds; Cedar-Sammamish Water Resource Inventory Area 8. Accessed November 11, 2016. Available at: http://www.ecy.wa.gov/water/wria/08.html.

Intlekofer, Charles, 1989. "Construction of Great Northern's Seawall and Double-Track between Everett and Seattle, Washington." *The Great Northern Goat* (Issue 61). December 1989.

Lantz, D.W., H.B. Berge, and R.A. Tabor, 2014. *Effects of Small Barriers on the Distribution of Sculpins* (Cottus spp.) *in Puget Sound Lowland Streams*. Poster presented at the 2014 Salish Sea Ecosystem Conference in Seattle, Washington. Available at: http://your.kingcounty.gov/dnrp/library/water-andland/science/SalishSea-2014/04POSTER-2014-04-30-Lantz-Berge-Tabor-Effects-of-small-barriers-ondistribution-of-sculpins.pdf.

Minard, J.P., 1982. Geologic Map of the Mukilteo Quadrangle, Washington: U.S. Geological Survey Miscellaneous Field Studies Map MF-1438, scale 1:24,000.

Murdoch, Tom, 2015. Personal communication between Tom Murdoch, Executive Director of Adopt A Stream Foundation, and Paul Schlenger, Confluence Environmental Company, on March 9, 2015.

NRC (National Research Council), 2012. *Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future*.

Pfeifer, R.L., 1979. *A Survey of Lund's Gulch Creek in Edmonds, Washington*. Washington State Game Department. February 1979.

Schlenger, P., A. MacLennan, E. Iverson, K. Fresh, C. Tanner, B. Lyons, S. Todd, R. Carman, D. Myers, S. Campbell, and A. Wick. 2011. *Strategic Needs Assessment: Analysis of Nearshore Ecosystem Process Degradation in Puget Sound*. Prepared for the Puget Sound Nearshore Ecosystem Restoration Project. Technical Report 2011-02.

Shannon & Wilson, 2015. Personal communication between William Laprade and Snohomish County Park Ranger Doug Dailer re: regrading timber structure in railroad berm. May 2015.

Smith, Mackay, 1976. Preliminary Surficial Geologic Map of the Mukilteo and Everett Quadrangles, Snohomish County, Washing: Washington State Division of Geology and Earth Sciences Geologic Map GM-20, scale 1:24,000.

Snohomish County, 1989. *Lund's Gulch Basin Study Draft Report*. Snohomish County Public Works, Surface Water Management. April 1989.

Snohomish County, 2002. *Puget Sound Tributaries Drainage Needs Report*. DNR No. 11. Snohomish County Public Works Department, Surface Water Management Division. December 2002. Available at: http://snohomishcountywa.gov/1079/Urban-Drainage.

Snohomish County, 2015. Snohomish County website. Accessed March 2015. Available at: http://snohomishcountywa.gov/Facilities/Facility/Details/Meadowdale-Beach-Park-56

Snohomish County, 2016. Snohomish County Code. Cited: November 11, 2016. Available at: https://snohomishcountywa.gov/1087/Codes-Regulations.

Uusitalo, Duane, 2015. Personal communication with Mr. Uusitalo (retired school teacher who rears and releases hatchery salmon) and Paul Schlenger (Confluence Environmental Company) on March 9, 2015.

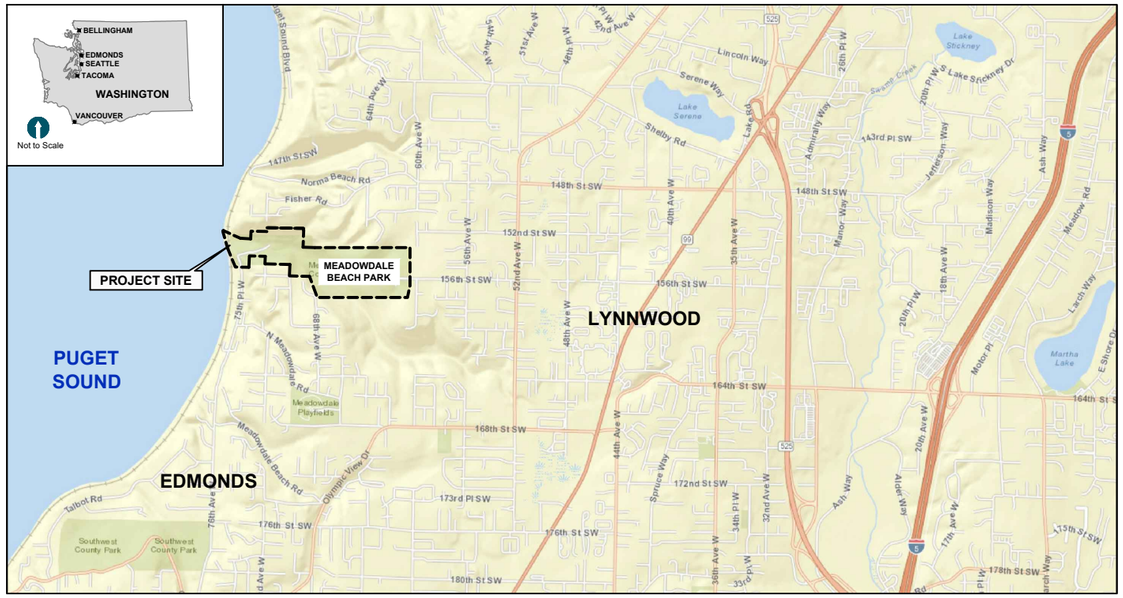
This page intentionally left blank.

Appendix A-1
Preliminary Design Drawings:
Habitat Restoration and Park Element

PRELIMINARY DESIGN SUBMITTAL

MEADOWDALE BEACH PARK AND ESTUARY DESIGN

SNOHOMISH COUNTY PARKS AND RECREATION



SOURCE: ESRI

VICINITY MAP

NORTH

0 2000 4000

SCALE IN FEET

COUNTY EXECUTIVE:
COUNCIL:
PARKS DIRECTOR:

SITE ADDRESS: 6026 156TH STREET SOUTHEAST, EDMONDS, WASHINGTON 98036
TPN:
PROJECT CESCL:
SECTION/TOWNSHIP/RANGE:

DRAWING INDEX

SHEET	DRAWING	DESCRIPTION
1	COVER SHEET	G-1
2	SHEET LAYOUT KEY PLAN	G-2
3	COMPOSITE SITE PLAN (1 OF 3)	G-3
4	COMPOSITE SITE PLAN (2 OF 3)	G-4
5	COMPOSITE SITE PLAN (3 OF 3)	G-5
6	TEMPORARY ACCESS AND STAGING PLAN	G-6
7	EXISTING CONDTIONS PLAN (1 OF 3)	EC-1
8	EXISTING CONDITIONS PLAN (2 OF 3)	EC-2
9	EXISTING CONDITIONS PLAN (3 OF 3)	EC-3
10	TEMPORARY EROSION AND SEDIMENT CONTROL (TESC) PLAN (1 OF 3)	T-1
11	TEMPORARY EROSION AND SEDIMENT CONTROL (TESC) PLAN (2 OF 3)	T-2
12	TEMPORARY EROSION AND SEDIMENT CONTROL (TESC) PLAN (3 OF 3)	T-3
13	DEMOLITION PLAN (1 OF 3)	D-1
14	DEMOLITION PLAN (2 OF 3)	D-2
15	DEMOLITION PLAN (3 OF 3)	D-3
16	GRADING PLAN (1 OF 3)	C-1
17	GRADING PLAN (2 OF 3)	C-2
18	GRADING PLAN (3 OF 3)	C-3
19	GRADING CROSS-SECTIONS (1 OF 4)	C-4
20	GRADING CROSS-SECTIONS (2 OF 4)	C-5
21	GRADING CROSS-SECTIONS (3 OF 4)	C-6
22	GRADING CROSS SECTIONS (4 OF 4)	C-7
23	CONSTRUCTION MATERIALS PLAN (1 OF 3)	C-8
24	CONSTRUCTION MATERIALS PLAN (2 OF 3)	C-9
25	CONSTRUCTION MATERIALS PLAN (3 OF 3)	C-10
26	UTILITY PLAN (1 OF 2)	C-12
27	UTILITY PLAN (2 OF 2)	C-13
28	ARCHITECTURAL GENERAL INFORMATION	A-1.1
29	ARCHITECTURAL GENERAL NOTES	A-1.2
30	FOUNDATION PLAN, FLOOR PLAN, ROOF PLAN	A-2.1
31	ELEVATIONS	A-3.1
32	PEDESTRIAN BRIDGE	S-1
33	PLANTING PLAN (1 OF 3)	L-1
34	PLANTING PLAN (2 OF 3)	L-2
35	PLANTING PLAN (3 OF 3)	L-3

Prime Consultant
ANCHOR QEA
720 Olive Way
Suite 1900
Seattle WA, 98101
(206) 287-9130

Architectural Consultant
Salt Studio LLC
66 Bell Street Unit #1
Seattle, WA 98121
(206) 948-2104

Surveyor
Duane Hartman and Associates
16928 Woodinville-Redmond Road, Suite B-107
Woodinville, WA 98072
(425) 483-5355

Structural Engineering Consultant
Swenson Say Faget
2124 Third Ave, Suite 100
Seattle, WA 98121
(206) 443-6212

Mechanical Engineering Consultant
Rainbow Consulting
336 NW 50th St
Seattle, WA 98107
(206) 235-6002

Irrigation Consultant
William Stewart Design
9220 58th Avenue SE
Olympia, WA 98513
(206) 605-9863

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: AS NOTED
DATE: OCTOBER 2017

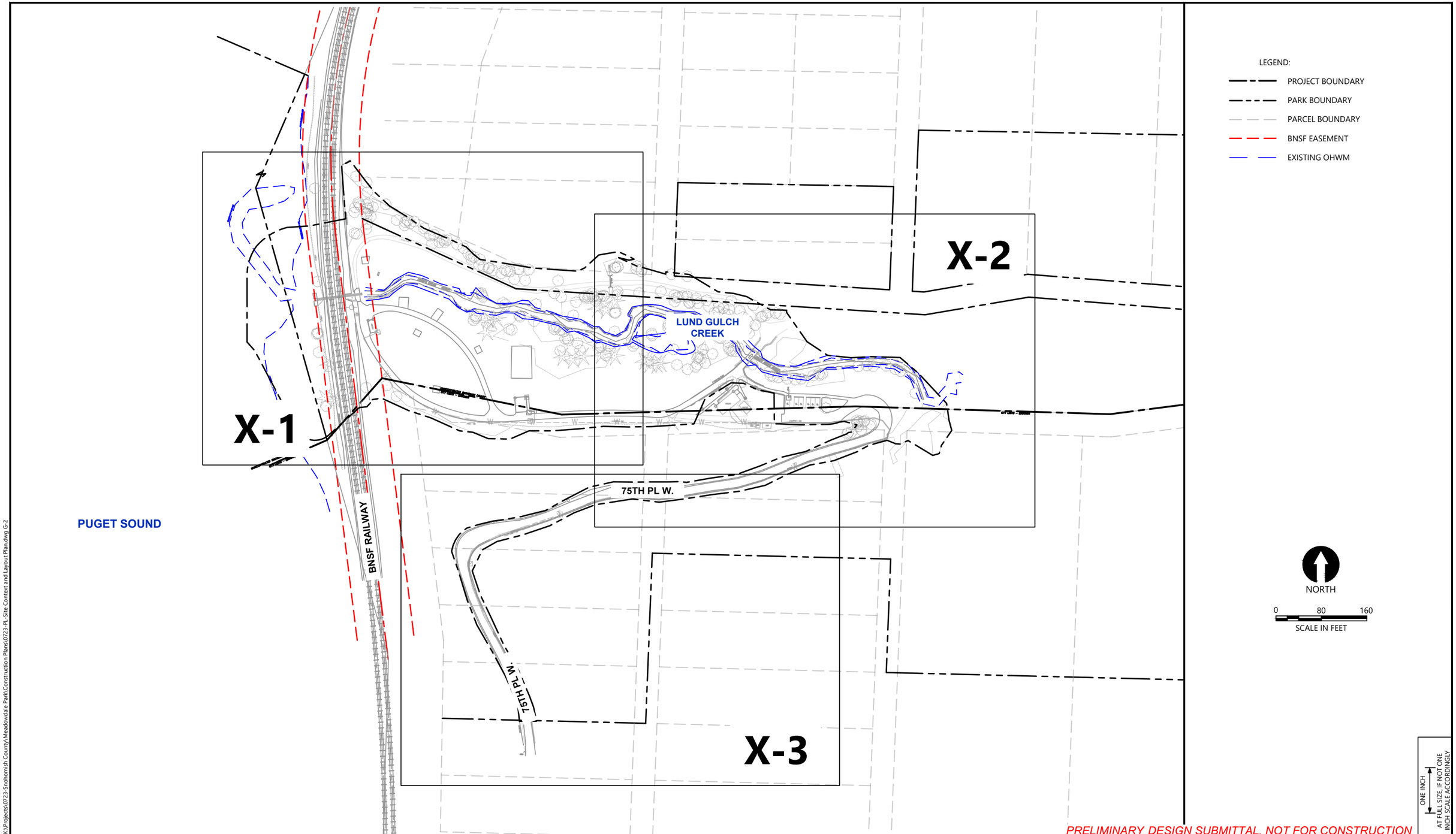
MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

COVER SHEET

G-1

SHEET NO. 1 OF 35

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Cover Sheet.dwg G-1
Dec 29, 2017 4:57pm bsevertsen



PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Site Context and Layout Plan.dwg G-2

Dec 29, 2017 4:58pm bsevertsen

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

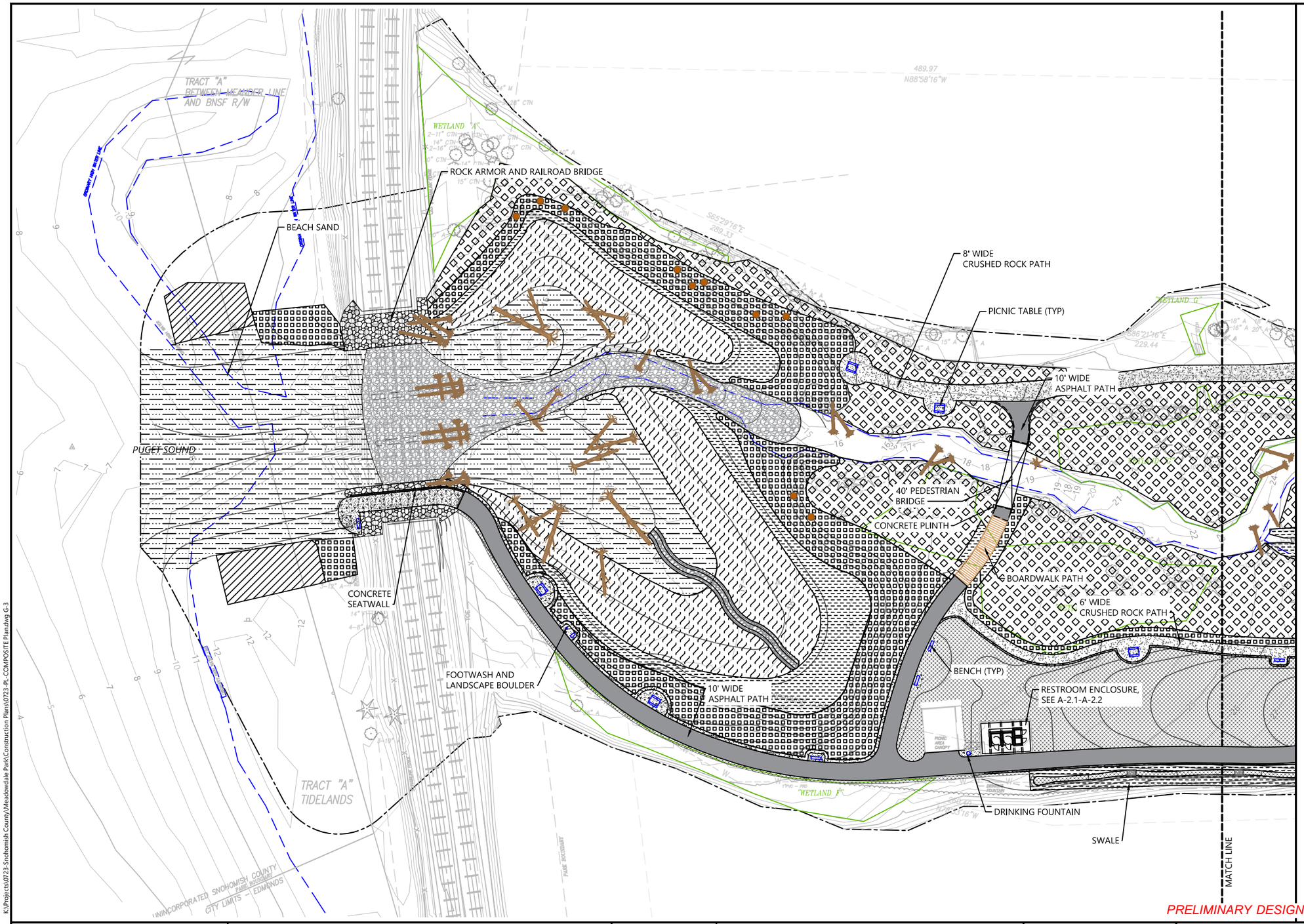
DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 80'
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

SHEET LAYOUT KEY PLAN

G-2

SHEET NO. **2** OF **35**



LEGEND:

- PROJECT BOUNDARY
- 12" BEACH SAND
- LARGE WOODY DEBRIS
- ROCK ARMORING
- STREAMBED AND SWALE COBBLES
- CRUSHED ROCK PATH OR TRENCH
- ASPHALT PATH/PAD
- CONCRETE PATH/PAD
- PEDESTRIAN BRIDGE
- BOARDWALK PATH
- PICNIC TABLE
- BENCH
- RIPARIAN ENHANCEMENT PLANTING
- RIPARIAN PLANTING
- FRESHWATER WETLAND PLANTING
- TIDAL MARSH PLANTING
- BACKSHORE BEACH PLANTING
- LAWN
- ROCK-LINED SWALE
- 10 PROPOSED CONTOUR
- TREE TO REMAIN
- EXISTING WETLAND TO BE PROTECTED

NORTH

0 30 60

SCALE IN FEET

NOTES:

1. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
2. VERTICAL DATUM: NAVD 88

ONE INCH

AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-COMPOSITE Plan.dwg G-3

Dec 29, 2017 5:10pm bsevertsen

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

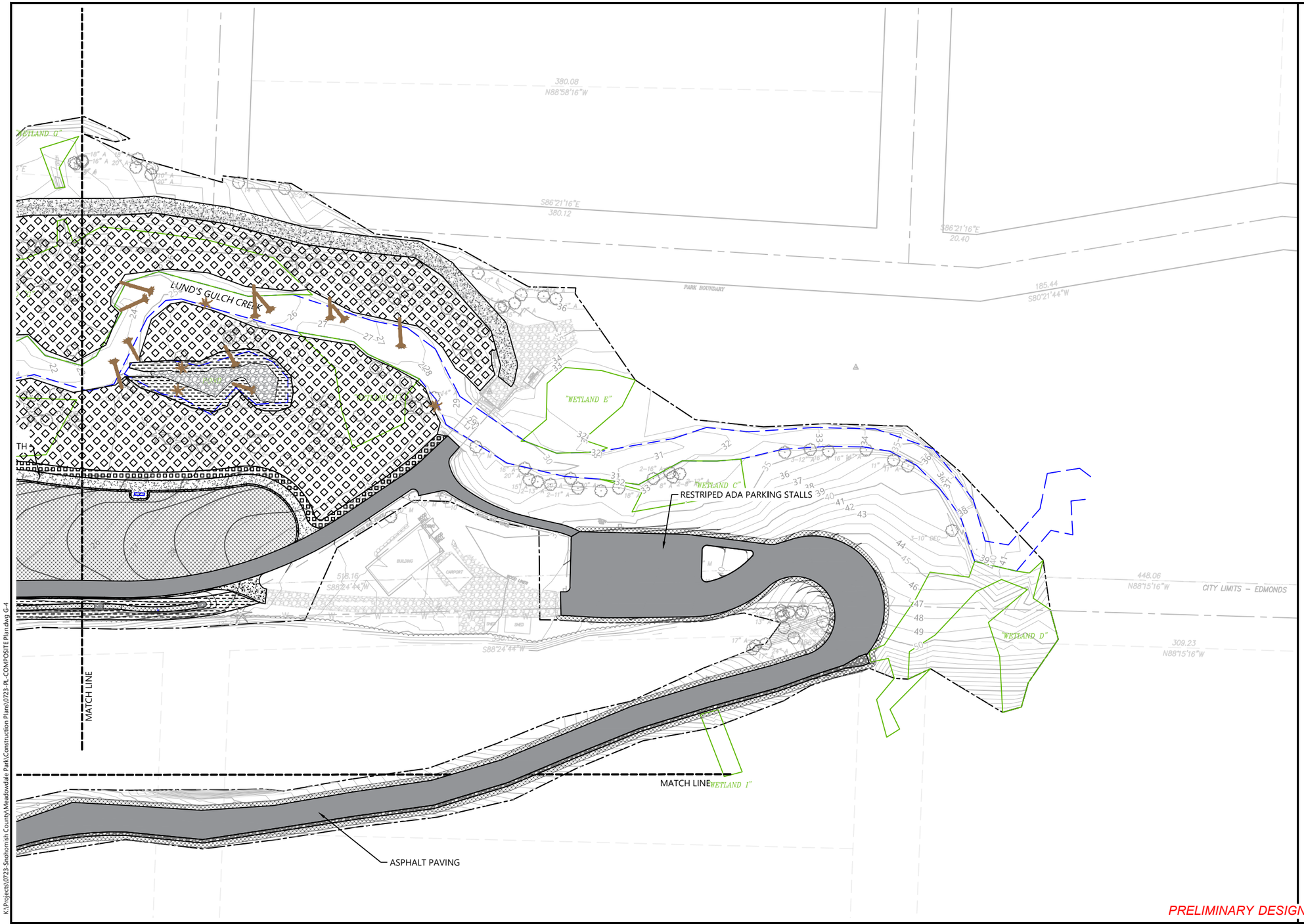
DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 30'
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

COMPOSITE SITE PLAN (1 OF 3)

G-3

SHEET NO. 3 OF 35



LEGEND:

- PROJECT BOUNDARY
- 12" BEACH SAND
- LARGE WOODY DEBRIS
- ROCK ARMORING
- STREAMBED AND SWALE COBBLES
- CRUSHED ROCK PATH OR TRENCH
- ASPHALT PATH/PAD
- CONCRETE PATH/PAD
- PEDESTRIAN BRIDGE
- BOARDWALK PATH
- PICNIC TABLE
- BENCH
- RIPARIAN ENHANCEMENT PLANTING
- RIPARIAN PLANTING
- FRESHWATER WETLAND PLANTING
- TIDAL MARSH PLANTING
- BACKSHORE BEACH PLANTING
- LAWN
- ROCK-LINED SWALE
- 10 PROPOSED CONTOUR
- TREE TO REMAIN
- EXISTING WETLAND TO BE PROTECTED

NORTH

0 30 60

SCALE IN FEET

NOTES:

1. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
2. VERTICAL DATUM: NAVD 88

ONE INCH

AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-COMPOSITE Plan.dwg G-4

Dec 29, 2017 5:10pm bsevertsen

ANCHOR QEA

Snohomish County Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 30'
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

COMPOSITE SITE PLAN (2 OF 3)

G-4

SHEET NO. 4 OF 35

LEGEND:

- PROJECT BOUNDARY
- 12" BEACH SAND
- LARGE WOODY DEBRIS
- ROCK ARMORING
- STREAMBED AND SWALE COBBLES
- CRUSHED ROCK PATH OR TRENCH
- ASPHALT PATH/PAD
- CONCRETE PATH/PAD
- PEDESTRIAN BRIDGE
- BOARDWALK PATH
- PICNIC TABLE
- BENCH
- RIPARIAN ENHANCEMENT PLANTING
- RIPARIAN PLANTING
- FRESHWATER WETLAND PLANTING
- TIDAL MARSH PLANTING
- BACKSHORE BEACH PLANTING
- LAWN
- ROCK-LINED SWALE
- 10 PROPOSED CONTOUR
- TREE TO REMAIN
- EXISTING WETLAND TO BE PROTECTED

NORTH

0 30 60
SCALE IN FEET

NOTES:

1. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
2. VERTICAL DATUM: NAVD 88

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-COMPOSITE Plan.dwg G-5

Dec 29, 2017 5:10pm bsevertsen

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

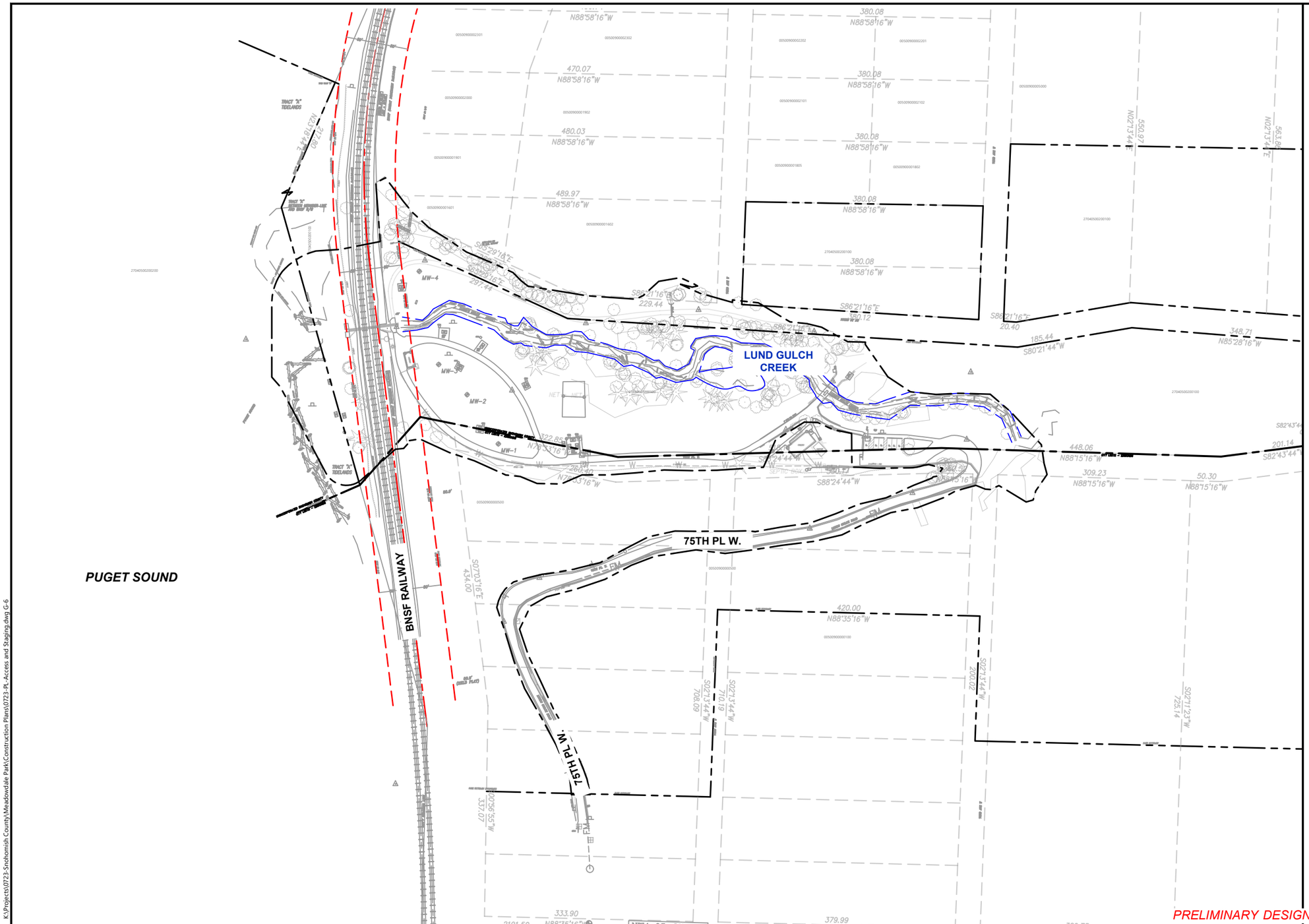
DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: AS NOTED
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

COMPOSITE SITE PLAN (3 OF 3)

G-5

SHEET NO. 5 OF 35



LEGEND:

- PROJECT BOUNDARY
- PARK BOUNDARY
- PARCEL BOUNDARY
- BNSF EASEMENT
- EXISTING OHWM

NORTH

0 80 160

SCALE IN FEET

ONE INCH

AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Access and Staging.dwg G-6

Dec 29, 2017 4:58pm bsevertsen

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS				
REV	DATE	BY	APP'D	DESCRIPTION

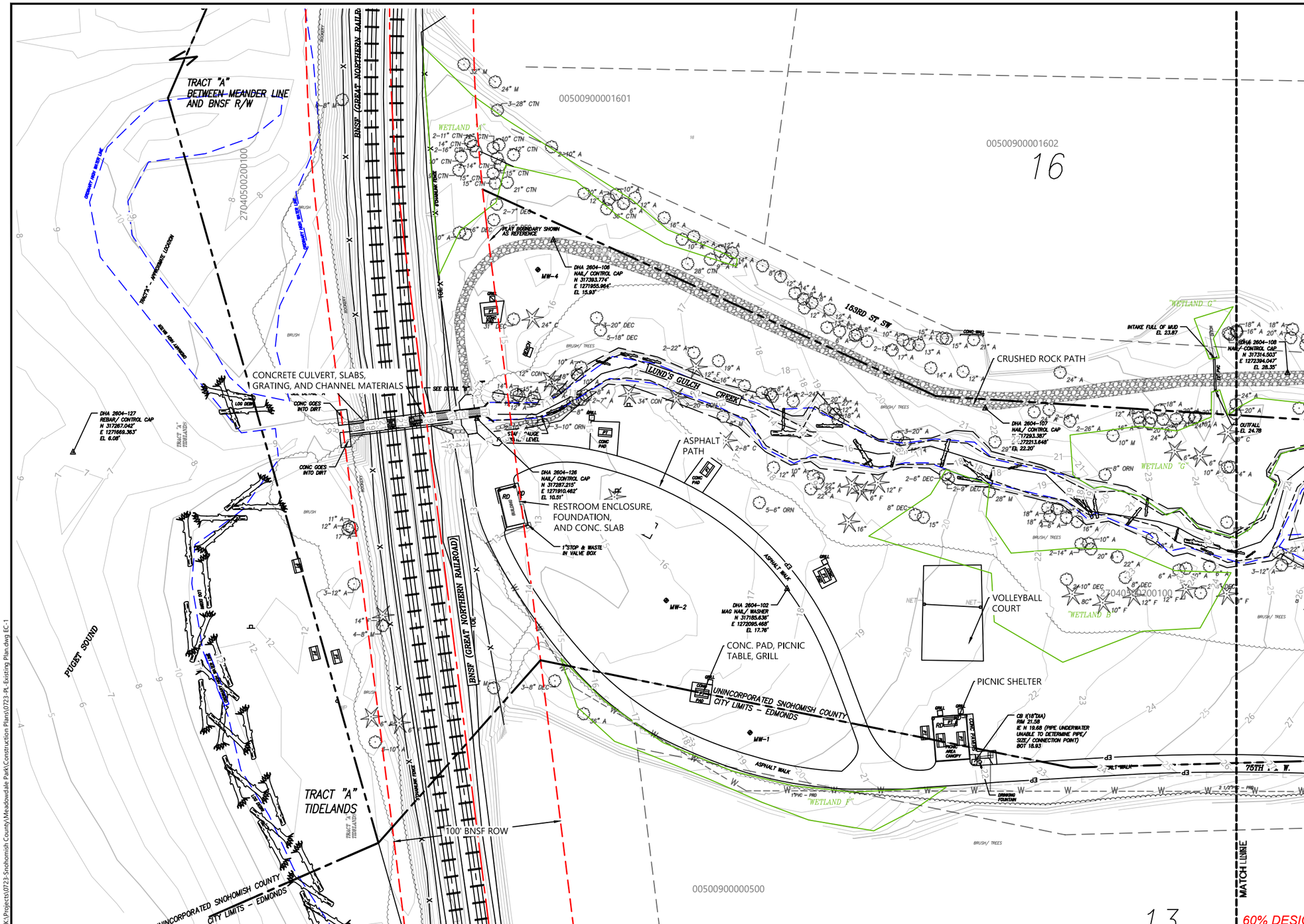
DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 80'
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

TEMPORARY ACCESS AND STAGING PLAN

C-6

SHEET NO. 6 OF 35



LEGEND:

- WATER METER
- JUNCTION BOX
- SANITARY/ STORM CLEAN-OUT
- SANITARY SEWER MANHOLE
- DHA SURVEY CONTROL
- MONUMENT IN CASE
- WETLAND/ ORDINARY HIGH WATER FLAG
- PICNIC TABLE x 13
- LOG DEBRIS
- DECIDUOUS
- CONIFER
- SIGN
- STORM DRAIN CATCH BASIN(TYPE I)
- YARD LIGHT
- POWER VAULT
- YARD DRAIN
- BOLLARD
- MONITOR WELL
- RAILROAD SIGNAL
- WETLAND BOUNDARY
- ORDINARY HIGH WATER MARK
- GRAVEL PATH
- EDGE OF ASPHALT
- CREEK TOE
- CREEK TOP
- PARK BOUNDARY LINE
- PLAT LOT LINE
- BNSF RIGHT OF WAY
- PLAT CENTERLINE
- FENCING
- SD UNDERGROUND STORM LINE
- SS UNDERGROUND SEWER GRAVITY LINE
- FM UNDERGROUND SEWER FORCEMAIN LINE
- W UNDERGROUND WATER LINE
- E UNDERGROUND POWER LINE
- T UNDERGROUND TELEPHONE LINE
- ROCKERY

ABBREVIATIONS:

CONC	CONCRETE
P.A.	PLANTED AREA
PVC	POLYVINYL CHLORIDE PIPE
(A)	APPROXIMATE
PRD	PER RECORD DRAWING
RD	ROOF DRAIN
CO	CLEAN-OUT
WP	WOOD POST

TREES:

C	CEDAR
F	FIR
P	PINE
DEC	DECIDUOUS
HEM	HEMLOCK
A	ALDER
M	MAPLE
CTN	COTTONWOOD
ORN	ORNAMENTAL
B	BIRCH

NORTH

0 30 60
SCALE IN FEET

NOTES:

1. SURVEY PROVIDED BY DHA, DATED JUNE 2017
2. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
3. VERTICAL DATUM: NAVD 88

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

60% DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Existing Plan.dwg EC-1

Dec 29, 2017 4:58pm bsevertsen

DUANE HARTMAN & ASSOCIATES, INC.
Surveyors
16928 WOODINVILLE-REDMOND ROAD, B-107
WOODINVILLE, WASHINGTON 98072
(425) 483-5355
FAX (425) 483-4650

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

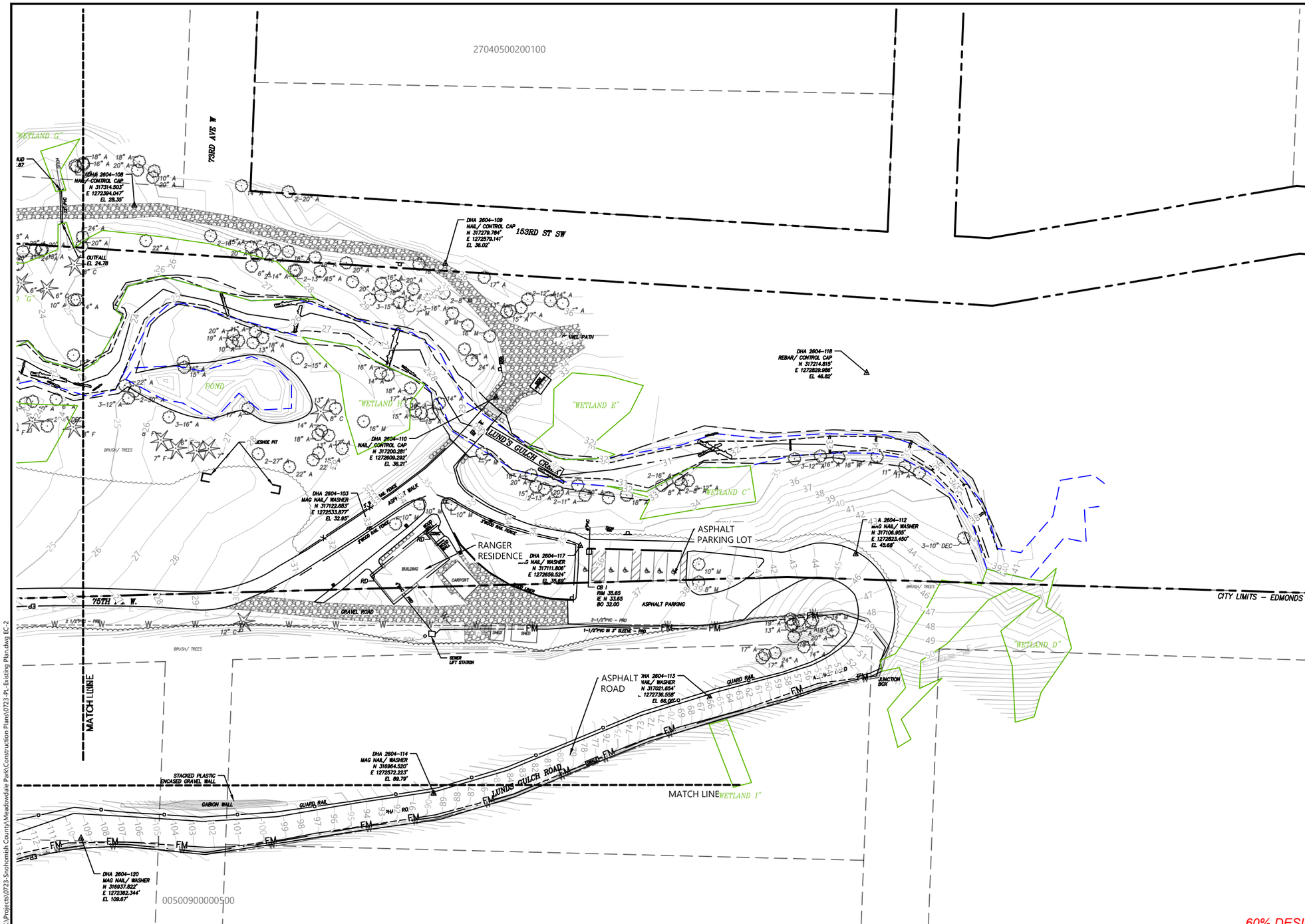
DESIGNED BY:
DRAWN BY: DHA
CHECKED BY:
APPROVED BY:
SCALE: 1" = 30'
DATE: JUNE 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

EXISTING CONDTIONS PLAN (1 OF 3)

EC-1

SHEET NO. 7 OF 35



LEGEND:

- WATER METER
- JUNCTION BOX
- SANITARY/ STORM CLEAN-OUT
- SANITARY SEWER MANHOLE
- DHA SURVEY CONTROL
- MONUMENT IN CASE
- WETLAND/ ORDINARY HIGH WATER FLAG
- PICNIC TABLE x 13
- LOG DEBRIS
- DECIDUOUS
- CONIFER
- SIGN
- STORM DRAIN CATCH BASIN(TYPE I)
- YARD LIGHT
- POWER VAULT
- YARD DRAIN
- BOLLARD
- MONITOR WELL
- RAILROAD SIGNAL
- WETLAND BOUNDARY
- ORDINARY HIGH WATER MARK
- GRAVEL PATH
- EDGE OF ASPHALT
- CREEK TOE
- CREEK TOP
- PARK BOUNDARY LINE
- PLAT LOT LINE
- BNSF RIGHT OF WAY
- PLAT CENTERLINE
- FENCING
- UNDERGROUND STORM LINE
- UNDERGROUND SEWER GRAVITY LINE
- UNDERGROUND SEWER FORCEMAIN LINE
- UNDERGROUND WATER LINE
- UNDERGROUND POWER LINE
- UNDERGROUND TELEPHONE LINE
- ROCKERY

ABBREVIATIONS:

CONC	CONCRETE
P.A.	PLANTED AREA
PVC	POLYVINYL CHLORIDE PIPE
(A)	APPROXIMATE
PRD	PER RECORD DRAWING
RD	ROOF DRAIN
CO	CLEAN-OUT
WP	WOOD POST

TREES:

C	CEDAR
F	FIR
P	PINE
DEC	DECIDUOUS
HEM	HEMLOCK
A	ALDER
M	MAPLE
CTN	COTTONWOOD
ORN	ORNAMENTAL
B	BIRCH

NORTH

0 30 60

SCALE IN FEET

NOTES:

1. SURVEY PROVIDED BY DHA, DATED JUNE 2017
2. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
3. VERTICAL DATUM: NAVD 88

ONE INCH

AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

60% DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Existing Plan.dwg EC-2

Dec 29, 2017 4:58pm bsevertsen

DUANE HARTMAN & ASSOCIATES, INC.
Surveyors
16928 WOODINVILLE-REDMOND ROAD, B-107
WOODINVILLE, WASHINGTON 98072
(425) 483-5355
FAX (425) 483-4650

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

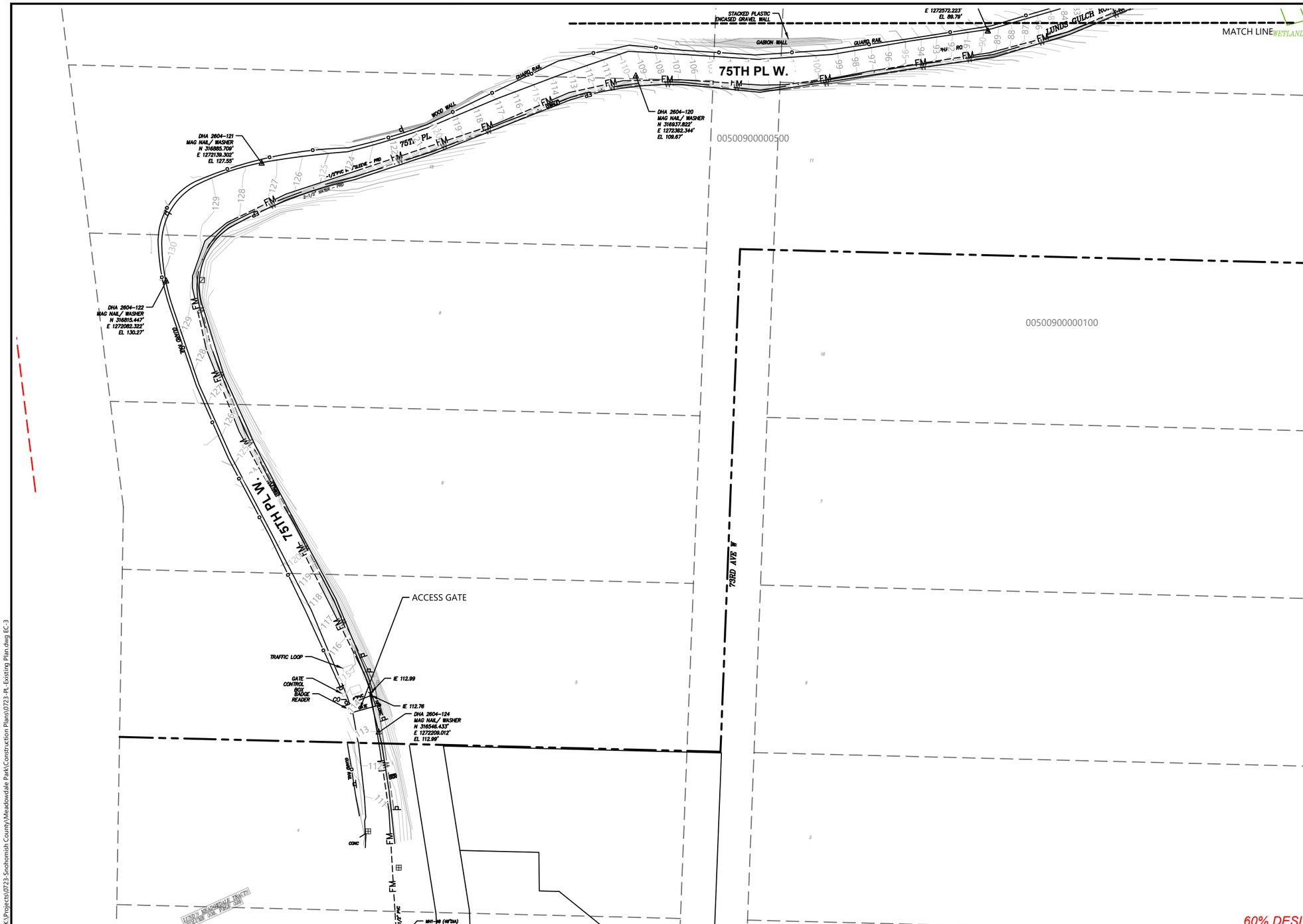
DESIGNED BY:
DRAWN BY: DHA
CHECKED BY:
APPROVED BY:
SCALE: 1" = 30'
DATE: JUNE 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

EXISTING CONDITIONS PLAN (2 OF 3)

EC-2

SHEET NO. **8** OF **35**



LEGEND:

- WATER METER
- JUNCTION BOX
- SANITARY/ STORM CLEAN-OUT
- SANITARY SEWER MANHOLE
- DHA SURVEY CONTROL
- MONUMENT IN CASE
- WETLAND/ ORDINARY HIGH WATER FLAG
- PICNIC TABLE x 13
- LOG DEBRIS
- DECIDUOUS
- CONIFER
- SIGN
- STORM DRAIN CATCH BASIN(TYPE I)
- YARD LIGHT
- POWER VAULT
- YARD DRAIN
- BOLLARD
- MONITOR WELL
- RAILROAD SIGNAL
- WETLAND BOUNDARY
- ORDINARY HIGH WATER MARK
- GRAVEL PATH
- EDGE OF ASPHALT
- CREEK TOE
- CREEK TOP
- PARK BOUNDARY LINE
- PLAT LOT LINE
- BNSF RIGHT OF WAY
- PLAT CENTERLINE
- FENCING
- UNDERGROUND STORM LINE
- UNDERGROUND SEWER GRAVITY LINE
- UNDERGROUND SEWER FORCEMAIN LINE
- UNDERGROUND WATER LINE
- UNDERGROUND POWER LINE
- UNDERGROUND TELEPHONE LINE
- ROCKERY

ABBREVIATIONS:

CONC	CONCRETE
P.A.	PLANTED AREA
PVC	POLYVINYL CHLORIDE PIPE
(A)	APPROXIMATE
PRD	PER RECORD DRAWING
RD	ROOF DRAIN
CO	CLEAN-OUT
WP	WOOD POST

TREES:

C	CEDAR
F	FIR
P	PINE
DEC	DECIDUOUS
HEM	HEMLOCK
A	ALDER
M	MAPLE
CTN	COTTONWOOD
ORN	ORNAMENTAL
B	BIRCH

NORTH

0 30 60

SCALE IN FEET

NOTES:

1. SURVEY PROVIDED BY DHA, DATED JUNE 2017
2. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
3. VERTICAL DATUM: NAVD 88

ONE INCH

AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

60% DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Existing Plan.dwg EC-3

Dec 29, 2017 4:58pm bsevertsen

DUANE HARTMAN & ASSOCIATES, INC.
Surveyors
16928 WOODINVILLE-REDMOND ROAD, B-107
WOODINVILLE, WASHINGTON 98072
(425) 483-5355
FAX (425) 483-4650

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

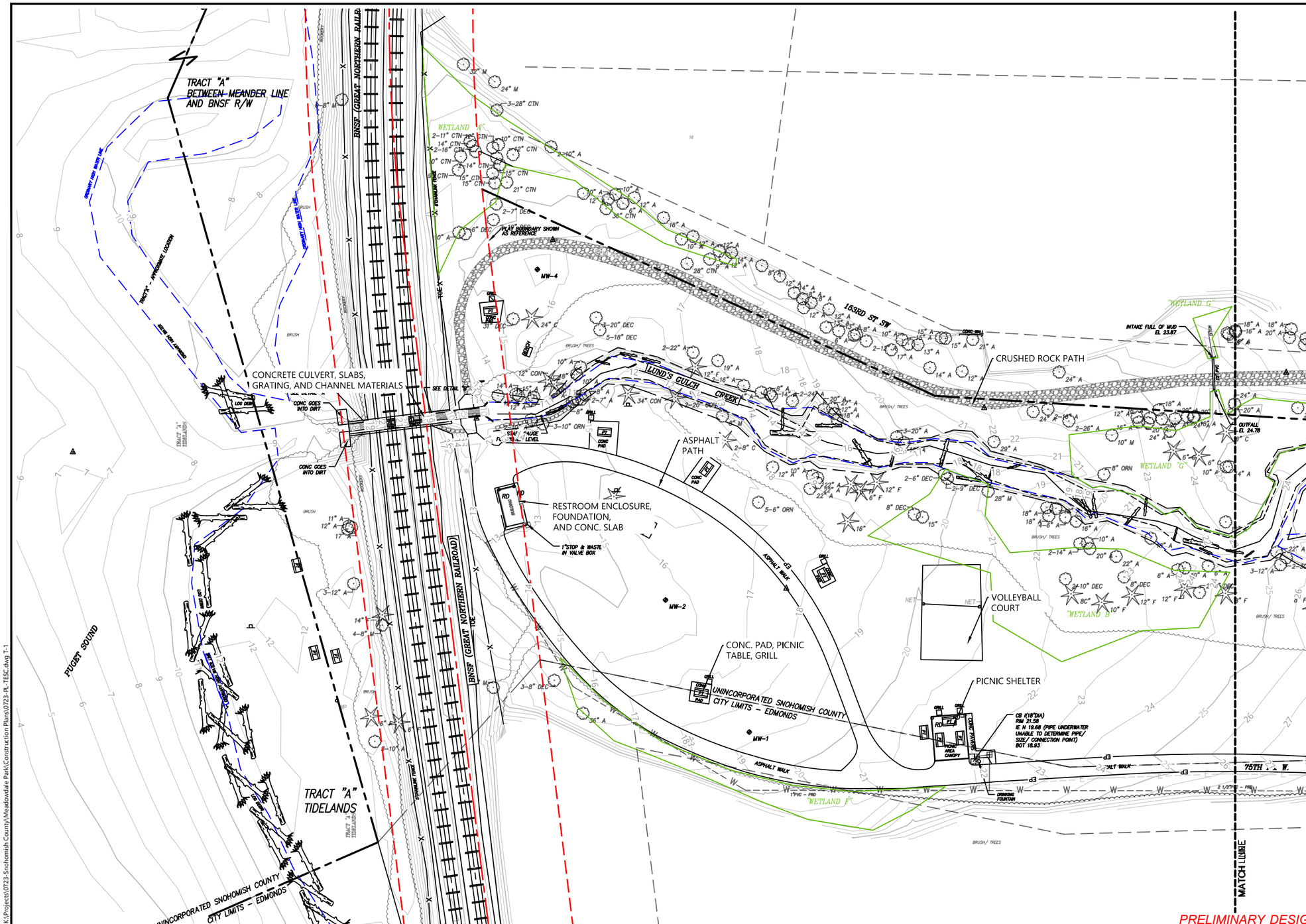
DESIGNED BY:
DRAWN BY: DHA
CHECKED BY:
APPROVED BY:
SCALE: 1" = 30'
DATE: JUNE 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

EXISTING CONDITIONS PLAN (3 OF 3)

EC-3

SHEET NO. 9 OF 35



LEGEND:

- WATER METER
- JUNCTION BOX
- SANITARY/ STORM CLEAN-OUT
- SANITARY SEWER MANHOLE
- DHA SURVEY CONTROL
- MONUMENT IN CASE
- WETLAND/ ORDINARY HIGH WATER FLAG
- PICNIC TABLE x 13
- LOG DEBRIS
- DECIDUOUS
- CONIFER
- SIGN
- STORM DRAIN CATCH BASIN(TYPE I)
- YARD LIGHT
- POWER VAULT
- YARD DRAIN
- BOLLARD
- MONITOR WELL
- RAILROAD SIGNAL
- WETLAND BOUNDARY
- ORDINARY HIGH WATER MARK
- GRAVEL PATH
- EDGE OF ASPHALT
- CREEK TOE
- CREEK TOP
- PARK BOUNDARY LINE
- PLAT LOT LINE
- BNSF RIGHT OF WAY
- PLAT CENTERLINE
- FENCING
- SD — UNDERGROUND STORM LINE
- SS — UNDERGROUND SEWER GRAVITY LINE
- FM — UNDERGROUND SEWER FORCEMAIN LINE
- W — UNDERGROUND WATER LINE
- E — UNDERGROUND POWER LINE
- T — UNDERGROUND TELEPHONE LINE
- ROCKERY

ABBREVIATIONS:

CONC	CONCRETE
P.A.	PLANTED AREA
PVC	POLYVINYL CHLORIDE PIPE
(A)	APPROXIMATE
PRD	PER RECORD DRAWING
RD	ROOF DRAIN
CO	CLEAN-OUT
WP	WOOD POST

TREES:

C	CEDAR
F	FIR
P	PINE
DEC	DECIDUOUS
HEM	HEMLOCK
A	ALDER
M	MAPLE
CTN	COTTONWOOD
ORN	ORNAMENTAL
B	BIRCH

NORTH

0 30 60
SCALE IN FEET

NOTES:

1. SURVEY PROVIDED BY DHA, DATED JUNE 2017
2. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
3. VERTICAL DATUM: NAVD 88

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-TESC.dwg T-1

Dec 29, 2017 4:59pm bsevertsen

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

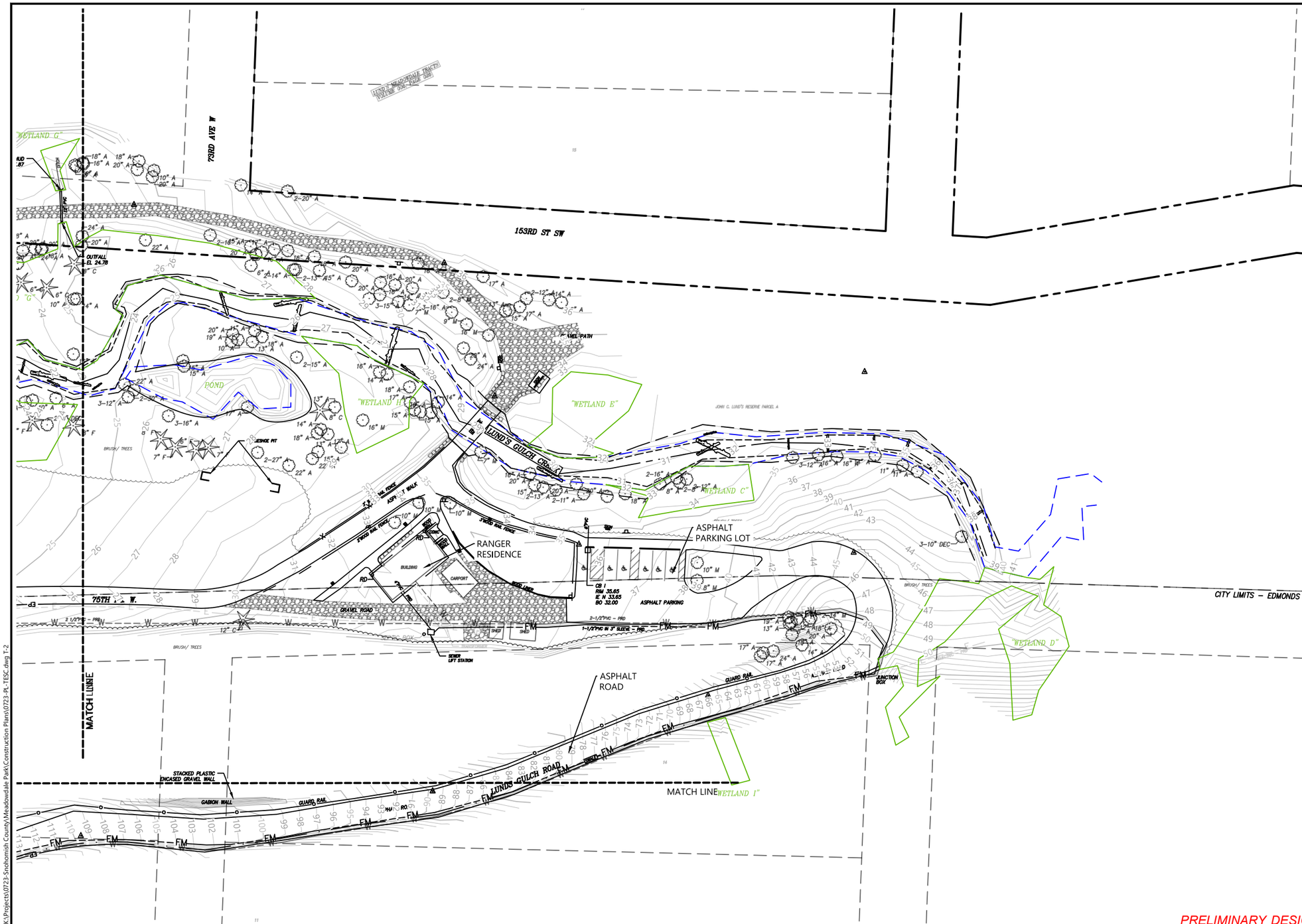
DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 30'
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

TEMPORARY EROSION AND SEDIMENT CONTROL (TESC) PLAN (1 OF 3)

T-1

SHEET NO. 10 OF 35



LEGEND:

- WATER METER
- JUNCTION BOX
- SANITARY/ STORM CLEAN-OUT
- SANITARY SEWER MANHOLE
- DHA SURVEY CONTROL
- MONUMENT IN CASE
- WETLAND/ ORDINARY HIGH WATER FLAG
- PICNIC TABLE x 13
- LOG DEBRIS
- DECIDUOUS
- CONIFER
- SIGN
- STORM DRAIN CATCH BASIN(TYPE I)
- YARD LIGHT
- POWER VAULT
- YARD DRAIN
- BOLLARD
- MONITOR WELL
- RAILROAD SIGNAL
- WETLAND BOUNDARY
- ORDINARY HIGH WATER MARK
- GRAVEL PATH
- EDGE OF ASPHALT
- CREEK TOE
- CREEK TOP
- PARK BOUNDARY LINE
- PLAT LOT LINE
- BNSF RIGHT OF WAY
- PLAT CENTERLINE
- FENCING
- UNDERGROUND STORM LINE
- UNDERGROUND SEWER GRAVITY LINE
- UNDERGROUND SEWER FORCEMAIN LINE
- UNDERGROUND WATER LINE
- UNDERGROUND POWER LINE
- UNDERGROUND TELEPHONE LINE
- ROCKERY

ABBREVIATIONS:

CONC	CONCRETE
P.A.	PLANTED AREA
PVC	POLYVINYL CHLORIDE PIPE
(A)	APPROXIMATE
PRD	PER RECORD DRAWING
RD	ROOF DRAIN
CO	CLEAN-OUT
WP	WOOD POST

TREES:

C	CEDAR
F	FIR
P	PINE
DEC	DECIDUOUS
HEM	HEMLOCK
A	ALDER
M	MAPLE
CTN	COTTONWOOD
ORN	ORNAMENTAL
B	BIRCH

NORTH

0 30 60

SCALE IN FEET

NOTES:

1. SURVEY PROVIDED BY DHA, DATED JUNE 2017
2. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
3. VERTICAL DATUM: NAVD 88

ONE INCH

AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-TESC.dwg T-2

Dec 29, 2017 4:59pm bsevertsen

ANCHOR QEA

Snohomish County Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 30'
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

TEMPORARY EROSION AND SEDIMENT CONTROL (TESC) PLAN (2 OF 3)

T-2

SHEET NO. 11 OF 35

LEGEND:

- WATER METER
- JUNCTION BOX
- SANITARY/ STORM CLEAN-OUT
- SANITARY SEWER MANHOLE
- DHA SURVEY CONTROL
- MONUMENT IN CASE
- WETLAND/ ORDINARY HIGH WATER FLAG
- PICNIC TABLE x 13
- LOG DEBRIS
- DECIDUOUS
- CONIFER
- SIGN
- STORM DRAIN CATCH BASIN(TYPE I)
- YARD LIGHT
- POWER VAULT
- YARD DRAIN
- BOLLARD
- MONITOR WELL
- RAILROAD SIGNAL
- WETLAND BOUNDARY
- ORDINARY HIGH WATER MARK
- GRAVEL PATH
- EDGE OF ASPHALT
- CREEK TOE
- CREEK TOP
- PARK BOUNDARY LINE
- PLAT LOT LINE
- BNSF RIGHT OF WAY
- PLAT CENTERLINE
- FENCING
- UNDERGROUND STORM LINE
- UNDERGROUND SEWER GRAVITY LINE
- UNDERGROUND SEWER FORCEMAIN LINE
- UNDERGROUND WATER LINE
- UNDERGROUND POWER LINE
- UNDERGROUND TELEPHONE LINE
- ROCKERY

ABBREVIATIONS:

CONC	CONCRETE
P.A.	PLANTED AREA
PVC	POLYVINYL CHLORIDE PIPE
(A)	APPROXIMATE
PRD	PER RECORD DRAWING
RD	ROOF DRAIN
CO	CLEAN-OUT
WP	WOOD POST

TREES:

C	CEDAR
F	FIR
P	PINE
DEC	DECIDUOUS
HEM	HEMLOCK
A	ALDER
M	MAPLE
CTN	COTTONWOOD
ORN	ORNAMENTAL
B	BIRCH

NORTH

0 30 60

SCALE IN FEET

NOTES:

1. SURVEY PROVIDED BY DHA, DATED JUNE 2017
2. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
3. VERTICAL DATUM: NAVD 88

ONE INCH

AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-TESC.dwg T-3

Dec 29, 2017 4:59pm bsevertsen

ANCHOR QEA

Snohomish County Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

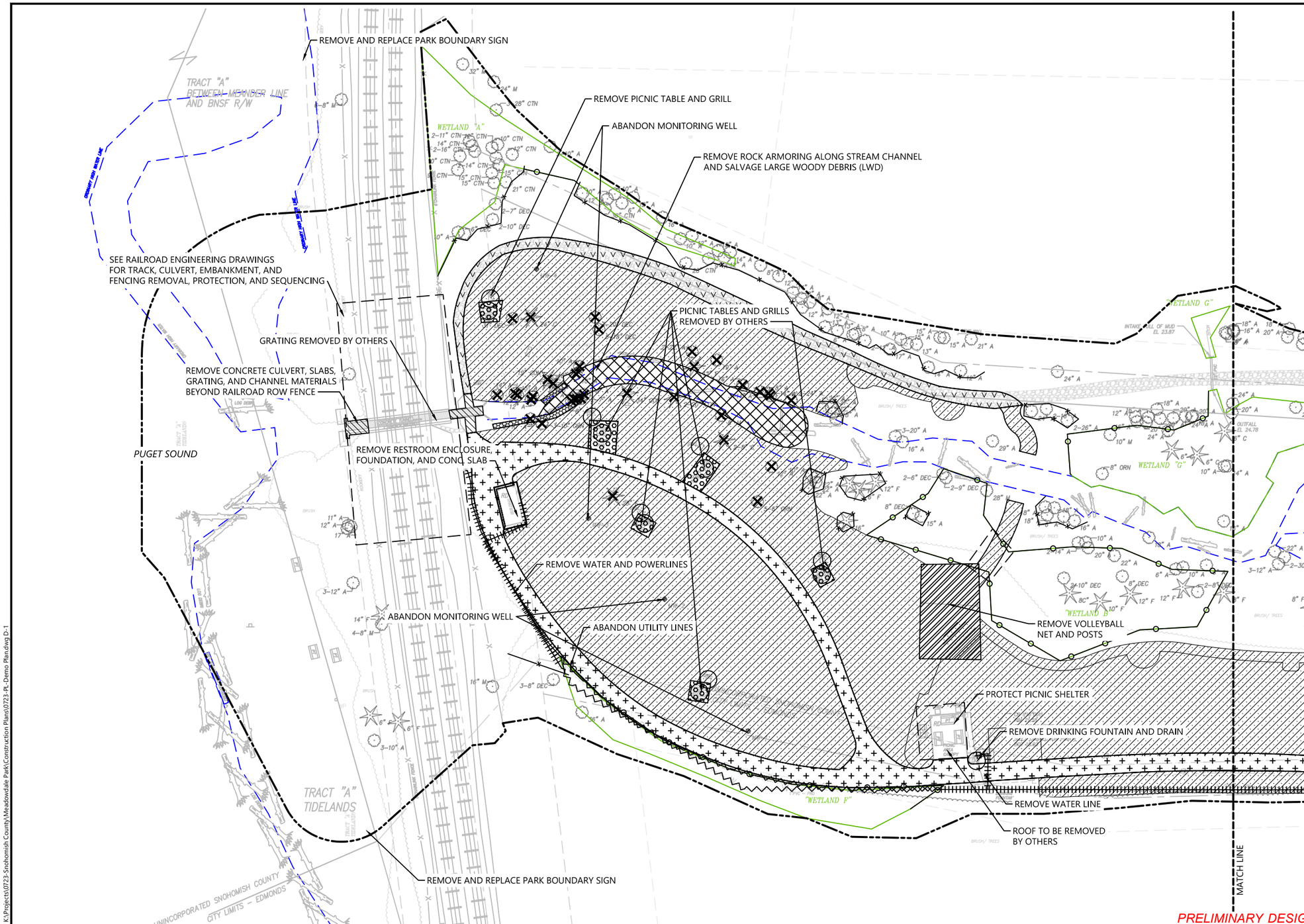
DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 30'
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

TEMPORARY EROSION AND SEDIMENT CONTROL (TESC) PLAN (3 OF 3)

T-3

SHEET NO. 12 OF 35



LEGEND:

- PROJECT BOUNDARY
- REMOVE CONCRETE CULVERT, SLABS, GRATING, AND CHANNEL MATERIALS
- REMOVE ASPHALT PAVING
- REMOVE CONCRETE PAVING
- REMOVE CRUSHED ROCK SURFACING
- CLEAR AND GRUB VEGETATION
- REMOVE VOLLEYBALL COURT SURFACING
- REMOVE STRUCTURE
- REMOVE ROCK ARMORING
- SALVAGE LARGE WOODY DEBRIS
- DEMO UTILITY LINE
- ABANDON UTILITY LINE
- TEMPORARY CONSTRUCTION FENCING
- TREE PROTECTION FENCING
- WETLAND PROTECTION FENCING
- REMOVE FEATURE
- REMOVE/SALVAGE TREE WITH ROOTBALL
- EXISTING WETLAND TO BE PROTECTED

NORTH

0 30 60
SCALE IN FEET

NOTES:

1. SURVEY PROVIDED BY DHA, DATED JUNE 2017
2. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
3. VERTICAL DATUM: NAVD 88
4. ALL WORK WITHIN CRITICAL AREAS PER PROJECT PERMITS AND REQUIRES ENGINEER TO BE PRESENT.

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Demo Plan.dwg D-1

Dec 29, 2017 4:59pm bsevertsen

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

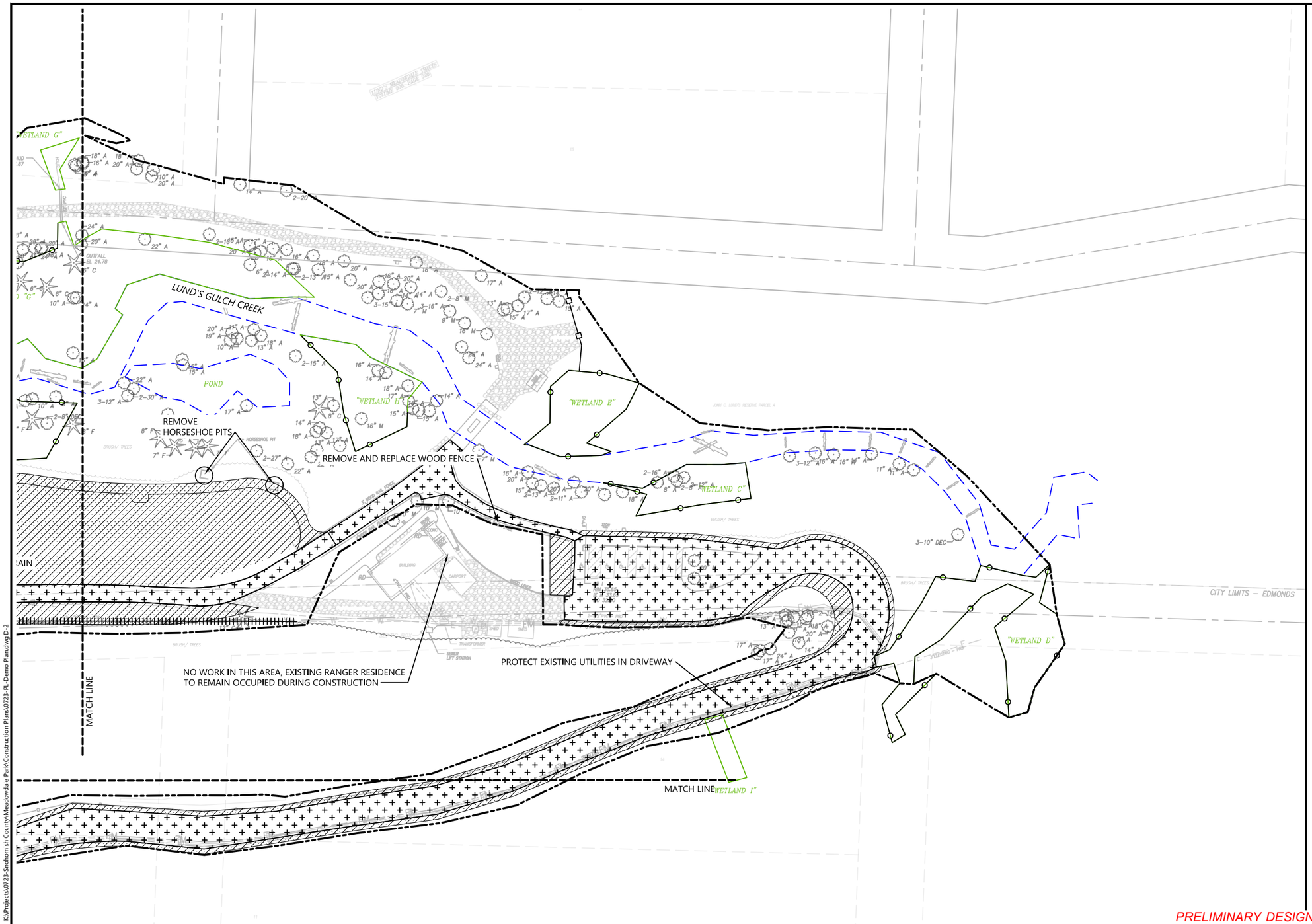
DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 30'
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

DEMOLITION PLAN (1 OF 3)

D-1

SHEET NO. 13 OF 35



LEGEND:

- PROJECT BOUNDARY
- REMOVE CONCRETE CULVERT, SLABS, GRATING, AND CHANNEL MATERIALS
- REMOVE ASPHALT PAVING
- REMOVE CRUSHED ROCK SURFACING
- CLEAR AND GRUB VEGETATION
- REMOVE VOLLEYBALL COURT SURFACING
- REMOVE STRUCTURE
- REMOVE ROCK ARMORING
- SALVAGE LARGE WOODY DEBRIS
- DEMO UTILITY LINE
- ABANDON UTILITY LINE
- TEMPORARY CONSTRUCTION FENCING
- TREE PROTECTION FENCING
- WETLAND PROTECTION FENCING
- REMOVE FEATURE
- REMOVE/SALVAGE TREE WITH ROOTBALL
- EXISTING WETLAND TO BE PROTECTED

NORTH

0 30 60

SCALE IN FEET

NOTES:

1. SURVEY PROVIDED BY DHA, DATED JUNE 2017
2. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
3. VERTICAL DATUM: NAVD 88
4. ALL WORK WITHIN CRITICAL AREAS PER PROJECT PERMITS AND REQUIRES ENGINEER TO BE PRESENT.

ONE INCH

AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Demo Plan.dwg D-2

Dec 29, 2017 5:00pm bsevertsen

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 30'
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

DEMOLITION PLAN (2 OF 3)

D-2

SHEET NO. 14 OF 35

LEGEND:

- PROJECT BOUNDARY
- REMOVE CONCRETE CULVERT, SLABS, GRATING, AND CHANNEL MATERIALS
- REMOVE ASPHALT PAVING
- REMOVE CRUSHED ROCK SURFACING
- CLEAR AND GRUB VEGETATION
- REMOVE VOLLEYBALL COURT SURFACING
- REMOVE STRUCTURE
- REMOVE ROCK ARMORING
- SALVAGE LARGE WOODY DEBRIS
- DEMO UTILITY LINE
- ABANDON UTILITY LINE
- TEMPORARY CONSTRUCTION FENCING
- TREE PROTECTION FENCING
- WETLAND PROTECTION FENCING
- REMOVE FEATURE
- REMOVE/SALVAGE TREE WITH ROOTBALL
- EXISTING WETLAND TO BE PROTECTED

NORTH

0 30 60

SCALE IN FEET

NOTES:

1. SURVEY PROVIDED BY DHA, DATED JUNE 2017
2. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
3. VERTICAL DATUM: NAVD 88
4. ALL WORK WITHIN CRITICAL AREAS PER PROJECT PERMITS AND REQUIRES ENGINEER TO BE PRESENT.

ONE INCH

AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Demo Plan.dwg D-3

Dec 29, 2017 5:00pm bsevertsen

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

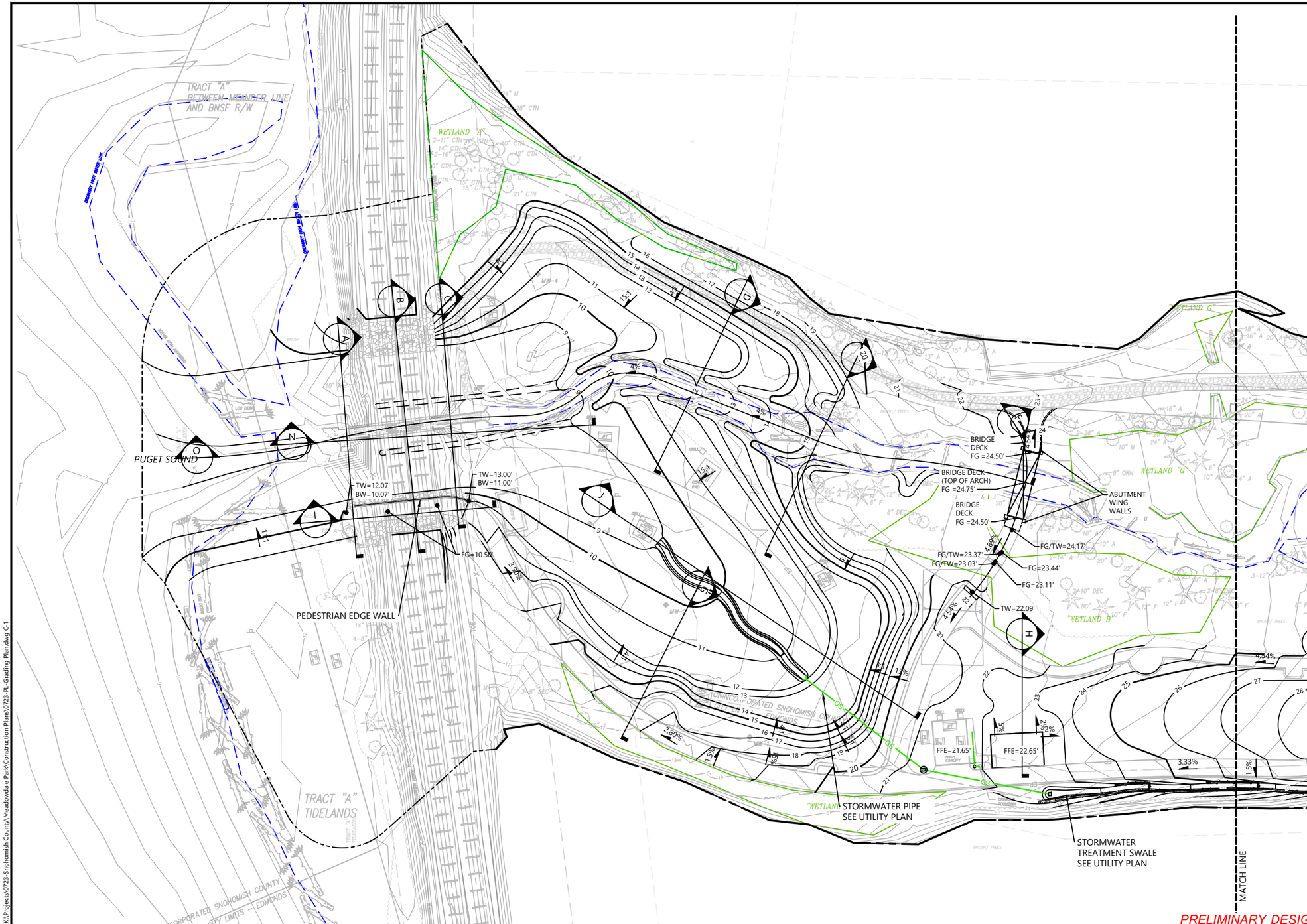
DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 30'
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

DEMOLITION PLAN (3 OF 3)

D-3

SHEET NO. **15** OF **35**



LEGEND:

- PROJECT BOUNDARY
- EXISTING CONTOUR
- EXISTING OHWM
- 10 PROPOSED MAJOR CONTOUR
- 11 PROPOSED MINOR CONTOUR
- TREE TO REMAIN
- EXISTING WETLAND TO BE PROTECTED

NORTH

0 30 60

SCALE IN FEET

NOTES:

1. SURVEY PROVIDED BY DHA, DATED JUNE 2017
2. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
3. VERTICAL DATUM: NAVD 88

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Grading Plan.dwg C-1

Dec 29, 2017 5:00pm bsevertsen

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS				
REV	DATE	BY	APP'D	DESCRIPTION

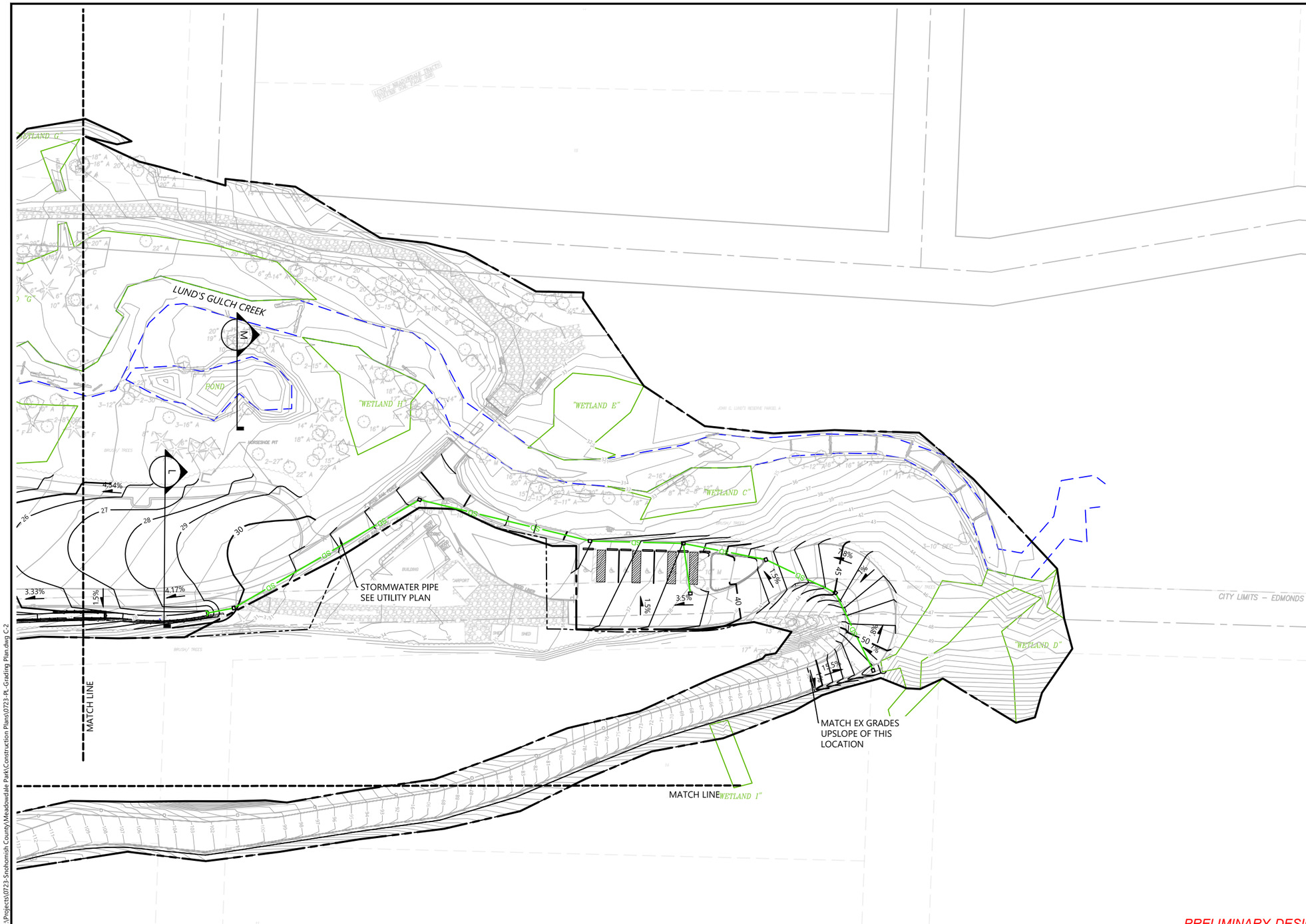
DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 30'
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

GRADING PLAN (1 OF 3)

C-1

SHEET NO. 16 OF 35



LEGEND:

- PROJECT BOUNDARY
- EXISTING CONTOUR
- EXISTING OHWM
- 10 PROPOSED MAJOR CONTOUR
- 11 PROPOSED MINOR CONTOUR
- TREE TO REMAIN
- EXISTING WETLAND TO BE PROTECTED

NORTH

0 30 60

SCALE IN FEET

NOTES:

1. SURVEY PROVIDED BY DHA, DATED JUNE 2017
2. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
3. VERTICAL DATUM: NAVD 88

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Grading Plan.dwg C-2

Dec 29, 2017 5:00pm bsevertsen

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 30'
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

GRADING PLAN (2 OF 3)

C-2

SHEET NO. **17** OF **35**

LEGEND:

- PROJECT BOUNDARY
- EXISTING CONTOUR
- EXISTING OHWM
- 10 PROPOSED MAJOR CONTOUR
- 11 PROPOSED MINOR CONTOUR
- TREE TO REMAIN
- EXISTING WETLAND TO BE PROTECTED

NORTH

0 30 60

SCALE IN FEET

NOTES:

1. SURVEY PROVIDED BY DHA, DATED JUNE 2017
2. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
3. VERTICAL DATUM: NAVD 88

ONE INCH

AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Grading Plan.dwg C-3

Dec 29, 2017 5:00pm bsevertsen

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

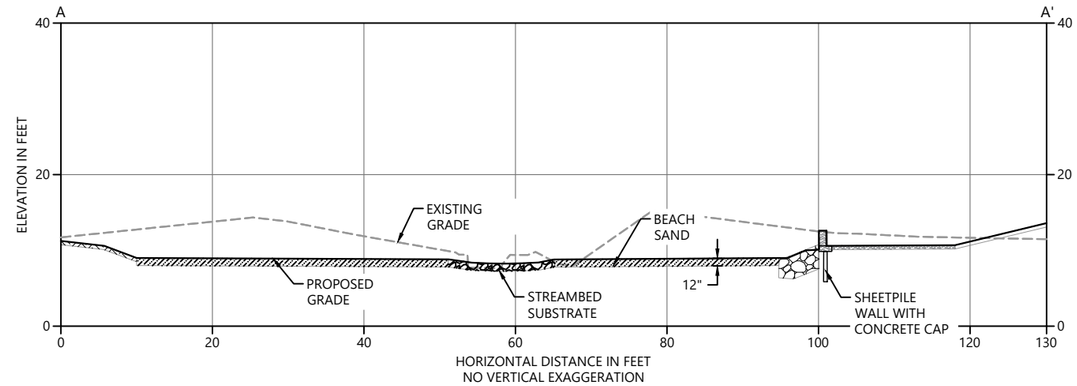
DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 30'
DATE: OCTOBER 2017

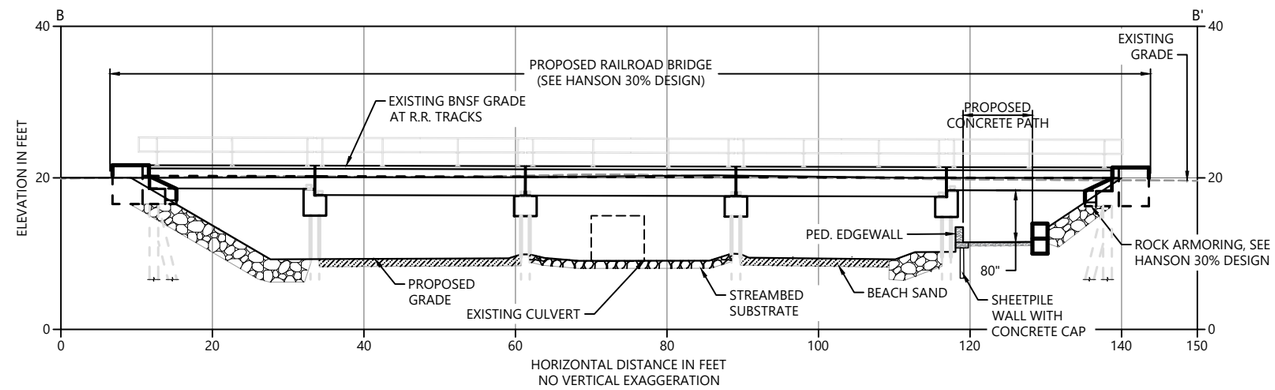
MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

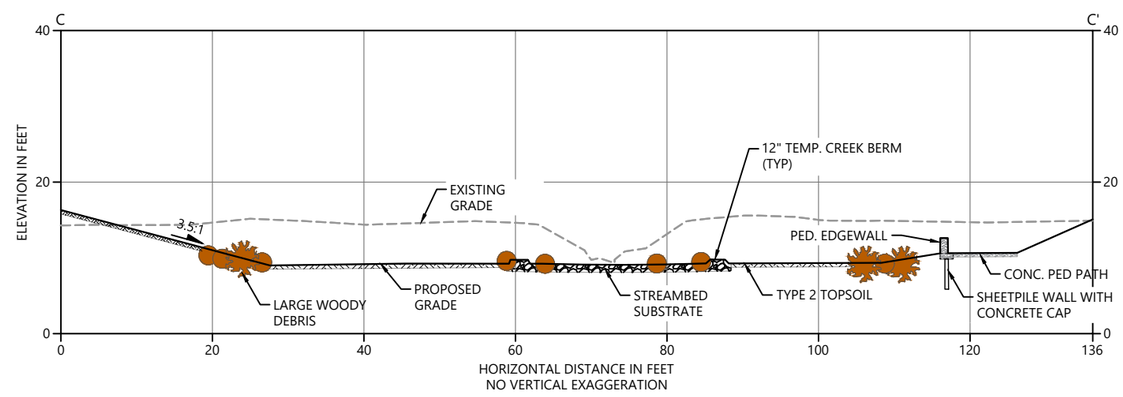
GRADING PLAN (3 OF 3)

C-3

SHEET NO. **18** OF **35**







LEGEND:

- 6" TYPE 1 TOPSOIL
- 6" TYPE 2 TOPSOIL
- TYPE 1 TOPSOIL OVER ON-SITE SALVAGED SAND
- 12" BEACH SAND
- ROCK ARMORING
- CRUSHED ROCK PATH
- ASPHALT PATH
- CONCRETE PATH
- LARGE WOODY DEBRIS

0 10 20
SCALE IN FEET

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Grading Plan_Sections.dwg C-4

Dec 29, 2017 5:01pm bsevertsen

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

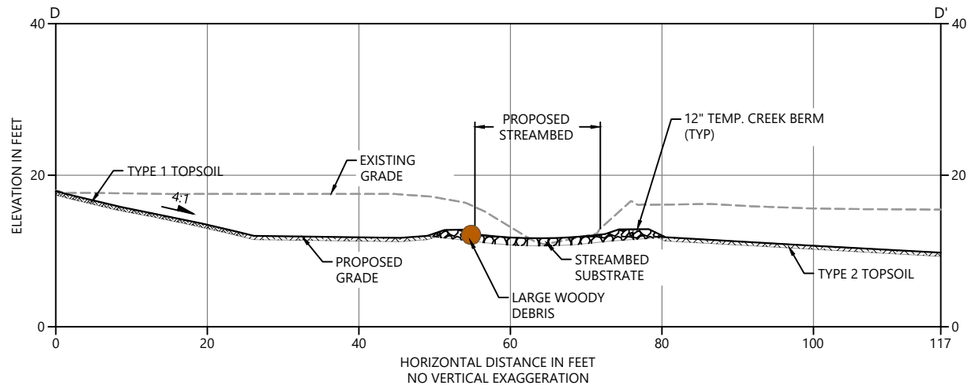
DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 10'
DATE: OCTOBER 2017

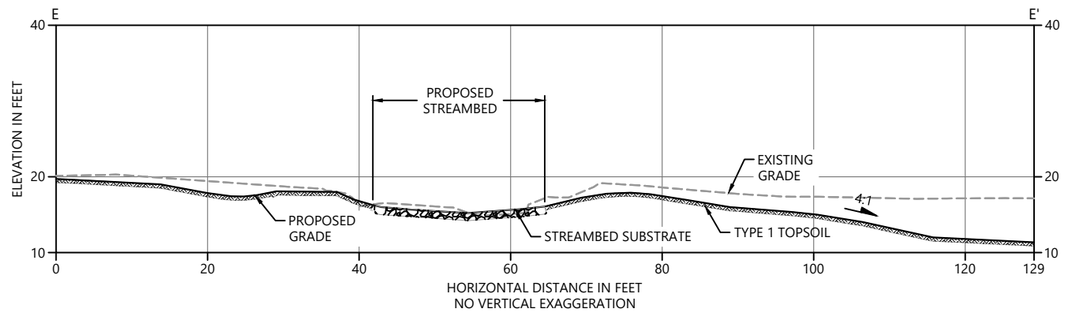
MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

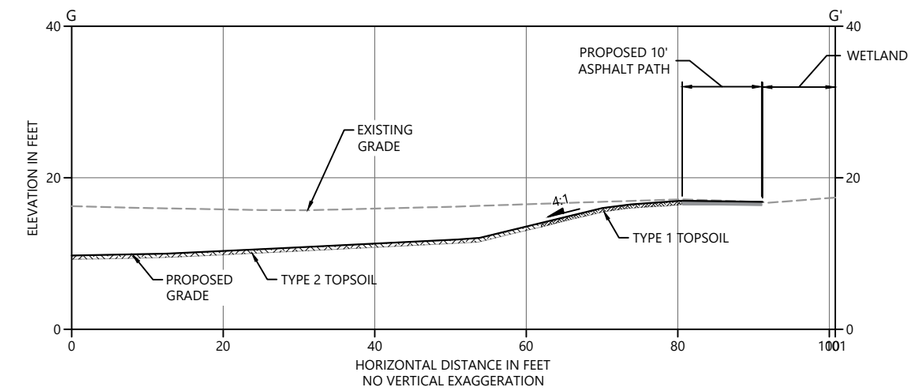
GRADING CROSS-SECTIONS (1 OF 4)

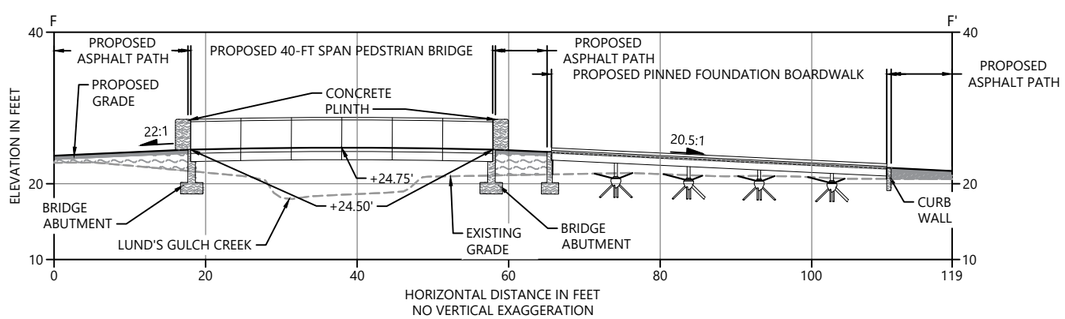
C-4

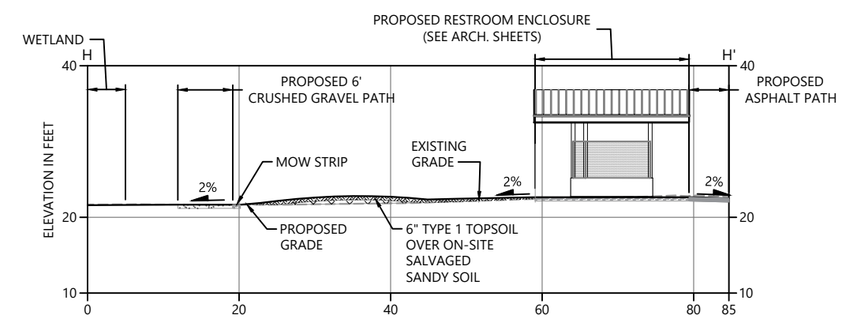
SHEET NO. **19** OF **35**











LEGEND:

- 6" TYPE 1 TOPSOIL
- 6" TYPE 2 TOPSOIL
- TYPE 1 TOPSOIL OVER ON-SITE SALVAGED SAND
- 12" BEACH SAND
- STREAMBED COBBLES
- ROCK ARMORING
- CRUSHED ROCK PATH
- ASPHALT PATH
- COMMON FILL
- CONCRETE
- LARGE WOODY DEBRIS

0 10 20
SCALE IN FEET

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Grading Plan Sections.dwg C-5

Dec 29, 2017 5:01pm bsevertsen

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

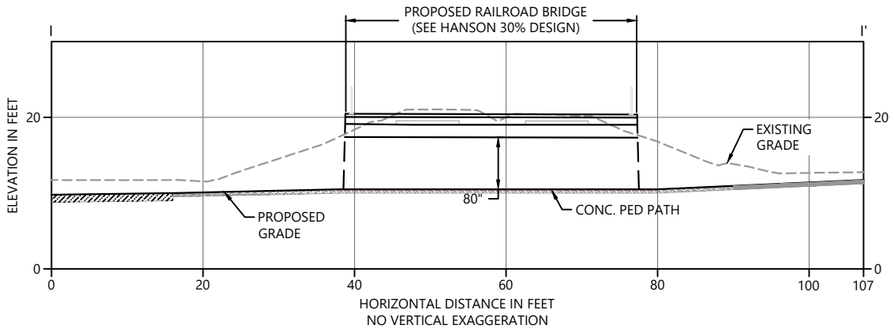
DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 10'
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

GRADING CROSS-SECTIONS (2 OF 4)

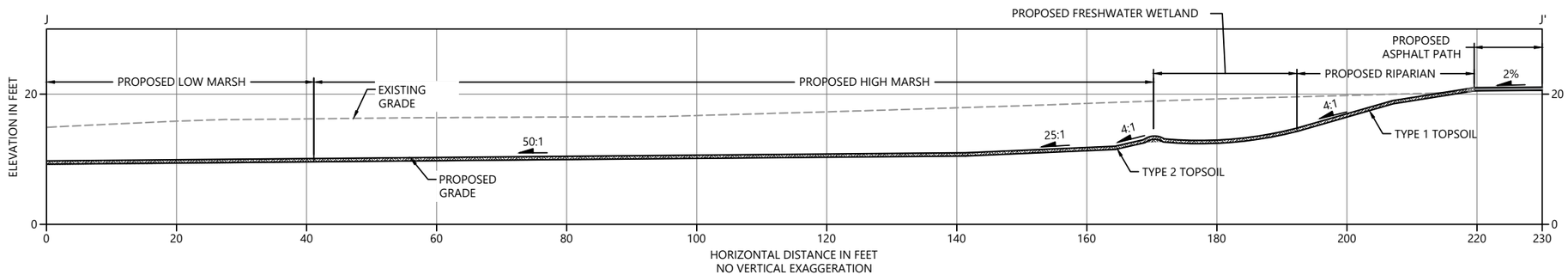
C-5

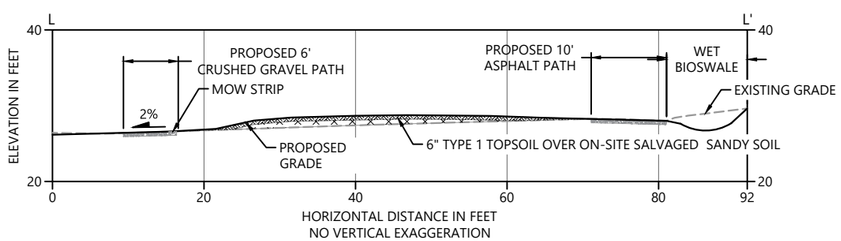
SHEET NO. **20** OF **35**

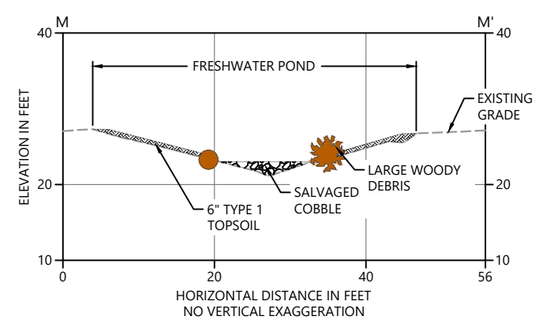


LEGEND:

- 6" TYPE 1 TOPSOIL
- 6" TYPE 2 TOPSOIL
- TYPE 1 TOPSOIL OVER ON-SITE SALVAGED SAND
- 12" BEACH SAND
- STREAMBED COBBLES
- ROCK ARMORING
- CRUSHED ROCK PATH OR TRENCH
- ASPHALT PATH
- CONCRETE PATH
- LARGE WOODY DEBRIS







0 10 20
SCALE IN FEET

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Grading Plan_Sections.dwg C-6

Dec 29, 2017 5:01pm bsevertsen

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

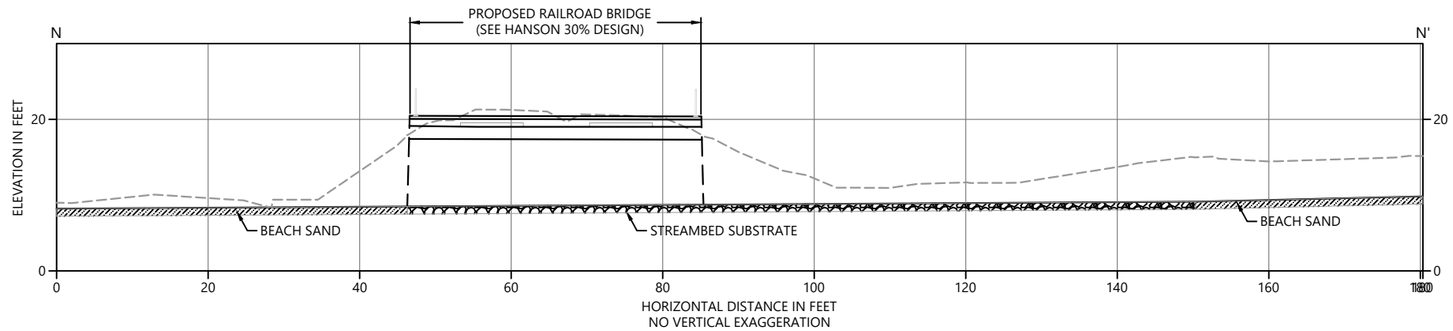
DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 10'
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

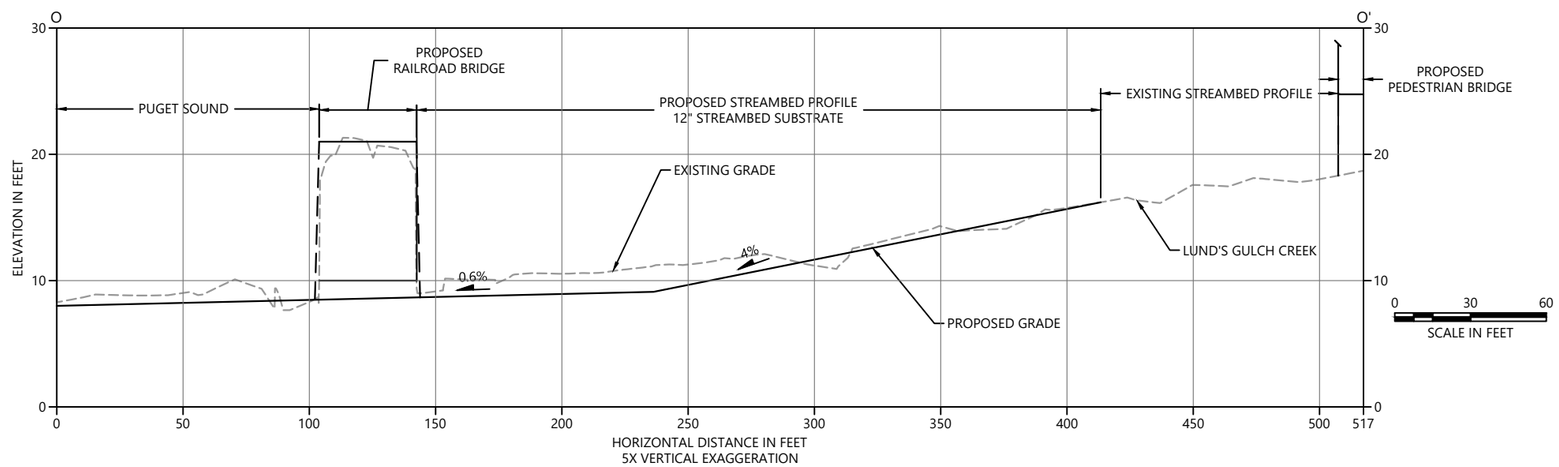
GRADING CROSS-SECTIONS (3 OF 4)

C-6

SHEET NO. **21** OF **35**



0 10 20
SCALE IN FEET



0 30 60
SCALE IN FEET

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Grading Plan_Sections.dwg C-7

Dec 29, 2017 5:01pm bsevertsen

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS				
REV	DATE	BY	APP'D	DESCRIPTION

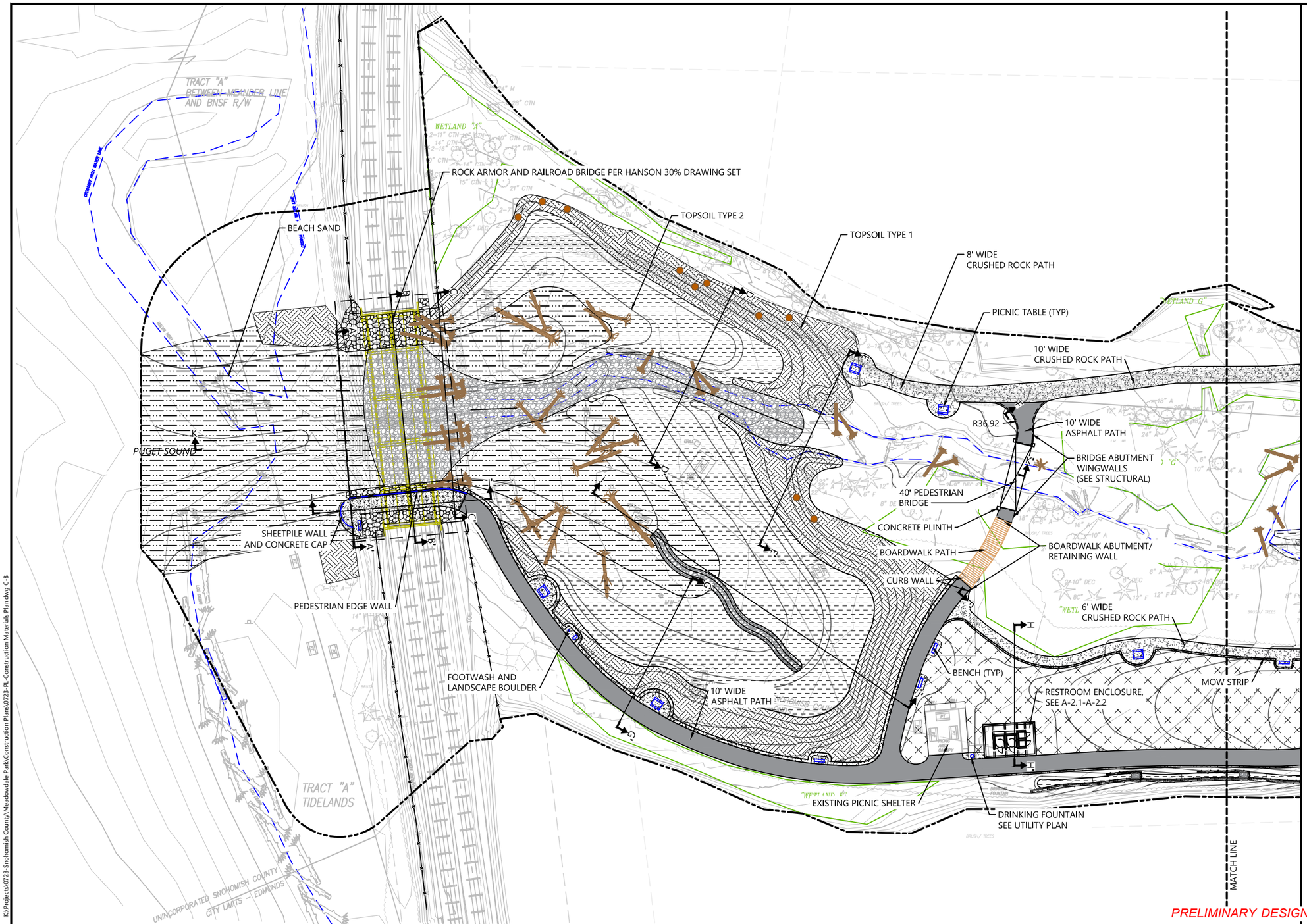
DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: VARIES
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

GRADING CROSS SECTIONS (4 OF 4)

C-7

SHEET NO. **22** OF **35**



LEGEND:

- PROJECT BOUNDARY
- 6" TYPE 1 TOPSOIL
- 6" TYPE 2 TOPSOIL
- 6" TYPE 1 TOPSOIL OVER ON-SITE SALVAGED SANDY SOIL
- 12" BEACH SAND/GRAVEL
- LARGE WOODY DEBRIS
- ROCK ARMORING (SEE HANSON 30%)
- STREAMBED AND SWALE COBBLES
- CRUSHED ROCK PATH OR TRENCH
- ASPHALT PATH/PAD
- CONCRETE PATH/PAD
- PEDESTRIAN BRIDGE
- BOARDWALK PATH
- EXISTING WETLAND TO BE PROTECTED
- SWALE LOG EDGING
- CHAIN LINK FENCE
- PICNIC TABLE
- BENCH
- SNAGS

NORTH

0 30 60
SCALE IN FEET

NOTES:

1. SURVEY PROVIDED BY DHA, DATED JUNE 2017
2. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
3. VERTICAL DATUM: NAVD 88

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Construction Materials Plan.dwg C-8

Dec 29, 2017 5:02pm bsevertsen

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

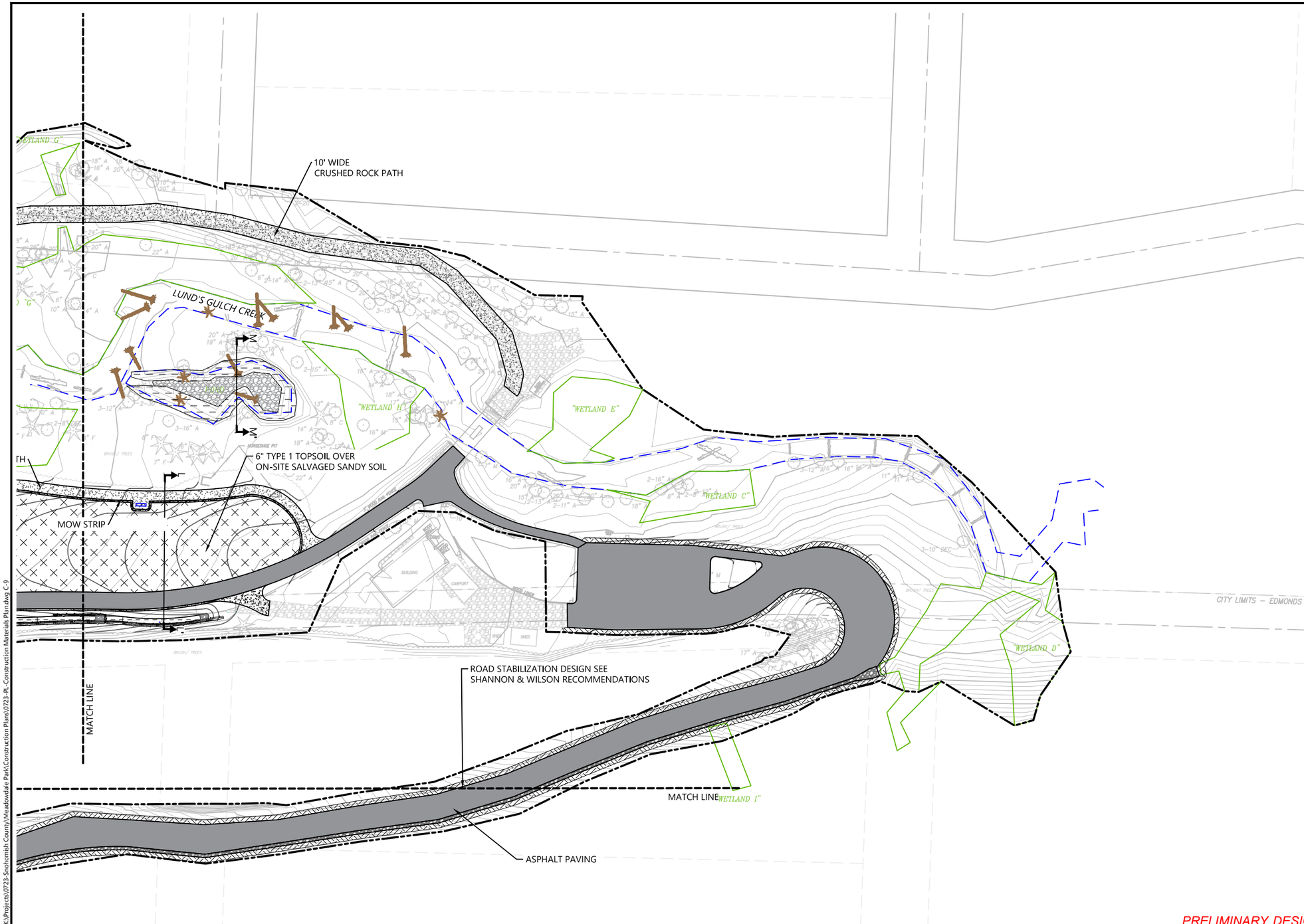
DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 30'
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

CONSTRUCTION MATERIALS PLAN (1 OF 3)

C-8

SHEET NO. 23 OF 35



LEGEND:

- PROJECT BOUNDARY
- 6" TYPE 1 TOPSOIL
- 6" TYPE 2 TOPSOIL
- 6" TYPE 1 TOPSOIL OVER ON-SITE SALVAGED SANDY SOIL
- 12" BEACH SAND
- LARGE WOODY DEBRIS
- ROCK ARMORING (SEE HANSON 30%)
- STREAMBED AND SWALE COBBLES
- CRUSHED ROCK PATH OR TRENCH
- ASPHALT PATH/PAD
- CONCRETE PATH/PAD
- PEDESTRIAN BRIDGE
- BOARDWALK PATH
- EXISTING WETLAND TO BE PROTECTED
- SWALE LOG EDGING
- CHAIN LINK FENCE
- PICNIC TABLE
- BENCH

NORTH

0 30 60
SCALE IN FEET

NOTES:

1. SURVEY PROVIDED BY DHA, DATED JUNE 2017
2. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
3. VERTICAL DATUM: NAVD 88

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Construction Materials Plan.dwg C-9

Dec 29, 2017 5:02pm bsewertsen

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 30'
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

CONSTRUCTION MATERIALS PLAN (2 OF 3)

C-9

SHEET NO. **24** OF **35**

LEGEND:

- PROJECT BOUNDARY
- 6" TYPE 1 TOPSOIL
- 6" TYPE 2 TOPSOIL
- 6" TYPE 1 TOPSOIL OVER ON-SITE SALVAGED SANDY SOIL
- 12" BEACH SAND
- LARGE WOODY DEBRIS
- ROCK ARMORING (SEE HANSON 30%)
- STREAMBED AND SWALE COBBLES
- CRUSHED ROCK PATH OR TRENCH
- ASPHALT PATH/PAD
- CONCRETE PATH/PAD
- PEDESTRIAN BRIDGE
- BOARDWALK PATH
- EXISTING WETLAND TO BE PROTECTED
- SWALE LOG EDGING
- CHAIN LINK FENCE
- PICNIC TABLE
- BENCH

NORTH

0 30 60

SCALE IN FEET

NOTES:

1. SURVEY PROVIDED BY DHA, DATED JUNE 2017
2. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
3. VERTICAL DATUM: NAVD 88

ONE INCH

AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Construction Materials Plan.dwg C-10

Dec 29, 2017 5:02pm bsevertsen

ANCHOR QEA

Snohomish County Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

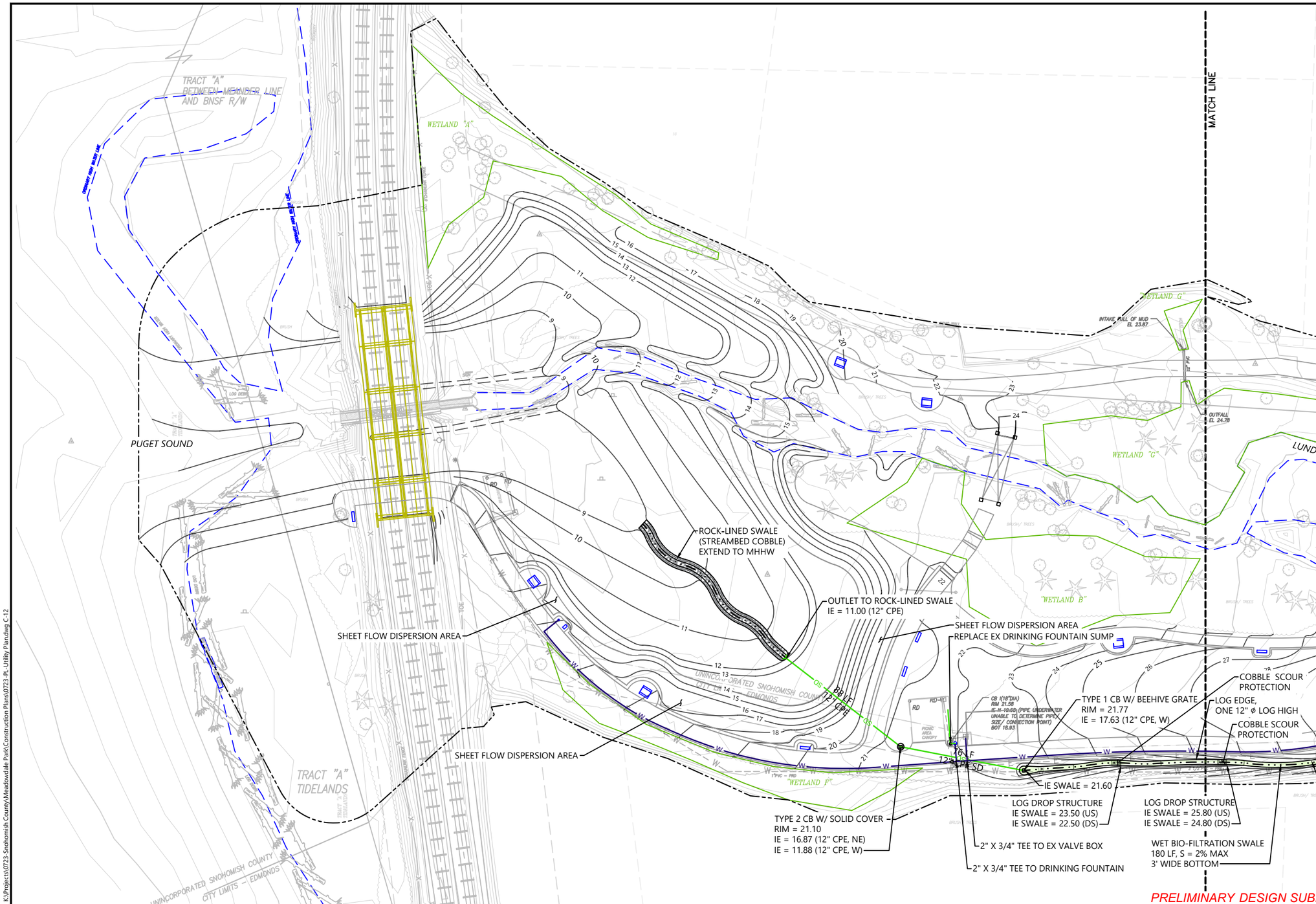
DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 30'
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

CONSTRUCTION MATERIALS PLAN (3 OF 3)

C-10

SHEET NO. 25 OF 35



LEGEND:

- PROJECT BOUNDARY
- WATER PIPE
- STORMWATER PIPE
- SWALE
- CATCH BASIN
- DRINKING FOUNTAIN
- WETLAND TO BE PROTECTED
- TREE TO REMAIN
- SD — UNDERGROUND STORM LINE
- SS — UNDERGROUND SEWER GRAVITY LINE
- FM — UNDERGROUND SEWER FORCEMAIN LINE
- W — UNDERGROUND WATER LINE
- E — UNDERGROUND POWER LINE
- T — UNDERGROUND TELEPHONE LINE

NORTH

0 30 60

SCALE IN FEET

NOTES:

1. SURVEY PROVIDED BY DHA, DATED JUNE 2017
2. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
3. VERTICAL DATUM: NAVD 88

ONE INCH

AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Utility Plan.dwg C-12

Dec 29, 2017 5:02pm bsevertsen

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

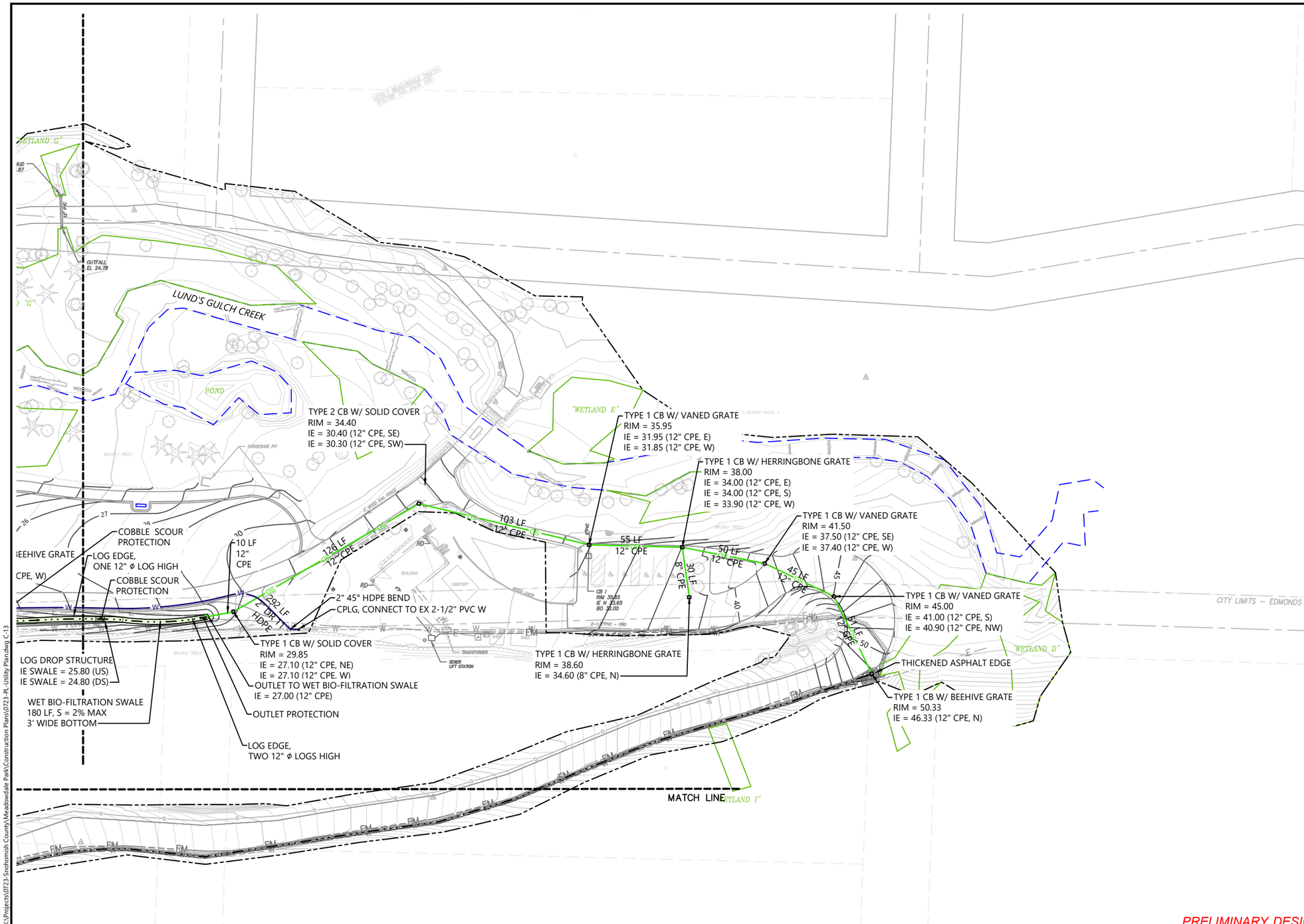
DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 30'
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

UTILITY PLAN (1 OF 2)

C-12

SHEET NO. **26** OF **35**



LEGEND:

- PROJECT BOUNDARY
- WATER PIPE
- STORMWATER PIPE
- SWALE
- CATCH BASIN
- DRINKING FOUNTAIN
- WETLAND TO BE PROTECTED
- TREE TO REMAIN
- SD — UNDERGROUND STORM LINE
- SS — UNDERGROUND SEWER GRAVITY LINE
- FM — UNDERGROUND SEWER FORCEMAIN LINE
- W — UNDERGROUND WATER LINE
- E — UNDERGROUND POWER LINE
- T — UNDERGROUND TELEPHONE LINE

NORTH

0 30 60

SCALE IN FEET

NOTES:

1. SURVEY PROVIDED BY DHA, DATED JUNE 2017
2. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
3. VERTICAL DATUM: NAVD 88

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Utility Plan.dwg C-13

Dec 29, 2017 5:02pm bsevertsen

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 30'
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

UTILITY PLAN (2 OF 2)

C-13

SHEET NO. 27 OF 35

GENERAL NOTES

1. ALL WORK SHALL BE IN CONFORMANCE WITH APPLICABLE CODES AND LOCAL BUILDING REQUIREMENTS, INCLUDING BUT NOT LIMITED TO THE 2015 EDITION OF THE IBC AND THE 2015 INTERNATIONAL ENERGY CONSERVATION CODE AS ADOPTED BY WA STATE.
2. ALL APPLICABLE CODES, ORDINANCES AND MINIMUM STRUCTURAL REQUIREMENTS TAKE PRECEDENCE OVER DRAWINGS AND NOTES.
3. CONTRACTOR SHALL VERIFY ALL DIMENSIONS SHOWN ON THE DRAWINGS BEFORE COMMENCING WITH WORK. ANY DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE OWNER AND ARCHITECT PRIOR TO STARTING ANY CONSTRUCTION OF THE AREA CONCERNED. DO NOT SCALE DRAWINGS
4. DIMENSIONS ARE TO FACE OF FRAMING OR CONCRETE U.O.N.
5. PARTITIONS AND WALLS NOT OTHERWISE DIMENSIONED SHALL BE LOCATED FLUSH WITH REFERENCE TO ADJACENT WALL FACE.
6. WHERE ON ANY OF THE DRAWINGS OR DETAILS, A PORTION OF THE WORK IS SHOWN AND/OR DETAILED, AND THE REMAINDER IS INDICATED IN OUTLINE, THE PARTS SHOWN AND/OR DETAILED SHALL APPLY TO ALL OTHER LIKE PORTIONS OF THE WORK.
7. PRIOR TO AND DURING THE WORK, CONTRACTOR SHALL VERIFY CONDITIONS; ANY CONDITIONS INCONSISTENT OR PROBLEMATIC WITH REGARD TO THE INTENT OF THE DRAWINGS SHALL BE BROUGHT TO THE ATTENTION OF THE OWNER AND ARCHITECT PRIOR TO STARTING OR CONTINUING WORK IN THE AREA CONCERNED.
8. PROVIDE SUFFICIENT STRUCTURE IN WALLS FOR SUPPORTING COUNTERS, CABINETS, ACCESSORIES, ETC., AS REQUIRED.
9. COORDINATE AND PROVIDE REQUIRED PENETRATIONS (AND PATCHING OF EXISTING TO MATCH) WITH INDIVIDUAL SUBCONTRACTORS TO SUIT NEW WORK.
10. VERTICAL DIMENSIONS ARE TYPICALLY REFERENCED FROM STRUCTURAL SLAB U.N.O.
11. AT FIRE RATED WALLS OR CEILING ASSEMBLIES WHERE PENETRATIONS FOR MECH., ELECT., OR PLUMBING OCCUR, PROVIDE APPROVED THRU PENETRATION FIRE STOP ASSEMBLIES. MAINTAIN REQUIRED RATING OF ASSEMBLIES.
12. CONTRACTOR TO ASSUME ALL MATERIALS AS NEW UNLESS NOTED AS "EXISTING".
13. PRESSURE TREAT ALL WOOD IN CONTACT WITH CONCRETE.
14. FLASH OPENINGS WITH MIN. 26 GA. STAINLESS STEEL TO ACCEPTABLE INDUSTRY STANDARDS. ALL FLASHING LAP SEAMS TO BE 12" MIN. W/ 2 BEADS OF SEALANT.
15. GLASS WITHIN 18" OF FLOOR AND ADJACENT TO DOORS AND AT HAZARDOUS LOCATIONS SHALL COMPLY WITH IBC IMPACT LOAD REQUIREMENTS, SECTION 5406, AND STANDARD 54-1.
16. CONTRACTOR TO PROVIDE & INSTALL SMOKE DETECTORS. VERIFY LOCATION W/OWNER AND ARCHITECT PRIOR TO INSTALLATION.
17. CONTRACTOR TO VERIFY LOCATION OF ALL EXISTING UTILITIES THROUGHOUT SITE PRIOR TO EXCAVATION.
18. BACKPRIME ALL EXTERIOR WOOD TRIM MATERIAL WHERE PAINTED, SEALER WHERE NOT PAINTED (ALL SIDES, EDGES AND CUT ENDS) PER WWPA AND WRCLA GUIDELINES.
19. VAPOR RETARDER PRIMER TO BE UTILIZED AT INTERIOR DRYWALL @ ALL EXTERIOR WALLS AND ROOF.
20. AT ALL DOORS AND WINDOWS: FULL ROUGH OPENING WRAP INCLUDING SILL PAN FLASHING U.N.O. SUBSILL FLASHING WO WRAP OVER ROUGH SILL AND 4-6" MIN. UP SIDE JAMBS. WATER BARRIER MEMBRANE AT ALL OPENINGS. CLOSED CELL BACKER ROD AND SEALANT AT AIR SEALS AROUND ALL WINDOWS.
21. WEATHER RESISTIVE BARRIER TO HAVE OVERLAP AS DIRECTED BY MFG.
22. WEATHER RESISTIVE BARRIER TO BE INSTALLED OVER TOP PLATE PRIOR TO SETTING OF RAFTERS OR ROOF TRUSSES, S.S. FASTENERS WHEN IN CONTACT WITH PT WOOD.
23. STAINLESS STEEL NAILS OR FASTENERS TO USED AT ALL APPLICATIONS WHERE NAILS OR FASTENERS ARE EXPOSED TO EXTERIOR.
24. SUBSILLL FLASHING AT ALL DOORS EXPOSED TO WEATHER, SEE NOTE #20 FOR OPENING WRAP.
25. CONTRACTOR TO ENSURE ADEQUATE INSULATION COVERAGE OVER RECESSED LIGHTING FIXTURES.
26. ALL RECESSED LIGHTS, SPRINKLER HEADS ETC. TO BE SEALED WITH CAULK OR GASKETS; SERVICE PENETRATIONS AT TOP WALL PLATES AND VERTICAL CHASES TO BE SEALED TO PREVENT AIR LEAKAGE.

SCOPE OF WORK

CONSTRUCTION OF NEW COVERED AREA FOR PORTABLE RESTROOMS.

CODE COMPLIANCE

- 2015 INTERNATIONAL BUILDING CODE (IBC) W/ WA STATE AMENDMENTS
- ICC A117.1-2009 ACCESSIBLE AND USABLE BUILDING FACILITIES
- 2015 WASHINGTON STATE ENERGY CODE (WSEC) (2015 INTERNATIONAL ENERGY CONSERVATION CODE W/ WA STATE AMENDMENTS)
- 2015 INTERNATIONAL FIRE CODE (IFC)
- 2015 NATIONAL ELECTRICAL CODE (NEC)
- 2015 INTERNATIONAL MECHANICAL CODE (IMC)
- 2015 UNIFORM PLUMBING CODE (UPC)

FIRE RESISTANCE RATING

STRUCTURAL FRAME	NON-RATED
BEARING WALLS, EXT.	NON-RATED
BEARING WALLS, INT.	NON-RATED
NONBEARING WALLS, EXT.	NON-RATED
NONBEARING WALLS, EXT.	NON-RATED
FLOOR CONSTRUCTION	NON-RATED
ROOF CONSTRUCTION	NON-RATED

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

DRAFT

C:\Users\laura\Desktop\Meadowdale\30% Design\drawings\30% Submittal\A-1 General.dwg A-1_1

Jul 10, 2017 2:33 pm S(GETVAR?)

ANCHOR QEA

SALT STUDIO

REVISIONS				
REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: SALT STUDIO
DRAWN BY: L.H
CHECKED BY: L.H
APPROVED BY: L.H
SCALE: AS NOTED
DATE: 07/10/17

MEADOWDALE 30% SUBMITTAL

GENERAL INFORMATION

A-1.1

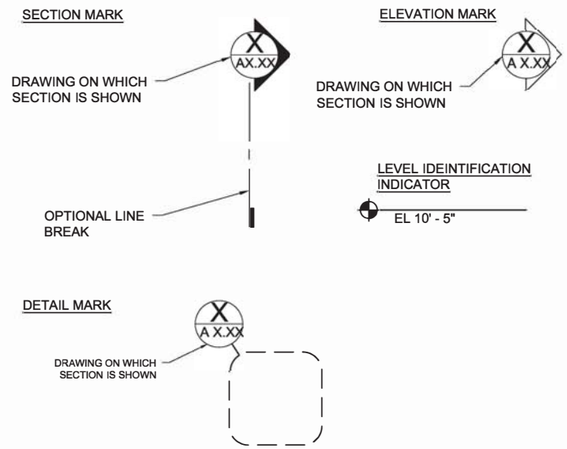
SHEET NO. 28 OF 35

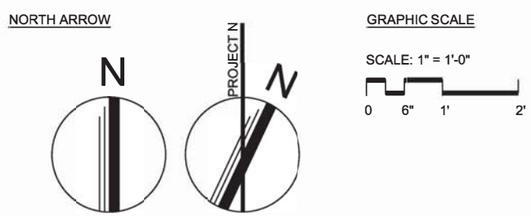
SYMBOLS

- GL — GRIDLINE MARK
- 102 — DOOR IDENTIFICATION MARK
- A — WALL TYPE MARK
- F1 — FLOOR/CEILING & ROOF ASSEMBLY TYPE MARK
- 1 — WINDOW TAG
- 1 — KEY NOTE
- FE — FIRE EXTINGUISHER CABINET
- FE — FIRE EXTINGUISHER ON HANGERS OR BRACKETS
- DS — DOWN SPOUT
- REVISION CLOUD
- 1 — REVISION DELTA
- BARRIER FREE SYMBOL
- WH — WATER HEATER W/ OVERFLOW PAN
- EXIT — ILLUMINATED EXIT SIGN W/ BATTERY BACK-UP
- EMERGENCY LIGHTING W/ BATTERY BACK-UP
- HB — HOSE BIB
- EXHAUST FAN
- FAN TERMINATION
- PASSIVE ROOF VENTILATOR
- DECK OR ROOF DRAIN
- ROOF DRAIN W/ OVERFLOW DRAIN
- SCUPPER
- ℄ CENTER LINE
- ⅊ PROPERTY LINE
- HIDDEN OR EXISTING CONSTRUCTION
- BREAK LINE
- CARPET / VINYL — FLOORING TRANSITION
- RAMP UP 5% — RAMP ARROW WITH PERCENT SLOPE
- 2% / 2:12 OR — DECK OR ROOF SLOPE

REFERENCING

SECTIONS ARE CROSS REFERENCED IN THE FOLLOWING MANNER:





DIMENSIONING STANDARDS

1. DO NOT SCALE DRAWINGS FOR DIMENSIONS. DIMENSIONS ARE INDICATED IN THE DOCUMENTS.
2. ALL INTERIOR PARTITIONS ARE DIMENSIONED TO THE FACE OF WALL UNLESS NOTED OTHERWISE.
3. THE TERM "EQUAL" OR "EQ" IS USED IN LIEU OF ACTUAL DIMENSIONS WHERE EQUAL SPACING OF ELEMENTS IS REQUIRED.
4. THE TERM "CLEAR" OR "CLR" IS USED TO DENOTE A MINIMUM DIMENSIONAL REQUIREMENT. HOWEVER, THE DIMENSION COULD BE LARGER.
5. WALLS CENTERED ON A COLUMN OR GRIDLINE WILL NOT BE DIMENSIONED ON PLANS BUT WILL BE DRAWN AS INDICATED BELOW.
6. WALLS WITH A FINISHED FACE FLUSH WITH THE FACE OF A COLUMN OR COREWALL WILL NOT BE DIMENSIONED ON PLANS BUT WILL BE DRAWN AS INDICATED BELOW.
7. DIMENSIONS AT WINDOW WALL ARE TO CENTER OF MULLION, TO FACE OF MULLION AT CORNER CONDITIONS, AND TO ROUGH OPENING AT HEAD AND JAM CONDITIONS, UNLESS NOTED OTHERWISE.
8. DOORS AND OPENINGS IN WALLS
   A. DOORS OR OPENINGS LOCATED ADJACENT TO A RIGHT ANGLE WALL ARE TO BE INSTALLED 4 " FROM ADJACENT WALL. THIS CONDITION IS TYPICAL AND WILL NOT BE DIMENSIONED.
   B. DOORS NOT LOCATED ADJACENT TO A RIGHT ANGLE WALL WILL BE DIMENSIONED TO THE CENTER OF DOOR FRAME OPENING, U.O.N.
   C. OPENINGS NOT LOCATED ADJACENT TO A RIGHT ANGLE WALL WILL BE DIMENSIONED TO THE JAMB OF THE OPENING AND THE OPENING WILL BE DIMENSIONED.
9. ALL HEIGHTS ARE DIMENSIONED FROM THE TOP OF THE STRUCTURAL (T.O.S.S.) SLAB UNLESS NOTED OTHERWISE.

MATERIALS

- EARTH SURFACE
- SAND / GROUT
- CONCRETE
- WOOD OR METAL STUD WALLS
- GYPSUM BOARD
- CONT. WOOD FRAMING
- WOOD BLOCKING
- FINISHED WOOD
- PLYWOOD
- BATT INSULATION
- RIGID INSULATION BOARD
- BRICK
- CONCRETE UNIT MASONRY
- STEEL
- GLASS
- RESILIENT TILES

ABBREVIATIONS

AB	ANCHOR BOLT
A/C	AIR CONDITIONING
ACT	ACOUSTICAL CEILING TILE
ADJC	ADJUSTABLE
AFF	ABOVE FINISH FLOO
AHU	AIR HANDLING UNIT
ALUM	ALUMINUM
APT	APARTMENT
BD	BOARD
BFE	BOTTOM FOOTING ELEVATION
BITUM	BITUMINOUS
BLDG	BUILDING
BLK	BLOCK
BLKG	BLOCKING MACHINE
BM	BEAM
BOT	BOTTOM
BRG	BEARING
BUR	BUILT-UP ROOFING
CAB	CABINET
CPT	CARPET
CH BD	CHALKBOARD
CEM	CEMENT
CHAN	CHANNEL
CJ	CONSTRUCTION JOINT
CL	CENTER LINE
CL	CLOSET
CLG	CEILING
CMU	CONCRETE MASONRY UNIT
CMT	CERAMIC MOSAIC TILE
CO	CLEAN OUT
COL	COLUMN
COMP	COMPRESSION, COMPACTED
CONC	CONCRETE
CONT	CONTINUOUS
CONTR	CONTRACTOR
CONV.	CONVECTOR
CORR	CORRIDOR
DBL	DOUBLE
DET	DETAIL
DF	DRINKING FOUNTAIN
DIA	DIAMETER
DIM	DIMENSION
DISP	DISPENSER
DN	DOWN
DO	DITTO
DR	DRAIN, DOOR
DTL	DETAIL
D/W	DISHWASHER
DWG	DRAWING
DS	DOWNSPOUT
DWL	DOWEL
EA	EACH
EPDM	ETYLENE PROPYLENE DIENE MONOMER
EF	EACH FACE
EL	ELEVATION
ELEC	ELECTRIC
EQUIP	EQUIPMENT
EW	EACH WAY
EWC	ELECTRIC WATER COOLER
ELVR	ELEVATOR
EXH	EXHAUST
EXST	EXISTING
EXP JT	EXPANSION JOINT
EXT	EXTERIOR
F	FAN
FD	FLOOR DRAIN
FDN	FOUNDATION
FHMS	FLAT HEAD MACHINE SCREW
FH	FIRE HYDRANT
FLR	FLOOR
FLG	FLANGE
FRPF	FIREPROOF, FRAME
FRC	FIBER REINFORCED CONCRETE
FSB	FOOD STORAGE BUILDING
FT	FEET
FTG	FOOTING
FTR	FINNED TUBE RADIATION
FURN	FURNITURE, FURNACE
GA	GAGE
GALV	GALVANIZED
GI	GALVANIZED IRON
GC	GENERAL CONTRACTOR
GL	GLASS, GLAZING
GND	GROUND
GR	GRADE
GRL	GRILLE
GRV	GRAVITY ROOF VENT
GWB	GYPSUM WALL BOARD
GWT	GLAZED WALL TILE
GYP	GYPSUM
HORIZ	HORIZONTAL
HC	HANDICAPPED
HDR	HEADER
HDWD	HARDWOOD
HHMS	HEX HEAD MACHINE SCREW
HM	HOLLOW METAL
H PT	HIGH POINT
HNDRL	HANDRAIL
HGT	HEIGHT
HR	HOUR
HVAC	HEATING, VENTILATION & AIR CONDITIONING
ID	INSIDE DIAMETER
IF	INSIDE FACE
IN	INCH
INSUL	INSULATION
INT	INTERIOR
INV	INVERT
JAN	JANITOR
JST	JOIST SND
JT	JOINT SND
LAM	LAMINATED
LAV	LAVATORY
LP	LOWPOINT
MATL	MATERIAL
MAX	MAXIMUM
MB	MARKER BOARD
MECH	MECHANICAL
MFR	MANUFACTURER
MH	MANHOLE
MIN	MINIMUM, MINUTE
MIR	MIRROR
MISC	MISCELLANEOUS
MO	MASONRY OPENING
MTL	METAL
MTD	MOUNTED
NIC	NOT IN CONTRACT
NO	NUMBER
NS	NEAR SIDE
OA	OVER ALL
OC	ON CENTER
OD	OUTSIDE DIAMETER
OF.	OUTSIDE FACE
OPNG	OPENING
PR	PAIR
PNL	PANEL
PART	PARTITION
PERF	PERFORATED
P/C	PRECAST
PLAS	PLASTER
PL	PLATE
P LAM	PLASTIC LAMINATE
PT	PAINT
PREFIN	PREFINISHED
PRV	POWER ROOF VENT
PSF	LBS PER SQUARE FOOT
PTD	PAPER TOWEL DISPENSER
QT	QUARRY TILE
R	RADIUS, RISER
RAD	RADIATOR
RC	REINFORCED CONCRETE
RCP	REINFORCED CONCRETE PIPE
RD	ROOF DRAIN
RECPT	RECEPTACLE
REINF	REINFORCED
RET	RETAINING
RHMS	ROUND HEAD MACHINE
RHWS	ROUND HEAD WOOD
RM	ROOM
RO	ROUGH OPENING
RWL	RAINWATER LEADER
SD	SOAP DISPENSER
SECT	SECTION
SFT	STRUCTURAL FACING TILE
SHR	SHOWER
SHT	SHEET
SIM	SIMILAR
SMS	SHEET METAL SCREW
SND	SAN. NAPKIN DISPENSER
SNR	SANITARY NAPKIN RECEPTACLE
SP	SPACE
SPEC	SPECIFICATION
SPKLR	SPRINKLER
SQ	SQUARE
SS	SANITARY SEWER
S SK	SERVICE SINK
SST	STAINLESS STEEL
STD	STANDARD
STL	STEEL
STRUC	STRUCTURAL
SUSP	SUSPENDED
T	TOP, TILE, TREAD
TEMP	TEMPORARY
TERR	TERRAZZO
T&G	TOUNGE & GROOVE
TH	THRESHOLD, THICK
TOD	TOP OF DECK
TOJ	TOP OF JOIST
TOS	TOP OF STEEL
TPD	TOILET PAPER DISPENCER
TR	TROWELED, TREAD
TS	TUBULAR STEEL
TYP	TYPICAL
UGRD	UNDERGROUND
UH	UNIT HEATER
UNO	UNLESS NOTED OTHERWISE
UR	URINAL
UTIL	UTILITY
VERT	VERTICAL
VCT	VINYL COMP. TILE
W/	WITH
WC	WATER CLOSET / TOILET
W/D	WASHER/DRYER
WD	WOOD
WDW	WINDOW
WH	WATER HEATER
WNSC	WAINSCOAT
WO	WITHOUT
WP	WORKING POINT

ONE INCH — AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

DRAFT

C:\Users\laura\Desktop\Meadowdale\30% Design\drawings\30% Submittal\A-1 General.dwg A-1.3

Jul 10, 2017 2:33pm $(GETVAR,?7)

ANCHOR QEA

SALT STUDIO

REVISIONS				
REV	DATE	BY	APP'D	DESCRIPTION

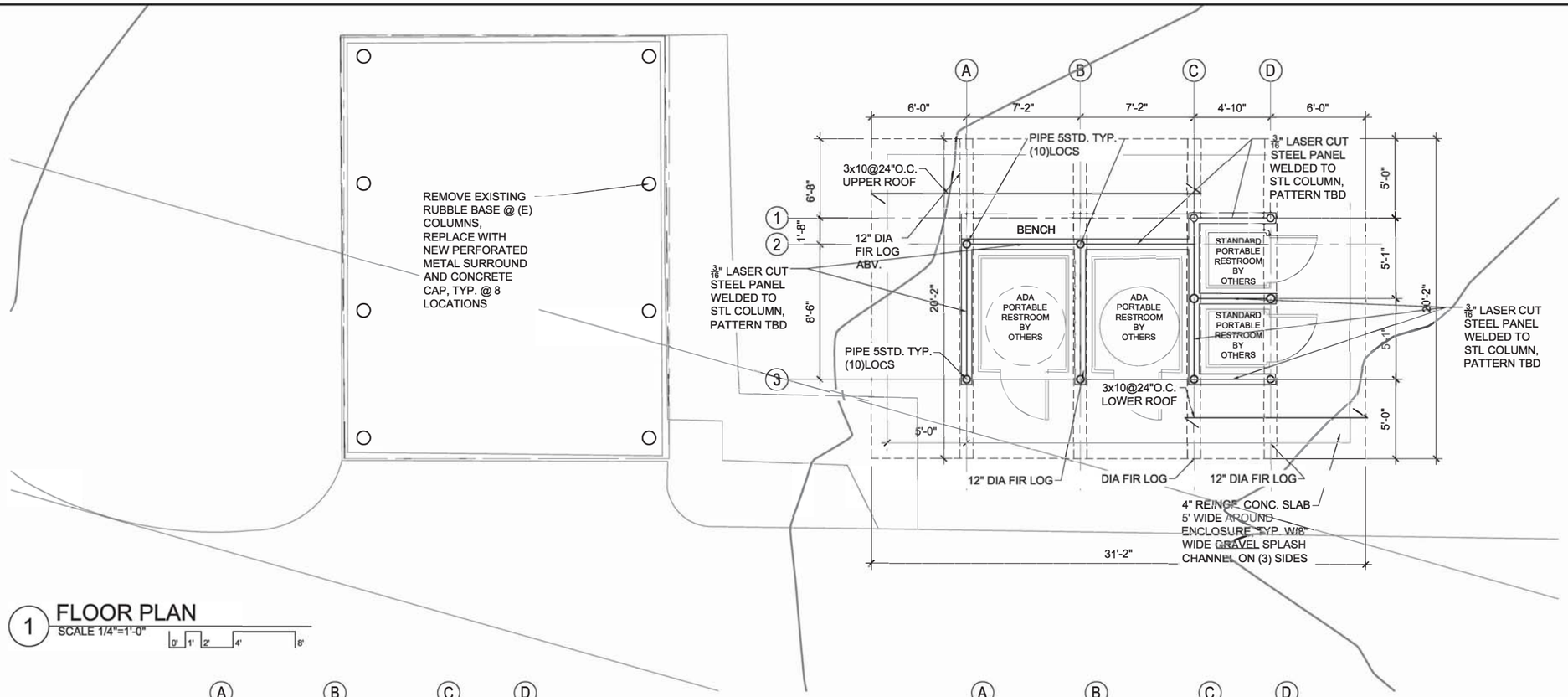
DESIGNED BY: SAL.TSTUDIO
DRAWN BY: LH
CHECKED BY: LH
APPROVED BY: LH
SCALE: AS NOTED
DATE: 07/10/17

MEADOWDALE 30% SUBMITTAL

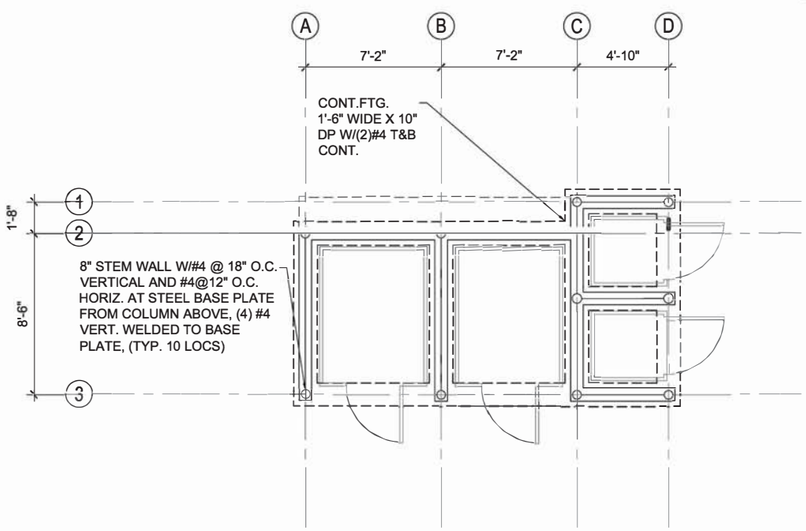
GENERAL NOTES

A-1.2

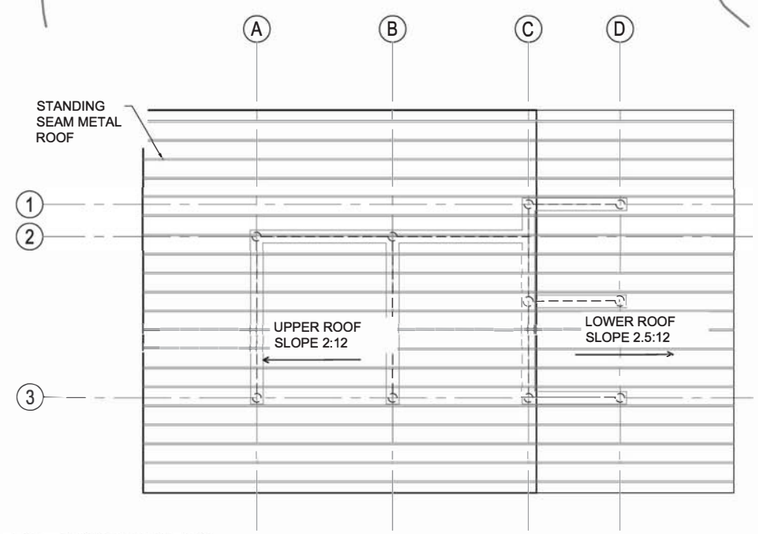
SHEET NO. 29 OF 35



1 FLOOR PLAN
SCALE 1/4"=1'-0"



2 FOUNDATION PLAN
SCALE 1/4"=1'-0"



3 ROOF PLAN
SCALE 1/4"=1'-0"

DRAFT

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

C:\Users\laura\Desktop\Meadowdale\30% Design\drawings\30% Submittal\A-2 Restroom Plan.dwg A-2.1
Jul 11, 2017 11:58am $(GETVAR,?)

ANCHOR QEA

SALT STUDIO

REVISIONS				
REV	DATE	BY	APP'D	DESCRIPTION

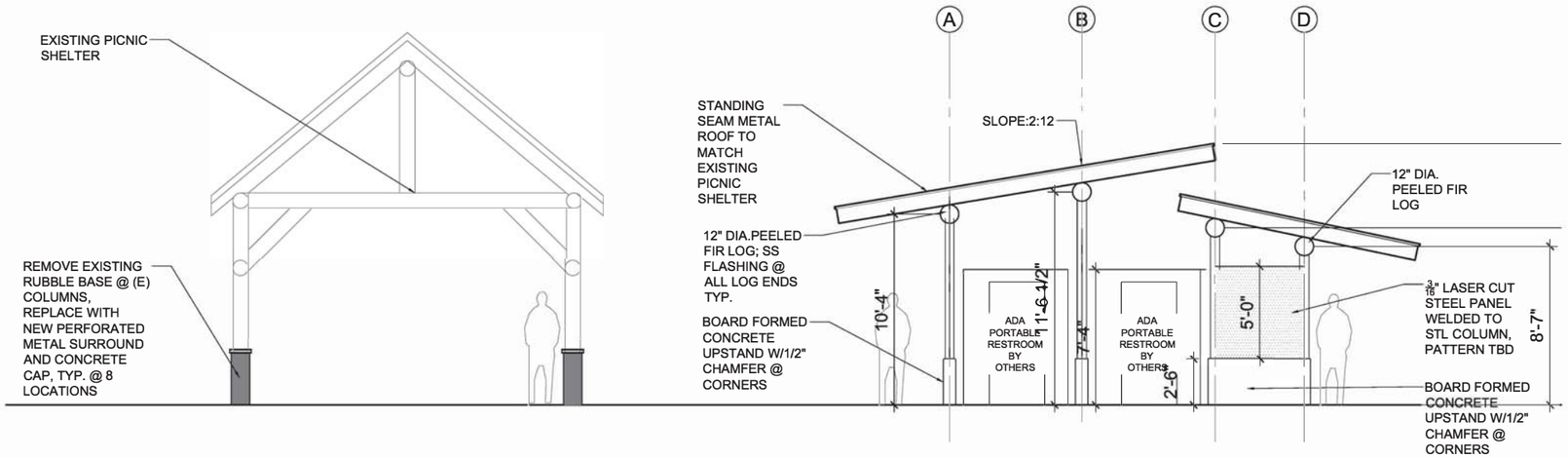
DESIGNED BY: SALT STUDIO
DRAWN BY: LH
CHECKED BY: LH
APPROVED BY: APPROVED BY
SCALE: AS NOTED
DATE: 07/10/17

MEADOWDALE 30% SUBMITTAL

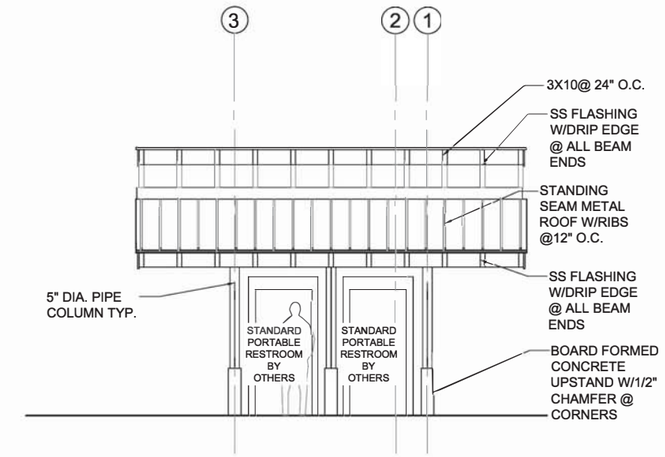
FOUNDATION PLAN, FLOOR PLAN, ROOF PLAN

A-2.1

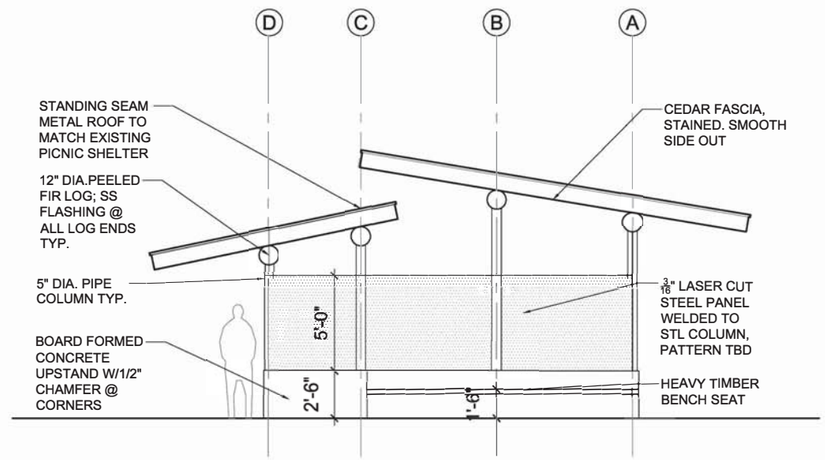
SHEET NO. 30 OF 35



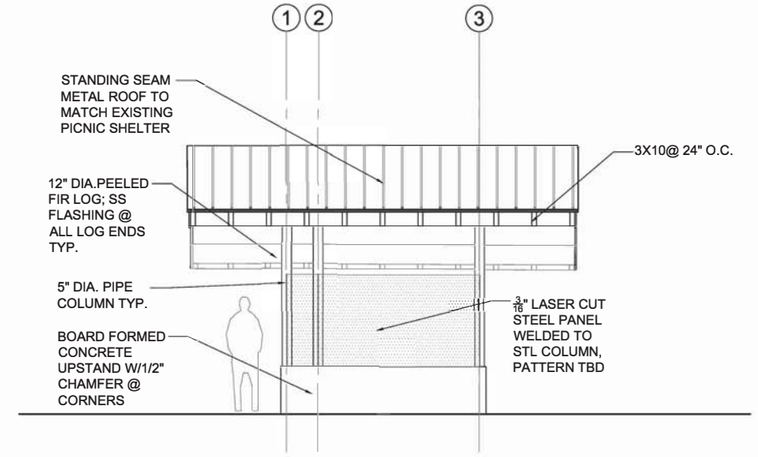
1 ELEVATION SOUTH
SCALE 1/4"=1'-0"



2 ELEVATION EAST
SCALE 1/4"=1'-0"



3 ELEVATION NORTH
SCALE 1/4"=1'-0"



4 ELEVATION WEST
SCALE 1/4"=1'-0"

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

DRAFT

C:\Users\laura\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\83QHU6T3\A-3 Restroom Elevations Sections.dwg A-3.1

Jul 10, 2017 2:51pm $(GETVAR,?)

ANCHOR QEA

SALT STUDIO

REVISIONS				
REV	DATE	BY	APP'D	DESCRIPTION

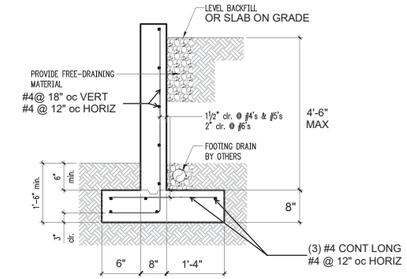
DESIGNED BY: SAL.TSTUDIO
DRAWN BY: LH
CHECKED BY: LH
APPROVED BY: LH
SCALE: AS NOTED
DATE: 07/10/17

MEADOWDALE 30% SUBMITTAL

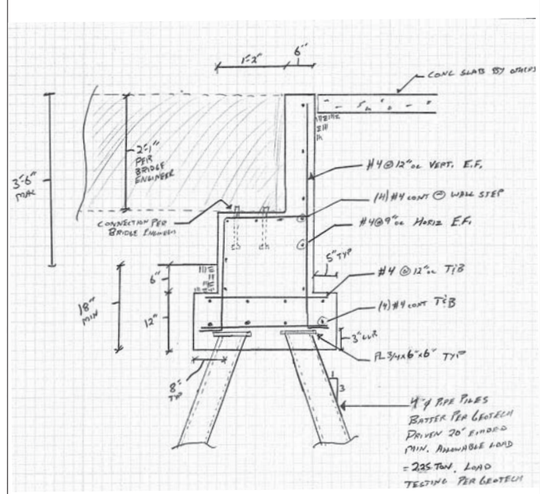
ELEVATIONS

A-3.1

SHEET NO. 31 OF 35

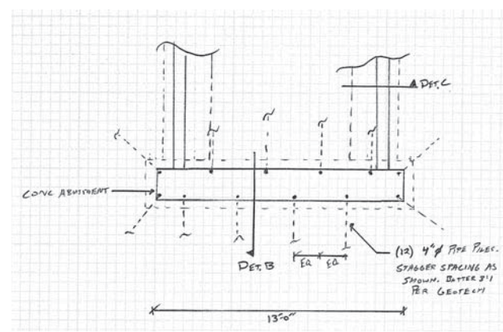


DETAIL C



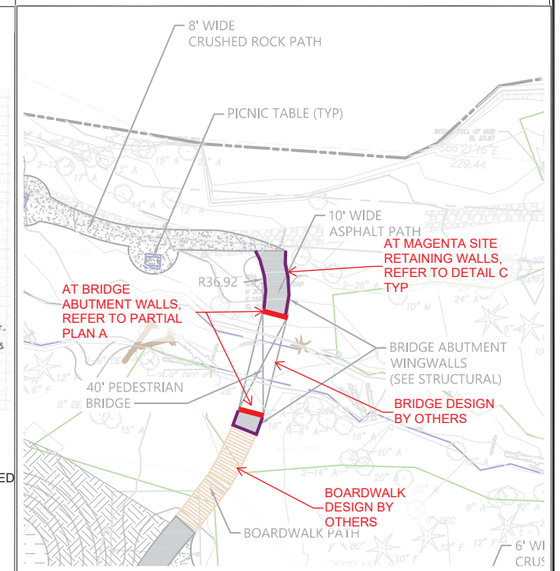
NOTES:
BRIDGE ENGINEER TO CONFIRM IF BRIDGE DESIGN ACCOUNTS FOR 0.001*H MOVEMENT ALLOWED FOR ACTIVE PRESSURES PER GEOTECH REPORT.

DETAIL B:
SCALE: 3/4" = 1'-0"



NOTES:
PRELIMINARY PILE DESIGN MAY BE MODIFIED PENDING FINAL GEOTECH RECOMMENDATIONS. PILES MAY BE REDUCED IN NUMBER IF 6" DIA PILES DESIRED

PARTIAL PLAN A:
SCALE: 1/4" = 1'-0"



NOTES:
DESIGN BASIS ON PRELIMINARY GEOTECH REPORT DATED 6/6/17 AND FURTHER PRELMINARY DESIGN INFORMATION PROVIDED BY SHANNON & WILSON INC. ON 7/14/17.
DESIGN CONCRETE STRENGTH f'c = 2500 PSI. DESIGN REINF STEEL GRADE 60 Fy = 60 ksi.
PILES TO BE DRIVEN PER GEOTECH REPORT.
SUBGRADE TO BE PREPARED PER GEOTECH REPORT.

SITE PLAN: SCALE 1'= 30'

30% DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

K:\2016\10213-2016-03 Meadowdale Beach Park\Coordination\30%\0723-Layout_template - Standard\0723-Layout_template-SSF.dwg S-1
Jul 19, 2017 7:36am jjames

SSF STRUCTURAL ENGINEERING
2124 Third Avenue - Suite 100 - Seattle, WA 98121
p: 206.443.6212 ssfengineers.com

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: RHM
DRAWN BY: RHM
CHECKED BY: DJS
APPROVED BY: DJS
SCALE: AS NOTED
DATE: JULY 19 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN

PEDESTRIAN BRIDGE

S-1

SHEET NO. 32 OF 35

LEGEND:

- RIPARIAN ENHANCEMENT PLANTING
- RIPARIAN PLANTING
- FRESHWATER WETLAND PLANTING
- TIDAL MARSH PLANTING
- BACKSHORE BEACH PLANTING
- LAWN
- 10 PROPOSED CONTOUR
- TREE TO REMAIN
- EXISTING WETLAND TO BE PROTECTED

NORTH

0 30 60

SCALE IN FEET

NOTES:

1. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
2. VERTICAL DATUM: NAVD 88

ONE INCH

AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Planting Plan.dwg L-1

Dec 29, 2017 5:02pm bsevertsen

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

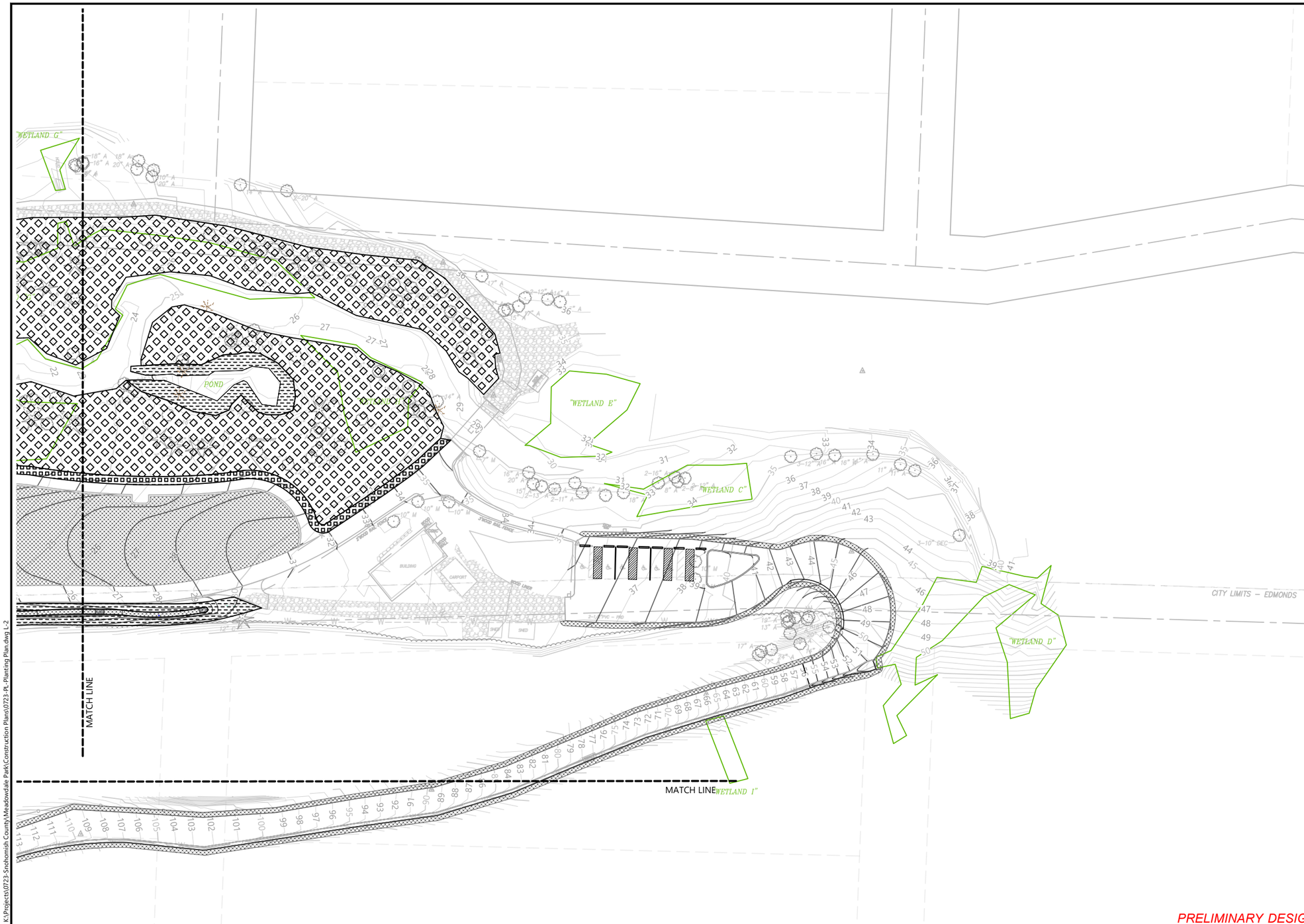
DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 30'
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

PLANTING PLAN (1 OF 3)

L-1

SHEET NO. **33** OF **35**



LEGEND:

- RIPARIAN ENHANCEMENT PLANTING
- RIPARIAN PLANTING
- FRESHWATER WETLAND PLANTING
- TIDAL MARSH PLANTING
- BACKSHORE BEACH PLANTING
- LAWN
- 10 PROPOSED CONTOUR
- TREE TO REMAIN
- EXISTING WETLAND TO BE PROTECTED

NORTH

0 30 60

SCALE IN FEET

NOTES:

1. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
2. VERTICAL DATUM: NAVD 88

ONE INCH

AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Planting Plan.dwg L-2

Dec 29, 2017 5:03pm bsevertsen

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

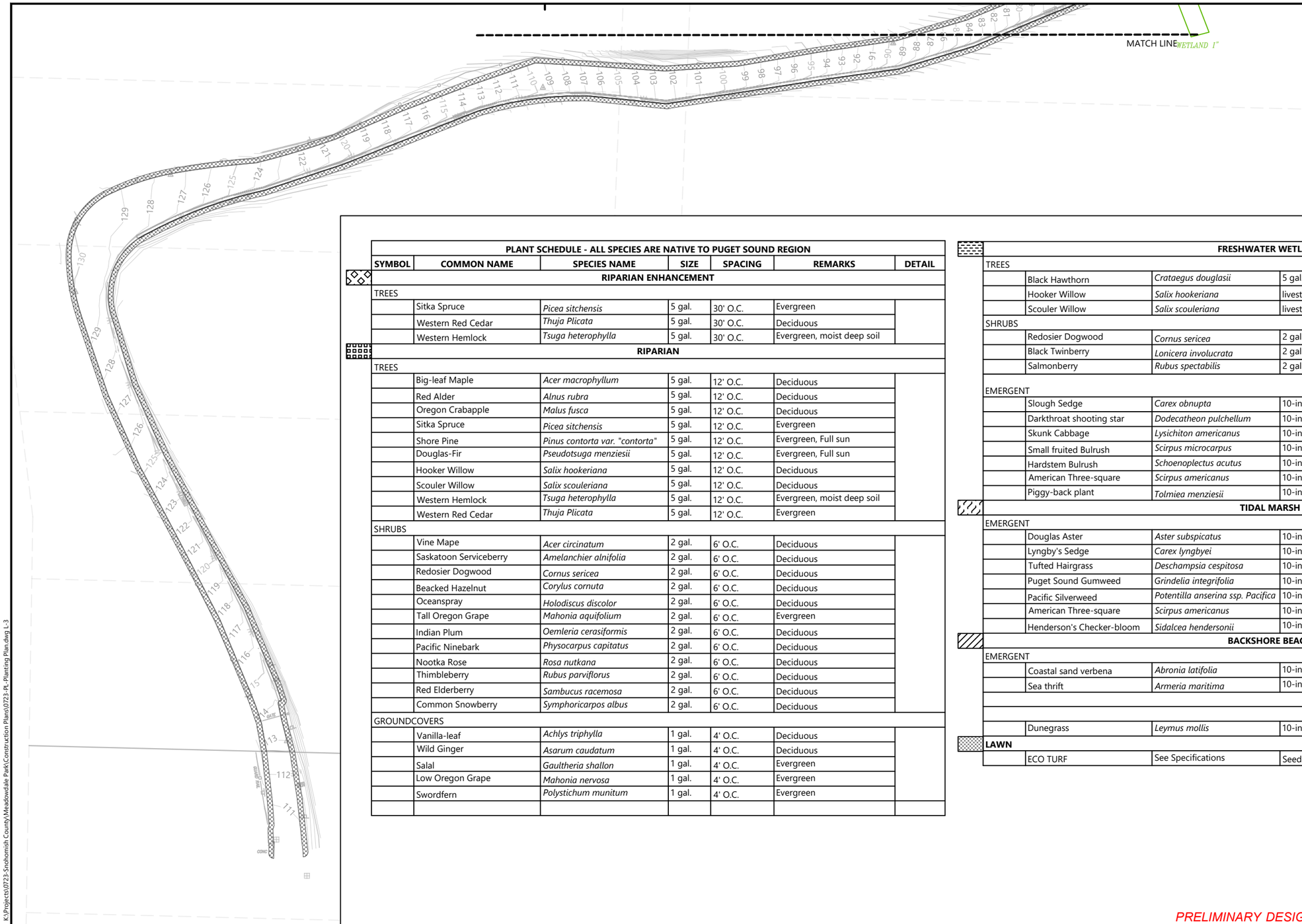
DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 30'
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

PLANTING PLAN (2 OF 3)

L-2

SHEET NO. **34** OF **35**



NOTES:

1. HORIZONTAL DATUM: WASHINGTON STATE PLANE NORTH ZONE, NAD 83, U.S. FEET.
2. VERTICAL DATUM: NAVD 88

SYMBOL	COMMON NAME	SPECIES NAME	SIZE	SPACING	REMARKS	DETAIL
	PLANT SCHEDULE - ALL SPECIES ARE NATIVE TO PUGET SOUND REGION					
	RIPARIAN ENHANCEMENT					
TREES						
	Sitka Spruce	*Picea sitchensis*	5 gal.	30' O.C.	Evergreen	
	Western Red Cedar	*Thuja Plicata*	5 gal.	30' O.C.	Deciduous	
	Western Hemlock	*Tsuga heterophylla*	5 gal.	30' O.C.	Evergreen, moist deep soil	
	RIPARIAN					
TREES						
	Big-leaf Maple	*Acer macrophyllum*	5 gal.	12' O.C.	Deciduous	
	Red Alder	*Alnus rubra*	5 gal.	12' O.C.	Deciduous	
	Oregon Crabapple	*Malus fusca*	5 gal.	12' O.C.	Deciduous	
	Sitka Spruce	*Picea sitchensis*	5 gal.	12' O.C.	Evergreen	
	Shore Pine	*Pinus contorta var. "contorta"*	5 gal.	12' O.C.	Evergreen, Full sun	
	Douglas-Fir	*Pseudotsuga menziesii*	5 gal.	12' O.C.	Evergreen, Full sun	
	Hooker Willow	*Salix hookeriana*	5 gal.	12' O.C.	Deciduous	
	Scouler Willow	*Salix scouleriana*	5 gal.	12' O.C.	Deciduous	
	Western Hemlock	*Tsuga heterophylla*	5 gal.	12' O.C.	Evergreen, moist deep soil	
	Western Red Cedar	*Thuja Plicata*	5 gal.	12' O.C.	Evergreen	
SHRUBS						
	Vine Mape	*Acer circinatum*	2 gal.	6' O.C.	Deciduous	
	Saskatoon Serviceberry	*Amelanchier alnifolia*	2 gal.	6' O.C.	Deciduous	
	Redosier Dogwood	*Cornus sericea*	2 gal.	6' O.C.	Deciduous	
	Beacked Hazelnut	*Corylus cornuta*	2 gal.	6' O.C.	Deciduous	
	Oceanspray	*Holodiscus discolor*	2 gal.	6' O.C.	Deciduous	
	Tall Oregon Grape	*Mahonia aquifolium*	2 gal.	6' O.C.	Evergreen	
	Indian Plum	*Oemleria cerasiformis*	2 gal.	6' O.C.	Deciduous	
	Pacific Ninebark	*Physocarpus capitatus*	2 gal.	6' O.C.	Deciduous	
	Nootka Rose	*Rosa nutkana*	2 gal.	6' O.C.	Deciduous	
	Thimbleberry	*Rubus parviflorus*	2 gal.	6' O.C.	Deciduous	
	Red Elderberry	*Sambucus racemosa*	2 gal.	6' O.C.	Deciduous	
	Common Snowberry	*Symphoricarpos albus*	2 gal.	6' O.C.	Deciduous	
GROUNDCOVERS						
	Vanilla-leaf	*Achlys triphylla*	1 gal.	4' O.C.	Deciduous	
	Wild Ginger	*Asarum caudatum*	1 gal.	4' O.C.	Deciduous	
	Salal	*Gaultheria shallon*	1 gal.	4' O.C.	Evergreen	
	Low Oregon Grape	*Mahonia nervosa*	1 gal.	4' O.C.	Evergreen	
	Swordfern	*Polystichum munitum*	1 gal.	4' O.C.	Evergreen	

	FRESHWATER WETLAND					
TREES						
	Black Hawthorn	*Crataegus douglasii*	5 gal.	12' O.C.	Deciduous	
	Hooker Willow	*Salix hookeriana*	livestake	3' O.C.	Deciduous	
	Scouler Willow	*Salix scouleriana*	livestake	3' O.C.	Deciduous	
SHRUBS						
	Redosier Dogwood	*Cornus sericea*	2 gal.	6' O.C.	Deciduous	
	Black Twinberry	*Lonicera involucrata*	2 gal.	6' O.C.	Deciduous	
	Salmonberry	*Rubus spectabilis*	2 gal.	6' O.C.	Deciduous	
EMERGENT						
	Slough Sedge	*Carex obnupta*	10-in plug	2' O.C.	Deciduous	
	Darkthroat shooting star	*Dodecatheon pulchellum*	10-in plug	2' O.C.	Deciduous	
	Skunk Cabbage	*Lysichiton americanus*	10-in plug	2' O.C.	Deciduous	
	Small fruited Bulrush	*Scirpus microcarpus*	10-in plug	2' O.C.	Deciduous	
	Hardstem Bulrush	*Schoenoplectus acutus*	10-in plug	2' O.C.	Deciduous, Full sun	
	American Three-square	*Scirpus americanus*	10-in plug	2' O.C.	Deciduous	
	Piggy-back plant	*Tolmiea menziesii*	10-in plug	2' O.C.	Deciduous	
	TIDAL MARSH					
EMERGENT						
	Douglas Aster	*Aster subspicatus*	10-in plug	2' O.C.	Deciduous	
	Lyngby's Sedge	*Carex lyngbyei*	10-in plug	2' O.C.	Deciduous	
	Tufted Hairgrass	*Deschampsia cespitosa*	10-in plug	2' O.C.	Deciduous	
	Puget Sound Gumweed	*Grindelia integrifolia*	10-in plug	2' O.C.	Deciduous	
	Pacific Silverweed	*Potentilla anserina ssp. Pacifica*	10-in plug	2' O.C.	Deciduous	
	American Three-square	*Scirpus americanus*	10-in plug	2' O.C.	Deciduous	
	Henderson's Checker-bloom	*Sidalcea hendersonii*	10-in plug	2' O.C.	Deciduous	
	BACKSHORE BEACH					
EMERGENT						
	Coastal sand verbena	*Abronia latifolia*	10-in plug	2' O.C.	Deciduous	
	Sea thrift	*Armeria maritima*	10-in plug	2' O.C.	Deciduous	
	Dunegrass	*Leymus mollis*	10-in plug	2' O.C.	Deciduous	
LAWN						
	ECO TURF	See Specifications	Seed			

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

PRELIMINARY DESIGN SUBMITTAL, NOT FOR CONSTRUCTION

K:\Projects\0723-Snohomish County\Meadowdale Park\Construction Plans\0723-PL-Planting Plan.dwg L-3

Dec 29, 2017 5:03pm bsevertsen

ANCHOR QEA

Snohomish County
Parks and Recreation

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: PH/BS
DRAWN BY: MD
CHECKED BY: BS
APPROVED BY: PH
SCALE: 1" = 30'
DATE: OCTOBER 2017

MEADOWDALE BEACH PARK AND ESTUARY DESIGN
18-XXXXX LDA

PLANTING PLAN (3 OF 3)

L-3

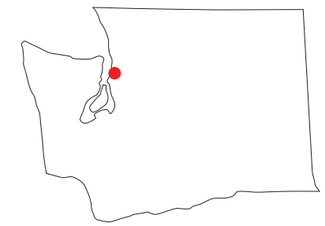
SHEET NO. 35 OF 35

Appendix A-2
Preliminary Design Drawings:
Railroad Bridge

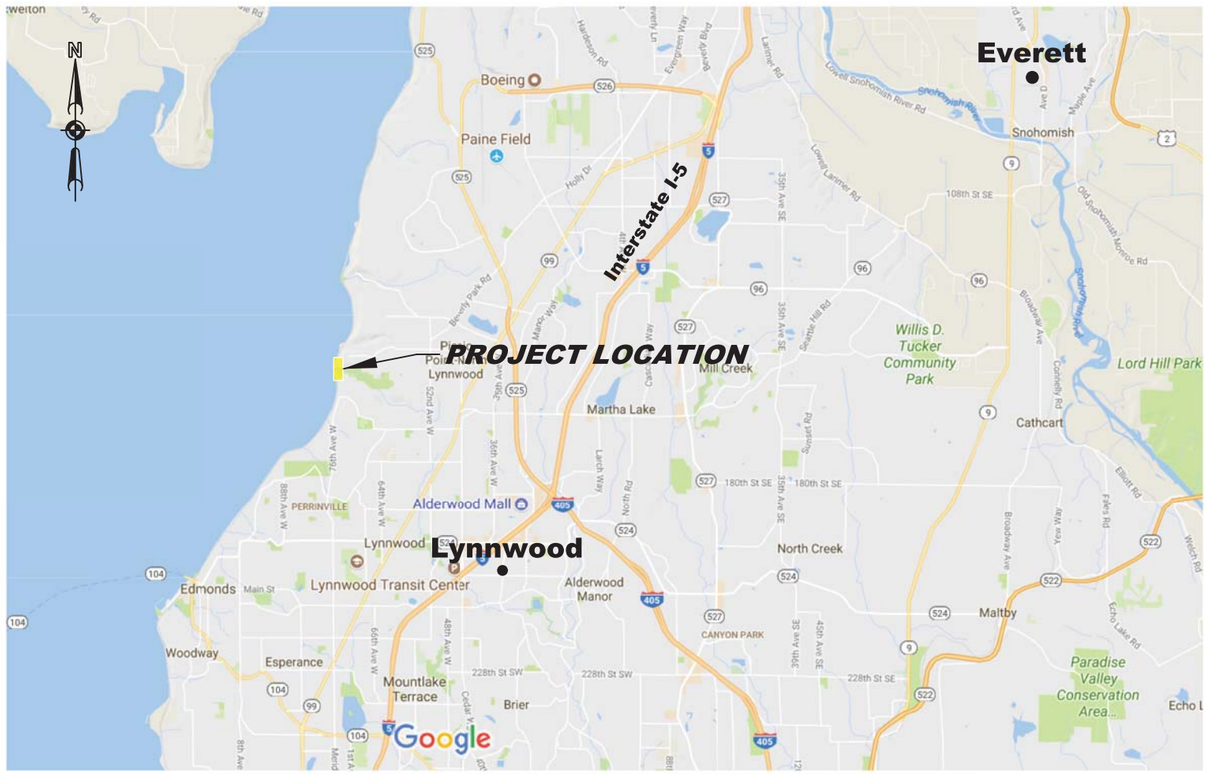
BNSF NORTHWEST DIVISION

MEADOWDALE BEACH PARK RAILROAD BRIDGE

WASHINGTON



PROJECT LOCATION



VICINITY MAP

NOT TO SCALE

SCENIC SUBDIVISION
LINE SEGMENT 50
MP 21.8 TO MP 21.9

PRELIMINARY DESIGN SUBMITTAL

STRUCTURAL ONLY

CIVIL ONLY

DATE: August 18, 2017

HANSON

© Copyright Hanson Professional Services Inc. 2017
11711 S.E. 8th Street, Suite 120
Bellevue, WA 98005

PRELIMINARY
NOT FOR CONSTRUCTION

Plot driver:pw:\spi-svr306.hanson.dom-Hanson Projects\Documents\Project_Workspace\MicroStation\Projects\BNSF_Railway-2011\Plot\BNSF_Railway_pdf_full.pltcfg
Pen table:pw:\spi-svr306.hanson.dom-Hanson Projects\Documents\Project_Workspace\MicroStation\Projects\BNSF_Railway-2011\Plot\BNSF_Railway_Color.tbl
File:pw:\spi-svr306.hanson.dom-Hanson Projects\Documents\11Jobs\13R0098\CAD\Rail\Sheet\G-0001-MeadowdaleCover.dgn
Date:8/18/2017 Time:11:21:46 AM

DRAWING NUMBER	DRAWING TITILE	SHEET NUMBER
	GENERAL	
CK-01	COVER	01
CK-02	INDEX OF DRAWINGS	02
CK-03	GENERAL NOTES	03
CK-04	ABBREVIATIONS & SYMBOLS	04
	TRACKWORK	
RP-01	TRACK PLAN AND PROFILE - MAIN 1 - SHEET 1 OF 2 STA 1251+00 TO STA 1262+00 MP 21.7 TO MP 21.9	05
RP-02	TRACK PROFILE - MAIN 2 - SHEET 2 OF 2 STA 1251+00 TO STA 1262+00 MP 21.7 TO MP 21.9	06
	CIVIL	
CP-01	BLOCK WALL PLAN AND PROFILE	07
CP-02	BLOCK WALL DETAILS	08
CP-03	FENCING PLAN	09
CP-04	FENCING DETAILS - SHEET 01 OF 02	10
CP-05	FENCING DETAILS - SHEET 02 OF 02	11
	STRUCTURAL	
ST-01	GENERAL PLAN & ELEVATION - SHEET 1 OF 6	12
ST-02	TYPICAL SECTIONS & PILE LAYOUT PLAN - SHEET 2 OF 6	13
ST-03	CONSTRUCTION SEQUENCE NOTES & DETAILS - SHEET 3 OF 6	14
ST-04	CONSTRUCTION SEQUENCE STAGING SECTIONS - SHEET 4 OF 6	15
ST-05	CONSTRUCTION SEQUENCE STAGE II & III - SHEET 5 OF 6	16
ST-06	CONSTRUCTION SEQUENCE - STAGE IV & V - SHEET 6 OF 6	17

DRAWING NUMBER	DRAWING TITILE	SHEET NUMBER

DRAWING NUMBER	DRAWING TITILE	SHEET NUMBER

PRELIMINARY
NOT FOR CONSTRUCTION
PRELIMINARY DESIGN SUBMITTAL

REV	DATE	DESCRIPTION	BY / SUB	APP

DESIGNED BY	TGR
DRAWN BY	TGR
CHECKED BY	MGO
APPROVED BY	MAF
DATE	8/18/2017

Snohomish County Parks and Recreation

HANSON

BNSF RAILWAY

TRISTAN GILES RICKETT
STATE OF WASHINGTON
52174
REGISTERED
PROFESSIONAL ENGINEER

BNSF RAILWAY & SNOHOMISH COUNTY
BNSF SCENIC SUBDIVISION
MEADOWDALE BEACH PARK RAILROAD BRIDGE
INDEX OF DRAWINGS

CONTRACT NO.	14L006802
DRAWING NO.	CK-02
REVISION	
SHEET NO.	2 OF 17
SCALE	NONE

Plot driver:pw:\spi-svr306.hanson.dom-Hanson Projects\Documents\Project_Workspace\MicroStation\Users\Clients\BNSF\BNSF_Railway\tables\pen\BNSF_Railway_pdf_full.pltcfg
Pen table:pw:\spi-svr306.hanson.dom-Hanson Projects\Documents-Jobs-R0087\CAD\Shared\Borders\BNSF_Railway_Color.tbl
File:pw:\spi-svr306.hanson.dom-Hanson Projects\Documents-Jobs-R0087\CAD\Rail\Sheet\G-0002-Meadowdaleindex.dgn
Date:8/23/2017 Time:4:21:31 PM

GENERAL NOTES

UTILITY LOCATES

THE LOCATIONS OF BURIED AND ABOVE GROUND UTILITIES SHOWN ARE APPROXIMATE, ARE SHOWN FOR CONTRACTOR INFORMATIONAL USE ONLY, AND ARE NOT TO BE REFERENCED FOR CONSTRUCTION PURPOSES.

THE IMPLIED PRESENCE OR ABSENCE OF UTILITIES IS NOT TO BE CONSTRUED BY THE OWNER, ENGINEER, CONTRACTOR, OR SUBCONTRACTORS TO BE AN ACCURATE AND COMPLETE REPRESENTATION OF UTILITIES THAT MAY OR MAY NOT EXIST ON THE CONSTRUCTION SITE.

BURIED AND ABOVE GROUND UTILITY LOCATION, IDENTIFICATION AND MARKING ARE THE SOLE RESPONSIBILITY OF THE CONTRACTOR. REROUTING, DISCONNECTION, PROTECTION, ETC. OF THE UTILITIES MUST BE COORDINATED BETWEEN THE CONTRACTOR, UTILITY COMPANY, AND OWNER. SITE SAFETY, INCLUDING THE AVOIDANCE OF HAZARDS ASSOCIATED WITH THE BURIED AND ABOVE GROUND UTILITIES REMAINS THE SOLE RESPONSIBILITY OF THE CONTRACTOR.

(REFERENCE 2015 BNSF STANDARD CONSTRUCTION SPECIFICATION, PARTS 1300(1.21), 1300(1.22)(B), 1600(1.6)(G), 1600(1.10)(A)(4)(C), 1700(1.1)(C)(46 & 47), AND THE 2011 BNSF UTILITY ACCOMMODATION POLICY).

BNSF SIGNAL AND TELECOM LOCATES

CALL 1-800-533-2891 TO ARRANGE FOR A BNSF UNDERGROUND CABLE LOCATE. BNSF FORM 'UNDERGROUND CABLE LOCATION AND ACKNOWLEDGEMENT' WILL BE COMPLETED BY A BNSF REPRESENTATIVE AND A COPY PROVIDED TO THE CONTRACTOR. THE CONTRACTOR MUST HAVE THIS FORM IN POSSESSION AT THE JOB SITE AT ALL TIMES. (REFERENCE 2015 BNSF STANDARD CONSTRUCTION SPECIFICATION, PARTS 1300(1.21), 1300(1.22)(B), 1600(1.6)(G), 1600(1.10)(A)(4)(C), 1700(1.1)(C)(46 & 47), AND THE 2011 BNSF UTILITY ACCOMMODATION POLICY).

SURVEY

- AERIAL IMAGES DATING MAY 2017 WERE OBTAINED FROM GOOGLE EARTH PRO.

- GROUND CONTROL AND TOP OF RAIL SURVEY ON MAINLINE TRACKS WITHIN THE PROJECT LIMITS WAS PERFORMED BY DUANE HARTMAN & ASSOCIATES, INC., WOODINVILLE, WA. (APRIL 2017).

RIGHT-OF-WAY

BNSF RIGHT-OF-WAY AND PARCEL BOUNDARY INFORMATION REPRESENTED ON THESE DRAWINGS IS BASED ON STATION AND RIGHT-OF-WAY MAPS PROVIDED BY BNSF. PARK BOUNADRY LINES WERE OBTAINED FROM THE SURVEYOR. ALL BOUNDARY LINES ARE APPROXIMATE UNLESS SPECIFICALLY NOTED OTHERWISE.

NEAT LINE QUANTITIES USED

EMBANKMENT QUANTITIES SHOWN ON THE PLANS ARE MEASURED TO THE NEAT LINES AS COMPACTED QUANTITIES, NO ADJUSTMENTS TO GRADING QUANTITIES HAVE BEEN MADE FOR COMPACTION, SHRINKAGE, SWELLING, OR CLEARING AND GRUBBING, REFER TO THE 2015 BNSF STANDARD CONSTRUCTION SPECIFICATION, PART 3200(4.3)(A).

BASIS OF TRACK STATIONING

TRACK STATIONING IS MEASURED NORTH TO SOUTH FROM STA. 1256+42.00 AT THE CENTERLINE OF BOX CULVERT 21.8, AS SHOWN ON BNSF ROLLED PROFILE MAP NO. P62462.

MILEPOST STATIONING (SHORT MILES)

FOR PURPOSES OF ESTABLISHING MILEPOST LOCATIONS, THE FOLLOWING WAS USED:

FROM MP	TO MP	DESCRIPTION	LENGTH OF MILE (FT)	LENGTH OF 1/10 OF MILE (FT)
20	21	LONG MILE	5483	548.3
21	22	LONG MILE	5326	532.6

Plot driver:pw:\spi-svr306.hanson.dom\Hanson Projects\Documents\Project_Workspace\MicroStation\Users\Clients\BNSF\BNSF_Railway\tables\pen\BNSF_Railway_pdf_full.pltcfg
Pen table:pw:\spi-svr306.hanson.dom\Hanson Projects\Documents\Jobs\R0087\CAD\Shared\Borders\BNSF_Railway_Color.tbl
File:pw:\spi-svr306.hanson.dom\Hanson Projects\Documents\Jobs\R0087\CAD\Rail\Sheet\C-0003-MeadowdaleGeneralNotes.dgn
Date: 8/18/2017 Time: 11:22:08 AM

PRELIMINARY
NOT FOR CONSTRUCTION
PRELIMINARY DESIGN SUBMITTAL

REV	DATE	DESCRIPTION	BY	SUB	APP

DESIGNED BY	TGR
DRAWN BY	TGR
CHECKED BY	MGO
APPROVED BY	MAF
DATE	8/18/2017

Snohomish County Parks and Recreation
HANSON
BNSF RAILWAY

TRISTAN GILES RICKETT
STATE OF WASHINGTON
52174
REGISTERED
PROFESSIONAL ENGINEER

BNSF RAILWAY & SNOHOMISH COUNTY
BNSF SCENIC SUBDIVISION
MEADOWDALE BEACH PARK RAILROAD BRIDGE
GENERAL NOTES

CONTRACT NO.	14L006802
DRAWING NO.	CK-03
REVISION	
SHEET NO.	3 OF 17
SCALE	NONE

ABBREVIATIONS

&	AND
@	AT
°	DEGREE(S)
'	FOOT or FEET or MINUTE(S)
"	INCH or INCHES or SECOND(S)
%	PERCENT
#	POUND or NUMBER
△	CENTRAL ANGLE OF CIRCULAR CURVE
2500	TRACK 2500
AC	ASPHALT CONCRETE
AP	ANGLE POINT
APE	AREA OF POTENTIAL EFFECT
APPROX	APPROXIMATELY
APWA	AMERICAN PUBLIC WORKS ASSOCIATION
AVE	AVENUE
BC	BEGINNING OF CURVE
BLVD	BOULEVARD
BNSF	BURLINGTON NORTHERN SANTA FE RAILWAY
BM	BENCHMARK
BR	BRIDGE
CB	CATCH BASIN
CC	CENTER OF CURVE
CIP	CAST IRON PIPE OR CAST IN PLACE
C/L OR ℄	CENTERLINE
CLR	CLEAR
CONC	CONCRETE
CMP	CORRUGATED METAL PIPE
CP	CONTROL POINT
CORR	CORRUGATED
CS	CURVE TO SPIRAL
CT	CONCRETE TIES
CTLVR	CANTILEVER
DC	DEGREE OF CURVE
DESC	DESCRIPTION
DI	DUCTILE IRON
DIP	DUCTILE IRON PIPE
DMS	DEGREES MINUTES SECONDS
DOT	DEPARTMENT OF TRANSPORTATION
DR	DRIVE
DU	DUCT
DWG	DRAWING
Ea	SUPERELEVATION, ACTUAL
E	EAST or EASTERLY or EASTING
EC	END OF CURVE
EF	EACH FACE
EGL	ENERGY GRADE LINE
EL or ELEV	ELEVATION
EQ	EQUAL or EQUATION
EQNAHD	EQUATION AHEAD
EQNBK	EQUATION BACK
EW	EACH WAY
Eu	SUPERELEVATION, UNBALANCED
(E), EX	EXISTING
EXMT OR EMT	EXISTING MAIN TRACK
EMT1	EXISTING MAIN TRACK 1
EMT2	EXISTING MAIN TRACK 2
F	FREIGHT
FH	FIRE HYDRANT
FL	FLOWLINE
FS	FINISHED SURFACE
FT	FOOT or FEET
G	GRADE
G1	GRADE ENTERING VERTICAL CURVE
G2	GRADE EXITING VERTICAL CURVE
ga	GAGE
GB	GRADE BREAK
GM	GAS MATER
GRD	GROUND
GV	GAS VALVE
HGL	HYDRAULIC GRADE LINE
HORIZ	HORIZONTAL
HP	HIGH POINT or HIGH PRESSURE
HWY	HIGHWAY
I	TOTAL INTERSECTION ANGLE
INV	INVERT
IE	INVERT ELEVATION
L	LENGTH
Lc	LENGTH OF CURVE (CIRCULAR)
LF	LINEAR FOOT or LINEAR FEET
LH	LEFT HAND
LP	LOW POINT
Ls or LS	LENGTH OF SPIRAL
LT	LEFT
MAIN	MAIN TRACK
MAX	MAXIMUM
MAX	MAXIMUM
MH	MANHOLE
MIN	MINIMUM
MP	MILEPOST or MEDIUM PRESSURE
MSST	MAIN STREET SPUR TRACK
MT	MAIN TRACK
MTD	MULTIPLE TILE DUCT
N	NORTH or NORTHERLY or NORTHING
NMT1	NEW MAIN TRACK 1
NMT2	NEW MAIN TRACK 2
NMT3	NEW MAIN TRACK 3
NO	NUMBER or NORTHERN
NTS	NOT TO SCALE
NW	NORTHWEST
OD	OUTSIDE DIAMETER
OH	OVERHEAD
OP	OVERPASS
OPP	OPPOSITE
OTM	OTHER TRACK MATERIAL
O. TO O.	OUT TO OUT
P or PSGR	PASSENGER
PB	PULLBOX
PC	POINT OF CURVE
PCC	POINT OF COMPOUND CURVATURE or PORTLAND CEMENT CONCRETE
PI	POINT OF INTERSECTION
PIP	PROTECT IN PLACE
PITO	POINT OF INTERSECTION OF TURNOUT
POB	POINT OF BEGINNING
POE	POINT OF ENDING
POT	POINT ON TANGENT
PRC	POINT OF REVERSE CURVATURE
(P), PROP	PROPOSED
PS	POINT OF SWITCH
PT	POINT OF TANGENT
PVC	POINT OF VERTICAL CURVE or POLYVINYL CHLORIDE (PIPE)
PVI	POINT OF VERTICAL INTERSECTION
PVT	POINT OF VERTICAL TANGENT
R	RADIUS or RATE OF CHANGE
RCB	REINFORCED CONCRETE BOX
ROW or R/W	RIGHT-OF-WAY
RCP	REINFORCED CONCRETE PIPE
RD	ROAD
RH	RIGHT HAND
RPM	RAISED PAVEMENT MARKER
RR	RAILROAD
RT	RIGHT
S	SOUTH or SOUTHERLY or SLOPE
SC	SPIRAL TO CURVE
SDMH	STORM DRAIN MANHOLE
SDNG	SIDING TRACK
SF	SQUARE FOOT or SQUARE FEET
SO	SOUTHERN
SMH or SSMH	SANITARY SEWER MANHOLE
STA	STATION
STD	STANDARD
ST	STREET or SPIRAL TO TANGENT
SUB	SUBDIVISION
SW	SOUTHWEST
T	TANGENT or TALGO
TC	TRACK CENTER(S) or TOP OF CURB
TG	TOP OF GRATE
TGC	THE GAS COMPANY
T.O. or TO	TURNOUT
T/R or TOR	TOP OF RAIL
TF	TRACK FOOT or TRACK FEET
TRK	TRACK
TS	TANGENT TO SPIRAL
TT	TIMBER TRANSITION TIES
TYP	TYPICAL
UD	UNDERDRAIN
UNO	UNLESS NOTED OTHERWISE
UP	UNDERPASS
UPRR	UNION PACIFIC RAILROAD
V	VELOCITY
VAR	VARIES
VCP	VITRIFIED CLAY PIPE
VERT	VERTICAL
W	WEST or WESTERLY
WM	WATER METER
WUTC	WASHINGTON UTILITIES AND TRANSPORTATION COMMISION
WV	WATER VALVE
XING	CROSSING
XO	CROSSOVER

CURVE C-20 ← CURVE NUMBER
Dc = 1° 12' ← DEGREE OF CURVE
V = 80(P), 70(F) ← DESIGN SPEED (TIMETABLE SPEED)
Ea = 2½" ← ACTUAL SUPERELEVATION
Ls = 240' ← LENGTH OF SPIRAL(S)

SYMBOLS

EXISTING | PROPOSED

CANTILEVER WITH DUAL SIGNALS
CANTILEVER WITH SIGNALS
CITY OR COUNTY BOUNDARY
CONCRETE PANELS
CROSSING GATE & FLASHING LIGHTS
CROSSING GATE
FLASHING LIGHTS
RAILROAD CROSSING SYMBOL
RAILROAD SIGNAL (SINGLE UNIT)
RAILROAD SIGNAL (TRIPE UNIT)
SIGNPOST
℄ DITCH FLOWLINE
FENCE
POWER POLE
SURVEY CONTROL POINT

EXISTING | PROPOSED

HISTORICAL MILEPOST — MP 6
RIGHT-OF-WAY — R/W
LEASE / EASEMENT
GRADING LIMIT FILL — FILL
GRADING LIMIT CUT — CUT
FUTURE PEDESTRIAN ACCESS TRAIL
TOP OF ACCESS ROAD
POINT OF VERTICAL INTERSECTION
STATION EQUATION SYMBOL
TRACK
TRACK TO BE REMOVED
TRACK TO BE UPGRADED
TRACK TO RELOCATED FROM
TRACK TO RELOCATE TO
WETLAND DELINEATION FLAG
WETLANDS
POINT OF SWITCH (MANUAL)
POINT OF SWITCH (POWER)
CROSSOVER MANUAL
CROSSOVER POWER
TURNOUT MANUAL
TURNOUT POWER

TYPICAL TURNOUT IDENTIFYING POINTS
PS
½" POINT OF FROG
HEEL OF FROG
LAST SWITCH TIE

PROFILE DATA

EXISTING MAIN TRACK TOP OF RAIL ELEVATION
EXISTING GROUND ELEVATION
4042.99
(4041.4)
1749+00 ← EXISTING MAIN TRACK STATIONING

UTILITIES

C&S	COMMUNICATION & SIGNALING	C&S
E	ELECTRIC	E
TV	CABLE TELEVISION	CTV
SAN	SANITARY SEWER	SAN
W	WATER	W
G	GAS	G
T	TELEPHONE	T
FO	FIBER OPTIC	FO
C	CASING	
SD	STORM DRAIN	SD
OHE	OVERHEAD ELECTRIC	OHE
OHFO	OVERHEAD FIBER OPTIC	OHFO

PRELIMINARY
NOT FOR CONSTRUCTION
PRELIMINARY DESIGN SUBMITTAL

REV	DATE	DESCRIPTION	BY	SUB	APP

DESIGNED BY	TGR
DRAWN BY	TGR
CHECKED BY	MGO
APPROVED BY	MAF
DATE	8/18/2017

Snohomish County Parks and Recreation
HANSON
BNSF RAILWAY
TRISTAN GILES MCKEEFF STATE OF WASHINGTON 52174 REGISTERED PROFESSIONAL ENGINEER

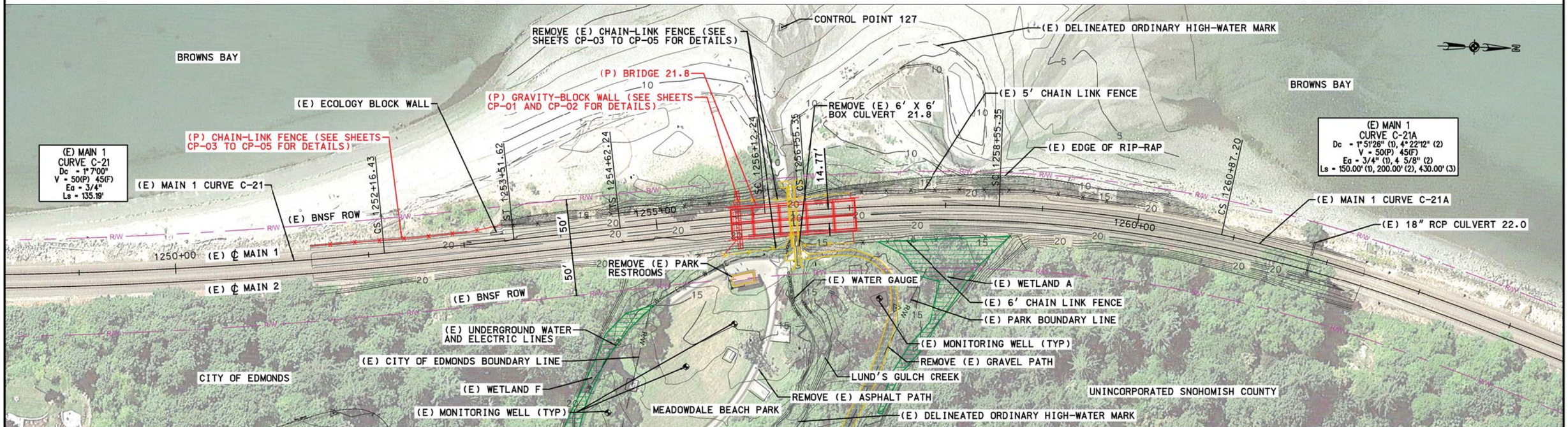
BNSF RAILWAY & SNOHOMISH COUNTY
BNSF SCENIC SUBDIVISION
MEADOWDALE BEACH PARK RAILROAD BRIDGE
ABBREVIATIONS AND SYMBOLS

CONTRACT NO.	14L006802
DRAWING NO.	CK-04
REVISION	
SHEET NO.	4 OF 17
SCALE	NONE

Plot dr ver:pw:\spi-svr306.hanson.dom-Hanson Projects\Documents\Project_Workspace\MicroStation\Users\Clients\BNSF\BNSF_Railway\tables\pen\BNSF_Railway_pdf_fullplt.cfg
Pen tbl e:pw:\spi-svr306.hanson.dom-Hanson Projects\Documents-Jobs+R0087\CAD\Shared\Borders\BNSF_Railway_Color.tbl
File:pw:\spi-svr306.hanson.dom-Hanson Projects\Documents-Jobs+R0087\CAD\Rail\Sheet G-0004-Meadowdale\Abreviations&Symbol.dgn
Date:8/18/2017 Time:11:22:11 AM

TO SEATTLE, WA

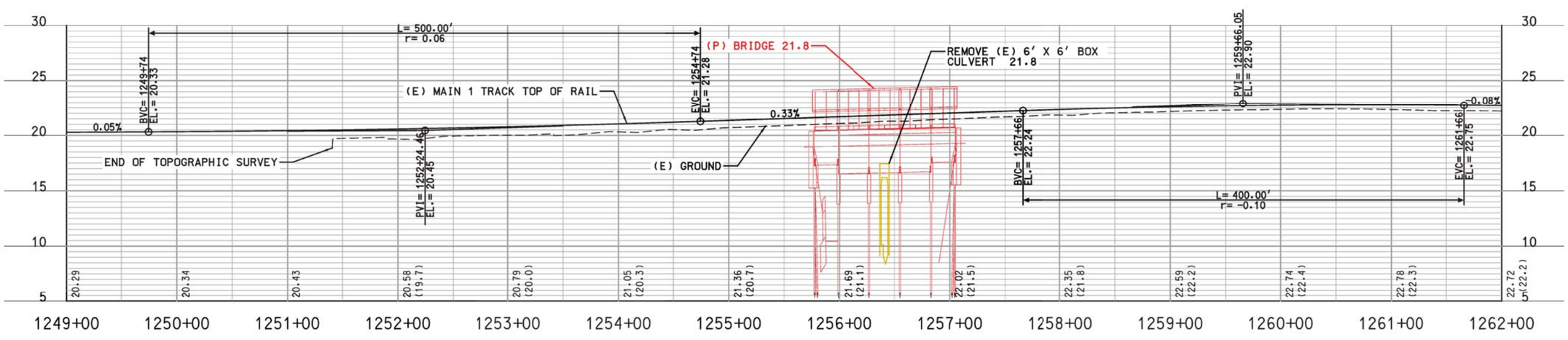
TO WENATCHEE, WA



MAIN 1 PLAN

GRAPHIC SCALE HORIZ: 50 0 25 50 100

GRAPHIC SCALE VERT: 5 0 2.5 5 10



MAIN 1 PROFILE

PRELIMINARY
NOT FOR CONSTRUCTION
PRELIMINARY DESIGN SUBMITTAL

REV	DATE	DESCRIPTION	BY / SUB	APP

DESIGNED BY	TGR
DRAWN BY	TGR
CHECKED BY	MGQ
APPROVED BY	MAF
DATE	8/18/2017

Snohomish County Parks and Recreation

HANSON

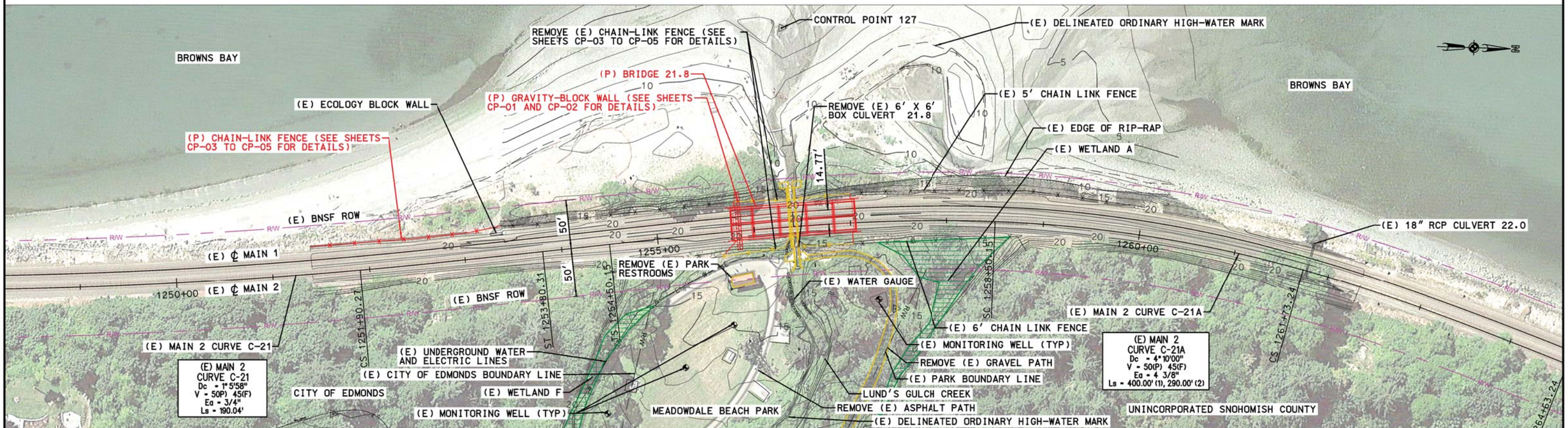
BNSF RAILWAY

TRISTAN GILES BACKETT — STATE OF WASHINGTON — 52174 — REGISTERED PROFESSIONAL ENGINEER

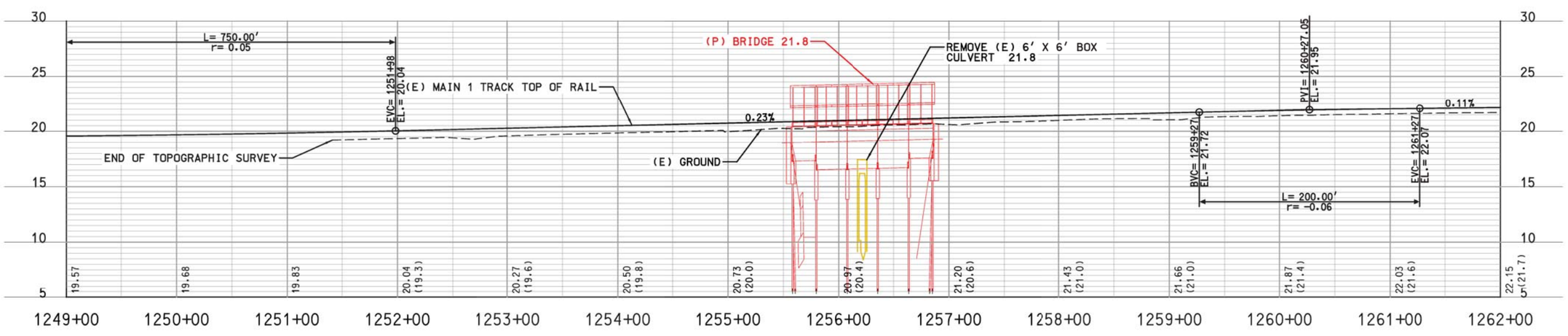
BNSF RAILWAY & SNOHOMISH COUNTY
BNSF SCENIC SUBDIVISION
MEADOWDALE BEACH PARK RAILROAD BRIDGE
TRACK PLAN AND PROFILE – MAIN 1
STA 1251+00 TO STA 1262+00
MP 21.7 TO MP 21.9

CONTRACT NO.	14L006802
DRAWING NO.	RP-01
REVISION	
SHEET NO.	5 OF 17
SCALE	AS SHOWN

Plot driver: pw:\\spi-svr306.hanson.dom:Hanson Projects\Documents\Project_Workspace\MicroStation\Users\Clients\BNSF_Railway\tables\penBNSF_Railway_pdf_full.pltcfg
Pen table: pw:\\spi-svr306.hanson.dom:Hanson Projects\Documents*Job*R0037\CAD\Shared\Borders\BNSF_Railway_Color.tbl
File: I:\14Jobs*L0068\CAD\Rail\Sheet\C-7001-Meadowdale.dgn
Date: 8/23/2017 Time: 4:25:35 PM



MAIN 2 PLAN



MAIN 2 PROFILE

PRELIMINARY
NOT FOR CONSTRUCTION
PRELIMINARY DESIGN SUBMITTAL

REV	DATE	DESCRIPTION	BY / SUB	APP

DESIGNED BY	TGR
DRAWN BY	TGR
CHECKED BY	MGQ
APPROVED BY	MAF
DATE	8/18/2017

Snohomish County Parks and Recreation

HANSON

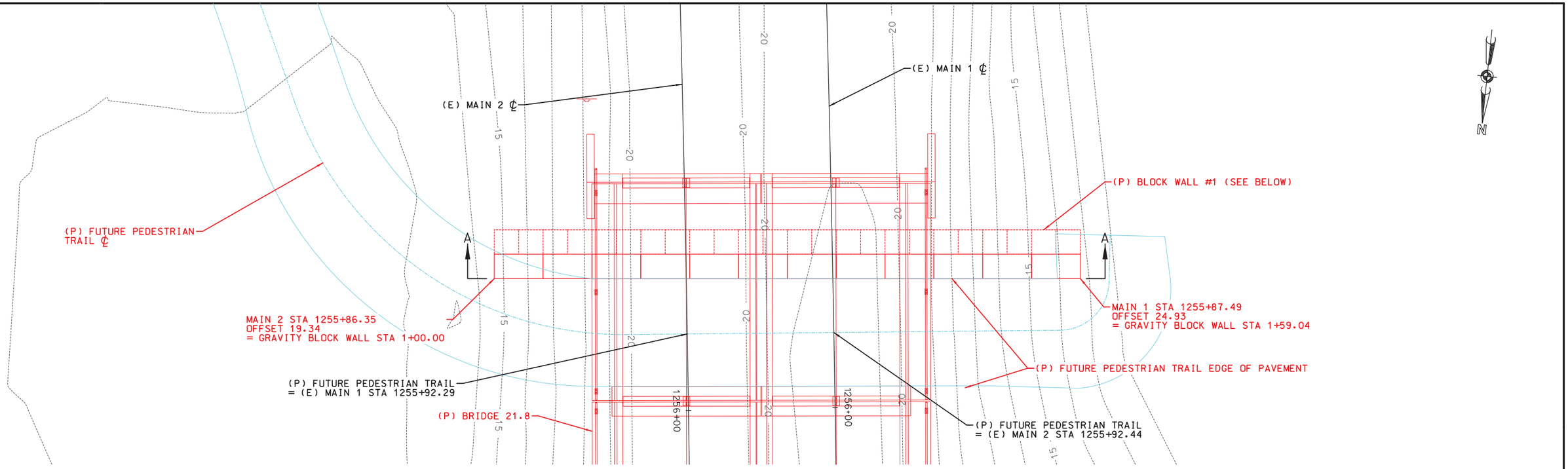
BNSF RAILWAY

TRISTAN GILES BACKETT — STATE OF WASHINGTON — 52174 — REGISTERED PROFESSIONAL ENGINEER

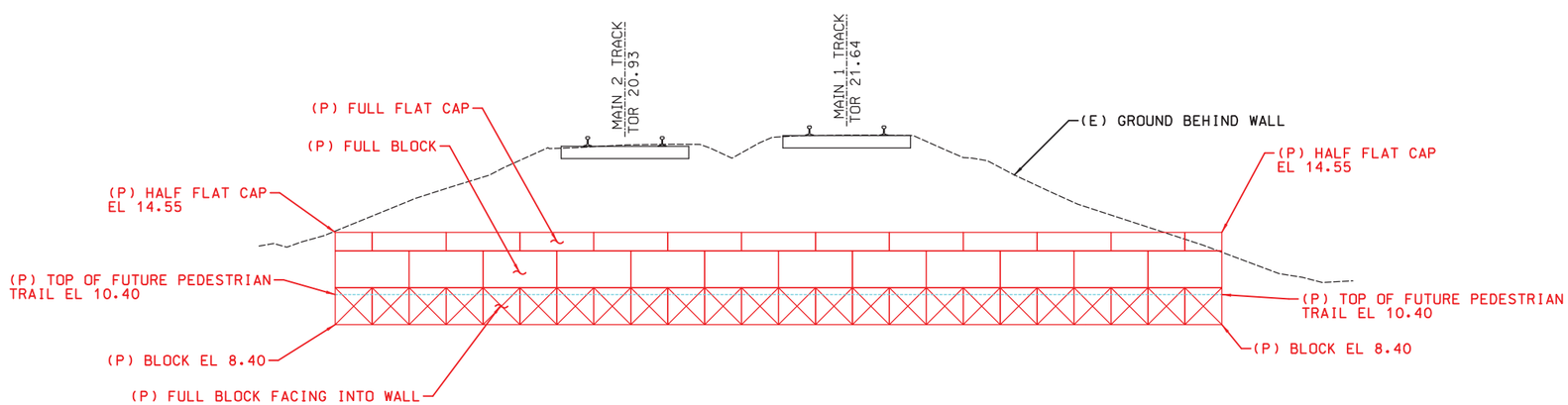
BNSF RAILWAY & SNOHOMISH COUNTY
BNSF SCENIC SUBDIVISION
MEADOWDALE BEACH PARK RAILROAD BRIDGE
TRACK PROFILE – MAIN 2
STA 1251+00 TO STA 1262+00
MP 21.7 TO MP 21.9

CONTRACT NO.	14L006802
DRAWING NO.	RP-02
REVISION	
SHEET NO.	6 OF 17
SCALE	AS SHOWN

Plot driver: pw\spi-svr306.hanson.dom:Hanson Projects\Documents\Project_Workspace\MicroStation\Users\Clients\BNSF_Railway\tables\pen\BNSF_Railway_pdf_full.plt.cfg
Pen table: pw\spi-svr306.hanson.dom:Hanson Projects\Documents+Jobs+R0037\CAD\Shared\Borders\BNSF_Railway_Color.tbl
File: I:\14Jobs+L0068\CAD\Rail\Sheet\C-7002-Meadowdale.dgn
Date: 8/23/2017 Time: 4:28:08 PM



PLAN



PROFILE A-A

PRELIMINARY
NOT FOR CONSTRUCTION
PRELIMINARY DESIGN SUBMITTAL

REV	DATE	DESCRIPTION	BY / SUB	APP

DESIGNED BY	TGR
DRAWN BY	TGR
CHECKED BY	MGO
APPROVED BY	MAF
DATE	8/18/2017

Snohomish County Parks and Recreation

HANSON

BNSF RAILWAY

TRISTAN GILES RACKETT
STATE OF WASHINGTON
52174
REGISTERED
PROFESSIONAL ENGINEER

BNSF RAILWAY & SNOHOMISH COUNTY
BNSF SCENIC SUBDIVISION
MEADOWDALE BEACH PARK RAILROAD BRIDGE
BLOCK WALL PLAN AND PROFILE

CONTRACT NO.	14L006802
DRAWING NO.	CP-01
REVISION	
SHEET NO.	7 OF 17
SCALE	AS SHOWN

Plot driver:pw:\spi-svr306.hanson.dom\Hanson Projects\Documents\Project_Workspace\MicroStation\Users\Clients\BNSF\BNSF_Railway\tables\pen\BNSF_Railway_pdf_fr_Railway_pdf_full.plt.cfg
Pen table:pw:\spi-svr306.hanson.dom\Hanson Projects\Documents\Jobs\R0037\CAD\Shared\Borders\BNSF_Railway_Color.tbl
File:I:\14Jobs\L0068\CAD\Wall\Sheet\C-5001-BlockWall.dgn
Date:8/18/2017 Time:3:31:26 PM

NOTES:

GENERAL NOTES:

ALL MATERIAL AND WORKMANSHIP PERTAINING TO THE DESIGN AND CONSTRUCTION SHALL BE AS PROJECT SPECIFICATIONS.

STRUCTURAL DESIGN:

DESIGN OF THE ULTRABLOCK GRAVITY WALLS SHALL BE PERFORMED BY THE CONTRACTOR. THE CALCULATIONS AND DRAWINGS FOR THE ULTRABLOCK WALLS SHALL BE DESIGNED AND STAMPED BY A REGISTERED PROFESSIONAL ENGINEER IN CONFORMANCE WITH PROJECT SPECIFICATIONS. CALCULATIONS AND DRAWINGS SHALL BE SUBMITTED FOR VERIFICATION PURPOSES.

STRUCTURE EXCAVATION AND BACKFILL:

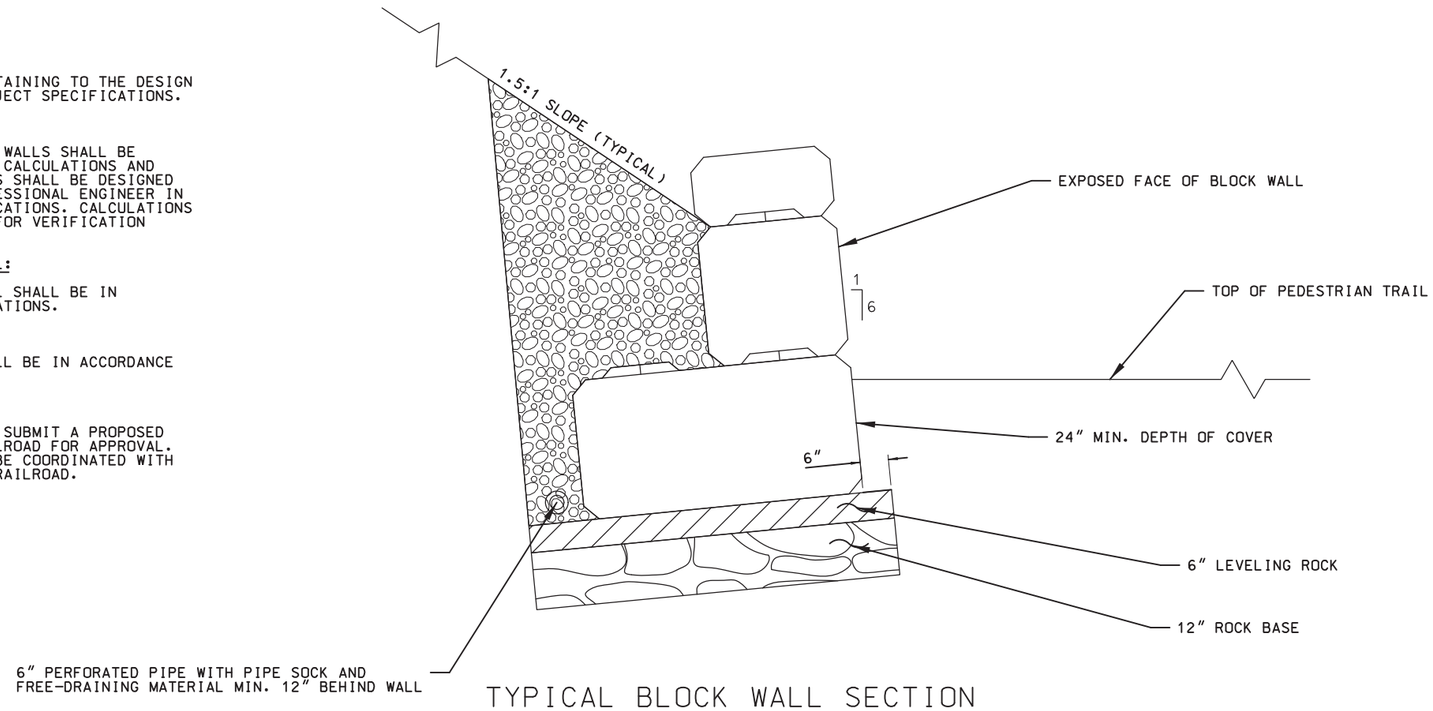
STRUCTURE EXCAVATION AND BACKFILL SHALL BE IN ACCORDANCE WITH PROJECT SPECIFICATIONS.

ULTRABLOCK WALL CONSTRUCTION:

ULTRABLOCK WALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH PROJECT SPECFICIATIONS.

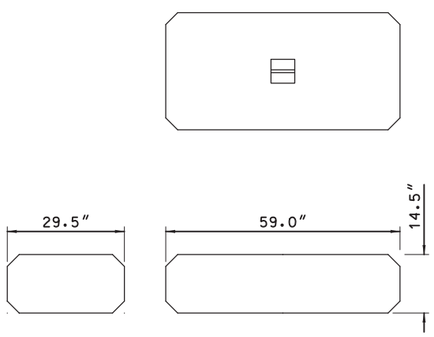
CONSTRUCTION SEQUENCE:

THE CONTRACTOR SHALL DEVELOP AND SUBMIT A PROPOSED CONSTRUCTION SEQUENCE TO THE RAILROAD FOR APPROVAL. THIS CONSTRUCTION SEQUENCE MUST BE COORDINATED WITH WORK WINDOWS AS PROVIDED BY THE RAILROAD.



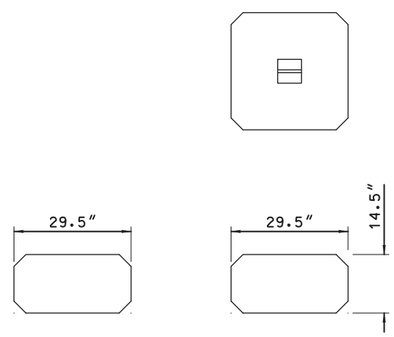
TYPICAL BLOCK WALL SECTION

NOT TO SCALE



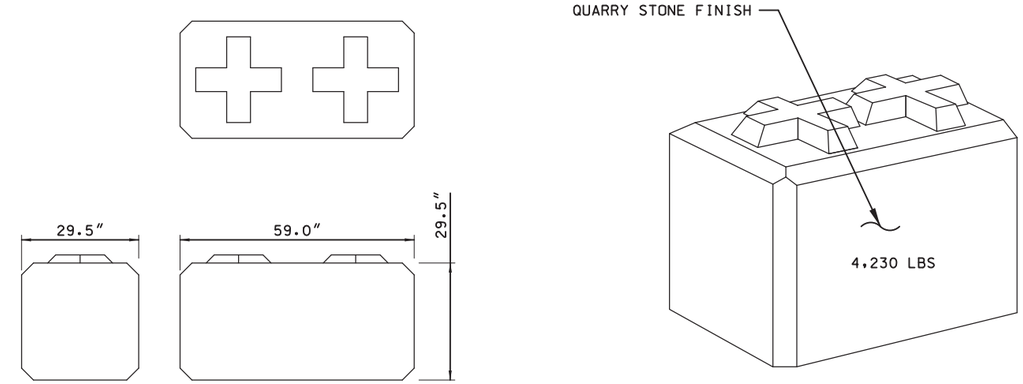
FULL FLAT CAP

NOT TO SCALE



HALF FLAT CAP BLOCK

NOT TO SCALE



FULL BLOCK

NOT TO SCALE

PRELIMINARY
NOT FOR CONSTRUCTION
PRELIMINARY DESIGN SUBMITTAL

REV	DATE	DESCRIPTION	BY / SUB	APP

DESIGNED BY	TGR
DRAWN BY	TGR
CHECKED BY	MGO
APPROVED BY	MAF
DATE	8/18/2017

Snohomish County Parks and Recreation

HANSON

BNSF RAILWAY

TRISTAN GILES RICKETT STATE OF WASHINGTON 52174 REGISTERED PROFESSIONAL ENGINEER

BNSF RAILWAY & SNOHOMISH COUNTY
BNSF SCENIC SUBDIVISION
MEADOWDALE BEACH PARK RAILROAD BRIDGE
BLOCK WALL DETAILS

CONTRACT NO.	14L006802
DRAWING NO.	CP-02
REVISION	
SHEET NO.	8 OF 17
SCALE	NONE

Plot driver:pw:\spi-svr306.hanson.dom-Hanson Projects\Documents\Project_Workspace\MicroStation\Users\Clients\BNSF\BNSF_Railway\tables\pen\BNSF_Railway_pdf_full.pltcfg
Pen table:pw:\spi-svr306.hanson.dom-Hanson Projects\Documents-Jobs-R0087\CAD\Shared\Borders\BNSF_Railway_Color.tbl
File:pw:\spi-svr306.hanson.dom-Hanson Projects\Documents-Jobs-R0087\CAD\Rail\Sheet\C-5002-BlockWallDetails.dgn
Date:8/18/2017 Time:11:28:19 AM

TO SEATTLE, WA

TO WENATCHEE, WA

BEGIN (P) FENCE
(P) FENCE POST
MAIN 1 STA 1251+40.74
OFF 14.2249

(P) WSDOT TYPE 3
CHAIN-LINK FENCE ##### LF

END (P) FENCE
TIE INTO (E) FENCE
(P) FENCE POST
MAIN 1 STA 1253+39.70
OFF 16.26

(E) BNSF ROW

(E) CHAIN-LINK FENCE

(E) MAIN 1 ℄

(E) MAIN 2 ℄

(E) BNSF ROW

CS 1251+90.27

CS 1252+16.43

ST 1253+51.62

ST 1253+80.31

TS 1254+50.15

TS 1254+62.24

TIE INTO (E) FENCE
(P) FENCE POST
MAIN 1 STA 1255+81.22
OFF 15.51

PLACE (P) CHAIN-LINK
FENCE POST ADJACENT TO
BRIDGE ABUTMENT

(P) BRIDGE 21.8

PLACE (P) CHAIN-LINK FENCE POST
ADJACENT TO BRIDGE ABUTMENT

(P) WSDOT TYPE 3 CHAIN-LINK FENCE ##### LF

(E) CHAIN-LINK FENCE

TIE INTO (E) FENCE
(P) FENCE POST
MAIN 2 STA 1255+65.40
OFF 24.30

(P) WSDOT TYPE 3 CHAIN-LINK FENCE ##### LF

REMOVE (E) CHAIN-LINK FENCE ##### LF

(P) WSDOT TYPE 3
CHAIN-LINK FENCE #####
LF

CS 1256+12.24

CS 1256+55.35

TIE INTO (E) FENCE
(P) FENCE POST
MAIN 1 STA 1257+01.44
OFF 15.43

PLACE (P) CHAIN-LINK
FENCE POST ADJACENT TO
BRIDGE ABUTMENT

PLACE (P) CHAIN-LINK
FENCE POST ADJACENT TO
BRIDGE ABUTMENT

(P) GRAVITY-BLOCK WALL

(P) FUTURE PEDESTRIAN
TRAIL (BY OTHERS)

REMOVE (E) CHAIN-LINK FENCE ##### LF

(P) WSDOT TYPE 3
CHAIN-LINK FENCE ##### LF

TIE INTO (E) FENCE
(P) FENCE POST
MAIN 2 STA 1257+02.00
OFF 21.43

MEADOWDALE BEACH PARK

LUND'S GULCH CREEK

R/W

RW

1255+00

N

20' 0 10' 20' 40'
GRAPHIC SCALE

PRELIMINARY
NOT FOR CONSTRUCTION
PRELIMINARY DESIGN SUBMITTAL

REV	DATE	DESCRIPTION	BY / SUB	APP

DESIGNED BY	TGR
DRAWN BY	TGR
CHECKED BY	MCO
APPROVED BY	MAF
DATE	8/18/2017

Snohomish County
Parks and Recreation

HANSON

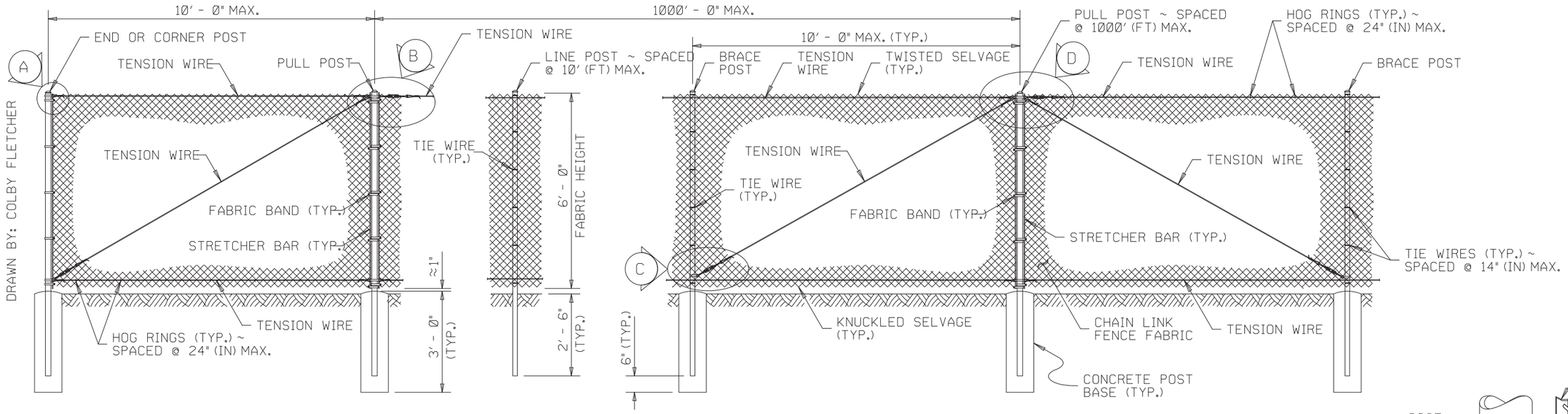
BNSF RAILWAY

TRISTAN GILES RICKETT
STATE OF WASHINGTON
52174
REGISTERED
PROFESSIONAL ENGINEER

BNSF RAILWAY & SNOHOMISH COUNTY
BNSF SCENIC SUBDIVISION
MEADOWDALE BEACH PARK RAILROAD BRIDGE
FENCING PLAN

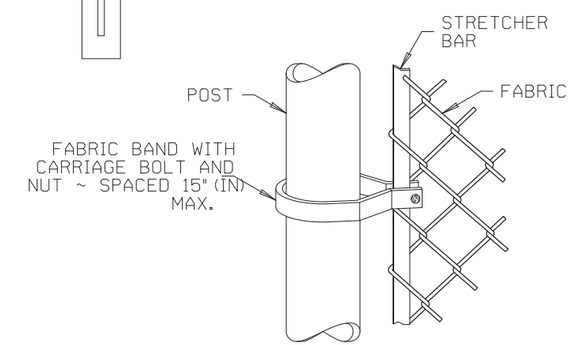
CONTRACT NO.	14L006802
DRAWING NO.	CP-03
REVISION	
SHEET NO.	9 OF 17
SCALE	AS SHOWN

Plot driver:pw:\spi-svr306.hanson.com\Hanson Projects\Documents\Project_Workspace\MicroStation\Users\Clients\BNSF\BNSF_Railway\tables\pen\BNSF_Railway_pdf_full.plt.cfg
Pen table:pw:\spi-svr306.hanson.com\Hanson Projects\Documents\Jobs\R0087\CAD\Shared\Borders\BNSF_Railway_Color.tbl
File:pw:\spi-svr306.hanson.com\Hanson Projects\Documents\Jobs\R0087\CAD\Rail\Sheet\C-5003-FencingPlan.dgn
Date:8/18/2017 Time:11:28:23 AM



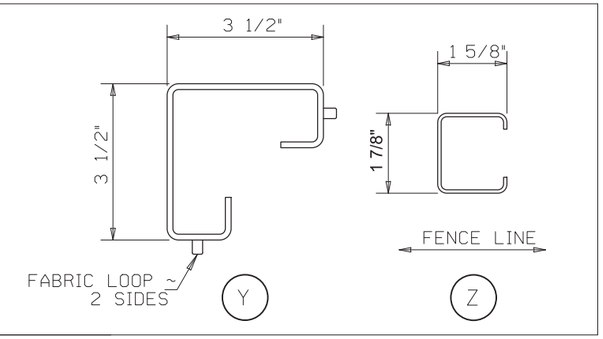
DRAWN BY: COLBY FLETCHER

WSDOT TYPE 3 CHAIN-LINK FENCE



METHOD OF FASTENING STRETCHER BAR TO POST

POST AND RAIL SPECIFICATIONS			
POST	PIPE	ROLL FORMED	
	NOM. SIZE (SCH. 40) I.D.	SECTION	WEIGHT (lb/ft)
END, CORNER, OR PULL POST	2 1/2" DIAM.	Y	5.10
LINE OR BRACE POST	2" DIAM.	Z	1.85



NOTES

1. All concrete post bases shall be 10" (in) minimum diameter.
2. Along the top and bottom, using Hog Rings, fasten the Chain Link Fence Fabric to the Tension Wire within the limits of the first full fabric weave.
3. Details are illustrative and shall not limit hardware design or post selection of any particular fence type.
4. Fencing shall be used for security and boundary delineation only.

PRELIMINARY
NOT FOR CONSTRUCTION
PRELIMINARY DESIGN SUBMITTAL

REV	DATE	DESCRIPTION	BY	SUB	APP

DESIGNED BY	TGR
DRAWN BY	TGR
CHECKED BY	MGO
APPROVED BY	MAF
DATE	8/18/2017

Snohomish County Parks and Recreation

HANSON

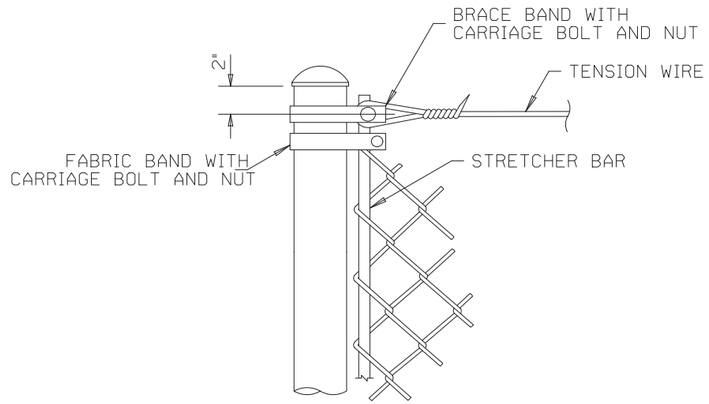
BNSF RAILWAY

TRISTAN GILES RICKETT STATE OF WASHINGTON 52174 REGISTERED PROFESSIONAL ENGINEER

BNSF RAILWAY & SNOHOMISH COUNTY
BNSF SCENIC SUBDIVISION
MEADOWDALE BEACH PARK RAILROAD BRIDGE
FENCING DETAILS
SHEET 01 OF 02

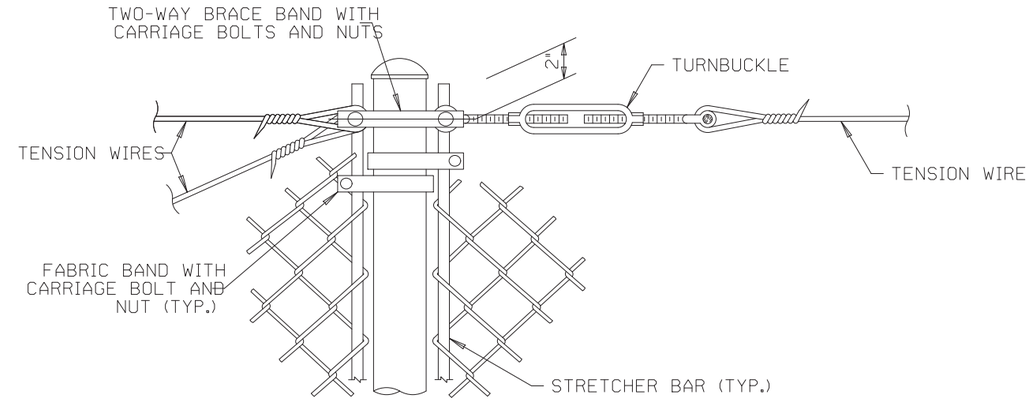
CONTRACT NO.	14L006802
DRAWING NO.	CP-04
REVISION	
SHEET NO.	10 OF 17
SCALE	NONE

Plot driver:pw:\spi-svr306.hanson.dom:Hanson Projects\Documents\Project_Workspace\MicroStation\Users\Clients\BNSF\BNSF_Railway\tables\pen\BNSF_Railway_pdf_full.plt.cfg
Pen table:pw:\spi-svr306.hanson.dom:Hanson Projects\Documents\Jobs\R0087\CAD\Share\Borders\BNSF_Railway_Color.tbl
File:pw:\spi-svr306.hanson.dom:Hanson Projects\Documents\Jobs\R0087\CAD\Rail\Sheet\C-5004-FencingDetails.dgn
Date: 8/18/2017 Time: 11:28:26 AM



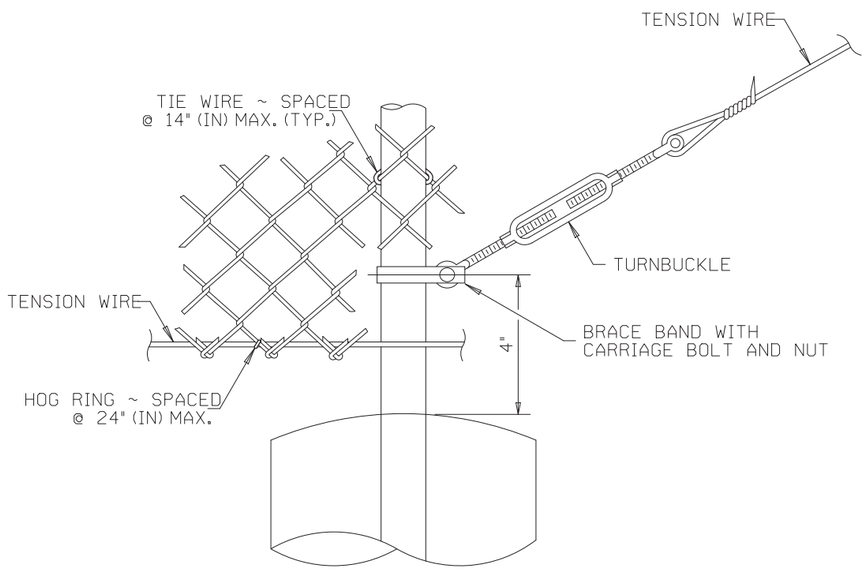
END OR CORNER POST

DETAIL A



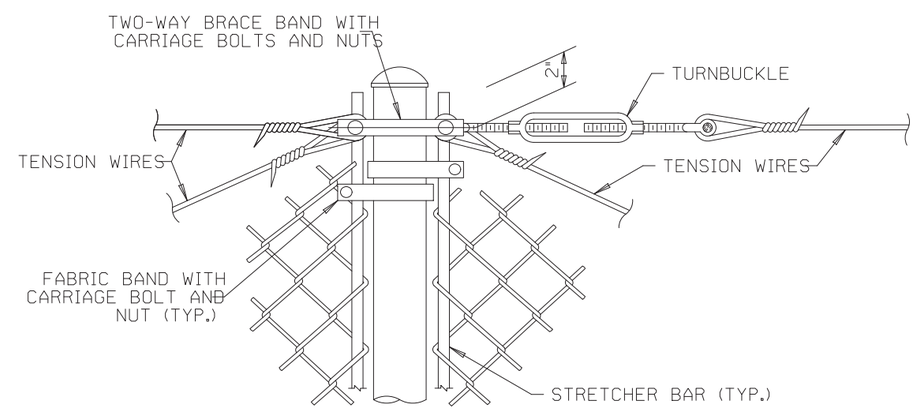
PULL POST (AT END OR CORNER)

DETAIL B



BRACE POST

DETAIL C



PULL POST (WITHIN RUN)

DETAIL D

PRELIMINARY
NOT FOR CONSTRUCTION
PRELIMINARY DESIGN SUBMITTAL

REV	DATE	DESCRIPTION	BY	SUB	APP

DESIGNED BY	TGR
DRAWN BY	TGR
CHECKED BY	MGO
APPROVED BY	MAF
DATE	8/18/2017

Snohomish County Parks and Recreation

HANSON

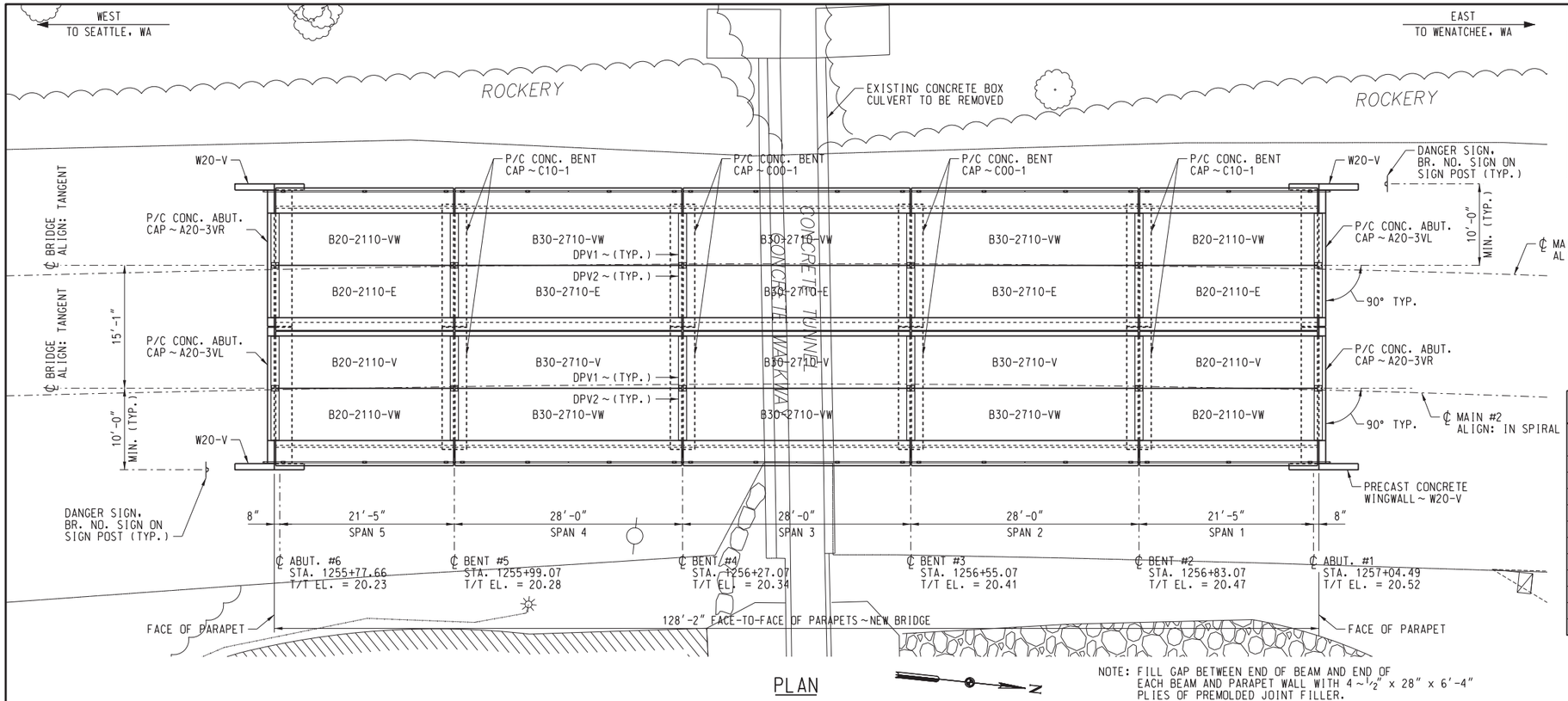
BNSF RAILWAY

TRISTAN GILES RICKETT
STATE OF WASHINGTON
53174
REGISTERED
PROFESSIONAL ENGINEER

BNSF RAILWAY & SNOHOMISH COUNTY
BNSF SCENIC SUBDIVISION
MEADOWDALE BEACH PARK RAILROAD BRIDGE
FENCING DETAILS
SHEET 02 OF 02

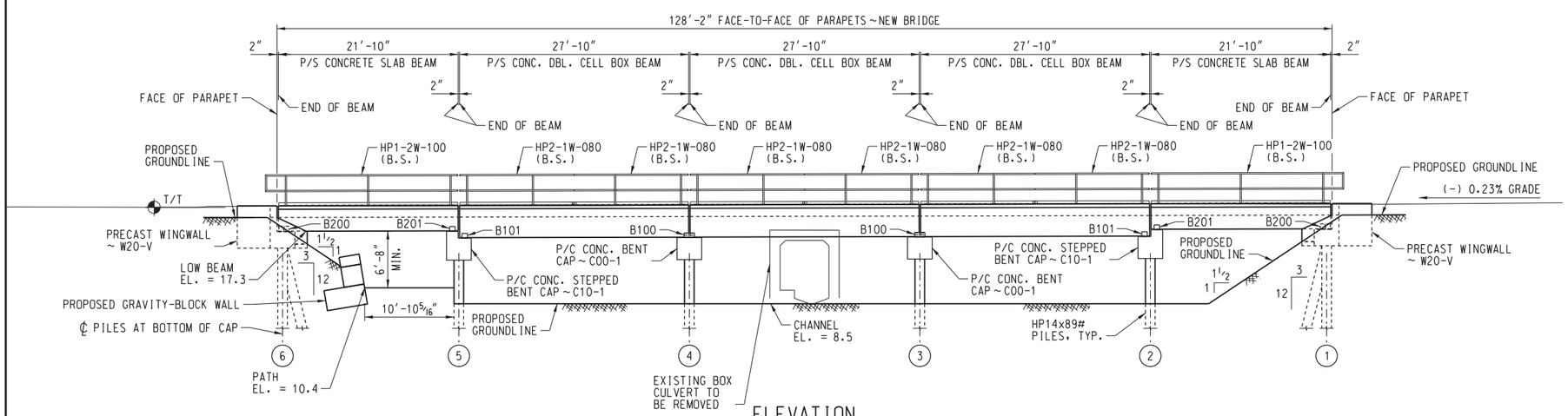
CONTRACT NO.	14L006802
DRAWING NO.	CP-05
REVISION	
SHEET NO.	11 OF 17
SCALE	NONE

Plot driver:pw:\spi-svr306.hanson.dom\Hanson Projects\Documents\Project_Workspace\MicroStation\Users\Clients\BNSF\BNSF_Railway\tables\pen\BNSF_Railway_pdf_full.pltcfg
Pen table:pw:\spi-svr306.hanson.dom\Hanson Projects\Documents\Jobs\R0087\CAD\Shared\Borders\BNSF_Railway_Color.tbl
File:pw:\spi-svr306.hanson.dom\Hanson Projects\Documents\Jobs\R0087\CAD\Rail\Sheet\C-5004-FencingDetails.dgn
Date:8/18/2017 Time:11:28:31 AM



PLAN

NOTE: FILL GAP BETWEEN END OF BEAM AND END OF EACH BEAM AND PARAPET WALL WITH 4 ~ 1/2" x 28" x 6'-4" PLIES OF PREMOLDED JOINT FILLER.



ELEVATION

LOOKING RY NORTH

LIST OF DRAWINGS - BR. 21.8

PLAN NO.	TITLE
0050-0021.800-001	GENERAL PLAN & ELEVATION
0050-0021.800-002	TYPICAL SECTIONS & PILE LAYOUT PLAN
0050-0021.800-003	CONSTRUCTION SEQUENCE NOTES & DETAILS
0050-0021.800-004	CONSTRUCTION SEQUENCE STAGING SECTIONS
0050-0021.800-005	CONSTRUCTION SEQUENCE PLAN - STAGE II & III
0050-0021.800-006	CONSTRUCTION SEQUENCE PLAN - STAGE IV & V

REFERENCES

NO.	PLAN NO.	SHEET NO.	DESCRIPTION
1	X	X	JUNE 1, 2016 BNSF STANDARD BRIDGE & COMPONENT PLANS

TABLE OF EST. LIFTING WEIGHTS

ITEM	MARK NO.	ESTIMATED WEIGHT (LBS)
PRECAST P/S CONC. DBL. CELL BOX BEAM - TYPE II	B30-2710-VW	48,150
PRECAST P/S CONC. DBL. CELL BOX BEAM - TYPE II	B30-2710-E	45,370
PRECAST P/S CONC. DBL. CELL BOX BEAM - TYPE II	B30-2710-V	43,420
PRECAST P/S CONC. SLAB BEAM	B20-2110-VW	46,280
PRECAST P/S CONC. SLAB BEAM	B20-2110-E	44,100
PRECAST P/S CONC. SLAB BEAM	B20-2110-V	42,570
PRECAST CONC. ABUTMENT CAP	A20-3VR	21,510
PRECAST CONC. ABUTMENT CAP	A20-3VL	21,510
PRECAST CONC. BENT CAP	C00-1	20,060
PRECAST CONC. STEPPED BENT CAP	C10-1	22,820
PRECAST CONC. WINGWALL	W20-V	4,140

TABLE OF ELEVATIONS - MAIN #2

LOCATION	TOP/TIE	TOP/CAP	PILE CUTOFF	T/T TO PILE CUTOFF
ABUT. 1	20.52	17.54	15.54	4'-11 3/4"
BENT 2	20.47	17.49/16.66	13.99	6'-5 3/4"
BENT 3	20.41	16.60	13.93	6'-5 3/4"
BENT 4	20.34	16.53	13.86	6'-5 3/4"
BENT 5	20.28	17.30/16.47	13.80	6'-5 3/4"
ABUT. 6	20.23	17.25	15.25	4'-11 3/4"

BENCH MARK:

BM #? - ??

NOTE: STATIONS AND ELEVATIONS ARE BASED ON MAIN #2

LEGEND:

T/T = TOP OF TIE
RY = RAILWAY
B.S. = BOTH SIDES

PRELIMINARY
NOT FOR CONSTRUCTION
08-18-17

DESIGN DATA:

2016 A.R.E.M.A. DESIGN SPECIFICATIONS
LOADING: COOPER E 80 W/ DIESEL IMPACT

DES:	TDP
DRAWN:	CDP
CHECK:	MAF
DATE:	8/18/2017
AUTH:	
LINE SEG:	0050

Snohomish County Parks and Recreation

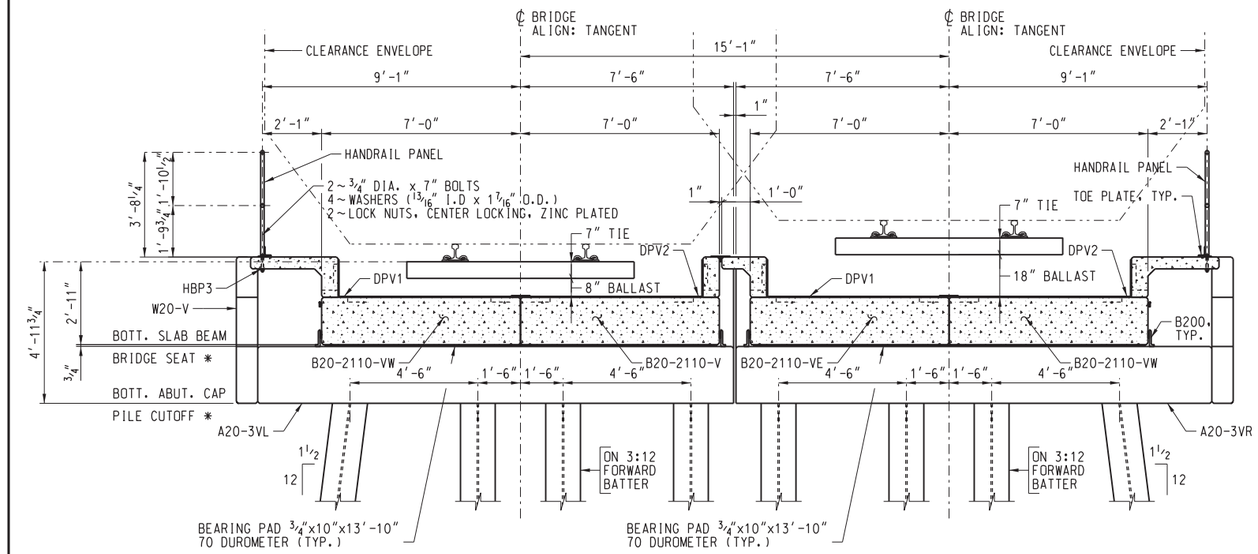
SEATTLE, WA TO WENATCHEE, WA
BRIDGE NUMBER 21.80
OVER LUNDS GULCH CREEK
EDMONDS, WA
GENERAL PLAN & ELEVATION

PLAN NO: 0050-0021.800-001 | SHEET: 01 OF 06

HANSON
Hanson Professional Services Inc.

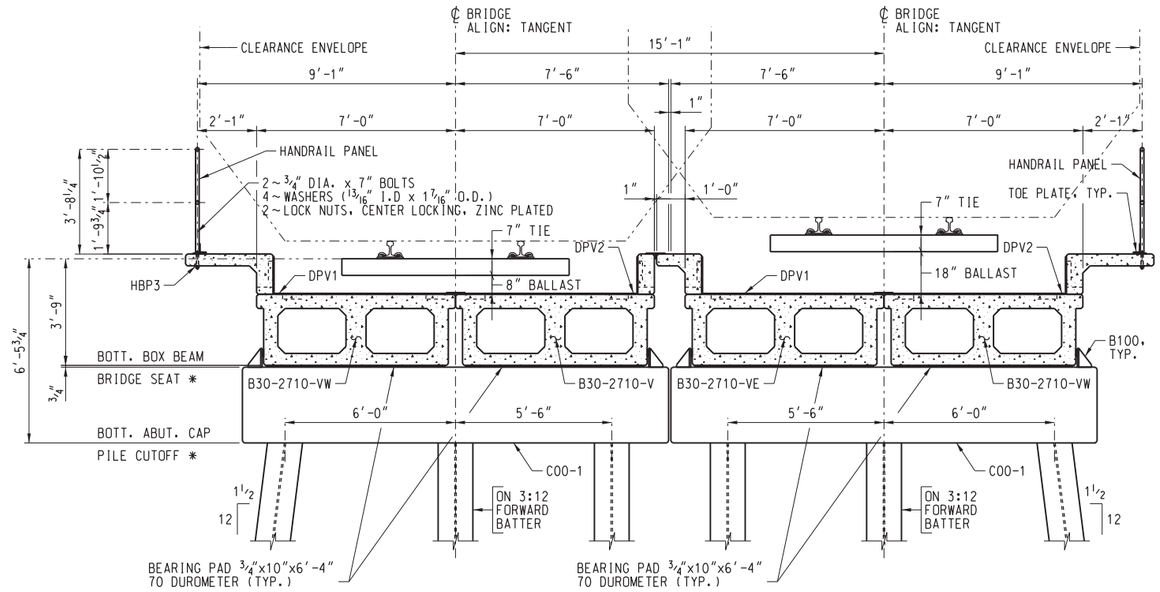
File Location: E:\Projects\L0080\CAD\Struct\Sheet\0213000001.dgn

Date Printed: 8/18/2017 Time Printed: 10:25:04 AM



TYPICAL SECTION AT ABUTMENT

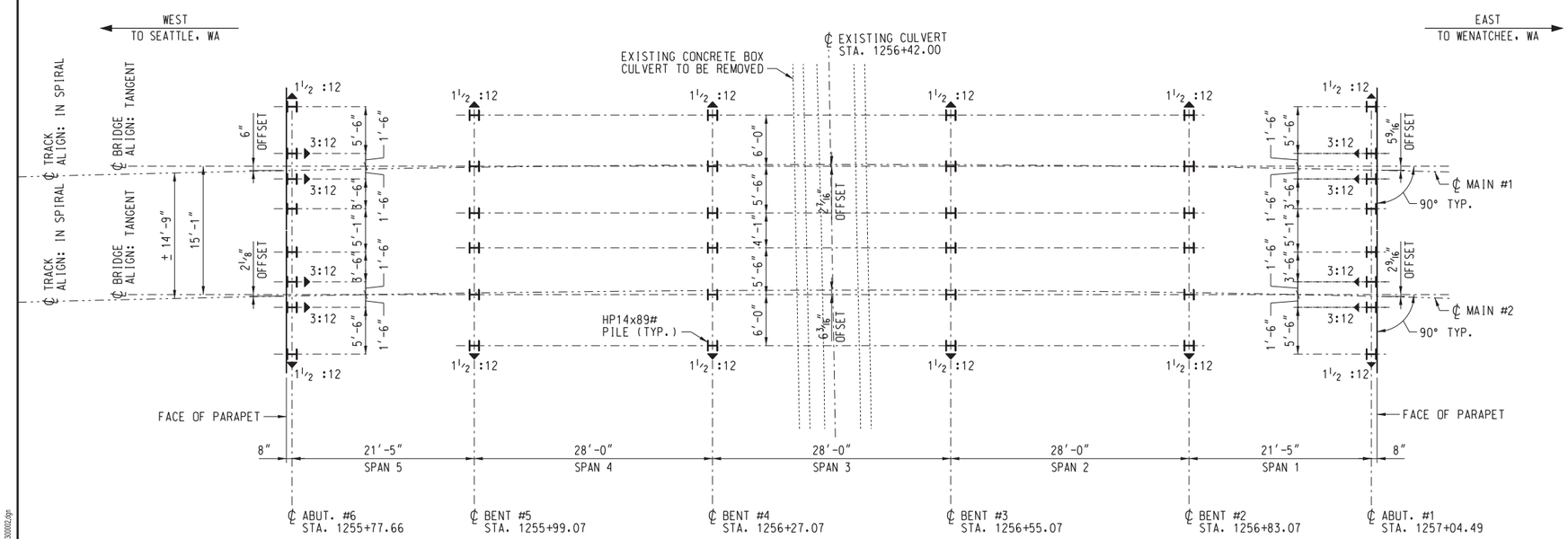
(WEST ABUTMENT SHOWN, EAST ABUTMENT OPPOSITE HAND)



TYPICAL SECTION AT BENT

(LOOKING RY WEST)

* SEE ELEVATION TABLE ON SHEET 1 OF 5 FOR ELEVATIONS.



PLAN

NOTES:

▼ - Indicates direction of batter.

X:12 - Indicates amount of batter

All dimensions are given at bottom of precast cap.

Use weld metal to write the date and average pile depth in 3 inch tall letters on each bent.

Piles shall meet the material requirements of and shall be driven in accordance with BNSF Standard Specifications. HP14x89# piles shall be driven to refusal, if possible, or to a minimum ultimate resistance of 250 tons as determined by the Modified Engineering News-Record Formula as per the BNSF Engineering Instruction, 17.3.4.

Provide pile points for abutment piles - Model VS314-89 by Versa Steel Inc., Portland, OR or equal.

Estimated Pile Tip Elevation of abutment piles = ???.?

PRELIMINARY
NOT FOR CONSTRUCTION
08-18-17

DES:	TDP
DRAWN:	CDP
CHECK:	MAF
DATE:	8/18/2017
AUTH:	
LINE SEG:	0050

Snohomish County
Parks and Recreation

SEATTLE, WA TO WENATCHEE, WA
BRIDGE NUMBER 21.80
OVER LUNDS GULCH CREEK
EDMONDS, WA
TYPICAL SECTIONS & PILE LAYOUT PLAN

PLAN NO: 0050-0021.800-002 | SHEET: 02 OF 06

HANSON
Hanson Professional Services Inc.

File Location: E:\Apps\ALL008\CAD\Struct\Sheet\0213\0002.dgn

Date Printed: 8/18/2017 Time Printed: 10:25:05 AM

CONSTRUCTION SEQUENCE

STAGE I 1. DRIVE H-PILE AT ALL LOCATIONS TO GRADE, BNSF TO ADJUST TRACK TIES WHERE NEEDED. (SEE PILE LAYOUT PLAN)

STAGE II 1. PROVIDE TEMPORARY SOIL RETENTION SYSTEM BETWEEN MAIN TRACK #1 AND MAIN TRACK #2. (SEE THIS SHEET)

STAGE III 1. EXCAVATE AND CUT H-PILE TO CORRECT ELEVATION AT ABUTMENTS AND PIERS.
2. PLACE AND WELD PRECAST ABUTMENT & PIER CAPS.
3. PLACE CONTROLLED LOW-STRENGTH MATERIAL AT ABUTMENTS.
4. EXCAVATE BETWEEN FOUNDATION ELEMENTS AS REQUIRED TO INSTALL SUPERSTRUCTURE.
5. BACKFILL ABUTMENT CAPS.
6. SET BEARING PADS AND INSTALL SUPERSTRUCTURE.
7. BNSF TO INSTALL TRACKS ON MAIN #1 AND OPEN TO RAIL TRAFFIC.

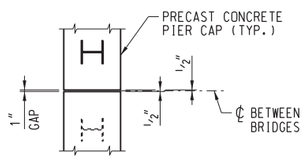
STAGE IV- SAME AS III WITH CLOSURE WINDOW ON MAIN TRACK #2

- TEMPORARY SOIL RETENTION SYSTEM SHALL BE REMOVED (LOCATIONS OF INTERFERENCE WITH STRUCTURE INSTALLATION) AT ANY TIME AFTER EXCAVATION FOR THE SUPERSTRUCTURE DURING CLOSURE WINDOW AND COORDINATED WITH THE BNSF REPRESENTATIVE (SEE NOTE 3 BELOW).

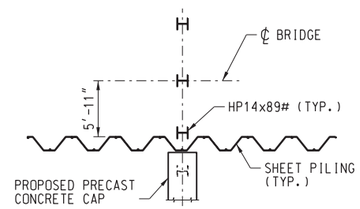
STAGE V 1. EXCAVATE TO REQUIRED ELEVATIONS FOR STREAM RESTORATION.
2. CONSTRUCT NEW WALK PATH.

NOTES

1. THE CONTRACTOR MUST COORDINATE WITH THE BNSF REPRESENTATIVE TO WORK AROUND THE TRAIN SCHEDULE TO MINIMIZE THE IMPACT ON TRAIN OPERATIONS.
2. THE CONTRACTOR SHALL INSTALL THE STEEL H-PILES AND TEMPORARY SOIL RETENTION SYSTEM IN XX (X) HOUR CLOSURE WINDOWS. CONTRACTOR SHALL COORDINATE WITH BNSF ON MOVING TIES TO INSTALL PILES AND SHORING. THE XX (X) HOUR CLOSURE WINDOW SHALL INCLUDED TIME FOR BNSF FORCES TO MAKE MODIFICATIONS TO TIES AND/OR RAIL AS NEEDED TO COMPLETE WORK AND PRIOR TO RESTORING TRAIN OPERATIONS.
3. ONLY CONCEPTUAL LAYOUT AND DETAILS ARE SHOWN FOR THE TEMPORARY SOIL RETENTION SYSTEM. THE FINAL DESIGN AND DETAILS ARE THE RESPONSIBILITY OF THE CONTRACTOR. FINAL DESIGN AND DETAILS SIGNED AND SEALED BY A REGISTERED STRUCTURAL ENGINEER IN THE STATE OF WASHINGTON SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL.
4. FINAL CONSTRUCTION SEQUENCE, DESIGN AND DETAILS SHALL BE SUBMITTED TO BNSF FOR APPROVAL AND COORDINATION PRIOR TO INSTALLATION OF THE TEMPORARY SOIL RETENTION SYSTEM.
5. FOR ADDITIONAL SUGGESTED CONSTRUCTION SEQUENCE AND DETAILS, SEE SHEETS 04 TO 06.
6. MATS OR OTHER MEANS OF PROTECTION MUST BE PROVIDED TO PROTECT RAILS AND BALLAST FROM DAMAGE DUE TO EQUIPMENT OR CONSTRUCTION OPERATIONS. COST INCLUDED IN TRACK MONITORING. DETAILS SHALL BE SUBMITTED TO BNSF FOR REVIEW AND APPROVAL.
7. DESIGN OF TEMPORARY SOIL RETENTION SYSTEM SHOULD BE PER THE BNSF GUIDELINES FOR TEMPORARY SHORING.
8. RAILROAD UTILITIES MAY EXIST WITHIN BNSF RIGHT-OF-WAY. PRIOR TO THE START OF ANY CONSTRUCTION OR EXCAVATION, UTILITY RELOCATIONS WILL HAVE TO BE COORDINATED WITH BNSF.
9. ALL WELDING OF CAPS TO PILES SHALL BE PERFORMED BY A CERTIFIED WELDER.
10. BNSF WILL CUT EXISTING TRACK PANELS TO BE REMOVED (INTO 40 FOOT LENGTHS) AND THE CONTRACTOR WILL BE RESPONSIBLE FOR REMOVAL OF THE TRACK FROM THE BALLAST.



PLAN - PIER CAPS



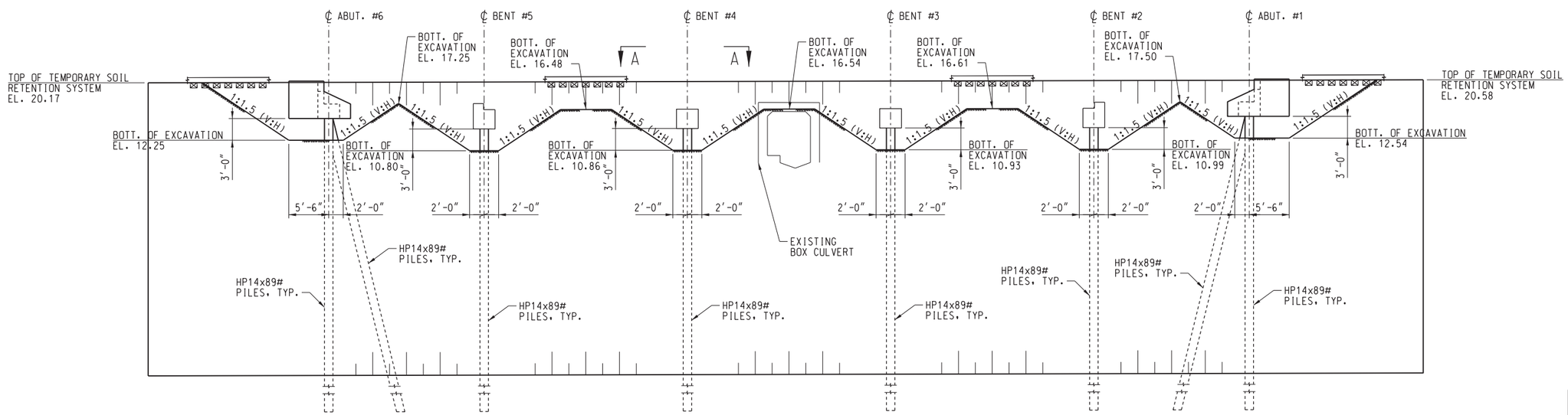
VIEW A-A

TYPICAL AT ABUTMENTS & PIERS

BNSF REQUIREMENTS

NOTES

1. CONTRACTOR SHALL NOTE DATES FOR BNSF TO MOVE TIES IN 3 WEEK PLANNING SCHEDULES TO COORDINATE WORK WITH BNSF FORCES
2. DURING CLOSURE WINDOW, THE MOVEMENT AND LOCATION OF PERSONAL AND EQUIPMENT SHALL BE RESTRICTED DURING PASSAGE OF TRAINS ON ADJACENT TRACKS. THE CONTRACTOR SHALL COORDINATE WITH BNSF REPRESENTATIVE.
3. CONTRACTOR SCHEDULE MUST INCLUDE TIME FOR BNSF FORCES TO MODIFY TIES AND/OR RAIL AS NEEDED.
4. STAGE CLOSURE WINDOWS SHALL BE COORDINATED A MINIMUM OF 60 DAYS AHEAD OF WHEN REQUIRED.



TYPICAL SECTION - TEMPORARY SOIL RETENTION SYSTEM

NOTES:

1. THE TEMPORARY SOIL RETENTION SYSTEM INCLUDES TWO DIFFERENT EXCAVATION REQUIREMENTS: (1) DEPTH TO ALLOW FOR SETTING OF SUPERSTRUCTURE. (2) DEPTH TO ALLOW FOR SETTING AND ATTACHING PRECAST CAPS AND ASSOCIATED SAFE WORKING SLOPES.
2. AT ABUTMENTS & PIERS, A CANTILEVERED SHEET PILING DESIGN MAY NOT BE FEASIBLE AND ADDITIONAL MEMBERS OR OTHER RETENTION SYSTEMS MAY BE NECESSARY. THE CONTRACTOR SHALL SUBMIT A TEMPORARY SOIL RETENTION SYSTEM DESIGN INCLUDING PLAN DETAILS AND CALCULATIONS SIGNED AND SEALED BY A REGISTERED STRUCTURAL ENGINEER IN THE STATE OF WASHINGTON TO THE ENGINEER FOR REVIEW AND APPROVAL PRIOR TO COMMENCING CONSTRUCTION.
3. IF THE CONTRACTOR ELECTS TO CUT AND REMOVE PORTIONS OF THE TEMPORARY SOIL RETENTION WALL INSTEAD OF REMOVING THE ENTIRE WALL, THE WALL SHALL BE REMOVED TO AN ELEVATION OF XX.XX BETWEEN THE PROPOSED BRIDGE PIERS AND TO AN ELEVATION OF 5' BELOW FINISHED GRADE AT LOCATIONS OUTSIDE OF THE PIERS.

PRELIMINARY
NOT FOR CONSTRUCTION
08-18-17

HANSON
Hanson Professional Services Inc.

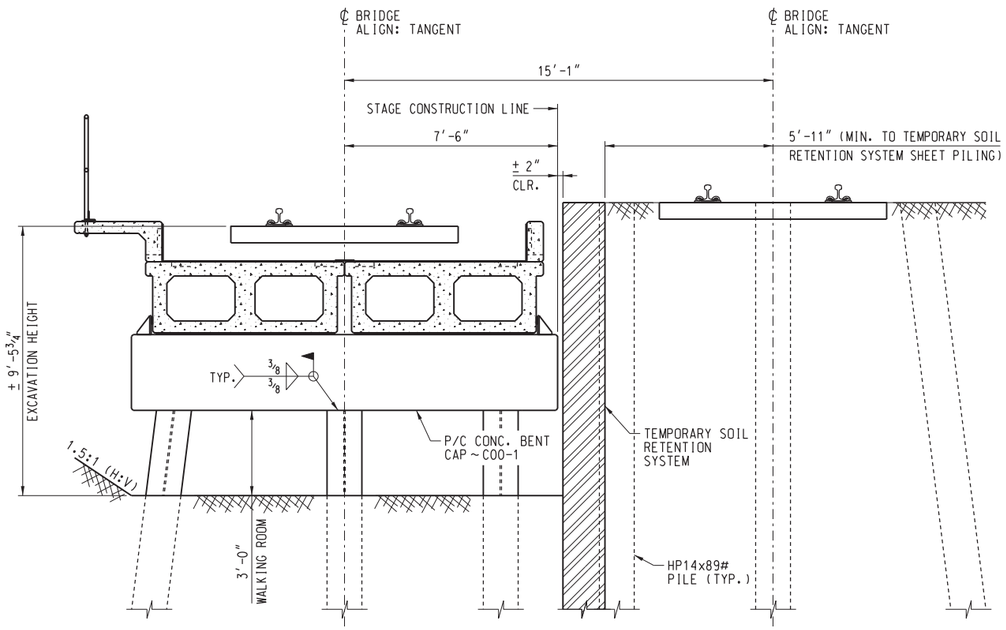
DES:	TDP
DRAWN:	CDP
CHECK:	MAF
DATE:	8/18/2017
AUTH:	
LINE SEG:	0050

Snohomish County
Parks and Recreation

SEATTLE, WA TO WENATCHEE, WA
BRIDGE NUMBER 21.80
OVER LUNDS GULCH CREEK
EDMONDS, WA
CONSTRUCTION SEQUENCE NOTES & DETAILS

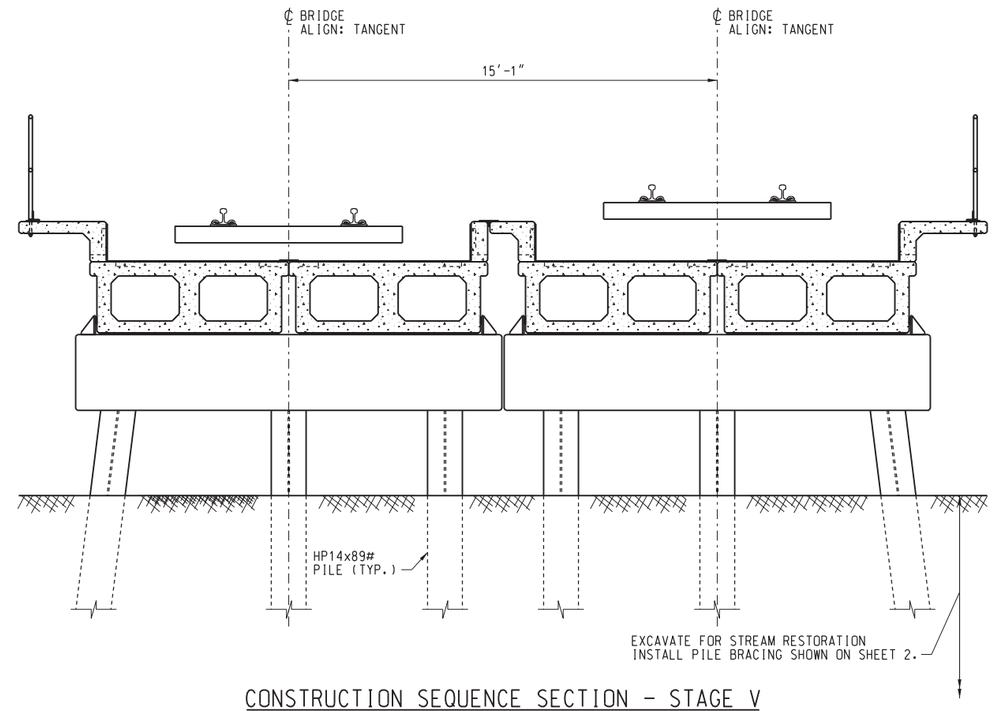
PLAN NO: 0050-0021.800-003 | SHEET: 03 OF 06

File Location: E:\Projects\4.008\CAD\Sheet\0210300 3.dgn
Date Printed: 8/18/2017 Time Printed: 10:25:05 AM



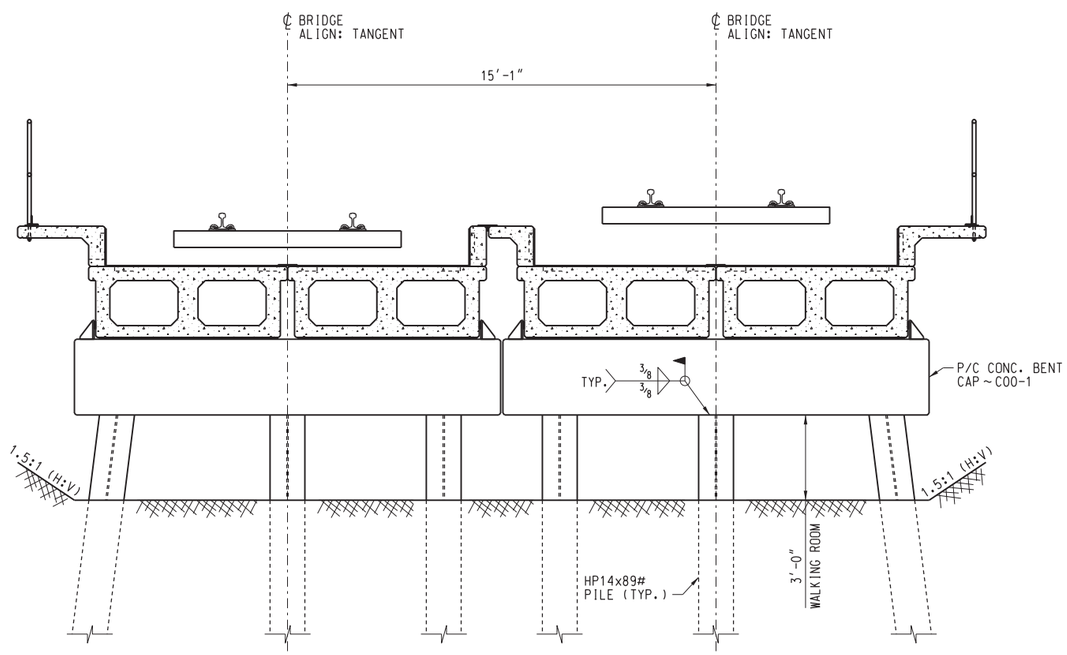
CONSTRUCTION SEQUENCE SECTION - STAGE III

(LOOKING RY WEST AT BENT #3)



CONSTRUCTION SEQUENCE SECTION - STAGE V

(LOOKING RY WEST AT BENT #3)



CONSTRUCTION SEQUENCE SECTION - STAGE IV

(LOOKING RY WEST AT BENT #3)

PRELIMINARY
NOT FOR CONSTRUCTION
08-18-17

DES:	TDP
DRAWN:	CDP
CHECK:	MAF
DATE:	8/18/2017
AUTH:	
LINE SEG:	0050

Snohomish County
Parks and Recreation

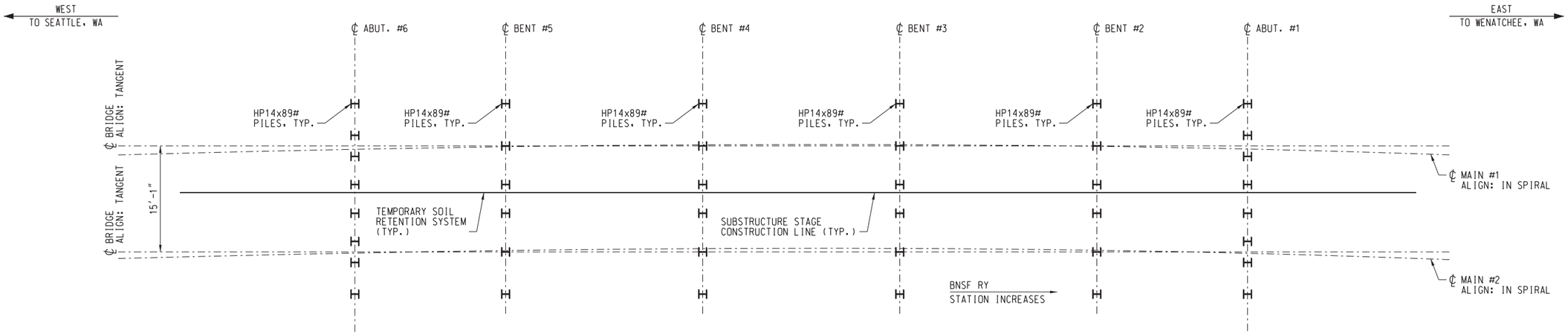
SEATTLE, WA TO WENATCHEE, WA
BRIDGE NUMBER 21.80
OVER LUNDS GULCH CREEK
EDMONDS, WA
CONSTRUCTION SEQUENCE STAGING SECTIONS

PLAN NO: 0050-0021.800-004 | SHEET: 04 OF 06

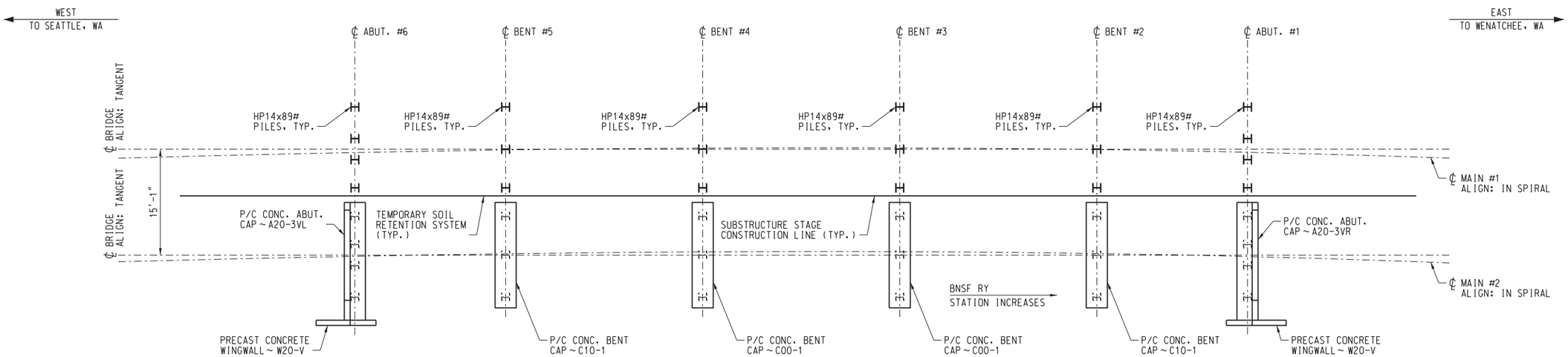
HANSON
Hanson Professional Services Inc.

File Location: D:\Projects\4L0068\CAD\Struct\Sheet\02130000A.dgn

Date Printed: 8/18/2017 Time Printed: 10:25:06 AM



PLAN - STAGE II



PLAN - STAGE III

MAIN #2 SUPERSTRUCTURE NOT SHOWN FOR CLARITY.

PRELIMINARY
NOT FOR CONSTRUCTION
08-18-17

DES:	TDP
DRAWN:	CDP
CHECK:	MAF
DATE:	8/18/2017
AUTH:	
LINE SEG:	0050

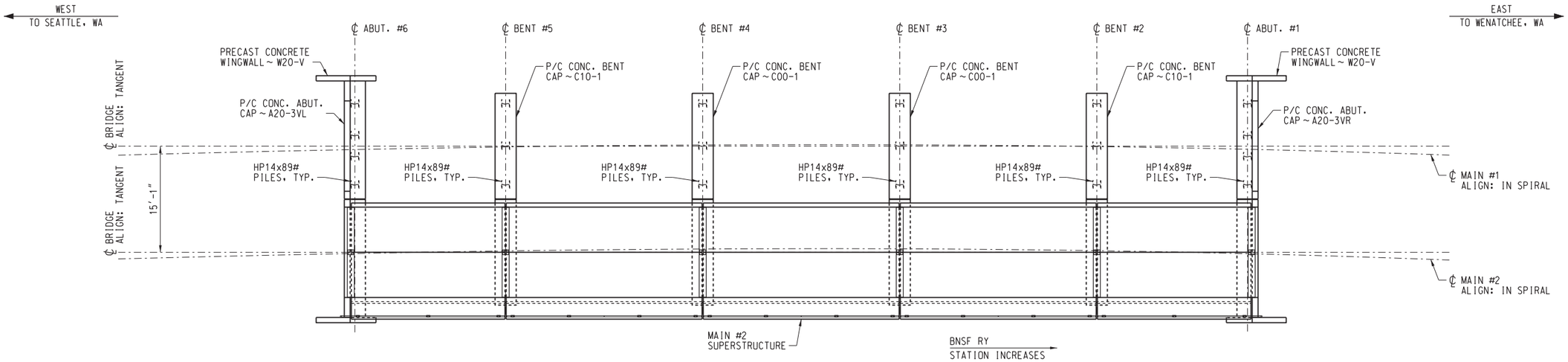
Snohomish County
Parks and Recreation

SEATTLE, WA TO WENATCHEE, WA
BRIDGE NUMBER 21.80
OVER LUNDS GULCH CREEK
EDMONDS, WA
CONSTRUCTION SEQUENCE - STAGE II & III

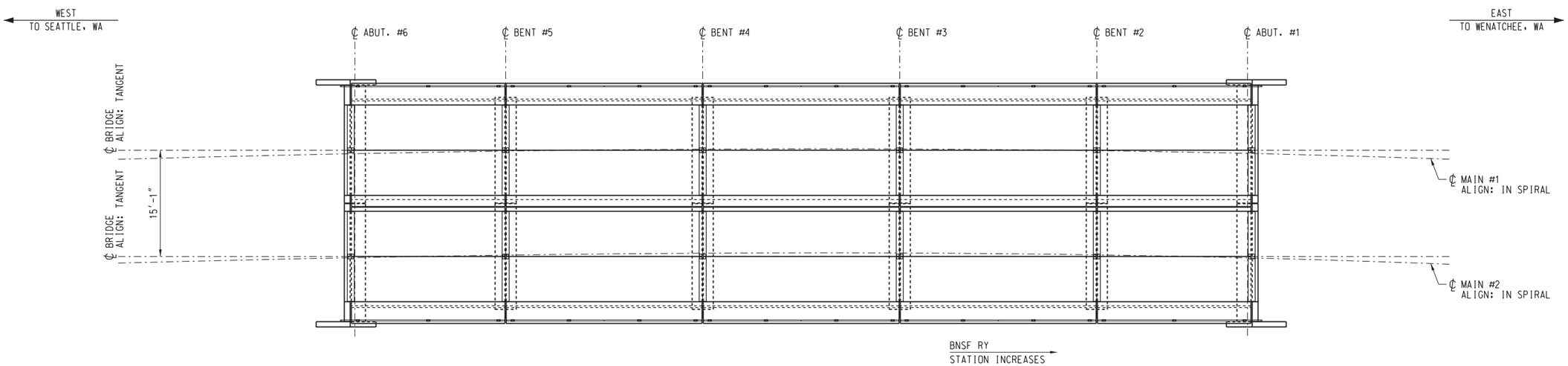
PLAN NO: 0050-0021.800-005 | SHEET: 05 OF 06

HANSON
Hanson Professional Services Inc.

File Location: E:\Projects\4L0068\CADD\Sheets\0021800005.dgn
Date Printed: 8/18/2017 Time Printed: 10:25:06 AM



PLAN - STAGE IV



PLAN - STAGE V

PRELIMINARY
NOT FOR CONSTRUCTION
08-18-17

DES:	TDP
DRAWN:	CDP
CHECK:	MAF
DATE:	8/18/2017
AUTH:	
LINE SEG:	0050

Snohomish County
Parks and Recreation

SEATTLE, WA TO WENATCHEE, WA
BRIDGE NUMBER 21.80
OVER LUNDS GULCH CREEK
EDMONDS, WA
CONSTRUCTION SEQUENCE - STAGE IV & V

PLAN NO: 0050-0021.800-006 | SHEET: 06 OF 06

HANSON
Hanson Professional Services Inc.

File Location: E:\Projects\4L0068\CADD\Sheets\0212300008.dgn
Date Printed: 8/18/2017 Time Printed: 10:25:07 AM

Appendix B
Phase 1 Environmental Site Assessment

Meadowdale Beach Park
Phase I Environmental Site Assessment
Edmonds, Washington

September 15, 2015

SHANNON & WILSON, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Excellence. Innovation. Service. Value.

Since 1954.

Submitted To:
Ms. Kathy Ketteridge
Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, WA 98101

By:
Shannon & Wilson, Inc.
400 N 34th Street, Suite 100
Seattle, Washington 98103

21-1-22034-001

EXECUTIVE SUMMARY

Shannon & Wilson, Inc. has completed a Phase I Environmental Site Assessment (ESA) for a portion of Meadowdale Beach Park located at 15433 75th Place West in Edmonds, Washington (the Subject Property). This study was conducted on behalf of Anchor QEA in anticipation of potential construction activities on the Subject Property that may require ground disturbance.

The Subject Property is within Meadowdale Beach Park and consists of parkland on the east and a beach on the west that are separated by BNSF Railway Company railroad tracks with an approximately 6-foot-wide by 7-foot-high culvert running east-west underneath. Location and site maps are included as Figures 1 and 2.

The research conducted for this Phase I ESA indicates that the Subject Property was occupied by a country club pool house from at least 1941 until the late 1960s. The property was then converted to a public park and the pool house was demolished and the pool was eventually filled in. Later, a picnic shelter, restroom building, and sand volleyball court were built on the Subject Property.

The surrounding properties are and have been mostly undeveloped park land. A park ranger's residence with a small parking area and maintenance shed were built on the property adjacent to the east of the Subject Property in 1988.

Recognized Environmental Conditions (RECs)

In our opinion, this assessment revealed the presence of one REC on the Subject Property: potential contaminants associated with the presence of railroad tracks on the Subject Property.

Controlled Recognized Environmental Conditions (CRECs)

In our opinion, this assessment revealed no CRECs in connection with the Subject Property.

Historical Recognized Environmental Conditions (HRECs)

In our opinion, this assessment revealed no HRECs in connection with the Subject Property.

TABLE OF CONTENTS

Page

EXECUTIVE SUMMARY i
Recognized Environmental Conditions (RECs) i
Controlled Recognized Environmental Conditions (CRECs) i
Historical Recognized Environmental Conditions (HRECs) i

1.0 INTRODUCTION 1
1.1 Purpose of Phase I Environmental Site Assessment (ESA) 1
1.2 Scope of Work 2

2.0 SITE DESCRIPTION AND PHYSICAL SETTING 3
2.1 Location and Legal Description 3
2.2 Site and Vicinity Characteristics 3

3.0 GEOLOGIC AND HYDROGEOLOGIC SETTING 3
3.1 Regional and Site Geology 3
3.2 Site Hydrogeology 4

4.0 SITE HISTORY 4
4.1 Subject Property History 5
4.2 Adjacent Property History 6

5.0 INTERVIEW 6

6.0 SITE RECONNAISSANCE 6
6.1 Methodology and Limiting Conditions 6
6.2 General Site Setting 7
6.3 Potable Water Supply and Sewage Disposal System 7
6.4 Site Observations 7
6.4.1 Pits, Ponds, and Lagoons 7
6.4.2 Septic Systems 8
6.4.3 Stained Soil or Pavement 8
6.4.4 Interior Drains and Sumps 8
6.4.5 Stressed Vegetation 8
6.4.6 Aboveground and Underground Storage Tanks (USTs) 8
6.4.7 Odors 8
6.4.8 Pools of Liquid 8
6.4.9 Drums or Hazardous Substances/Petroleum Products Containers 8
6.4.10 Unidentified Substance Containers 8
6.4.11 Electrical or Hydraulic Equipment with Polychlorinated Biphenyls 8
6.4.12 Stormwater and Wastewater Discharges 9
6.5 Adjacent and Surrounding Properties Evaluation 9

TABLE OF CONTENTS (cont.)

Page

7.0 RESULTS OF ENVIRONMENTAL RECORDS REVIEW 9

8.0 DATA GAPS 10

9.0 SUMMARY OF FINDINGS AND CONCLUSIONS 10
9.1 Subject Property 10
9.2 Potential Off-site Sources 10

10.0 LIMITATIONS, UNCERTAINTY, AND RISK 11

12.0 CERTIFICATIONS, SIGNATURES, AND CREDENTIALS 13

13.0 REFERENCES 14

TABLE

1 Summary of Site and Surrounding Properties Historical Uses

FIGURES

1 Vicinity Map
2 Site and Surrounding Properties

APPENDICES

A Site Photographs
B Environmental Data Resources, Inc. (EDR) Report
C Important Information About Your Environmental Site Assessment/Evaluation Report

PHASE I ENVIRONMENTAL SITE ASSESSMENT
MEADOWDALE BEACH PARK
SHORELINE, WASHINGTON

1.0 INTRODUCTION

Shannon & Wilson, Inc. has completed a Phase I Environmental Site Assessment (ESA) for the area surrounding the existing BNSF Railway Company (BNSF) embankment (excluding the embankment) and park facilities at the lower end of Meadowdale Beach Park in Edmonds, Washington (Figure 1) (the "Subject Property"). The work was conducted for Anchor QEA in accordance with our proposal dated November 26, 2014. Authorization to proceed was received from Mr. Peter Hummel via a signed subconsultant agreement in December 2014.

1.1 Purpose of Phase I Environmental Site Assessment (ESA)

The purpose of a Phase I ESA is to identify, to the extent feasible pursuant to the process described in the ASTM International (ASTM) Practice E1527-13 (Phase I ASTM Standard) (ASTM, 2013), *recognized environmental conditions* (RECs), *controlled RECs* (CRECs), and/or *historical recognized conditions* (HRECs) associated with the site.

The term RECs means:

> The presence or likely presence of hazardous substances or petroleum products in, on or at a property: (1) due to a release to the environment, (2) under conditions indicative of a release to the environment, or (3) under conditions that pose a material threat of a future release to the environment.

The term CREC means:

> A REC resulting from a past release of hazardous substances or petroleum products that has been addressed to the satisfaction of the applicable regulatory authority (for example, as evidenced by the issuance of a no further action letter or equivalent, or meeting risk-based criteria established by regulatory authority), with hazardous substances or petroleum products allowed to remain in place subject to the implementation of required controls (for example, property use restrictions, activity and use limitations, institutional controls, or engineering controls).

The term HREC means:

> A past release of any hazardous substances or petroleum products that has occurred in connection with the property and has been addressed to the satisfaction of the applicable regulatory authority or meeting unrestricted use criteria established by a regulatory authority, without subjecting the property to any required controls (for example, property use restrictions, activity and use limitations, institutional controls, or engineering controls).

The terms REC, CREC, and HREC are not intended to include de minimis conditions that generally do not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies. Conditions determined to be de minimis are not RECs, CRECs, or HRECs.

The U.S. Environmental Protection Agency (EPA) has determined that the Phase I ASTM Standard is consistent with and meets the requirements for performing All Appropriate Inquiry (AAI) and may be used to comply with federal AAI regulations at 40 Code of Federal Regulations (CFR) Part 312. Shannon & Wilson, Inc. has not determined whether additional inquiry requirements may exist to potentially qualify for similar landowner liability protection under state law.

1.2 Scope of Work

The scope of work included the following subtasks:

- Review of readily available information pertaining to current uses of the Subject Property and their surroundings.
- Review of readily available information from various sources, including city directories, historical maps, and aerial photographs, pertaining to the historical uses of the Subject Property.
- Review of state and federal databases of known and suspected contaminated sites.
- Visual reconnaissance of the Subject Property and cursory reconnaissance of the immediate site vicinity.
- Review of information related to the physical setting of the site.
- Preparation of this report.

The scope of this project did not include an audit of environmental regulatory compliance issues or permits, wetland delineation, or collection and testing of environmental samples, including those for radon gas, lead-based paint, polychlorinated biphenyls, asbestos, mold, soil, surface water, and/or groundwater.

2.0 SITE DESCRIPTION AND PHYSICAL SETTING

2.1 Location and Legal Description

The Subject Property consists of Snohomish County tax parcel 27040500200200 and a portion of 27040500200100 in Edmonds, Washington (Figure 1) in Section 37, Township 27 North, Range 4 East of the Willamette Meridian. The Subject Property is within Meadowdale Beach Park and consists of parkland on the east and a beach on the west that are separated by BNSF railroad tracks with an approximately 6-foot-wide by 7-foot-high culvert running east-west underneath (Figure 2). The culvert is located at the west end of Lund's Gulch, which is a roughly 1.5-mile-long drainage channel oriented west-northwest from uplands to Puget Sound (Figure 1). The Subject Property is part of the park and is undeveloped apart from the culvert/tunnel, man-made paths/trails leading through the park, a picnic shelter, pedestrian bridge, Sanican enclosure, and ADA parking lot.

2.2 Site and Vicinity Characteristics

The Subject Property is located within Meadowdale Beach Park, an approximately 108-acre park located on Puget Sound. Much of the park is located within an east-west running gulch (Lund's Gulch), such that the north and south sides slope down to a channel that outlets to Puget Sound on the west. Contours on the U.S. Geological Survey (USGS) topographic map – Edmunds east Quadrangle (USGS, 1953) indicate that the ground surface elevation is at or near sea level in the vicinity of site area.

3.0 GEOLOGIC AND HYDROGEOLOGIC SETTING

This section describes the general geologic setting of the site vicinity and discusses the subsurface conditions beneath the subject properties and surrounding area, as they relate to the potential for contamination to migrate through the soils and groundwater. The geologic and hydrogeologic summaries below are based on Shannon & Wilson, Inc.'s research for the geologic loading and sediment assessment report for the site (Shannon & Wilson, Inc., 2015).

3.1 Regional and Site Geology

Geologists generally agree that the Puget Sound area was subjected to six or more major glacial events. Each glaciation deposited new sediment and partially eroded previous sediments. During the intervening periods when glacial ice was not present, normal stream processes, wave action, weathering, and landsliding eroded and reworked some of the glacially derived sediment, further complicating the geologic setting.

During the most recent Vashon Stade of the Fraser Glaciation that covered the central Puget Lowland, approximately 18,000 to 16,000 years before present (Porter and Swanson, 1998), the glacial ice is estimated to have been about 3,000 feet thick in the project area (Thorson, 1989). The weight of the glacial ice resulted in compaction of the glacial and nonglacial soils beneath the ice. The glacial and nonglacial deposits are overlain by younger (Holocene Epoch), relatively loose and soft, post-glacial soils that include peat, beach, colluvial, and fill deposits.

Lund's Gulch incises through glacial and non-glacial soils from uplands of greater than 300 feet elevation to Puget Sound along a west-northwest trend in south Snohomish County (Figure 1, Vicinity Map). Meadowdale Beach Park encompasses the lower half of Lund's Gulch.

Lund's Gulch was carved by glacial meltwater after ice from the most recent (Fraser) glaciation retreated and the land was uncovered (Applied Geotechnology, Inc., 1986). During the time of the ice retreat, the steep slopes along the sides of the meltwater channel became destabilized and slid following retreat of the glacial ice sheet and remain largely stable in their position (Applied Geotechnology Inc., 1986). Several of these glacial meltwater channels and slump block benches can be seen with terrain or Light Detection and Ranging mapping in the central Puget Sound region, as seen in Figure 1 along Norma Beach Road and Picnic Point Road.

The upper mile of Lund's Gulch is deeply incised with several smaller gullies, drainages, and seeps flowing into the Gulch. A tributary from the north joins Lund's Gulch within Meadowdale Beach Park. The lower half-mile of Lund's Gulch is a broader valley bottom, but also with steep side slopes.

3.2 Site Hydrogeology

The west end of the site, from approximately the culvert to the west is located at or near sea level, adjacent to Puget Sound. Groundwater at the site is therefore expected to be within one foot of the surface. The east end of the Subject Property is higher in elevation and groundwater is expected to be correspondingly deeper. The groundwater flow direction is expected to be to the west, toward Puget Sound.

However, sudden rises in the water table following heavy rains can cause temporary and local changes, as well as reversals in flow direction.

4.0 SITE HISTORY

The history of land use for the Subject Property was evaluated to identify past uses that might have adversely affected the environmental conditions of the property, primarily through the use

and release of potentially hazardous materials. The historical information was obtained by reviewing readily available data from public agencies and library resources.

The following site history is based on a compilation of information obtained from the following resources:

- Washington State Archives, Puget Sound Regional Division, Bellevue, Washington.
- Aerial photographs obtained from Environmental Data Resources (EDR) (1941, 1952, 1968, 1975, 1979, 1980, 1990, 2006, 2009, and 2011).
- Snohomish County Assessor's records from the Snohomish County Online Property Information Interactive Map.
- Cole City Directory (1987, 1992, 1995, 1999, 2003, 2008, and 2013)

Sanborn Fire Insurance Maps and Polk City Directories were requested for the site, but were unavailable.

Table 1 provides a summary of the historical uses of the Subject Property and the adjacent properties based on the compilation of information obtained from the above sources.

4.1 Subject Property History

According to information on the Snohomish County website (Snohomish County, 2015), Meadowdale Beach Park was first homesteaded by John Lund in 1878, but eventually was purchased by the Meadowdale Country Club (MCC). Structures at the MCC included a clubhouse, a swimming pool with bath houses, and a fish hatchery. The MCC closed in the late 1960s, partially due to access road failure. Snohomish County Parks acquired the land in 1968. A fire destroyed the already vandalized clubhouse in 1970 and Snohomish County subsequently filled in the swimming pool because of the safety hazard.

In 1979, the park was closed for public access and use until a safe public and emergency vehicle access road was built. The park was reopened in 1988. The park was closed again in 1996 due to excessive storm damage and re-opened the following year.

The culvert/beach access tunnel was originally constructed by BNSF as a culvert for Lund's Gulch Creek. In 1987 an agreement was made to allow for a shared-use of the tunnel as a culvert and beach access tunnel. The culvert was subsequently modified with a boardwalk, and later with a steel grating, to allow for pedestrian access. Erosion and sedimentation processes within the gulch have significantly increased and continue to worsen becoming a barrier to fish as well as causing flooding within the tunnel.

Based on a review of the aerial photographs, it appears that the Subject Property has been undeveloped apart from a road/path heading to, and the railroad tracks running above, the culvert since at least 1941. A cleared area, which may be a parking lot, is visible adjacent to the east of the culvert in the photographs starting in 1952. Beginning in the 1968 photograph, a building is visible on the east side of the cleared area. This building is not visible in the 1990 photograph, and may not be present in the 1980 photograph, which is of poor resolution. This building was likely the clubhouse, which was demolished in 1970. A new Sanican enclosure that appears to be directly adjacent to the east of the culvert is visible starting with the 1990 photograph. Conditions appear mostly unchanged in the 2006 photograph, apart from the presence of a large rectangular structure/feature to the east of the culvert, in the vicinity of the building formerly located in this area. This feature is also present in the 2009 and 2011 photographs.

4.2 Adjacent Property History

Based on our review of the aerial photographs, the on-land properties adjacent to the Subject Property have been mostly undeveloped and/or part of the park since at least 1941. The parcel adjacent to the east of the Subject Property has been occupied by the park ranger's residence, which uses electric baseboard heaters, since about 1988. The area to the west of the Subject Property is part of Puget Sound.

5.0 INTERVIEW

On February 15, 2015, Shannon & Wilson, Inc.'s representative interviewed Park Ranger Doug Dailer by telephone. Ranger Dailer indicated that he has been the Park Ranger since 1992. Ranger Dailer had no knowledge of any hazardous materials use or storage on the Subject Property. He indicated that motor fuel is stored in a maintenance shed in the ranger's residence area on the property adjacent to the east of the Subject Property and that the residence is hooked up to the City of Edmonds water and sewer service. He knew of no past use of hazardous materials, underground storage tanks (USTs), or aboveground storage tanks (ASTs) at the site, but did say that a swimming pool building was formerly located on the Subject Property in the vicinity of the existing picnic shelter and volley ball courts when the property was owned by a country club.

6.0 SITE RECONNAISSANCE

6.1 Methodology and Limiting Conditions

The objective of the site reconnaissance is to obtain information indicating the likelihood of identifying RECs in connection with the property. A Shannon & Wilson, Inc. representative

assessed the site and surrounding area on February 6, 2015, to visually observe the property for evidence of confirmed and potential impacts of hazardous substances or petroleum resulting from historical or current site use. The site visit consisted of observation of the site and the property's periphery. Photographs taken during the site reconnaissance are included in Appendix A.

6.2 General Site Setting

At the time of the reconnaissance, the Subject Property consisted of a park on the east and beach on the west, separated by north-south running railroad tracks. The park area was located in a small ravine and was generally flat with a slight slope towards the west. The surrounding areas to the north and south sloped steeply down to the park. The park area included a maintained grass lawn area with paved paths, a picnic shelter, a sand volleyball court, and a restroom building (Photo A). The areas surrounding this section of the park were wooded. Lund's Gulch drainage ran east-west along the northern end of the park area and discharged through a culvert (Photo B) under the railroad tracks (Photo C) to the beach area. At the time of the reconnaissance, floor of the culvert was covered with running water (Photo D), so it could not be observed, but appeared to consist of metal grating. The beach area on the west side of the railroad tracks consisted of an undeveloped sandy and rock beach with drainage from Lund's Gulch (Photo E).

No hazardous materials use or storage was observed in the Subject Property during this reconnaissance.

6.3 Potable Water Supply and Sewage Disposal System

The Sanican enclosure and a water fountain on the Subject Property are connected to the municipal water supply. According to Ranger Dailer, the bathroom waste system is self-contained and is cleaned out with a vacuum truck on a regular basis. There is no sanitary sewer systems connection to the Subject Property.

6.4 Site Observations

The following sections describe observations made during our site reconnaissance.

6.4.1 Pits, Ponds, and Lagoons

No pits, ponds, or lagoons were observed on the Subject Property.

6.4.2 Septic Systems

No septic systems were observed on the Subject Property.

6.4.3 Stained Soil or Pavement

Stained soil and pavement were not observed on the Subject Property.

6.4.4 Interior Drains and Sumps

No interior drains or sumps were observed in the restroom building.

6.4.5 Stressed Vegetation

No stressed vegetation was observed at the site.

6.4.6 Aboveground and Underground Storage Tanks (USTs)

No evidence of USTs or ASTs was observed on the Subject Property.

6.4.7 Odors

No odors were noted on the site.

6.4.8 Pools of Liquid

No pools of liquid (apart from standing water and water in the Lund's Gulch drainage) were observed on the Subject Property.

6.4.9 Drums or Hazardous Substances/Petroleum Products Containers

No drums or hazardous substances were noted on site.

6.4.10 Unidentified Substance Containers

No unidentified substance containers were observed on the site.

6.4.11 Electrical or Hydraulic Equipment with Polychlorinated Biphenyls

No transformers or other potentially polychlorinated biphenyl-containing equipment were observed on the Subject Property.

6.4.12 Stormwater and Wastewater Discharges

Stormwater runoff from the developed portions of the site would appear to flow toward the west. No wastewater discharges were observed.

6.5 Adjacent and Surrounding Properties Evaluation

Apart from the property adjacent to the east, the adjacent properties were undeveloped park land. The property to the east was part of the park and was occupied by the park ranger's residence (Photos F and G). The ranger's residence consisted of a small house, a shed, and a carport. An AST was observed on this site, but according to Ranger Dailer it is for water storage only. No signs of hazardous materials use or storage were observed on this property.

7.0 RESULTS OF ENVIRONMENTAL RECORDS REVIEW

We subcontracted EDR to conduct a search of the EPA and the Washington Department of Ecology (Ecology) environmental databases that contain information regarding environmental conditions at and near the Subject Property. The EDR report was reviewed for accuracy of site locations and was modified appropriately. The complete EDR report, including figures identifying locations of reportable sites within 1 mile of the Subject Property, is provided on a compact disc and is included in Appendix B.

In addition to the listed sites, EDR compiles a list of historic service stations, repair shops, and dry cleaner sites. Other than the approximate dates of site use, no more information was found. However, releases could have occurred at these sites.

The following three sites within the selected search radii were listed in the local, state, and/or federal databases reviewed:

- Norma Beach Boathouse – located approximately 1,800 feet north of the Subject Property;
- Norma Beach Road – located approximately 1,850 feet north/northeast of the Subject Property; and
- Arbutus Gardens – located approximately 2,440 feet east of the Subject Property.

The Norma Beach Boathouse and Norma Beach Road sites are both located cross-gradient from the Subject Property. Contaminants at these sites are therefore unlikely to migrate onto the Subject Property. Files for these sites were therefore not requested from Ecology for review.

The Arbutus Gardens site is located upgradient of the Subject Property. This site appears only on the "ALLSITES" database, which lists sites of interest to Ecology that do may not appear on other databases. According to the EDR report, this site is listed because it has a construction stormwater permit with no recorded violations. It is therefore unlikely that it would affect the Subject Property, so the file was not requested for review from Ecology.

8.0 DATA GAPS

We have not identified data gaps in the context of our AAI for RECs at the Subject Property.

9.0 SUMMARY OF FINDINGS AND CONCLUSIONS

Based on our site visit and information review, it is the professional opinion of Shannon & Wilson, Inc. that RECs exist for the subject site from an off-site source. Specific findings and conclusions regarding on- and off-site environmental risks are discussed in the following sections.

9.1 Subject Property

The Subject Property has been mostly vacant and undeveloped since the early 1900s. From at least 1941 until the late 1960s when the park was owned by a country club, it was occupied by a pool house that contained an Olympic-sized swimming pool. After the country club closed down, the property was converted to a park, the pool house was demolished, and the pool was filled in due to safety concerns. A picnic shelter, restroom building, and sand volleyball court were subsequently constructed on the site. No RECs associated with these past site uses were identified.

9.2 Potential Off-site Sources

The parcels adjacent to the Subject Property are mostly occupied by undeveloped park land. A portion of property to the east has been occupied by the park ranger's residence since 1988. Small quantities of fuel are stored at the ranger's residence, but there have been no known spills at this site. There are therefore no known RECs associated with the adjacent properties.

BNSF railroad tracks are located within a right-of-way owned by BNSF that runs north-south across the western end of the Subject Property. Photographic evidence indicates that the tracks have been present since at least 1941, but are known to have been built in the late 1800s. Railroad contaminants of concern include polycyclic aromatic hydrocarbons associated with creosote-treated railroad ties or buried track superstructure, petroleum hydrocarbons due to lube oil leaks, and herbicides used to keep vegetation clear of the tracks. In addition, fill materials

used during the construction and maintenance of the railroad tracks may have contained hazardous materials. These railroad tracks therefore are considered a REC. This REC may require the segregation and disposal of material excavated and removed from the site.

10.0 LIMITATIONS, UNCERTAINTY, AND RISK

This Phase I ESA was conducted to render a professional opinion about the likelihood of regulated contaminants being present on, in, or beneath the site at the time services were conducted. No matter how thorough a Phase I ESA study may be, findings derived from its conduct are limited, and Shannon & Wilson, Inc. cannot know or state for an absolute fact that a site is unaffected by reportable quantities of regulated contaminants. Furthermore, even if Shannon & Wilson, Inc. believes that reportable quantities of regulated contaminants are not present, Anchor QEA still bears the risk that such contaminants may be present or may migrate to the site after the study is complete.

Shannon & Wilson, Inc. has reviewed historical records, conducted interviews with the property owner, and conducted an on-site visual inspection of the Subject Property. We have examined and relied on documents referenced in the report and on oral statements made by certain individuals. Shannon & Wilson, Inc. has not conducted an independent examination of the facts contained in referenced materials and statements. We have assumed that these documents are genuine, and that the information provided in these documents and statements is true and accurate. We have no knowledge or indication to the contrary unless otherwise stated in the body of the report.

Data generated from the site reconnaissance reflect that which can be reasonably inferred or is obvious by direct visual observation. Shannon & Wilson, Inc. assumes no responsibility for identifying characteristics of the Subject Property that were not readily identifiable by visual reconnaissance at the time of our site visit.

Shannon & Wilson, Inc. has prepared this report in a professional manner, using that level of skill and care normally exercised for similar projects under similar conditions by reputable and competent environmental consultants currently practicing in the area, and in accordance with the terms and conditions set forth in our contract, and our proposal dated August 9, 2013. Shannon & Wilson, Inc. is not responsible for conditions or consequences arising from relevant facts that were concealed, withheld, or not fully disclosed at the time the report was prepared. We also note that the facts and conditions referenced in this report may change over time, and that the conclusions set forth here are applicable to the facts and conditions as described only at the time of this report. Conclusions were made within the operative constraints of the scope,

budget, and schedule for this project. We believe that the conditions stated here are factual, but no guarantee is made or implied.

This report is for the exclusive use of Anchor QEA and its representatives. Shannon & Wilson, Inc. has prepared Appendix C, "Important Information About Your Environmental Site Assessment/Evaluation Report," to help you and others understand the use and limitations of our reports.

12.0 CERTIFICATIONS, SIGNATURES, AND CREDENTIALS

We declare that, to the best of our professional knowledge and belief, we meet the definition of Environmental Professional as defined in the CFR Title 40, Part 312. We have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the Subject Property.

This ESA was performed by:

Scott W. Gaulke, P.E, L.H.G.
Vice President

Mr. Scott W. Gaulke, a Vice President at Shannon & Wilson, Inc., prepared this Phase I ESA. Mr. Gaulke is a Professional Engineer with over 25 years of experience conducting Phase I ESAs and other environmental assessments.

CMJ:SWG/cmj

13.0 REFERENCES

Applied Geotechnology, Inc., 1986: available: https://fortress.wa.gov/dnr/geology/?Theme=subsurf, Borehole ID 60442, Document ID10996, accessed 11/2014.

ASTM International (ASTM), 2013, Standard practice for environmental site assessments: phase I environmental site assessment process: West Conshohocken, Penn, ASTM International, standard E1527-05, 35 p.

Porter, S.C., and Swanson, T.W., 1998, Radiocarbon age constraints on rates of advance and retreat of the Puget lobe of the Cordilleran Ice Sheet during the last glaciations: Quaternary Research, v. 50, p. 205-213.

Shannon & Wilson, Inc., 2015, Draft letter report to Ms. Kathy Ketteridge, Anchor QEA, LLC, Re: Meadowdale Beach Park Feasibility Study, Geologic Assessment and Sediment Loading, South Snohomish County, Washington, Seattle, Wash., January 23.

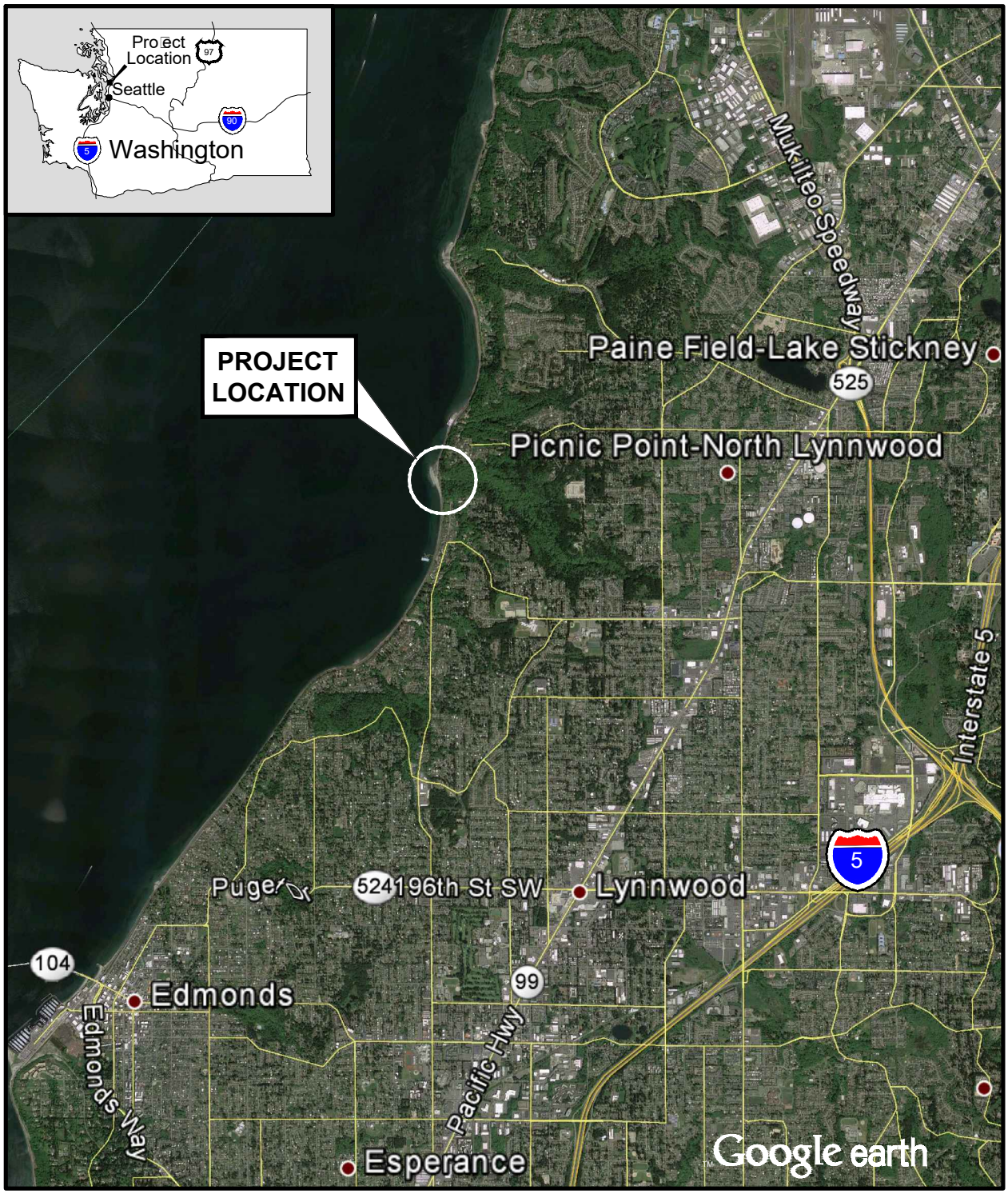
Snohomish County, 2015, Meadowdale Beach Park: available: http://snohomishcountywa.gov/Facilities/Facility/Details/Meadowdale-Beach-Park-56

Thorson, R.M., 1989, Glacio-isostatic response of the Puget Sound area, Washington: Geological Society of American Bulletin, v. 101, no. 9, p. 1,163-1,174.

U.S. Geological Survey (USGS), 1953, revised 1968, Edmonds east quadrangle, Washington 7.5 minute series (topographic): Denver, Colorado, scale 1:24,000.

Table 1
Summary of Site and Surrounding Properties Historical Uses

Parcel Location	Tax Parcel	Site Address	Tax Assessor	Aerial Photo	Recognized Environmental Condition?
Subject Property	27040500200100	15433 75th Place West	Park	1941: Site appears somewhat less forested than surrounding area, otherwise undeveloped except for railroad tracks over culvert 1952: Similar to 1941 with cleared area or building at south side of site. 1968: Same as 1952 with building at south side of site. 1975: Poor quality photo. Site appears to be similar to 1962. 1979: Similar to 1975, building on south side of site is gone. 1980: Similar to 1979. 1990: Site is more forested,current restroom building and picnic shelter appear to be present. 2006: Similar to 1990 with new sand volleyball court. 2009: Similar to as 2006. 2011: Similar to 2009.	Yes - railroad tracks on site.
	27040500200200	Unknown	Beach	1941 - 2011: Beach	
Adjacent West, Northwest, & Southwest	None	None	None	1941 - 2011: Puget Sound	No - These areas are portions of Puget Sound
Adjacent Northeast	00500900002400	Unknown	Undeveloped land	1941 - 2011: Undeveloped	No - Properties appear to be forested/undeveloped with no indication of hazardous materials use or storage.
	00500900002301	Unknown	Undeveloped land	1941 - 2011: Undeveloped	
	00500900001603	Unknown	No information	1941 - 2011: Undeveloped	
	00500900002000	Unknown	Undeveloped land	1941 - 2011: Undeveloped	
	00500900001901	Unknown	Undeveloped land	1941 - 2011: Undeveloped	
Adjacent North	00500900001601	Unknown	Undeveloped land	1941 - 2011: Undeveloped	No - Properties appear to be forested/undeveloped with no indication of hazardous materials use or storage
	00500900001602	Unknown	Undeveloped land	1941 - 2011: Undeveloped	
Adjacent East	27040500200100	15433 75th Place West	Park	1941: Site appears somewhat less forested than surrounding area.	No - No indication of hazardous materials use or storage.
				1952: Similar to 1941.	
				1968: Building located near east end of proiperty. There appears to be a small lake/pond to the east of the building.	
				1975: Poor quality photo. Site appears to be similar to 1962.	
				1979: Building and lake/pond are gone.	
				1980 - 2011 similar to 1979 with new Park Ranger's residence starting in 1990.	
Adjacent South & Southeast	00500900000500	Unknown	Undeveloped land	1941 - 2011: Undeveloped	No - Properties appear to be forested/undeveloped with no indication of hazardous materials use or storage



0 1 2

Approximate Scale in Miles

NOTE

Map adapted from aerial imagery provided by Google Earth Pro, reproduced by permission granted by Google Earth ™ Mapping Service.

Meadowdale Beach Park Feasibility Study
Phase 1 Environmental Site Assessment
Snohomish County, Washington

VICINITY MAP

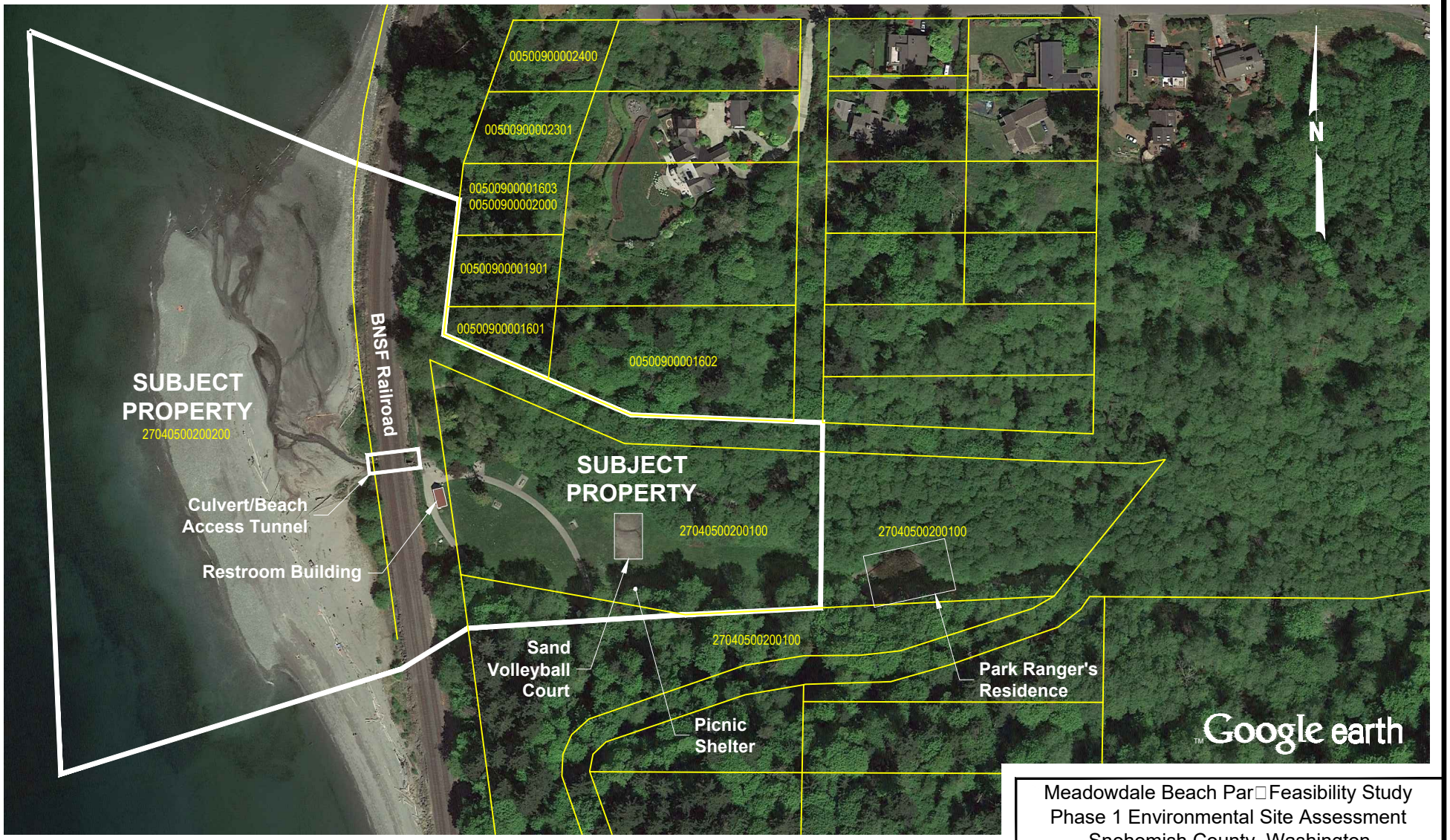
February 2015 21-1-22034-001

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 1

Filename: 211\22034-001\21-1-22034-001 Fig 1.dwg Date: 02-10-2015 Login: sac

Filename: □211□22034-001□21-1-22034-001 Fig 2.dwg Date: 02-17-2015 Login: sac



0 200 400

Approximate Scale in Feet

NOTE

Map adapted from aerial imagery provided by Google Earth Pro, reproduced by permission granted by Google Earth ™ Mapping Service.

Meadowdale Beach Park Feasibility Study
Phase 1 Environmental Site Assessment
Snohomish County, Washington

SITE AND SURROUNDING PROPERTIES

February 2015 21-1-22034-001

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2

FIG. 2

APPENDIX A

SITE PHOTOGRAPHS

Photo A: Park area of subject property with picnic shelter, restroom building, and sand volleyball court.

Photo B: Culvert beneath railroad tracks.

Photo C: Railroad tracks separating east and west portions of subject property.

Photo D: Culvert with water covering floor.

Photo E: Beach area on west side of railroad tracks with drainage from Lund's Gulch.

Photo F: East facing view of ranger's residence.

Photo G: South facing view of ranger's residence with shed and carport.

APPENDIX B

ENVIRONMENTAL DATA RESOURCES, INC. (EDR) REPORT

Meadowdale Park
6026 156th St SW
Edmonds, WA 98026

Inquiry Number: 4168089.2s
December 23, 2014

The EDR Radius Map™ Report with GeoCheck®

EDR® Environmental Data Resources Inc

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

TABLE OF CONTENTS

SECTION	PAGE
Executive Summary	ES1
Overview Map	2
Detail Map	3
Map Findings Summary	4
Map Findings	8
Orphan Summary	11
Government Records Searched/Data Currency Tracking	GR-1

GEOCHECK ADDENDUM

Physical Setting Source Addendum	A-1
Physical Setting Source Summary	A-2
Physical Setting SSURGO Soil Map	A-5
Physical Setting Source Map	A-11
Physical Setting Source Map Findings	A-13
Physical Setting Source Records Searched	PSGR-1

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

Disclaimer - Copyright and Trademark Notice

This Report contains certain information obtained from a variety of public and other sources reasonably available to Environmental Data Resources, Inc. It cannot be concluded from this Report that coverage information for the target and surrounding properties does not exist from other sources. **NO WARRANTY EXPRESSED OR IMPLIED, IS MADE WHATSOEVER IN CONNECTION WITH THIS REPORT. ENVIRONMENTAL DATA RESOURCES, INC. SPECIFICALLY DISCLAIMS THE MAKING OF ANY SUCH WARRANTIES, INCLUDING WITHOUT LIMITATION, MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE. ALL RISK IS ASSUMED BY THE USER. IN NO EVENT SHALL ENVIRONMENTAL DATA RESOURCES, INC. BE LIABLE TO ANYONE, WHETHER ARISING OUT OF ERRORS OR OMISSIONS, NEGLIGENCE, ACCIDENT OR ANY OTHER CAUSE, FOR ANY LOSS OF DAMAGE, INCLUDING, WITHOUT LIMITATION, SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES. ANY LIABILITY ON THE PART OF ENVIRONMENTAL DATA RESOURCES, INC. IS STRICTLY LIMITED TO A REFUND OF THE AMOUNT PAID FOR THIS REPORT.** Purchaser accepts this Report "AS IS". Any analyses, estimates, ratings, environmental risk levels or risk codes provided in this Report are provided for illustrative purposes only, and are not intended to provide, nor should they be interpreted as providing any facts regarding, or prediction or forecast of, any environmental risk for any property. Only a Phase I Environmental Site Assessment performed by an environmental professional can provide information regarding the environmental risk for any property. Additionally, the information provided in this Report is not to be construed as legal advice.

Copyright 2014 by Environmental Data Resources, Inc. All rights reserved. Reproduction in any media or format, in whole or in part, of any report or map of Environmental Data Resources, Inc., or its affiliates, is prohibited without prior written permission.

EDR and its logos (including Sanborn and Sanborn Map) are trademarks of Environmental Data Resources, Inc. or its affiliates. All other trademarks used herein are the property of their respective owners.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

6026 156TH ST SW
SNOHOMISH County, WA 98026

COORDINATES

Latitude (North):	47.8642000 - 47˚ 51' 51.12''
Longitude (West):	122.3328000 - 122˚ 19' 58.08''
Universal Tranverse Mercator:	Zone 10
UTM X (Meters):	549902.1
UTM Y (Meters):	5301203.5
Elevation:	61 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	47122-G3 EDMONDS EAST, WA
Most Recent Revision:	1981
North Map:	47122-H3 MUKILTEO, WA
Most Recent Revision:	1978

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20110826
Source:	USDA

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL---------- National Priority List

EXECUTIVE SUMMARY

Proposed NPL ..... Proposed National Priority List Sites
NPL LIENS ..... Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL ..... National Priority List Deletions

Federal CERCLIS list

CERCLIS ..... Comprehensive Environmental Response, Compensation, and Liability Information System
FEDERAL FACILITY ..... Federal Facility Site Information listing

Federal CERCLIS NFRAP site List

CERC-NFRAP ..... CERCLIS No Further Remedial Action Planned

Federal RCRA CORRACTS facilities list

CORRACTS ..... Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF ..... RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG ..... RCRA - Large Quantity Generators
RCRA-SQG ..... RCRA - Small Quantity Generators
RCRA-CESQG ..... RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

US ENG CONTROLS ..... Engineering Controls Sites List
US INST CONTROL ..... Sites with Institutional Controls
LUCIS ..... Land Use Control Information System

Federal ERNS list

ERNS ..... Emergency Response Notification System

State- and tribal - equivalent NPL

HSL ..... Hazardous Sites List

State- and tribal - equivalent CERCLIS

CSCSL ..... Confirmed and Suspected Contaminated Sites List

State and tribal landfill and/or solid waste disposal site lists

SWF/LF ..... Solid Waste Facility Database

State and tribal leaking storage tank lists

LUST ..... Leaking Underground Storage Tanks Site List

EXECUTIVE SUMMARY

INDIAN LUST ..... Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

AST ..... Aboveground Storage Tank Locations
INDIAN UST ..... Underground Storage Tanks on Indian Land
FEMA UST ..... Underground Storage Tank Listing

State and tribal institutional control / engineering control registries

INST CONTROL ..... Institutional Control Site List

State and tribal voluntary cleanup sites

ICR ..... Independent Cleanup Reports
VCP ..... Voluntary Cleanup Program Sites
INDIAN VCP ..... Voluntary Cleanup Priority Listing

State and tribal Brownfields sites

BROWNFIELDS ..... Brownfields Sites Listing

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS ..... A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

ODI ..... Open Dump Inventory
DEBRIS REGION 9 ..... Torres Martinez Reservation Illegal Dump Site Locations
SWTIRE ..... Solid Waste Tire Facilities
SWRCY ..... Recycling Facility List
INDIAN ODI ..... Report on the Status of Open Dumps on Indian Lands

Local Lists of Hazardous waste / Contaminated Sites

US CDL ..... Clandestine Drug Labs
CSCSL NFA ..... Confirmed & Contaminated Sites - No Further Action
CDL ..... Clandestine Drug Lab Contaminated Site List
HIST CDL ..... List of Sites Contaminated by Clandestine Drug Labs
US HIST CDL ..... National Clandestine Laboratory Register

Local Land Records

LIENS 2 ..... CERCLA Lien Information

Records of Emergency Release Reports

HMIRS ..... Hazardous Materials Information Reporting System
SPILLS ..... Reported Spills
SPILLS 90 ..... SPILLS 90 data from FirstSearch

Other Ascertainable Records

DOT OPS ..... Incident and Accident Data

EXECUTIVE SUMMARY

DOD	Department of Defense Sites
FUDS	Formerly Used Defense Sites
CONSENT	Superfund (CERCLA) Consent Decrees
ROD	Records Of Decision
UMTRA	Uranium Mill Tailings Sites
US MINES	Mines Master Index File
TRIS	Toxic Chemical Release Inventory System
TSCA	Toxic Substances Control Act
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
SSTS	Section 7 Tracking Systems
ICIS	Integrated Compliance Information System
PADS	PCB Activity Database System
MLTS	Material Licensing Tracking System
RADINFO	Radiation Information Database
FINDS	Facility Index System/Facility Registry System
RAATS	RCRA Administrative Action Tracking System
RMP	Risk Management Plans
UIC	Underground Injection Wells Listing
MANIFEST	Hazardous Waste Manifest Data
DRYCLEANERS	Drycleaner List
NPDES	Water Quality Permit System Data
AIRS	Washington Emissions Data System
Inactive Drycleaners	Inactive Drycleaners
INDIAN RESERV	Indian Reservations
SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing
PCB TRANSFORMER	PCB Transformer Registration Database
US FIN ASSUR	Financial Assurance Information
EPA WATCH LIST	EPA WATCH LIST
LEAD SMELTERS	Lead Smelter Sites
US AIRS	Aerometric Information Retrieval System Facility Subsystem
PRP	Potentially Responsible Parties
2020 COR ACTION	2020 Corrective Action Program List
COAL ASH DOE	Steam-Electric Plant Operation Data
COAL ASH	Coal Ash Disposal Site Listing
Financial Assurance	Financial Assurance Information Listing
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP	EDR Proprietary Manufactured Gas Plants
EDR US Hist Auto Stat	EDR Exclusive Historic Gas Stations
EDR US Hist Cleaners	EDR Exclusive Historic Dry Cleaners

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA LF	Recovered Government Archive Solid Waste Facilities List
RGA LUST	Recovered Government Archive Leaking Underground Storage Tank

EXECUTIVE SUMMARY

RGA HWS..... Recovered Government Archive State Hazardous Waste Facilities List

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STANDARD ENVIRONMENTAL RECORDS

State and tribal registered storage tank lists

UST: The Underground Storage Tank database contains registered USTs. USTs are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA). The data come from the Department of Ecology's Statewide UST Site/Tank Report.

A review of the UST list, as provided by EDR, and dated 09/29/2014 has revealed that there is 1 UST site within approximately 0.25 miles of the target property.

Lower Elevation	Address	Direction / Distance	Map ID	Page
NORMA BEACH BOATHOUSE	***14725 NORMA BEACH RD***	***NNE 0 - 1/8 (0.055 mi.)***	***1***	***8***

ADDITIONAL ENVIRONMENTAL RECORDS

Local Lists of Hazardous waste / Contaminated Sites

ALLSITES: Information on facilities and sites of interest to the Department of Ecology.

A review of the ALLSITES list, as provided by EDR, and dated 08/06/2014 has revealed that there are 2 ALLSITES sites within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
NORMA BEACH ROAD	***7200 NORMA BEACH RD***	***ENE 0 - 1/8 (0.102 mi.)***	***2***	***9***

Lower Elevation	Address	Direction / Distance	Map ID	Page
NORMA BEACH BOATHOUSE	***14725 NORMA BEACH RD***	***NNE 0 - 1/8 (0.055 mi.)***	***1***	***8***

Other Ascertainable Records

RCRA NonGen / NLR: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

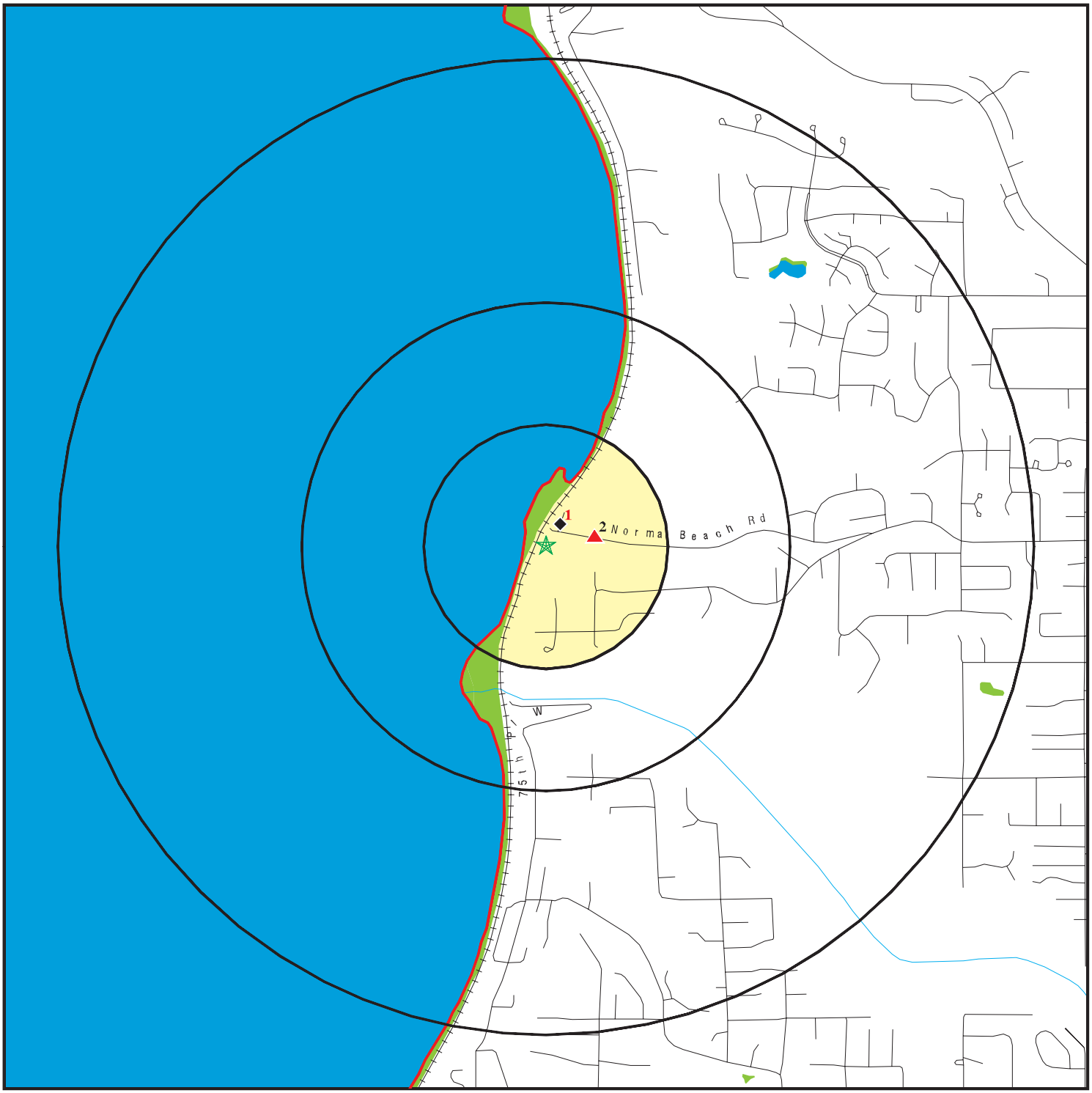
A review of the RCRA NonGen / NLR list, as provided by EDR, and dated 06/10/2014 has revealed that there is 1 RCRA NonGen / NLR site within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
NORMA BEACH ROAD	***7200 NORMA BEACH RD***	***ENE 0 - 1/8 (0.102 mi.)***	***2***	***9***

EXECUTIVE SUMMARY

There were no unmapped sites in this report.

OVERVIEW MAP - 4168089.2S



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- County Boundary
- Oil & Gas pipelines from USGS
- National Wetland Inventory

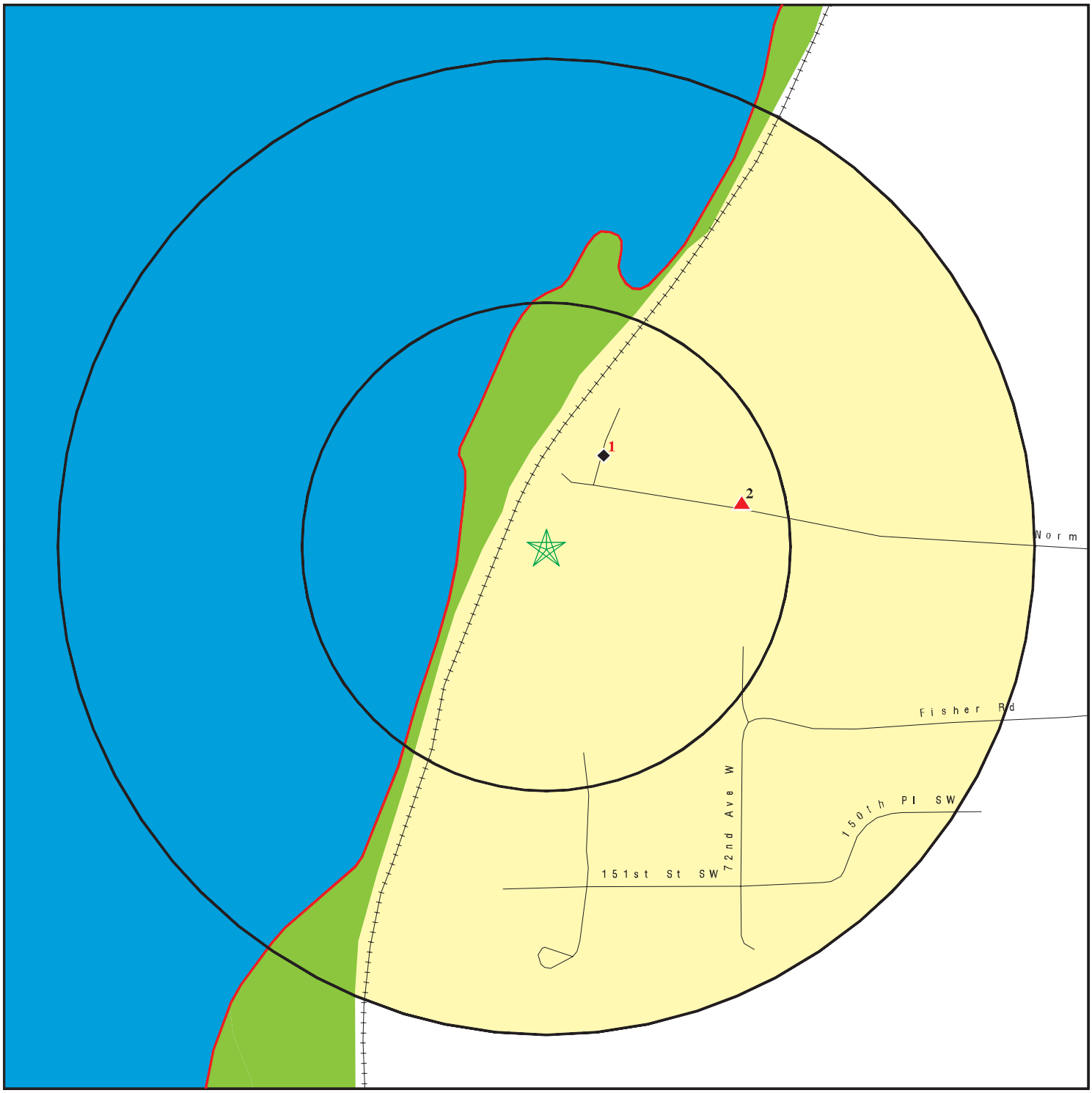
0 1/4 1/2 1 Miles

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Meadowdale Park	CLIENT: Shannon & Wilson, Inc.
ADDRESS: 6026 156th St SW Edmonds WA 98026	CONTACT: Cody Johnson INQUIRY #: 4168089.2s
LAT/LONG: 47.8642 / 122.3328	DATE: December 23, 2014 1:11 pm

Copyright © 2014 EDR, Inc. © 2010 Tele Atlas Rel. 07/2009.

DETAIL MAP - 4168089.2S



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites

0 1/16 1/8 1/4 Miles

- Indian Reservations BIA
- County Boundary
- Oil & Gas pipelines from USGS
- National Wetland Inventory

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Meadowdale Park ADDRESS: 6026 156th St SW Edmonds WA 98026 LAT/LONG: 47.8642 / 122.3328	CLIENT: Shannon & Wilson, Inc. CONTACT: Cody Johnson INQUIRY #: 4168089.2s DATE: December 23, 2014 1:11 pm

Copyright © 2014 EDR, Inc. © 2010 Tele Atlas Rel. 07/2009.

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	TP		NR	NR	NR	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
CERCLIS	0.500		0	0	0	NR	NR	0
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
Federal CERCLIS NFRAP site List								
CERC-NFRAP	0.500		0	0	0	NR	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	0	NR	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-CESQG	0.250		0	0	NR	NR	NR	0
Federal institutional controls / engineering controls registries								
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
LUCIS	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	TP		NR	NR	NR	NR	NR	0
State- and tribal - equivalent NPL								
HSL	1.000		0	0	0	0	NR	0
State- and tribal - equivalent CERCLIS								
CSCSL	1.000		0	0	0	0	NR	0
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF	0.500		0	0	0	NR	NR	0
State and tribal leaking storage tank lists								
LUST	0.500		0	0	0	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
INDIAN LUST	0.500		0	0	0	NR	NR	0
State and tribal registered storage tank lists								
UST	0.250		1	0	NR	NR	NR	1
AST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
FEMA UST	0.250		0	0	NR	NR	NR	0
State and tribal institutional control / engineering control registries								
INST CONTROL	0.500		0	0	0	NR	NR	0
State and tribal voluntary cleanup sites								
ICR	0.500		0	0	0	NR	NR	0
VCP	0.500		0	0	0	NR	NR	0
INDIAN VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
SWTIRE	0.500		0	0	0	NR	NR	0
SWRCY	0.500		0	0	0	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US CDL	TP		NR	NR	NR	NR	NR	0
ALLSITES	0.500		2	0	0	NR	NR	2
CSCSL NFA	0.500		0	0	0	NR	NR	0
CDL	TP		NR	NR	NR	NR	NR	0
HIST CDL	TP		NR	NR	NR	NR	NR	0
US HIST CDL	TP		NR	NR	NR	NR	NR	0
Local Land Records								
LIENS 2	TP		NR	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0
SPILLS	TP		NR	NR	NR	NR	NR	0
SPILLS 90	TP		NR	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		1	0	NR	NR	NR	1

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
DOT OPS	TP		NR	NR	NR	NR	NR	0
DOD	1.000		0	0	0	0	NR	0
FUDS	1.000		0	0	0	0	NR	0
CONSENT	1.000		0	0	0	0	NR	0
ROD	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
FINDS	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
RMP	TP		NR	NR	NR	NR	NR	0
UIC	TP		NR	NR	NR	NR	NR	0
MANIFEST	0.250		0	0	NR	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
NPDES	TP		NR	NR	NR	NR	NR	0
AIRS	TP		NR	NR	NR	NR	NR	0
Inactive Drycleaners	0.250		0	0	NR	NR	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
US AIRS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
COAL ASH	0.500		0	0	0	NR	NR	0
Financial Assurance	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
EDR HIGH RISK HISTORICAL RECORDS								
EDR Exclusive Records								
EDR MGP	1.000		0	0	0	0	NR	0
EDR US Hist Auto Stat	0.250		0	0	NR	NR	NR	0
EDR US Hist Cleaners	0.250		0	0	NR	NR	NR	0
EDR RECOVERED GOVERNMENT ARCHIVES								
Exclusive Recovered Govt. Archives								
RGA LF	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
RGA LUST	TP		NR	NR	NR	NR	NR	0
RGA HWS	TP		NR	NR	NR	NR	NR	0

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

1 NNE < 1/8 0.055 mi. 291 ft. | **NORMA BEACH BOATHOUSE**
14725 NORMA BEACH RD
EDMONDS, WA 98026 | **ALLSITES UST** | **U003028998 N/A**

Relative: Lower

Actual: 30 ft.

ALLSITES:

Facility Id:	59636524
Latitude:	47.863944
Longitude:	-122.32208
Ecology Interest Type Code:	UST
Facility ID:	59636524
Facility Company:	NORMA BEACH BOATHOUSE
Interaction:	I
Interaction 1:	UST
Interaction 2:	Underground Storage Tank
Ecology Program:	TOXICS
Program Data:	UST
Facility Alt.:	Not reported
Program ID:	97272
Date Interaction:	6/8/1998 0:00
Date Interaction 3:	5/3/2000 0:00

UST:

Facility ID:	59636524
Site Id:	97272
UBI:	6010368360010002
Phone Number:	2067430178
Decimal Latitude:	47.863944
Decimal Longitude:	-122.322085
Tank Name:	1
Tag Number:	Not reported
Tank Status:	Removed
Tank Status Date:	08/06/1996
Tank Install Date:	00/31/1964
Tank Closure Date:	Not reported
Capacity Range:	Not reported
Tank Permit Expiration Date:	Not reported
Tank Upgrade Date:	Not reported
Tank Spill Prevention:	Not reported
Tank Overfill Prevention:	Not reported
Tank Material:	Steel
Tank Construction:	Single Wall Tank
Tank Tightness Test:	Not reported
Tank Corrosion Protection:	Sacrificial Anode
Tank Manifold:	Not reported
Tank Release Detection:	Not reported
Tank SFC Type:	Not reported
Pipe Material:	Steel
Pipe Construction:	Not reported
Pipe Primary Release Detection:	Not reported
Pipe Second Release Detection:	Not reported
Pipe Corrosion Protection:	Not reported
Pipe Pumping System:	Not reported
Responsible Unit:	NORTHWEST
Dispencer/Pump SFC Type:	Not reported

2 ENE < 1/8 0.102 mi. 541 ft. | **NORMA BEACH ROAD 7200 NORMA BEACH RD LYNNWOOD, WA 98036** | **RCRA NonGen / NLR FINDS ALLSITES** | **1000199598 WAD980984546**

Relative: Higher

Actual: 79 ft.

RCRA NonGen / NLR:

Date form received by agency:	07/01/1986
Facility name:	NORMA BEACH ROAD
Facility address:	7200 NORMA BEACH RD LYNNWOOD, WA 98036
EPA ID:	WAD980984546
Mailing address:	4350 150TH AVE NE REDMOND, WA 98052-5301
Contact:	WA ECY WA ECY
Contact address:	4350 150TH AVE NE REDMOND, WA 98052-5301
Contact country:	US
Contact telephone:	(000)000-0000
Contact email:	Not reported
EPA Region:	10
Classification:	Non-Generator
Description:	Handler: Non-Generators do not presently generate hazardous waste

Owner/Operator Summary:

Owner/operator name:	WA ECY W
Owner/operator address:	7200 NORMA BCH RD LYNNWOOD, WA 98036
Owner/operator country:	US
Owner/operator telephone:	(000)000-0000
Legal status:	Private
Owner/Operator Type:	Owner
Owner/Op start date:	05/02/1996
Owner/Op end date:	Not reported

Handler Activities Summary:

U.S. importer of hazardous waste:	No
Mixed waste (haz. and radioactive):	No
Recycler of hazardous waste:	No
Transporter of hazardous waste:	No
Treater, storer or disposer of HW:	No
Underground injection activity:	No
On-site burner exemption:	No
Furnace exemption:	No
Used oil fuel burner:	No
Used oil processor:	No
User oil refiner:	No
Used oil fuel marketer to burner:	No
Used oil Specification marketer:	No
Used oil transfer facility:	No
Used oil transporter:	No

Violation Status: No violations found

FINDS:

Registry ID: 110005338599

Environmental Interest/Information System

NORMA BEACH ROAD (Continued) **1000199598**

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

ALLSITES:

Facility Id:	64368186
Latitude:	47.81065
Longitude:	-122.29735
Ecology Interest Type Code:	HWG
Facility ID:	64368186
Facility Company:	Norma Beach Road
Interaction:	I
Interaction 1:	HWG
Interaction 2:	Hazardous Waste Generator
Ecology Program:	HAZWASTE
Program Data:	TURBOWASTE
Facility Alt.:	Not reported
Program ID:	WAD980984546
Date Interaction:	7/1/1986 0:00
Date Interaction 3:	12/31/1991 0:00

Count: 0 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
		NO SITES FOUND			

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 09/29/2014
Date Data Arrived at EDR: 10/08/2014
Date Made Active in Reports: 11/17/2014
Number of Days to Update: 40

Source: EPA
Telephone: N/A
Last EDR Contact: 10/08/2014
Next Scheduled EDR Contact: 01/19/2015
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 6
Telephone: 214-655-6659

EPA Region 3
Telephone 215-814-5418

EPA Region 7
Telephone: 913-551-7247

EPA Region 4
Telephone 404-562-8033

EPA Region 8
Telephone: 303-312-6774

EPA Region 5
Telephone 312-886-6686

EPA Region 9
Telephone: 415-947-4246

EPA Region 10
Telephone 206-553-8665

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 09/29/2014
Date Data Arrived at EDR: 10/08/2014
Date Made Active in Reports: 11/17/2014
Number of Days to Update: 40

Source: EPA
Telephone: N/A
Last EDR Contact: 10/08/2014
Next Scheduled EDR Contact: 01/19/2015
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: No Update Planned

Federal Delisted NPL site list

DELISTED NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 09/29/2014	Source: EPA
Date Data Arrived at EDR: 10/08/2014	Telephone: N/A
Date Made Active in Reports: 11/17/2014	Last EDR Contact: 10/08/2014
Number of Days to Update: 40	Next Scheduled EDR Contact: 01/19/2015
	Data Release Frequency: Quarterly

Federal CERCLIS list

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System

CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 10/25/2013	Source: EPA
Date Data Arrived at EDR: 11/11/2013	Telephone: 703-412-9810
Date Made Active in Reports: 02/13/2014	Last EDR Contact: 11/24/2014
Number of Days to Update: 94	Next Scheduled EDR Contact: 03/09/2015
	Data Release Frequency: Quarterly

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 07/21/2014	Source: Environmental Protection Agency
Date Data Arrived at EDR: 10/07/2014	Telephone: 703-603-8704
Date Made Active in Reports: 10/20/2014	Last EDR Contact: 10/07/2014
Number of Days to Update: 13	Next Scheduled EDR Contact: 01/19/2015
	Data Release Frequency: Varies

Federal CERCLIS NFRAP site List

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned

Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 10/25/2013	Source: EPA
Date Data Arrived at EDR: 11/11/2013	Telephone: 703-412-9810
Date Made Active in Reports: 02/13/2014	Last EDR Contact: 11/24/2014
Number of Days to Update: 94	Next Scheduled EDR Contact: 03/09/2015
	Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 06/10/2014
Date Data Arrived at EDR: 07/02/2014
Date Made Active in Reports: 09/18/2014
Number of Days to Update: 78

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 11/07/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 06/10/2014
Date Data Arrived at EDR: 07/02/2014
Date Made Active in Reports: 09/18/2014
Number of Days to Update: 78

Source: Environmental Protection Agency
Telephone: (206) 553-1200
Last EDR Contact: 11/07/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 06/10/2014
Date Data Arrived at EDR: 07/02/2014
Date Made Active in Reports: 09/18/2014
Number of Days to Update: 78

Source: Environmental Protection Agency
Telephone: (206) 553-1200
Last EDR Contact: 11/07/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 06/10/2014
Date Data Arrived at EDR: 07/02/2014
Date Made Active in Reports: 09/18/2014
Number of Days to Update: 78

Source: Environmental Protection Agency
Telephone: (206) 553-1200
Last EDR Contact: 11/07/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 06/10/2014
Date Data Arrived at EDR: 07/02/2014
Date Made Active in Reports: 09/18/2014
Number of Days to Update: 78

Source: Environmental Protection Agency
Telephone: (206) 553-1200
Last EDR Contact: 11/07/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Varies

Federal institutional controls / engineering controls registries

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 09/18/2014
Date Data Arrived at EDR: 09/19/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 31

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 12/03/2014
Next Scheduled EDR Contact: 03/16/2015
Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 09/18/2014
Date Data Arrived at EDR: 09/19/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 31

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 12/03/2014
Next Scheduled EDR Contact: 03/16/2015
Data Release Frequency: Varies

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 08/29/2014
Date Data Arrived at EDR: 10/09/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 11

Source: Department of the Navy
Telephone: 843-820-7326
Last EDR Contact: 11/17/2014
Next Scheduled EDR Contact: 03/02/2015
Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 09/29/2014
Date Data Arrived at EDR: 09/30/2014
Date Made Active in Reports: 11/06/2014
Number of Days to Update: 37

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 09/30/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Annually

State- and tribal - equivalent NPL

HSL: Hazardous Sites List

The Hazardous Sites List is a subset of the CSCSL Report. It includes sites which have been assessed and ranked using the Washington Ranking Method (WARM).

Date of Government Version: 08/27/2014
Date Data Arrived at EDR: 09/16/2014
Date Made Active in Reports: 10/13/2014
Number of Days to Update: 27

Source: Department of Ecology
Telephone: 360-407-7200
Last EDR Contact: 12/09/2014
Next Scheduled EDR Contact: 03/23/2015
Data Release Frequency: Semi-Annually

State- and tribal - equivalent CERCLIS

CSCSL: Confirmed and Suspected Contaminated Sites List

State Hazardous Waste Sites. State hazardous waste site records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.

Date of Government Version: 10/21/2014
Date Data Arrived at EDR: 10/23/2014
Date Made Active in Reports: 10/27/2014
Number of Days to Update: 4

Source: Department of Ecology
Telephone: 360-407-7200
Last EDR Contact: 10/23/2014
Next Scheduled EDR Contact: 02/02/2015
Data Release Frequency: Semi-Annually

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: Solid Waste Facility Database

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 12/01/2014
Date Data Arrived at EDR: 12/12/2014
Date Made Active in Reports: 12/22/2014
Number of Days to Update: 10

Source: Department of Ecology
Telephone: 360-407-6132
Last EDR Contact: 12/08/2014
Next Scheduled EDR Contact: 03/23/2015
Data Release Frequency: Annually

State and tribal leaking storage tank lists

LUST: Leaking Underground Storage Tanks Site List

Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 08/18/2014
Date Data Arrived at EDR: 08/22/2014
Date Made Active in Reports: 08/29/2014
Number of Days to Update: 7

Source: Department of Ecology
Telephone: 360-407-7183
Last EDR Contact: 11/20/2014
Next Scheduled EDR Contact: 03/02/2015
Data Release Frequency: Quarterly

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land

A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 02/01/2013
Date Data Arrived at EDR: 05/01/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 184

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 10/31/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Varies

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 03/01/2013
Date Data Arrived at EDR: 03/01/2013
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 42

Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Quarterly

INDIAN LUST R5: Leaking Underground Storage Tanks on Indian Land

Leaking underground storage tanks located on Indian Land in Michigan, Minnesota and Wisconsin.

Date of Government Version: 11/03/2014
Date Data Arrived at EDR: 11/05/2014
Date Made Active in Reports: 11/17/2014
Number of Days to Update: 12

Source: EPA, Region 5
Telephone: 312-886-7439
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Varies

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 05/20/2014
Date Data Arrived at EDR: 06/10/2014
Date Made Active in Reports: 08/22/2014
Number of Days to Update: 73

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Quarterly

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 11/04/2014
Date Data Arrived at EDR: 11/07/2014
Date Made Active in Reports: 11/17/2014
Number of Days to Update: 10

Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Quarterly

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 05/22/2014
Date Data Arrived at EDR: 08/22/2014
Date Made Active in Reports: 09/18/2014
Number of Days to Update: 27

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Varies

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 10/06/2014
Date Data Arrived at EDR: 10/29/2014
Date Made Active in Reports: 11/17/2014
Number of Days to Update: 19

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 07/30/2014
Date Data Arrived at EDR: 08/12/2014
Date Made Active in Reports: 08/22/2014
Number of Days to Update: 10

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Semi-Annually

State and tribal registered storage tank lists

UST: Underground Storage Tank Database
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 09/29/2014
Date Data Arrived at EDR: 09/30/2014
Date Made Active in Reports: 10/13/2014
Number of Days to Update: 13

Source: Department of Ecology
Telephone: 360-407-7183
Last EDR Contact: 11/14/2014
Next Scheduled EDR Contact: 03/02/2015
Data Release Frequency: Quarterly

AST: Aboveground Storage Tank Locations
A listing of aboveground storage tank locations regulated by the Department of Ecology's Spill Prevention, Preparedness and Response Program.

Date of Government Version: 04/01/2014
Date Data Arrived at EDR: 05/06/2014
Date Made Active in Reports: 06/04/2014
Number of Days to Update: 29

Source: Department of Ecology
Telephone: 360-407-7562
Last EDR Contact: 11/03/2014
Next Scheduled EDR Contact: 02/16/2015
Data Release Frequency: Varies

INDIAN UST R9: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 08/14/2014
Date Data Arrived at EDR: 08/15/2014
Date Made Active in Reports: 08/22/2014
Number of Days to Update: 7

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Quarterly

INDIAN UST R8: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 11/04/2014
Date Data Arrived at EDR: 11/07/2014
Date Made Active in Reports: 11/17/2014
Number of Days to Update: 10

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Quarterly

INDIAN UST R7: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 08/20/2014
Date Data Arrived at EDR: 08/22/2014
Date Made Active in Reports: 09/18/2014
Number of Days to Update: 27

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 10/06/2014
Date Data Arrived at EDR: 10/29/2014
Date Made Active in Reports: 11/06/2014
Number of Days to Update: 8

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Semi-Annually

INDIAN UST R5: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 11/03/2014
Date Data Arrived at EDR: 11/05/2014
Date Made Active in Reports: 11/17/2014
Number of Days to Update: 12

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Varies

INDIAN UST R4: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 07/30/2014
Date Data Arrived at EDR: 08/12/2014
Date Made Active in Reports: 08/22/2014
Number of Days to Update: 10

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Semi-Annually

INDIAN UST R1: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 02/01/2013
Date Data Arrived at EDR: 05/01/2013
Date Made Active in Reports: 01/27/2014
Number of Days to Update: 271

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 10/31/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Varies

INDIAN UST R10: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 05/20/2014
Date Data Arrived at EDR: 06/10/2014
Date Made Active in Reports: 08/15/2014
Number of Days to Update: 66

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Quarterly

FEMA UST: Underground Storage Tank Listing
A listing of all FEMA owned underground storage tanks.

Date of Government Version: 01/01/2010
Date Data Arrived at EDR: 02/16/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 55

Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 10/10/2014
Next Scheduled EDR Contact: 01/26/2015
Data Release Frequency: Varies

State and tribal institutional control / engineering control registries

INST CONTROL: Institutional Control Site List
Sites that have institutional controls.

Date of Government Version: 10/21/2014
Date Data Arrived at EDR: 10/23/2014
Date Made Active in Reports: 10/27/2014
Number of Days to Update: 4

Source: Department of Ecology
Telephone: 360-407-7170
Last EDR Contact: 10/23/2014
Next Scheduled EDR Contact: 02/02/2015
Data Release Frequency: Varies

State and tribal voluntary cleanup sites

INDIAN VCP R1: Voluntary Cleanup Priority Listing
A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 09/29/2014
Date Data Arrived at EDR: 10/01/2014
Date Made Active in Reports: 11/06/2014
Number of Days to Update: 36

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 10/01/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Varies

ICR: Independent Cleanup Reports
These are remedial action reports Ecology has received from either the owner or operator of the sites. These actions have been conducted without department oversight or approval and are not under an order or decree. This database is no longer updated by the Department of Ecology.

Date of Government Version: 12/01/2002
Date Data Arrived at EDR: 01/03/2003
Date Made Active in Reports: 01/22/2003
Number of Days to Update: 19

Source: Department of Ecology
Telephone: 360-407-7200
Last EDR Contact: 08/10/2009
Next Scheduled EDR Contact: 11/09/2009
Data Release Frequency: No Update Planned

VCP: Voluntary Cleanup Program Sites
Sites that have entered either the Voluntary Cleanup Program or its predecessor Independent Remedial Action Program.

Date of Government Version: 10/21/2014
Date Data Arrived at EDR: 10/23/2014
Date Made Active in Reports: 10/27/2014
Number of Days to Update: 4

Source: Department of Ecology
Telephone: 360-407-7200
Last EDR Contact: 10/23/2014
Next Scheduled EDR Contact: 02/02/2015
Data Release Frequency: Varies

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng
A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

State and tribal Brownfields sites

BROWNFIELDS: Brownfields Sites Listing
A listing of brownfields sites included in the Confirmed & Suspected Sites Listing. Brownfields are abandoned, idle or underused commercial or industrial properties, where the expansion or redevelopment is hindered by real or perceived contamination. Brownfields vary in size, location, age, and past use -- they can be anything from a five-hundred acre automobile assembly plant to a small, abandoned corner gas station.

Date of Government Version: 10/21/2014
Date Data Arrived at EDR: 10/23/2014
Date Made Active in Reports: 10/27/2014
Number of Days to Update: 4

Source: Department of Ecology
Telephone: 360-725-4030
Last EDR Contact: 10/23/2014
Next Scheduled EDR Contact: 02/02/2015
Data Release Frequency: Varies

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites
Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 09/22/2014
Date Data Arrived at EDR: 09/23/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 27

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 12/22/2014
Next Scheduled EDR Contact: 04/06/2015
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

ODI: Open Dump Inventory
An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39
Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations
A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137
Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 10/24/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: No Update Planned

SWRCY: Recycling Facility List
A llisting of recycling center locations.

Date of Government Version: 07/14/2014
Date Data Arrived at EDR: 07/31/2014
Date Made Active in Reports: 08/29/2014
Number of Days to Update: 29
Source: Department of Ecology
Telephone: 360-407-6105
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Varies

SWTIRE: Solid Waste Tire Facilities
This study identified sites statewide with unauthorized accumulations of scrap tires.

Date of Government Version: 11/01/2005
Date Data Arrived at EDR: 03/16/2006
Date Made Active in Reports: 04/13/2006
Number of Days to Update: 28
Source: Department of Ecology
Telephone: N/A
Last EDR Contact: 12/08/2014
Next Scheduled EDR Contact: 03/23/2015
Data Release Frequency: Varies

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands
Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52
Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 10/29/2014
Next Scheduled EDR Contact: 02/16/2015
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

US CDL: Clandestine Drug Labs
A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 07/25/2014
Date Data Arrived at EDR: 09/09/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 41

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 11/25/2014
Next Scheduled EDR Contact: 03/16/2015
Data Release Frequency: Quarterly

ALLSITES: Facility/Site Identification System Listing
Information on facilities and sites of interest to the Department of Ecology.

Date of Government Version: 08/06/2014
Date Data Arrived at EDR: 08/07/2014
Date Made Active in Reports: 08/27/2014
Number of Days to Update: 20

Source: Department of Ecology
Telephone: 360-407-6423
Last EDR Contact: 11/03/2014
Next Scheduled EDR Contact: 02/16/2015
Data Release Frequency: Quarterly

CSCSL NFA: Confirmed and Contaminated Sites - No Further Action
This report contains information about sites that are undergoing cleanup and sites that are awaiting further investigation and/or cleanup. Sites on the Hazardous Sites List (see above) are included in this data set.

Date of Government Version: 10/21/2014
Date Data Arrived at EDR: 10/23/2014
Date Made Active in Reports: 10/27/2014
Number of Days to Update: 4

Source: Department of Ecology
Telephone: 360-407-7170
Last EDR Contact: 10/21/2014
Next Scheduled EDR Contact: 02/02/2015
Data Release Frequency: Semi-Annually

CDL: Clandestine Drug Lab Contaminated Site List
Illegal methamphetamine labs use hazardous chemicals that create public health hazards. Chemicals and residues can cause burns, respiratory and neurological damage, and death. Biological hazards associated with intravenous needles, feces, and blood also pose health risks.

Date of Government Version: 11/09/2014
Date Data Arrived at EDR: 11/24/2014
Date Made Active in Reports: 12/22/2014
Number of Days to Update: 28

Source: Department of Health
Telephone: 360-236-3380
Last EDR Contact: 11/10/2014
Next Scheduled EDR Contact: 02/23/2015
Data Release Frequency: Varies

HIST CDL: List of Sites Contaminated by Clandestine Drug Labs
This listing of contaminated sites by Clandestine Drug Labs includes non-remediated properties. The current CDL listing does not. This listing is no longer updated by the state agency.

Date of Government Version: 02/08/2007
Date Data Arrived at EDR: 06/26/2007
Date Made Active in Reports: 07/19/2007
Number of Days to Update: 23

Source: Department of Health
Telephone: 360-236-3381
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

US HIST CDL: National Clandestine Laboratory Register
A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 07/25/2014
Date Data Arrived at EDR: 09/09/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 41

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 11/25/2014
Next Scheduled EDR Contact: 03/16/2015
Data Release Frequency: No Update Planned

Local Land Records

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 02/18/2014
Date Data Arrived at EDR: 03/18/2014
Date Made Active in Reports: 04/24/2014
Number of Days to Update: 37

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Varies

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System

Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 09/30/2014
Date Data Arrived at EDR: 10/01/2014
Date Made Active in Reports: 11/06/2014
Number of Days to Update: 36

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 10/01/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Annually

SPILLS: Reported Spills

Spills reported to the Spill Prevention, Preparedness and Response Division.

Date of Government Version: 09/15/2014
Date Data Arrived at EDR: 09/18/2014
Date Made Active in Reports: 10/13/2014
Number of Days to Update: 25

Source: Department of Ecology
Telephone: 360-407-6950
Last EDR Contact: 12/08/2014
Next Scheduled EDR Contact: 03/23/2015
Data Release Frequency: Semi-Annually

SPILLS 90: SPILLS90 data from FirstSearch

Spills 90 includes those spill and release records available exclusively from FirstSearch databases. Typically, they may include chemical, oil and/or hazardous substance spills recorded after 1990. Duplicate records that are already included in EDR incident and release records are not included in Spills 90.

Date of Government Version: 05/23/2006
Date Data Arrived at EDR: 01/03/2013
Date Made Active in Reports: 03/06/2013
Number of Days to Update: 62

Source: FirstSearch
Telephone: N/A
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

Other Ascertainable Records

RCRA NonGen / NLR: RCRA - Non Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 06/10/2014
Date Data Arrived at EDR: 07/02/2014
Date Made Active in Reports: 09/18/2014
Number of Days to Update: 78

Source: Environmental Protection Agency
Telephone: (206) 553-1200
Last EDR Contact: 11/07/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Varies

DOT OPS: Incident and Accident Data

Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 07/31/2012
Date Data Arrived at EDR: 08/07/2012
Date Made Active in Reports: 09/18/2012
Number of Days to Update: 42

Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 11/04/2014
Next Scheduled EDR Contact: 02/16/2015
Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 11/10/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 62

Source: USGS
Telephone: 888-275-8747
Last EDR Contact: 11/07/2014
Next Scheduled EDR Contact: 01/26/2015
Data Release Frequency: Semi-Annually

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 06/06/2014
Date Data Arrived at EDR: 09/10/2014
Date Made Active in Reports: 09/18/2014
Number of Days to Update: 8

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 12/12/2014
Next Scheduled EDR Contact: 03/23/2015
Data Release Frequency: Varies

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 01/24/2014
Date Made Active in Reports: 02/24/2014
Number of Days to Update: 31

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 09/30/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Varies

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 11/25/2013
Date Data Arrived at EDR: 12/12/2013
Date Made Active in Reports: 02/24/2014
Number of Days to Update: 74

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 12/12/2014
Next Scheduled EDR Contact: 03/23/2015
Data Release Frequency: Annually

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 09/14/2010
Date Data Arrived at EDR: 10/07/2011
Date Made Active in Reports: 03/01/2012
Number of Days to Update: 146

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 11/26/2014
Next Scheduled EDR Contact: 03/09/2015
Data Release Frequency: Varies

US MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 08/05/2014
Date Data Arrived at EDR: 09/04/2014
Date Made Active in Reports: 11/17/2014
Number of Days to Update: 74

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 12/03/2014
Next Scheduled EDR Contact: 03/16/2015
Data Release Frequency: Semi-Annually

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 07/31/2013
Date Made Active in Reports: 09/13/2013
Number of Days to Update: 44

Source: EPA
Telephone: 202-566-0250
Last EDR Contact: 11/26/2014
Next Scheduled EDR Contact: 03/09/2015
Data Release Frequency: Annually

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2006
Date Data Arrived at EDR: 09/29/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 64

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 12/22/2014
Next Scheduled EDR Contact: 04/06/2015
Data Release Frequency: Every 4 Years

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
Last EDR Contact: 11/19/2014
Next Scheduled EDR Contact: 03/09/2015
Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 11/19/2014
Next Scheduled EDR Contact: 03/09/2015
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing

A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing

A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 12/10/2010
Date Made Active in Reports: 02/25/2011
Number of Days to Update: 77

Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 07/31/2014
Date Data Arrived at EDR: 10/29/2014
Date Made Active in Reports: 11/06/2014
Number of Days to Update: 8

Source: Environmental Protection Agency
Telephone: 202-564-5088
Last EDR Contact: 10/10/2014
Next Scheduled EDR Contact: 01/26/2015
Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 07/01/2014
Date Data Arrived at EDR: 10/15/2014
Date Made Active in Reports: 11/17/2014
Number of Days to Update: 33

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 10/15/2014
Next Scheduled EDR Contact: 01/26/2015
Data Release Frequency: Annually

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 07/22/2013
Date Data Arrived at EDR: 08/02/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 91

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 12/04/2014
Next Scheduled EDR Contact: 03/23/2015
Data Release Frequency: Quarterly

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 10/07/2014
Date Data Arrived at EDR: 10/08/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 12

Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 10/08/2014
Next Scheduled EDR Contact: 01/19/2015
Data Release Frequency: Quarterly

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 08/16/2014
Date Data Arrived at EDR: 09/10/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 40

Source: EPA
Telephone: (206) 553-1200
Last EDR Contact: 12/09/2014
Next Scheduled EDR Contact: 03/23/2015
Data Release Frequency: Quarterly

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

RMP: Risk Management Plans

When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 08/01/2014
Date Data Arrived at EDR: 08/12/2014
Date Made Active in Reports: 11/06/2014
Number of Days to Update: 86

Source: Environmental Protection Agency
Telephone: 202-564-8600
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Varies

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 02/26/2013
Date Made Active in Reports: 04/19/2013
Number of Days to Update: 52

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 11/26/2014
Next Scheduled EDR Contact: 03/09/2015
Data Release Frequency: Biennially

UIC: Underground Injection Wells Listing
A listing of underground injection wells.

Date of Government Version: 08/18/2014
Date Data Arrived at EDR: 08/20/2014
Date Made Active in Reports: 09/08/2014
Number of Days to Update: 19

Source: Department of Ecology
Telephone: 360-407-6143
Last EDR Contact: 11/21/2014
Next Scheduled EDR Contact: 03/02/2015
Data Release Frequency: Varies

WA MANIFEST: Hazardous Waste Manifest Data
Hazardous waste manifest information.

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 05/23/2014
Date Made Active in Reports: 06/04/2014
Number of Days to Update: 12

Source: Department of Ecology
Telephone: N/A
Last EDR Contact: 10/17/2014
Next Scheduled EDR Contact: 02/02/2015
Data Release Frequency: Annually

DRYCLEANERS: Drycleaner List
A listing of registered drycleaners who registered with the Department of Ecology (using the SIC code of 7215 and 7216) as hazardous waste generators.

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 05/23/2014
Date Made Active in Reports: 06/04/2014
Number of Days to Update: 12

Source: Department of Ecology
Telephone: 360-407-6732
Last EDR Contact: 10/17/2014
Next Scheduled EDR Contact: 02/02/2015
Data Release Frequency: Varies

NPDES: Water Quality Permit System Data
A listing of permitted wastewater facilities.

Date of Government Version: 10/21/2014
Date Data Arrived at EDR: 10/23/2014
Date Made Active in Reports: 10/28/2014
Number of Days to Update: 5

Source: Department of Ecology
Telephone: 360-407-6073
Last EDR Contact: 10/23/2014
Next Scheduled EDR Contact: 02/02/2015
Data Release Frequency: Quarterly

AIRS (EMI): Washington Emissions Data System
Emissions inventory data.

Date of Government Version: 12/31/2012
Date Data Arrived at EDR: 03/28/2014
Date Made Active in Reports: 04/22/2014
Number of Days to Update: 25

Source: Department of Ecology
Telephone: 360-407-6040
Last EDR Contact: 12/19/2014
Next Scheduled EDR Contact: 04/06/2015
Data Release Frequency: Annually

INACTIVE DRYCLEANERS: Inactive Drycleaners
A listing of inactive drycleaner facility locations.

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 05/23/2014
Date Made Active in Reports: 06/04/2014
Number of Days to Update: 12

Source: Department of Ecology
Telephone: 360-407-6732
Last EDR Contact: 10/17/2014
Next Scheduled EDR Contact: 02/02/2015
Data Release Frequency: Annually

INDIAN RESERV: Indian Reservations
This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 12/08/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 34

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 11/07/2014
Next Scheduled EDR Contact: 01/26/2015
Data Release Frequency: Semi-Annually

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing

The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 03/07/2011
Date Data Arrived at EDR: 03/09/2011
Date Made Active in Reports: 05/02/2011
Number of Days to Update: 54

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 11/18/2014
Next Scheduled EDR Contact: 02/02/2015
Data Release Frequency: Varies

FEDLAND: Federal and Indian Lands

Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 02/06/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 339

Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 11/07/2014
Next Scheduled EDR Contact: 01/26/2015
Data Release Frequency: N/A

PCB TRANSFORMER: PCB Transformer Registration Database

The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 02/01/2011
Date Data Arrived at EDR: 10/19/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 83

Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 10/31/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Varies

LEAD SMELTER 2: Lead Smelter Sites

A list of several hundred sites in the U.S. where secondary lead smelting was done from 1931and 1964. These sites may pose a threat to public health through ingestion or inhalation of contaminated soil or dust

Date of Government Version: 04/05/2001
Date Data Arrived at EDR: 10/27/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 36

Source: American Journal of Public Health
Telephone: 703-305-6451
Last EDR Contact: 12/02/2009
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

LEAD SMELTER 1: Lead Smelter Sites

A listing of former lead smelter site locations.

Date of Government Version: 06/04/2014
Date Data Arrived at EDR: 06/12/2014
Date Made Active in Reports: 07/28/2014
Number of Days to Update: 46

Source: Environmental Protection Agency
Telephone: 703-603-8787
Last EDR Contact: 10/06/2014
Next Scheduled EDR Contact: 01/19/2015
Data Release Frequency: Varies

Financial Assurance 1: Financial Assurance Information Listing

A listing of financial assurance information for underground storage tank facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

Date of Government Version: 02/24/2012
Date Data Arrived at EDR: 02/24/2012
Date Made Active in Reports: 03/27/2012
Number of Days to Update: 32

Source: Department of Ecology
Telephone: 360-586-1060
Last EDR Contact: 11/17/2014
Next Scheduled EDR Contact: 03/02/2015
Data Release Frequency: Varies

2020 COR ACTION: 2020 Corrective Action Program List

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 11/11/2011
Date Data Arrived at EDR: 05/18/2012
Date Made Active in Reports: 05/25/2012
Number of Days to Update: 7

Source: Environmental Protection Agency
Telephone: 703-308-4044
Last EDR Contact: 11/14/2014
Next Scheduled EDR Contact: 02/23/2015
Data Release Frequency: Varies

PRP: Potentially Responsible Parties

A listing of verified Potentially Responsible Parties

Date of Government Version: 10/25/2013
Date Data Arrived at EDR: 10/17/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 3

Source: EPA
Telephone: 202-564-6023
Last EDR Contact: 09/30/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Quarterly

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)

The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

Date of Government Version: 10/16/2014
Date Data Arrived at EDR: 10/31/2014
Date Made Active in Reports: 11/17/2014
Number of Days to Update: 17

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/29/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Annually

US AIRS MINOR: Air Facility System Data

A listing of minor source facilities.

Date of Government Version: 10/16/2014
Date Data Arrived at EDR: 10/31/2014
Date Made Active in Reports: 11/17/2014
Number of Days to Update: 17

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/29/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Annually

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List

A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 07/01/2014
Date Data Arrived at EDR: 09/10/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 12/12/2014
Next Scheduled EDR Contact: 03/23/2015
Data Release Frequency: Varies

COAL ASH: Coal Ash Disposal Site Listing

A listing of coal ash disposal site locations.

Date of Government Version: 09/10/2014
Date Data Arrived at EDR: 09/11/2014
Date Made Active in Reports: 10/15/2014
Number of Days to Update: 34

Source: Department of Ecology
Telephone: 360-407-6933
Last EDR Contact: 12/08/2014
Next Scheduled EDR Contact: 03/23/2015
Data Release Frequency: Varies

COAL ASH DOE: Sleam-Electric Plan Operation Data
A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 76

Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 10/17/2014
Next Scheduled EDR Contact: 01/26/2015
Data Release Frequency: Varies

Financial Assurance 3: Financial Assurance Information Listing
A listing of financial assurance information for solid waste facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

Date of Government Version: 02/01/2001
Date Data Arrived at EDR: 03/06/2007
Date Made Active in Reports: 04/19/2007
Number of Days to Update: 44

Source: Department of Ecology
Telephone: 360-407-6136
Last EDR Contact: 11/18/2014
Next Scheduled EDR Contact: 03/02/2015
Data Release Frequency: Varies

US FIN ASSUR: Financial Assurance Information
All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 09/04/2014
Date Data Arrived at EDR: 09/04/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 46

Source: Environmental Protection Agency
Telephone: 202-566-1917
Last EDR Contact: 11/11/2014
Next Scheduled EDR Contact: 03/02/2015
Data Release Frequency: Quarterly

Financial Assurance 2: Financial Assurance Information Listing
A listing of financial assurance information for hazardous waste facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

Date of Government Version: 05/23/2011
Date Data Arrived at EDR: 05/26/2011
Date Made Active in Reports: 06/27/2011
Number of Days to Update: 32

Source: Department of Ecology
Telephone: 360-407-6754
Last EDR Contact: 11/17/2014
Next Scheduled EDR Contact: 03/02/2015
Data Release Frequency: Varies

EPA WATCH LIST: EPA WATCH LIST
EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 08/30/2013
Date Data Arrived at EDR: 03/21/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 88

Source: Environmental Protection Agency
Telephone: 617-520-3000
Last EDR Contact: 11/14/2014
Next Scheduled EDR Contact: 02/23/2015
Data Release Frequency: Quarterly

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP: EDR Proprietary Manufactured Gas Plants

The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

EDR US Hist Auto Stat: EDR Exclusive Historic Gas Stations

EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR US Hist Cleaners: EDR Exclusive Historic Dry Cleaners

EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS: Recovered Government Archive State Hazardous Waste Facilities List

The EDR Recovered Government Archive State Hazardous Waste database provides a list of SHWS incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Ecology in Washington.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 12/24/2013
Number of Days to Update: 176

Source: Department of Ecology
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

RGA LUST: Recovered Government Archive Leaking Underground Storage Tank
The EDR Recovered Government Archive Leaking Underground Storage Tank database provides a list of LUST incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Ecology in Washington.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 12/24/2013
Number of Days to Update: 176

Source: Department of Ecology
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

RGA LF: Recovered Government Archive Solid Waste Facilities List
The EDR Recovered Government Archive Landfill database provides a list of landfills derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Ecology in Washington.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 01/10/2014
Number of Days to Update: 193

Source: Department of Ecology
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

COUNTY RECORDS

KING COUNTY:

Abandoned Landfill Study in King County
The King County Abandoned Landfill Survey was conducted from October through December 1984 by the Health Department's Environmental Health Division at the request of the King County Council. The primary objective of the survey was to determine if any public health problems existed at the predetermined 24 sites.

Date of Government Version: 04/30/1985
Date Data Arrived at EDR: 11/07/1994
Date Made Active in Reports: N/A
Number of Days to Update: 0

Source: Seattle-King County Department of Public Health
Telephone: 206-296-4785
Last EDR Contact: 10/21/1994
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

SEATTLE COUNTY:

Abandoned Landfill Study in the City of Seattle
The Seattle Abandoned Landfill Survey was conducted in June and July of 1984 by the Health Department's Environmental Health Division at the request of the Mayor's Office. The primary objective of the survey was to determine if any public health problems existed at the predetermined 12 sites.

Date of Government Version: 07/30/1984
Date Data Arrived at EDR: 11/07/1994
Date Made Active in Reports: N/A
Number of Days to Update: 0

Source: Seattle - King County Department of Public Health
Telephone: 206-296-4785
Last EDR Contact: 10/21/1994
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

SEATTLE/KING COUNTY:

Seattle - King County Abandoned Landfill Toxicity / Hazard Assessment Project
This report presents the Seattle-King County Health Department's follow-up investigation of two city owned and four county owned abandoned landfills which was conducted from February to December 1986.

Date of Government Version: 12/31/1986
Date Data Arrived at EDR: 08/18/1995
Date Made Active in Reports: 09/20/1995
Number of Days to Update: 33

Source: Department of Public Health
Telephone: 206-296-4785
Last EDR Contact: 08/14/1995
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

SNOHOMISH COUNTY:

Solid Waste Sites of Record at Snohomish Health District
Solid waste disposal and/or utilization sites in Snohomish County.

Date of Government Version: 11/16/2011
Date Data Arrived at EDR: 03/29/2012
Date Made Active in Reports: 05/03/2012
Number of Days to Update: 35

Source: Snohomish Health District
Telephone: 206-339-5250
Last EDR Contact: 12/22/2014
Next Scheduled EDR Contact: 04/06/2015
Data Release Frequency: Semi-Annually

TACOMA/PIERCE COUNTY:

Closed Landfill Survey
Following numerous requests for information about closed dumpsites and landfills in Pierce County, the Tacoma-Pierce County Health Department decided to conduct a study on the matter. The aim of the study was to evaluate public health risks associated with the closed dumpsites and landfills, and to determine the need, if any, for further investigations of a more detailed nature. The sites represent all of the known dumpsites and landfills closed after 1950.

Date of Government Version: 09/01/2002
Date Data Arrived at EDR: 03/24/2003
Date Made Active in Reports: 05/14/2003
Number of Days to Update: 51

Source: Tacoma-Pierce County Health Department
Telephone: 206-591-6500
Last EDR Contact: 03/19/2003
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

CT MANIFEST: Hazardous Waste Manifest Data
Facility and manifest data. Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a tsd facility.

Date of Government Version: 07/30/2013
Date Data Arrived at EDR: 08/19/2013
Date Made Active in Reports: 10/03/2013
Number of Days to Update: 45

Source: Department of Energy & Environmental Protection
Telephone: 860-424-3375
Last EDR Contact: 11/17/2014
Next Scheduled EDR Contact: 03/02/2015
Data Release Frequency: No Update Planned

NY MANIFEST: Facility and Manifest Data
Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 11/01/2014
Date Data Arrived at EDR: 11/05/2014
Date Made Active in Reports: 11/24/2014
Number of Days to Update: 19

Source: Department of Environmental Conservation
Telephone: 518-402-8651
Last EDR Contact: 11/05/2014
Next Scheduled EDR Contact: 02/16/2015
Data Release Frequency: Annually

PA MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 07/21/2014
Date Made Active in Reports: 08/25/2014
Number of Days to Update: 35

Source: Department of Environmental Protection
Telephone: 717-783-8990
Last EDR Contact: 10/20/2014
Next Scheduled EDR Contact: 02/02/2015
Data Release Frequency: Annually

WI MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 06/20/2014
Date Made Active in Reports: 08/07/2014
Number of Days to Update: 48

Source: Department of Natural Resources
Telephone: N/A
Last EDR Contact: 12/12/2014
Next Scheduled EDR Contact: 03/30/2015
Data Release Frequency: Annually

Oil/Gas Pipelines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines.

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Daycare Center Listing
Source: Department of Social & Health Services
Telephone: 253-383-1735

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2011 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

Scanned Digital USGS 7.5' Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

STREET AND ADDRESS INFORMATION

© 2010 Tele Atlas North America, Inc. All rights reserved. This material is proprietary and the subject of copyright protection and other intellectual property rights owned by or licensed to Tele Atlas North America, Inc. The use of this material is subject to the terms of a license agreement. You will be held liable for any unauthorized copying or disclosure of this material.

GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

MEADOWDALE PARK
6026 156TH ST SW
EDMONDS, WA 98026

TARGET PROPERTY COORDINATES

Latitude (North):	47.8642 - 47˚ 51' 51.12''
Longitude (West):	122.3328 - 122˚ 19' 58.08''
Universal Tranverse Mercator:	Zone 10
UTM X (Meters):	549902.1
UTM Y (Meters):	5301203.5
Elevation:	61 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	47122-G3 EDMONDS EAST, WA
Most Recent Revision:	1981
North Map:	47122-H3 MUKILTEO, WA
Most Recent Revision:	1978

EDR's GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principal investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

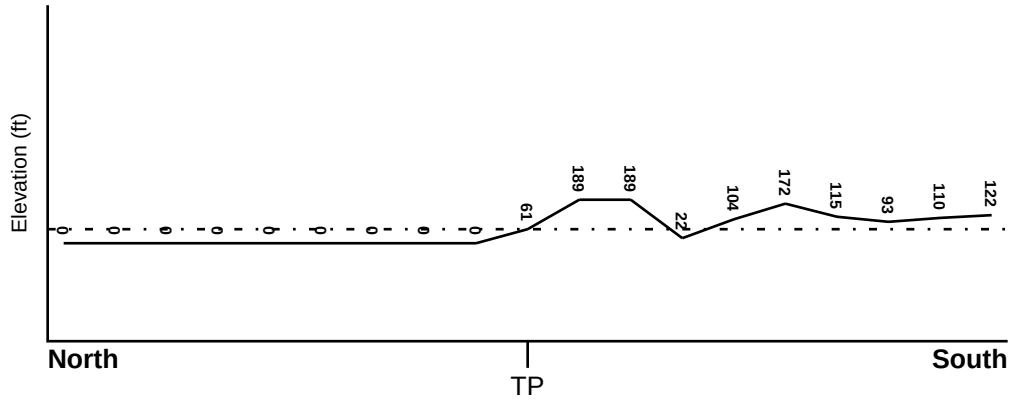
TOPOGRAPHIC INFORMATION

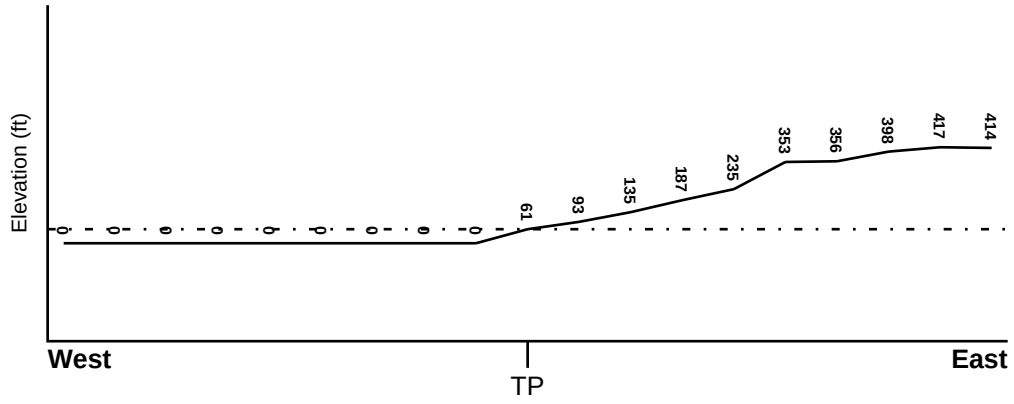
Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General NW

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES





Target Property Elevation: 61 ft.

0 1/2 1 Miles

Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Target Property County	FEMA Flood Electronic Data
SNOHOMISH, WA	YES - refer to the Overview Map and Detail Map

Flood Plain Panel at Target Property: Not Reported

Additional Panels in search area: Not Reported

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
EDMONDS EAST	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Site-Specific Hydrogeological Data*:

Search Radius: 1.25 miles
Status: Not found

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

* ©1996 Site−specific hydrogeological data gathered by CERCLIS Alerts, Inc., Bainbridge Island, WA. All rights reserved. All of the information and opinions presented are those of the cited EPA report(s), which were completed under a Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) investigation.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

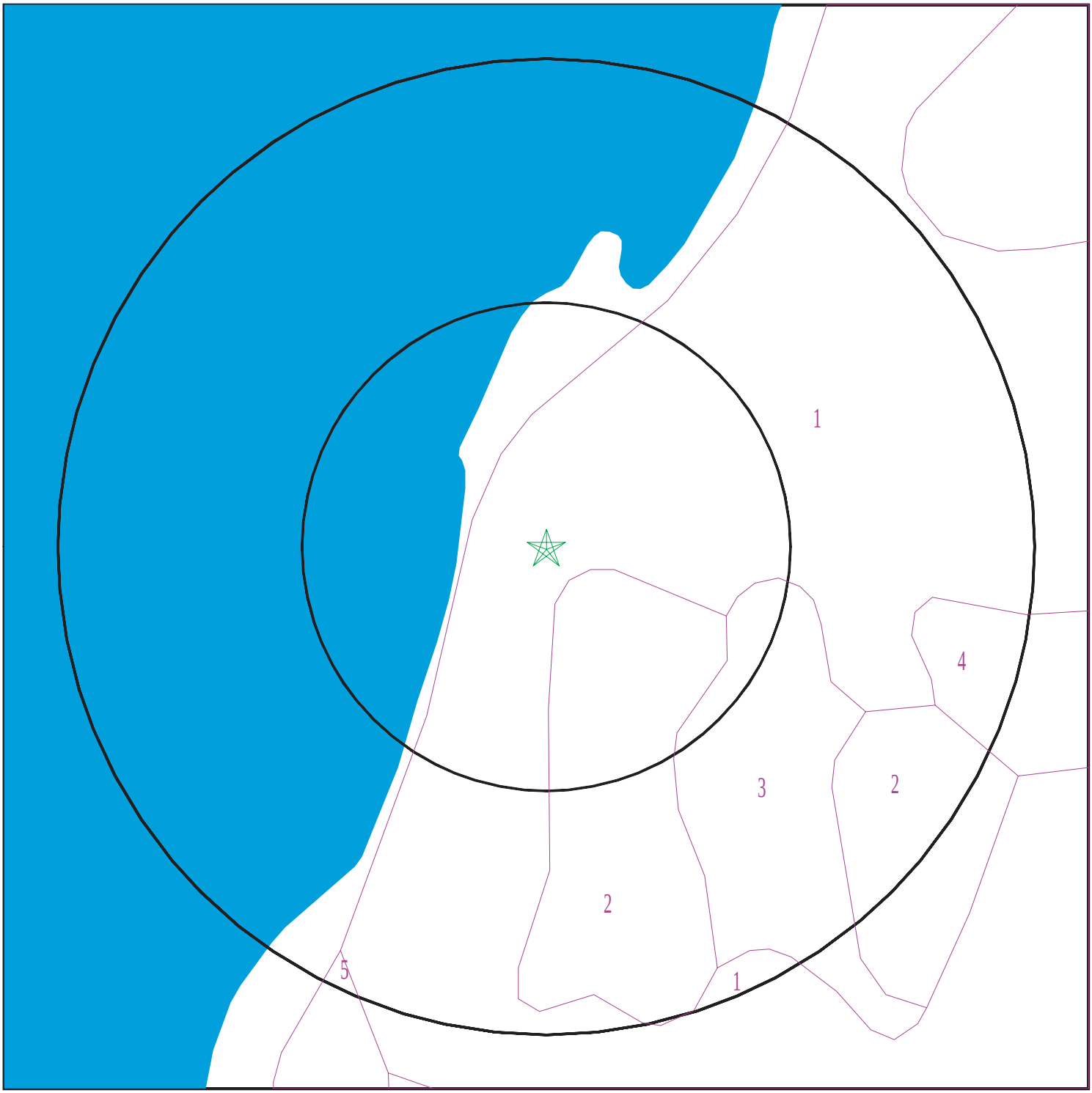
Era:	Cenozoic
System:	Quaternary
Series:	Quaternary
Code:	Q *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: Stratifed Sequence

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 4168089.2s



Target Property
SSURGO Soil
Water

0 1/16 1/8 1/4 Miles

N

SITE NAME: Meadowdale Park ADDRESS: 6026 156th St SW Edmonds WA 98026 LAT/LONG: 47.8642 / 122.3328	CLIENT: Shannon & Wilson, Inc. CONTACT: Cody Johnson INQUIRY #: 4168089.2s DATE: December 23, 2014 1:12 pm

Copyright © 2014 EDR, Inc. © 2010 Tele Atlas Rel. 07/2009.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name: Alderwood

Soil Surface Texture: gravelly sandy loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Moderately well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 69 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	7 inches	gravelly sandy loam	Granular materials (35 pct. or less passing No. 200), Stone Fragments, Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel	Max: 42 Min: 14	Max: 6.5 Min: 5.1
2	7 inches	35 inches	very gravelly sandy loam	Granular materials (35 pct. or less passing No. 200), Stone Fragments, Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel	Max: 42 Min: 14	Max: 6.5 Min: 5.6
3	35 inches	59 inches	gravelly sandy loam	Granular materials (35 pct. or less passing No. 200), Stone Fragments, Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel	Max: 0.42 Min: 0.01	Max: 6.5 Min: 5.1

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Map ID: 2

Soil Component Name: Alderwood

Soil Surface Texture: gravelly sandy loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Moderately well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 69 inches

Soil Layer Information

	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	**Upper**	**Lower**	**Soil Texture Class**	**AASHTO Group**	**Unified Soil**		**Soil Reaction (pH)**
1	0 inches	7 inches	gravelly sandy loam	Granular materials (35 pct. or less passing No. 200), Stone Fragments, Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel	Max: 42 Min: 14	Max: 6.5 Min: 5.1
2	7 inches	35 inches	very gravelly sandy loam	Granular materials (35 pct. or less passing No. 200), Stone Fragments, Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel	Max: 42 Min: 14	Max: 6.5 Min: 5.6
3	35 inches	59 inches	gravelly sandy loam	Granular materials (35 pct. or less passing No. 200), Stone Fragments, Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel	Max: 0.42 Min: 0.01	Max: 6.5 Min: 5.1

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Map ID: 3

Soil Component Name: Tokul

Soil Surface Texture: gravelly loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Moderately well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 69 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	3 inches	gravelly loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel	Max: 14 Min: 4	Max: 6.5 Min: 5.1
2	3 inches	22 inches	gravelly loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 14 Min: 4	Max: 6.5 Min: 5.1
3	22 inches	31 inches	gravelly fine sandy loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 14 Min: 4	Max: 6.5 Min: 5.1
4	31 inches	59 inches	gravelly sandy loam	Granular materials (35 pct. or less passing No. 200), Stone Fragments, Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel	Max: 0.42 Min: 0.01	Max: 6.5 Min: 5.1

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Map ID: 4

Soil Component Name: Alderwood

Soil Surface Texture: gravelly sandy loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Moderately well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 69 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	7 inches	gravelly sandy loam	Granular materials (35 pct. or less passing No. 200), Stone Fragments, Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel	Max: 42 Min: 14	Max: 6.5 Min: 5.1
2	7 inches	35 inches	very gravelly sandy loam	Granular materials (35 pct. or less passing No. 200), Stone Fragments, Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel	Max: 42 Min: 14	Max: 6.5 Min: 5.6
3	35 inches	59 inches	gravelly sandy loam	Granular materials (35 pct. or less passing No. 200), Stone Fragments, Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel	Max: 0.42 Min: 0.01	Max: 6.5 Min: 5.1

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Map ID: 5

Soil Component Name: Fluvaquents

Soil Surface Texture: silt loam

Hydrologic Group: Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Soil Drainage Class: Poorly drained

Hydric Status: All hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	7 inches	silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Organic Clay or Organic Silt.	Max: 14 Min: 4	Max: 5.5 Min: 3.6
2	7 inches	59 inches	stratified sand to silty clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 1.4 Min: 0.42	Max: 7.3 Min: 3.6

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
1	USGS40001275096	1/4 - 1/2 Mile ESE
2	USGS40001275160	1/4 - 1/2 Mile East

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

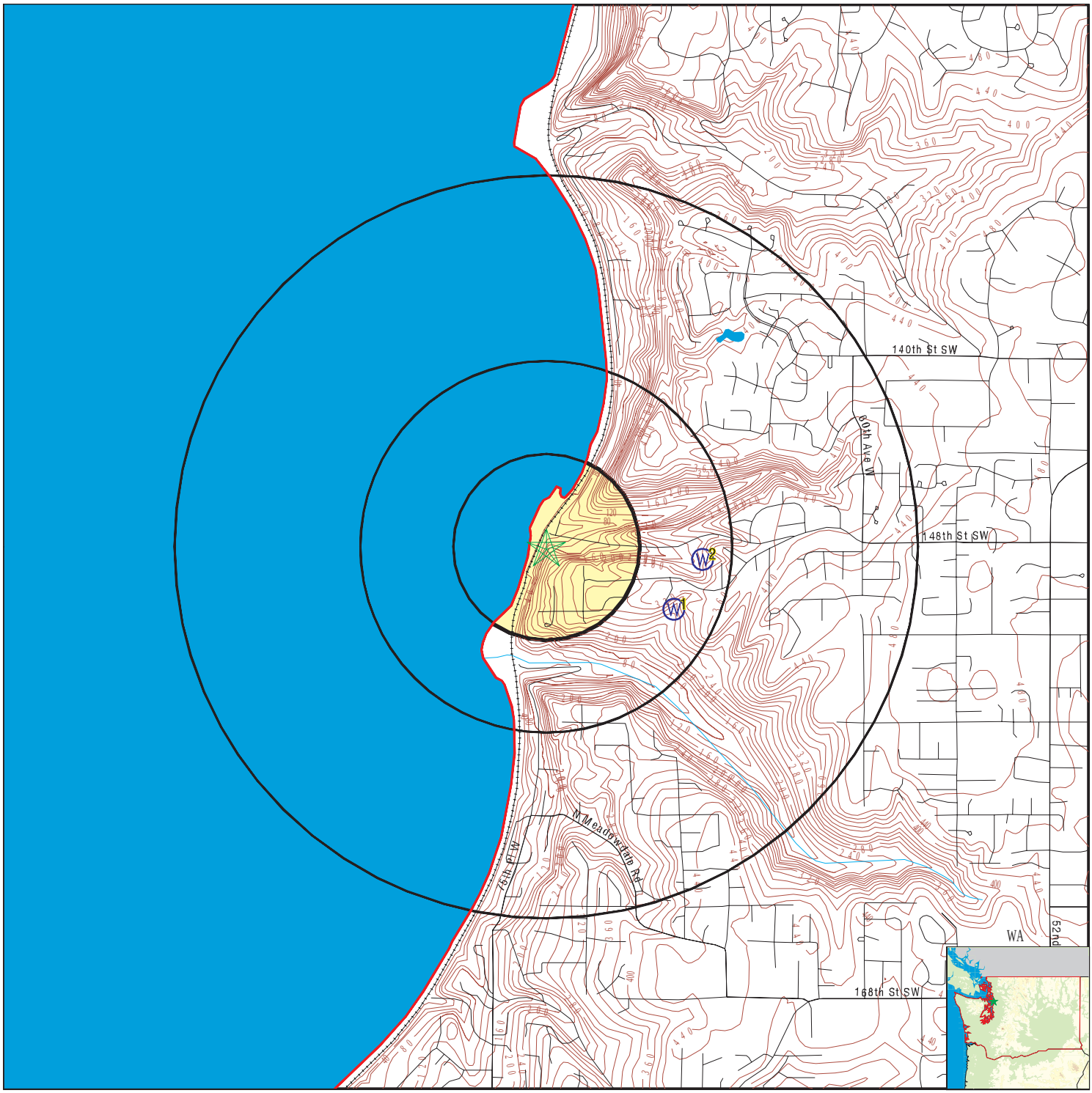
MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No Wells Found		

PHYSICAL SETTING SOURCE MAP - 4168089.2s



County Boundary
Major Roads
Contour Lines
Earthquake epicenter, Richter 5 or greater
Water Wells
Public Water Supply Wells
Cluster of Multiple Icons

0 1/4 1/2 1 Miles

Groundwater Flow Direction
GI Indeterminate Groundwater Flow at Location
GV Groundwater Flow Varies at Location
HD Closest Hydrogeological Data

N

SITE NAME: Meadowdale Park ADDRESS: 6026 156th St SW Edmonds WA 98026 LAT/LONG: 47.8642 / 122.3328	CLIENT: Shannon & Wilson, Inc. CONTACT: Cody Johnson INQUIRY #: 4168089.2s DATE: December 23, 2014 1:12 pm

Copyright © 2014 EDR, Inc. © 2010 Tele Atlas Rel. 07/2009.

Map ID Direction Distance Elevation	Database	EDR ID Number
1 **ESE** **1/4 - 1/2 Mile** **Higher**	**FED USGS**	**USGS40001275096**

Org. Identifier:	USGS-WA		
Formal name:	USGS Washington Water Science Center		
Monloc Identifier:	USGS-475143122192701		
Monloc name:	27N/04E-05C02		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	17110019	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	47.8617628
Longitude:	-122.3254115	Sourcemap scale:	24000
Horiz Acc measure:	5	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	260
Vert measure units:	feet	Vertacc measure val:	10
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	19810921	Welldepth:	358
Welldepth units:	ft	Wellholedepth:	358
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 2

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1993-04-15	316.99		1981-09-25	309	

2 **East** **1/4 - 1/2 Mile** **Higher**	**FED USGS**	**USGS40001275160**

Org. Identifier:	USGS-WA		
Formal name:	USGS Washington Water Science Center		
Monloc Identifier:	USGS-475150122192101		
Monloc name:	27N/04E-05B01		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	17110019	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	47.8637072
Longitude:	-122.3237449	Sourcemap scale:	24000
Horiz Acc measure:	5	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	260
Vert measure units:	feet	Vertacc measure val:	10
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Aquifer type:	Not Reported		
Construction date:	19871021	Welldepth:	160
Welldepth units:	ft	Wellholedepth:	160
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 13

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1995-01-17	135.37		1994-11-23	135.10	
1994-09-29	135.06		1994-07-14	135.06	
1994-05-19	34.90		1994-03-24	135.01	
1994-01-20	134.83		1993-11-26	134.88	
1993-09-24	134.73		1993-07-30	134.84	
1993-05-27	134.66		1993-03-26	134.90	
1992-06-02	134.08				

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

Federal EPA Radon Zone for SNOHOMISH County: 3

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for Zip Code: 98026

Number of sites tested: 4

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	0.025 pCi/L	100%	0%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	0.050 pCi/L	100%	0%	0%

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Scanned Digital USGS 7.5' Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

HYDROLOGIC INFORMATION

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2011 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

HYDROGEOLOGIC INFORMATION

AQUIFLOW[R] Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Services, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Water Wells
Source: Department of Health
Telephone: 360-236-3148
Group A and B well locations.

Water Well Listing
Source: Public Utility District
Telephone: 206-779-7656
A listing of water well locations in Kitsap County.

OTHER STATE DATABASE INFORMATION

Oil and Gas Well Listing
Source: Department of Natural Resources
Telephone: 360-902-1450
Locations that represent oil and gas test well sites in Washington State from 1890 to present.

RADON

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

Earthquake Fault Lines: The fault lines displayed on EDR's Topographic map are digitized quaternary faultlines, prepared in 1975 by the United State Geological Survey

PHYSICAL SETTING SOURCE RECORDS SEARCHED

STREET AND ADDRESS INFORMATION

© 2010 Tele Atlas North America, Inc. All rights reserved. This material is proprietary and the subject of copyright protection and other intellectual property rights owned by or licensed to Tele Atlas North America, Inc. The use of this material is subject to the terms of a license agreement. You will be held liable for any unauthorized copying or disclosure of this material.

APPENDIX C

IMPORTANT INFORMATION ABOUT YOUR ENVIRONMENTAL SITE ASSESSMENT/EVALUATION REPORT

Date: September 15, 2015
To: Ms. Kathy Ketteridge
Anchorage QEA, LLC

IMPORTANT INFORMATION ABOUT YOUR ENVIRONMENTAL SITE ASSESSMENT/EVALUATION REPORT

ENVIRONMENTAL SITE ASSESSMENTS/EVALUATIONS ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

This report was prepared to meet the needs you specified with respect to your specific site and your risk management preferences. Unless indicated otherwise, we prepared your report expressly for you and for the purposes you indicated. No one other than you should use this report for any purpose without first conferring with us. No one is authorized to use this report for any purpose other than that originally contemplated without our prior written consent.

The findings and conclusions documented in this site assessment/evaluation have been prepared for specific application to this project and have been developed in a manner consistent with that level of care and skill normally exercised by members of the environmental science profession currently practicing under similar conditions in this area. The conclusions presented are based on interpretation of information currently available to us and are made within the operational scope, budget, and schedule constraints of this project. No warranty, express or implied, is made.

OUR REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

Our environmental site assessment is based on several factors and may include (but not be limited to): reviewing public documents to chronicle site ownership for the past 30, 40, or more years; investigating the site's regulatory history to learn about permits granted or citations issued; determining prior uses of the site and those adjacent to it; reviewing available topographic and real estate maps, historical aerial photos, geologic information, and hydrologic data; reviewing readily available published information about surface and subsurface conditions; reviewing federal and state lists of known and potentially contaminated sites; evaluating the potential for naturally occurring hazards; and interviewing public officials, owners/operators, and/or adjacent owners with respect to local concerns and environmental conditions.

Except as noted within the text of the report, no sampling or quantitative laboratory testing was performed by us as part of this site assessment. Where such analyses were conducted by an outside laboratory, Shannon & Wilson relied upon the data provided and did not conduct an independent evaluation regarding the reliability of the data.

CONDITIONS CAN CHANGE.

Site conditions, both surface and subsurface, may be affected as a result of natural processes or human influence. An environmental site assessment/evaluation is based on conditions that existed at the time of the evaluation. Because so many aspects of a historical review rely on third party information, most consultants will refuse to certify (warrant) that a site is free of contaminants, as it is impossible to know with absolute certainty if such a condition exists. Contaminants may be present in areas that were not surveyed or sampled, or may migrate to areas that showed no signs of contamination at the time they were studied.

Unless your consultant indicates otherwise, your report should not be construed to represent geotechnical subsurface conditions at or adjacent to the site and does not provide sufficient information for construction-related activities. Your report also should not be used following floods, earthquakes, or other acts of nature; if the size or configuration of the site is altered; if the location of the site is modified; or if there is a change of ownership and/or use of the property.

INCIDENTAL DAMAGE MAY OCCUR DURING SAMPLING ACTIVITIES.

Incidental damage to a facility may occur during sampling activities. Asbestos and lead-based paint sampling often require destructive sampling of pipe insulation, floor tile, walls, doors, ceiling tile, roofing, and other building materials. Shannon & Wilson does not provide for paint repair. Limited repair of asbestos sample locations are provided. However, Shannon & Wilson neither warranties repairs made by our field personnel, nor are we held liable for injuries or damages as a result of those repairs. If you desire a specific form of repair, such as those provided by a licensed roofing contractor, you need to request the specific repair at the time of the proposal. The owner is responsible for repair methods that are not specified in the proposal.

READ RESPONSIBILITY CLAUSES CAREFULLY.

Environmental site assessments/evaluations are less exact than other design disciplines because they are based extensively on judgment and opinion, and there may not have been any (or very limited) investigation of actual subsurface conditions. Wholly unwarranted claims have been lodged against consultants. To limit this exposure, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses may appear in this report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

Consultants cannot accept responsibility for problems that may develop if they are not consulted after factors considered in their reports have changed, or conditions at the site have changed. Therefore, it is incumbent upon you to notify your consultant of any factors that may have changed prior to submission of the final assessment/evaluation.

An assessment/evaluation of a site helps reduce your risk, but does not eliminate it. Even the most rigorous professional assessment may fail to identify all existing conditions.

ONE OF THE OBLIGATIONS OF YOUR CONSULTANT IS TO PROTECT THE SAFETY, HEALTH, PROPERTY, AND WELFARE OF THE PUBLIC.

If our environmental site assessment/evaluation discloses the existence of conditions that may endanger the safety, health, property, or welfare of the public, we may be obligated under rules of professional conduct, statutory law, or common law to notify you and others of these conditions.

The preceding paragraphs are based on information provided by the
ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland

Appendix C
Memorandum: Eelgrass Survey of Meadowdale Beach Park

CONFLUENCE
ENVIRONMENTAL COMPANY

To: Peter Hummel, Anchor QEA

From: Paul Schlenger and Grant Novak

Date: October 4, 2017

Re: Eelgrass Survey of Meadowdale Beach Park

Enclosures: Figure 1. Meadowdale Underwater Video Survey
Figure 2. Meadowdale Eelgrass Beds
Photo Appendix

Confluence Environmental Company conducted an eelgrass survey along the shoreline of Snohomish County's Meadowdale Beach Park on August 30, 2017. The purpose of the survey was to document the location of eelgrass and macroalgae beds to inform preliminary planning for construction of a shoreline restoration project in the park. This memorandum describes the survey methods and findings.

1.0 SURVEY METHODS

The survey was conducted in accordance with the Washington Department of Fish and Wildlife Eelgrass/Macroalgae Habitat Interim Guidelines (WDFW 2008) for preliminary surveys. The survey of intertidal areas occurred during a low tide when tidal elevation was below 0-feet relative to mean lower low water and included a visual observation of the exposed beach. The survey of subtidal areas was conducted by towing an underwater video camera with integrated global positioning system (GPS) to record the presence and/or absence of eelgrass and macroalgae. The survey area extended along the entire park shoreline, and extended from the intertidal zone to beyond the depths providing sufficient light to support eelgrass and macroalgae. The survey extended out to water depths of -30 feet mean lower low water or deeper to ensure outside edge of eelgrass was delineated.

The underwater video camera was towed along a series of transects spaced approximately 25-feet apart and oriented parallel to shore. Additional video was collected along a series of transects aligned generally perpendicular to shore, overlapping the parallel transects. Further transects were surveyed in areas of interest or question based on our real-time review of the video screen.

The survey boat was equipped with a GPS and a mapping program to ensure the survey area was covered fully and each transect was appropriately spaced. The equipment allowed real-time mapping of location to allow the boat operator to accurately follow survey transects. The

boat maintained a consistent speed and the video was constantly monitored to confirm that the camera was close enough to the seafloor to accurately characterize vegetation and substrate.

2.0 POST-PROCESSING OF VIDEO

Recorded video was reviewed in the office by qualified biologists familiar with the flora and fauna of the Pacific Northwest. The entirety of the field-collected video data was reviewed in the office on a high definition monitor to ensure that observations were accurately characterized. To aid mapping, a proprietary program created by Confluence Environmental Company was used when reviewing the video. The video mapping program was synched with the video data through the video's time stamp. The program allowed the reviewer to create tabular records defining the eelgrass and macroalgae observations at one second intervals as the video was being viewed. These tabular data were then joined, using the time stamp, to the GPS positions collected with the sub-meter accuracy GPS unit. This allowed the high-quality characterization of video that occurred in the office to be linked to the highly accurate GPS positions collected in the field. This provided an efficient method to create accurate eelgrass distribution maps of the study area.

3.0 RESULTS

Substrate in the surveyed area consists of sand with some gravel. Native eelgrass (*Zostera marina*) was documented in beds with both patchy and continuous distribution along the park shoreline. The non-native dwarf eelgrass (*Zostera japonica*) was not observed during the survey. Some sparse, unattached macroalgae (e.g., *Ulva, Sarcodiotheca, Fucus*) were sporadically observed drifting with tidal currents through the survey area. No kelp or macroalgae of the Order *Laminariales* were observed during the survey.

The video transects and eelgrass observations are provided in Figure 1. Figure 2 shows an interpretation of the distribution of both continuous and patchy eelgrass beds. Generally, the eelgrass bed documented along the northern portion of the park shoreline was wider and more continuous than in the southern portion of the park shoreline. All eelgrass was observed below mean lower low water. Depending on construction methods used for the project, additional eelgrass monitoring may be necessary to quantify potential impacts.

4.0 REFERENCES

WDFW (Washington Department of Fish and Wildlife). 2008. Eelgrass/Macroalgae Habitat Interim Survey Guidelines. Available at: http://wdfw.wa.gov/publications/00714/wdfw00714.pdf

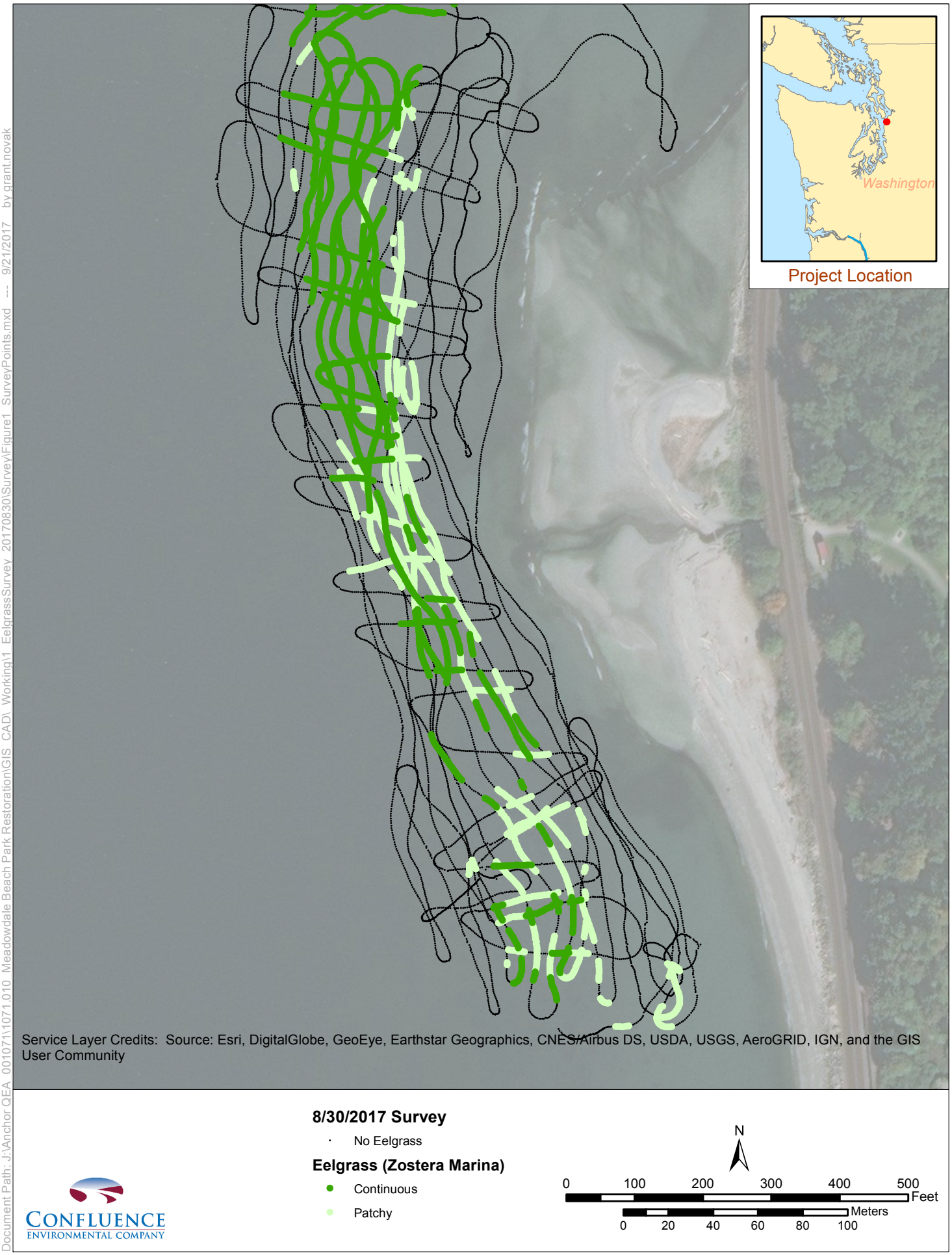


Figure 1. Meadowdale Underwater Video Survey

Document Path: J:\Anchor QEA_0010711\071.010_Meadowdale Beach Park Restoration\GIS_CAD_Working\1_EelgrassSurvey_20170830\Survey\Figure1_SurveyPoints.mxd --- 9/21/2017 by grant.novak

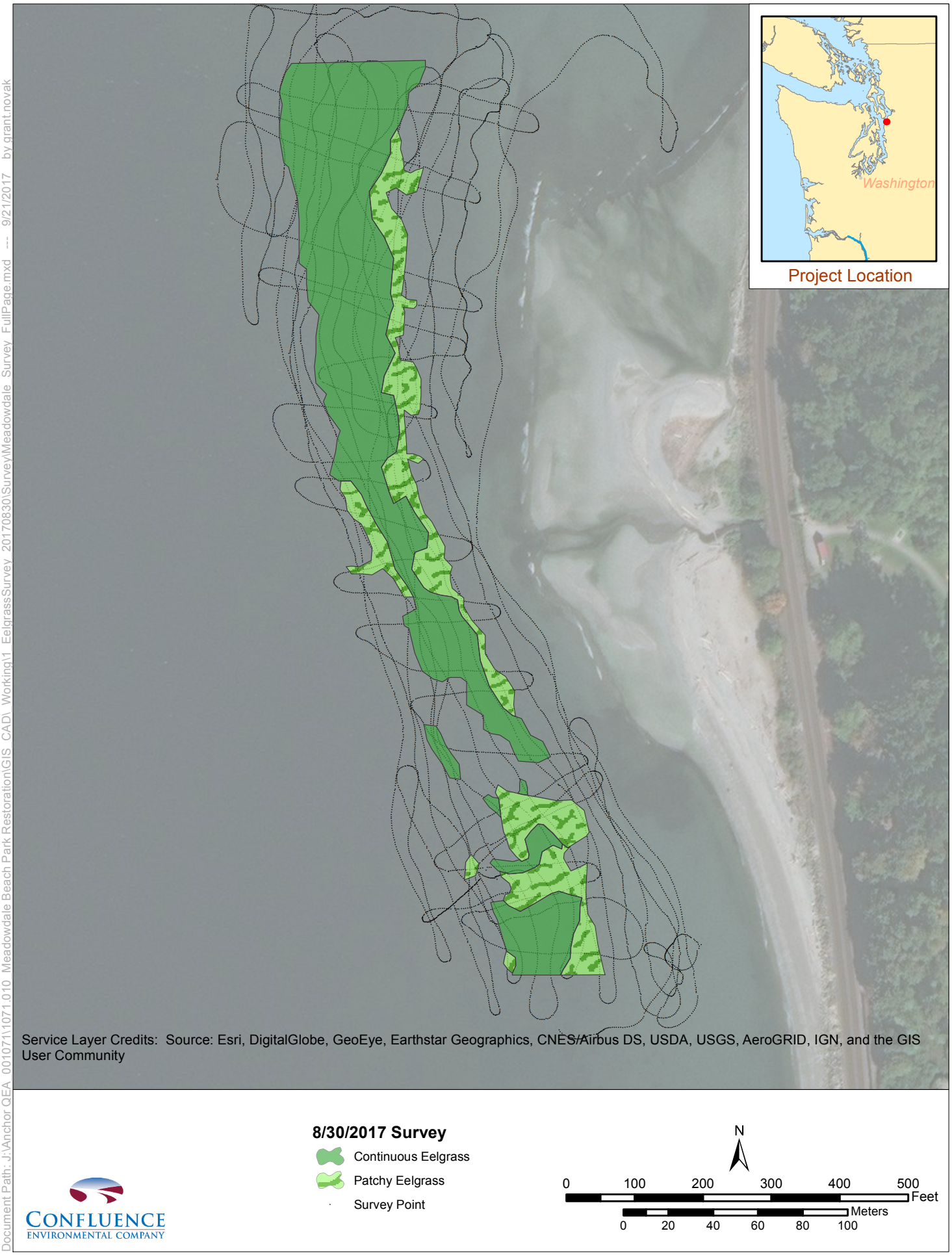


Figure 2. Meadowdale Eelgrass Beds.

Document Path: J:\Anchor QEA_00107111071.010_Meadowdale Beach Park Restoration\GIS_CAD_Working\1_EelgrassSurvey_20170830\Survey\Meadowdale_Survey_FullPage.mxd -- 9/21/2017 by grant.novak

PHOTO APPENDIX

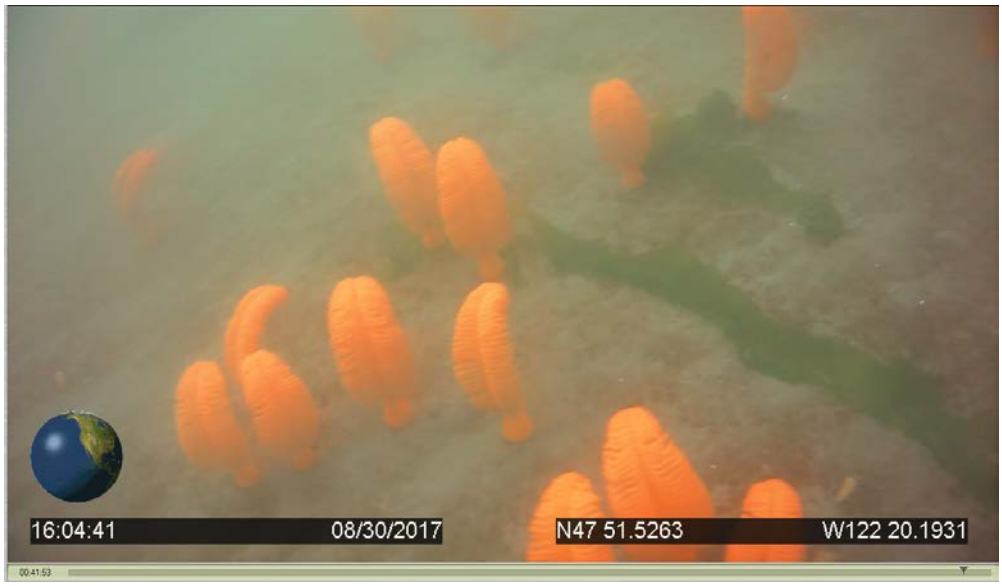
EELGRASS SURVEY OF MEADOWDALE BEACH PARK
AUGUST 30, 2017

Photo 1. Continuous Eelgrass Bed

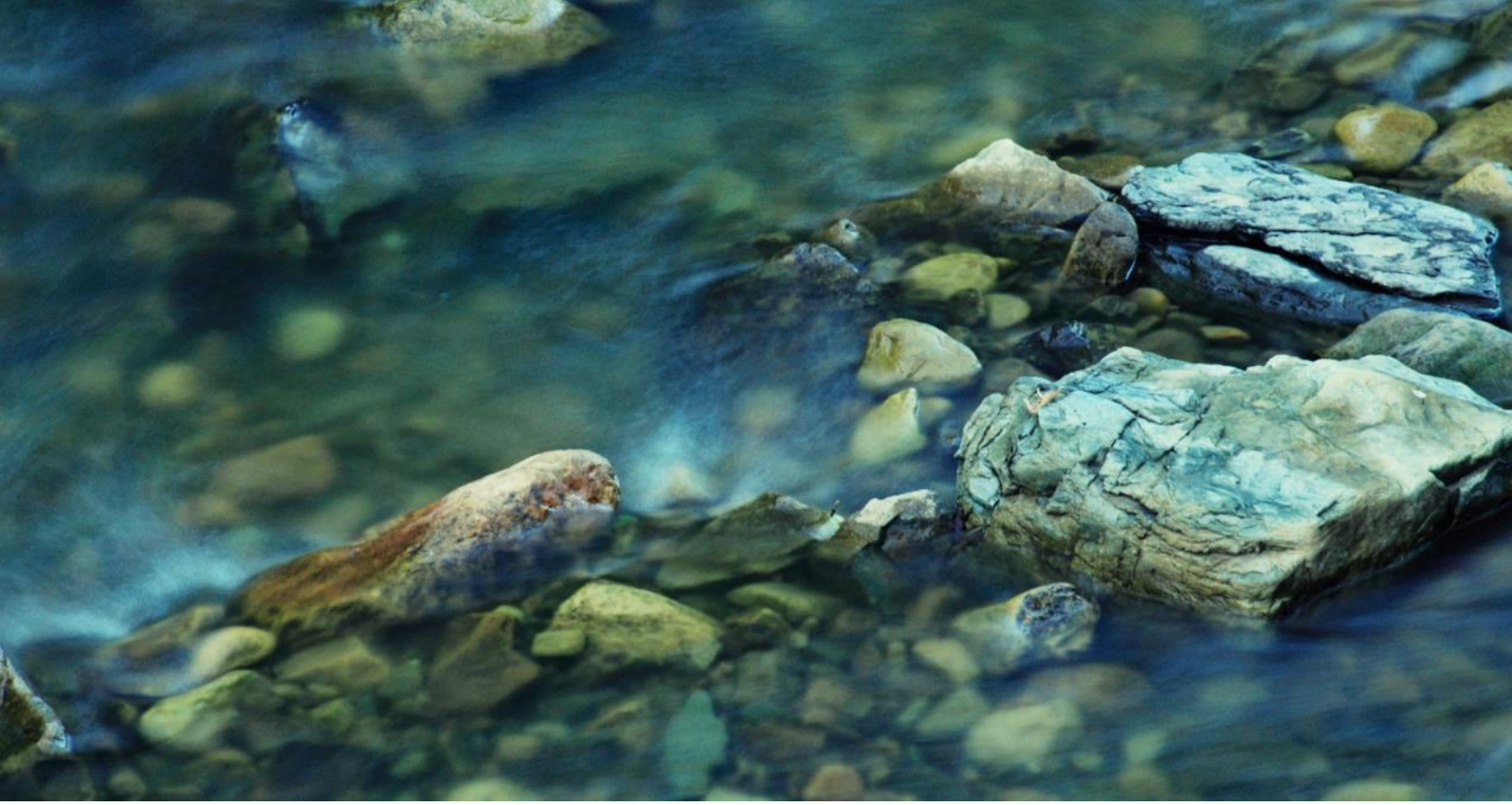
Photo 2. Patchy Eelgrass

Photo 3. Representative Sandy Bottom and Loose Ulva

Photo 4. Sea Pens among Sandy Bottom and Loose Ulva



Appendix D
Wetland, Stream, and Marine Delineation



May 2017
Meadowdale Beach Park and Estuary Restoration Design Project

Wetland, Stream, and Marine Delineation

Snohomish County Parks and Recreation

May 2017
Meadowdale Beach Park and Estuary Restoration Design Project

Wetland, Stream, and Marine Delineation

Prepared for
Snohomish County Parks and Recreation
6705 Puget Park Drive
Snohomish, Washington 98296

Prepared by
Anchor QEA, LLC
710 Olive Way, Suite 1900
Seattle, Washington 98101

Project Number: 160723-02.01
\\fuji\Anchor\Projects\Snohomish County\Meadowdale Beach Park\Park and Habitat Design\Task 4 Data Collection\Critical Areas\Wet & OHWM Delin Report\MeadowdalePark_WetlandDelinRpt_05-24-2017.docx

TABLE OF CONTENTS

1 Introduction 1

1.1 Review of Existing Information 1

2 Project Area Description 5

2.1 Topography 5

2.2 Soils 5

2.3 Hydrology 5

2.4 Plant Communities and Habitats 6

3 Wetland Delineation 13

3.1 Methods 13

3.2 Wetland Delineation Results 19

3.3 Regulatory Framework 24

3.4 Wetland Functional Assessment 27

3.5 Snohomish County Wetland Buffer Guidance 29

3.6 Wetland Delineation and Typing Limitations 29

4 Stream and Marine Ordinary High Water Mark Delineation 30

4.1 Methods 30

4.2 Ordinary High Water Mark Results 31

5 References 33

TABLES

Table 1 Wetland Plant Indicator Definitions 14

Table 2 U.S. Fish and Wildlife Service Wetland Classifications 24

Table 3 Summary of Wetland Classes and Ratings Using Ecology 2014 Wetlands Rating Systems 25

Table 4 Summary of Functions and Values 2014 Wetland Rating Scores 26

Table 5 Snohomish County Code Wetland Rating and Standard Buffer Width 29

Table 6 Snohomish County Code Stream Classification and Standard Buffer Distance 31

Table 7 Snohomish County Code Marine Waters Standard Buffer Distance 32

FIGURES

Figure 1 Vicinity Map 3
Figure 2 Project Area and Existing Park Features 7
Figure 3 Soil Types within the Project Area 9
Figure 4 Existing National Wetland Inventory Mapping Data 11
Figure 5 Wetland and Stream Delineation Results 15

APPENDICES

Appendix A Wetland Delineation Data
Appendix B Field Data Forms
Appendix C Ecology Wetland Ratings Forms

ABBREVIATIONS

CAO	Critical Area Ordinance
City	City of Edmonds
Corps	U.S. Army Corps of Engineers
Ecology	Washington State Department of Ecology
FAC	facultative
FACW	facultative wetland
HGM	Hydrogeomorphic
NRCS	Natural Resource Conservation Service
NWI	National Wetlands Inventory
OBL	obligate wetland
OHWM	ordinary high water mark
PEM	Palustrine emergent
PFO	Palustrine forested
PHS	Priority Habitats and Species
Project	Meadowdale Beach Park Recreation and Habitat Improvements Project
Project Area	Meadowdale Beach Park
PSS	Palustrine scrub-shrub
RCW	Revised Code of Washington
SCC	Snohomish County Code
sf	square feet
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife

This page intentionally left blank.

1 Introduction

Snohomish County Parks and Recreation Department is collecting information for the Meadowdale Beach Park and Estuary Restoration Design (Project), located in the Meadowdale Beach Park, along the Puget Sound shoreline in Snohomish County, Washington, Township 27 North, Range 4 East, Section 5 (Figure 1). A portion of the Project area also lies within the City of Edmonds.

This report provides information regarding the presence of wetlands, streams, and the marine shoreline, as defined in the Snohomish County Code (SCC) Critical Area Ordinance (CAO; Snohomish County 2016). Field studies were completed by biologists and wetland scientists from Anchor QEA in November and December 2016. These field studies consisted of wetland delineations and ordinary high water mark (OHWM) delineations for Lund's Gulch Creek and the marine shoreline. A County representative was present during the site visits and confirmed the wetland and OHWM boundaries. Anchor QEA ecologists also performed a wetland rating and functional analysis of wetland habitat delineated within the Project area. Information from this report will be used to support a Critical Areas Report for the Project for permitting and land-use approvals.

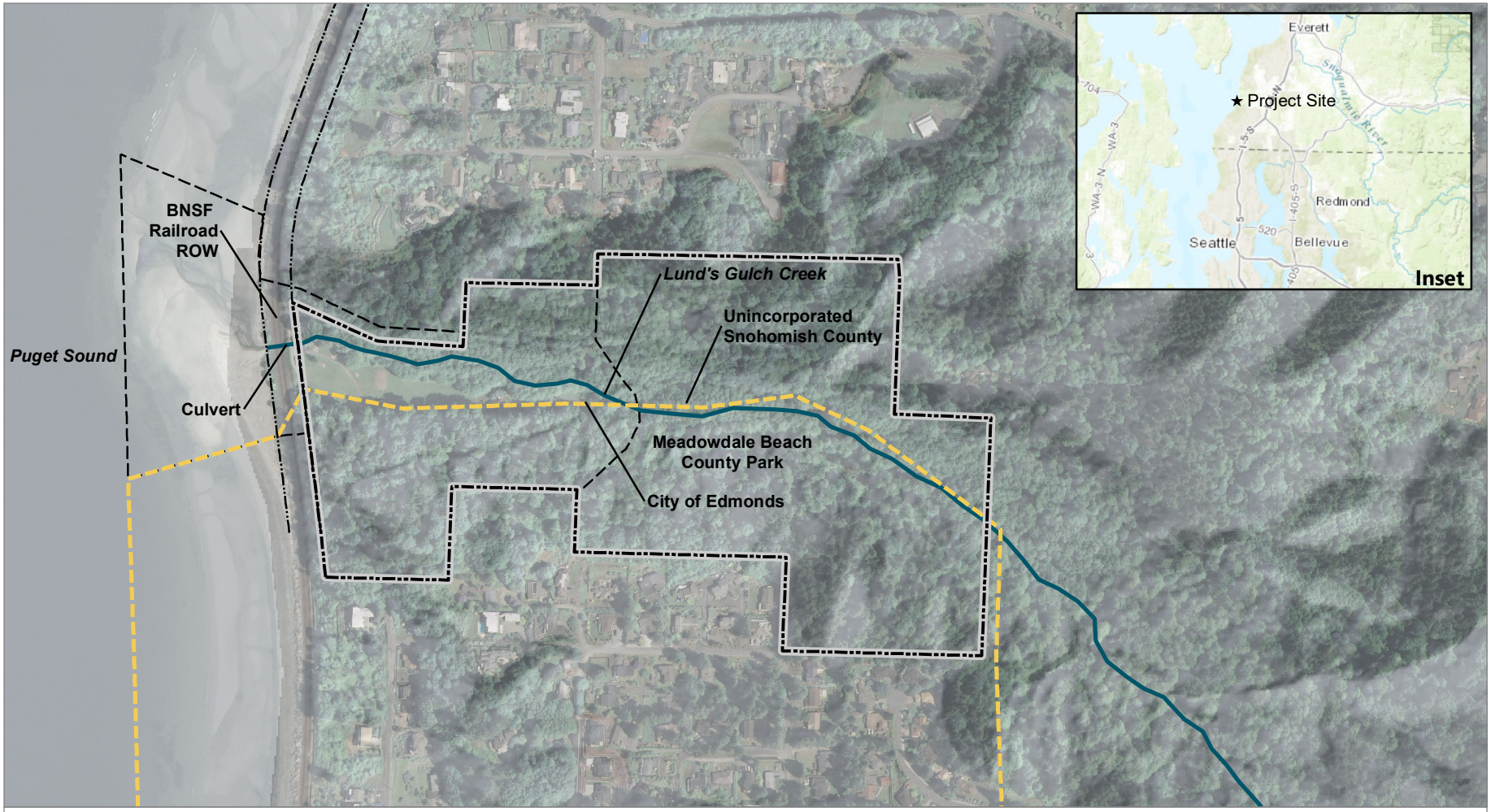
The proposed Project seeks to improve public access to the shoreline, address flooding, stormwater maintenance, and fish barrier issues associated with sediment deposition within a 6-foot-wide culvert for Lund's Gulch Creek under the BNSF Railway, as shown in Figure 1. A preferred alternative that combines habitat restoration and public access and safety improvements across an 11.4-acre area within the park was selected by the County following completion of a Feasibility Study in 2015. The Project will address public safety issues involving the existing railroad crossing, improve Americans with Disabilities Act-compliant access to the beach, and improve habitat conditions for salmon in the lower creek and creek delta. The following sections of this report describe the methods used in the field investigations and findings. A description of the Project area is included in Section 2. Summaries of the findings of the wetland delineation are included in Section 3. Summaries of the findings of the stream and marine shoreline OHWM delineation are included in Section 4. A summary of data collected at each sampling plot during the wetland delineation is presented in tables in Appendix A and in the field data forms in Appendix B. Washington State Department of Ecology (Ecology) Wetland Rating Forms are included in Appendix C.

1.1 Review of Existing Information

As part of the analysis to identify natural resources and critical areas in the study area, Anchor QEA ecologists reviewed the following sources of information to support field observations:

- Natural Resource Conservation Service (NRCS) Web Soil Survey (USDA 2016a)
- Hydric Soil List for Washington State (USDA 2016b)
- U.S. Fish and Wildlife Service (USFWS) Wetlands Mapper for National Wetlands Inventory (NWI) map information (USFWS 2016)

- Snohomish County Code (Snohomish County 2016)
- Meadowdale Beach County Park Feasibility Study (Anchor QEA 2015)
- Washington Department of Fish and Wildlife (WDFW) Priority Habitats and Species (PHS) maps (WDFW 2016a)
- WDFW SalmonScape website (WDFW 2016b)
- Aerial photographs, Google Earth, November 2016



LEGEND:

- Lund's Gulch Creek
- Park Boundary
- City/County Boundary
- Railroad Right-of-Way (ROW)
- Project Area

0 300
Feet

Publish Date: 2017/05/22, 6:22 PM | User: bsevertsen
Filepath: Q:\Jobs\SnohomishCounty_0723\MeadowdaleBeachPark\Maps\2017_05\VicinityMap.mxd

ANCHOR QEA

Figure 1
Vicinity Map
Wetland and Stream Delineation Report
Meadowdale Beach Park Recreation and Habitat Improvements Project

This page intentionally left blank.

2 Project Area Description

The Project area encompasses 11.4 acres of the Meadowdale Beach Park along the marine shoreline of Puget Sound (Figure 2). The Project area consists of walking trails, a gated access service road, mowed grass areas, picnic shelters, park maintenance facilities, and undeveloped forest and shrub habitat. The marine shoreline of Puget Sound forms the west boundary of the park. Railroad tracks are also located on a berm along the Puget Sound shoreline, which is part of the BNSF Railway right-of-way that lies within the park. The north, south, and east areas of the park include sloped forested areas. The park is only open to the public by using walking trails. A paved access road, used by park staff, is located on the sloped hillside to the south. Residential property is located north, south, and east of the park.

2.1 Topography

The topography of the Project area ranges from relatively flat (where the majority of the park features are located), to close to sea level, to very steep forested slopes as the park extends to the north, south, and east. Slopes in the Project area range from 0 to 70%, according to the U.S. Department of Agriculture (USDA) soil data (USDA 2016a).

2.2 Soils

The NRCS Web Soil Survey (USDA 2016a) identifies three soil series in the location of the Project area: 1) Alderwood gravelly sandy loam, 0 to 8% slopes and 15 to 30% slopes; 2) Alderwood–Everett gravelly sandy loams, 25 to 70% slopes, and 3) Fluvaquents tidal (Figure 3). The Alderwood gravelly sandy loam soil is the primary constituent within the Project area. According to the Hydric Soil List for Washington State (USDA 2016b), the Alderwood gravelly sandy loam and the Alderwood–Everett gravelly sandy loams soil series are moderately drained soils with hydric features in depressions. Fluvaquents tidal are soils in tidal areas.

In Section 3.2, Wetland Delineation Results, sample plot soil profiles are described for the wetlands within the Project area. A summary of soils data collected at each sample plot is presented in Appendix A, Table A-3, and in the field data forms in Appendix B. Soils observed in the sample plots were generally consistent in texture with the identified soil series.

2.3 Hydrology

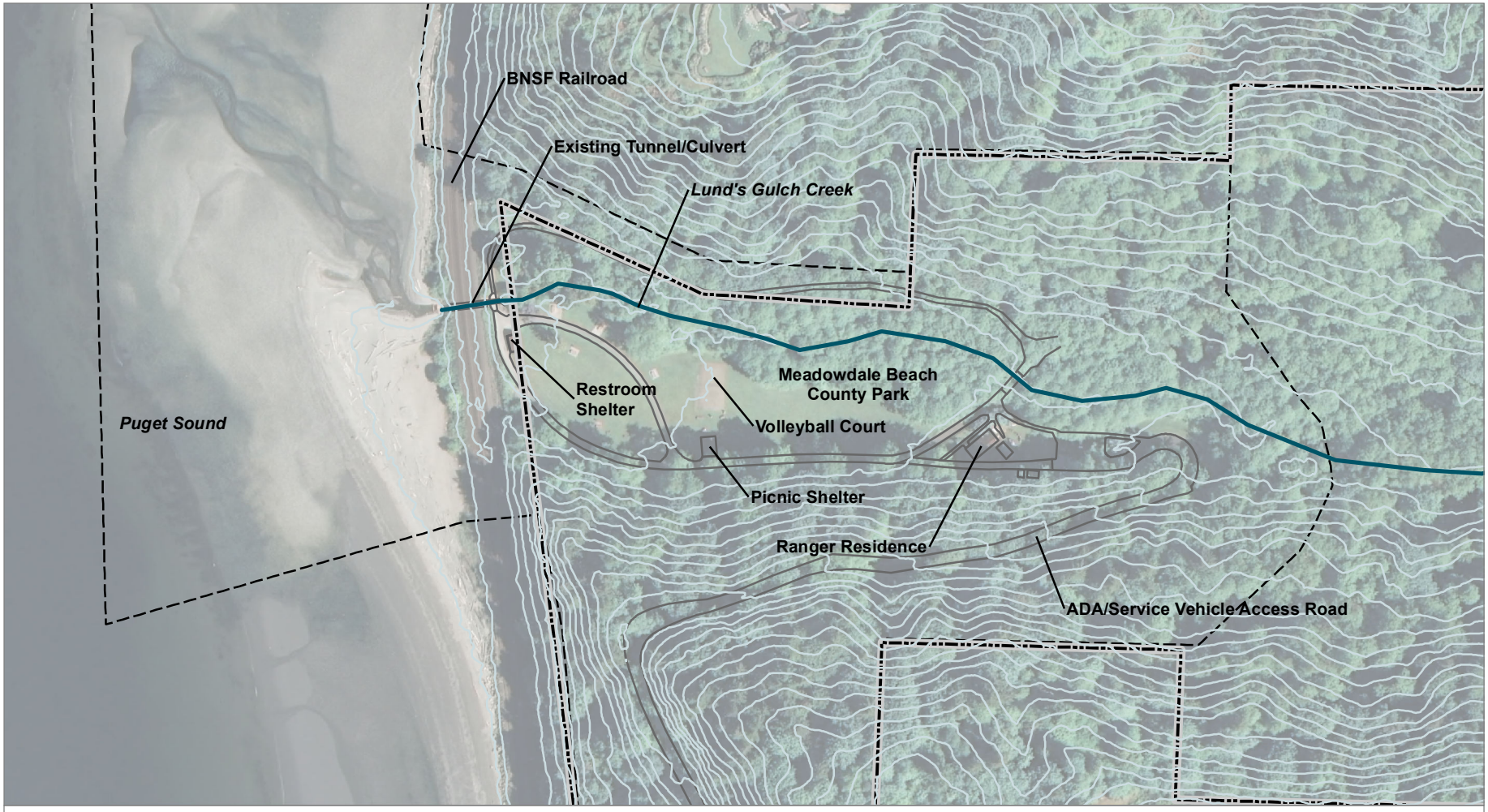
The Project is located in the Cedar-Sammamish Basin Water Resource Inventory Area 8 (Ecology 2016). Hydrologic characteristics in the Project area are influenced by regional groundwater, direct precipitation, surface water runoff, Lund's Gulch Creek, and Puget Sound.

Sample plot hydrology is described for the wetlands in Subsection 3.2, Wetland Delineation Results. A summary of hydrology data collected at each sampling plot is presented in Appendix A, Table A-4, and in the field data forms in Appendix B.

2.4 Plant Communities and Habitats

Vegetation within the Project area includes a variety of native, non-native, and ornamental trees, shrub, grass, and herbaceous species associated with upland, wetland, and riparian habitat. The USFWS Wetlands Mapper for NWI Map Information does not identify any freshwater wetland features in the Project area (USFWS 2016). The estuarine habitat of Puget Sound is identified on the NWI map information. WDFW PHS maps (WDFW 2016a) also do not identify freshwater wetland habitat within the Project area. Figure 4 shows the NWI information in the Project area.

Wetland and upland vegetation for the wetland areas are described in Section 3.2, Wetland Delineation Results. A summary of vegetation data collected in the Project area and at each sampling plot is presented in Appendix A, Tables A-1 and A-2, and in the field data forms in Appendix B.



LEGEND:

- Lund's Gulch Creek
- Topographic Contour (10' Interval)
- Park Boundary
- Project Area

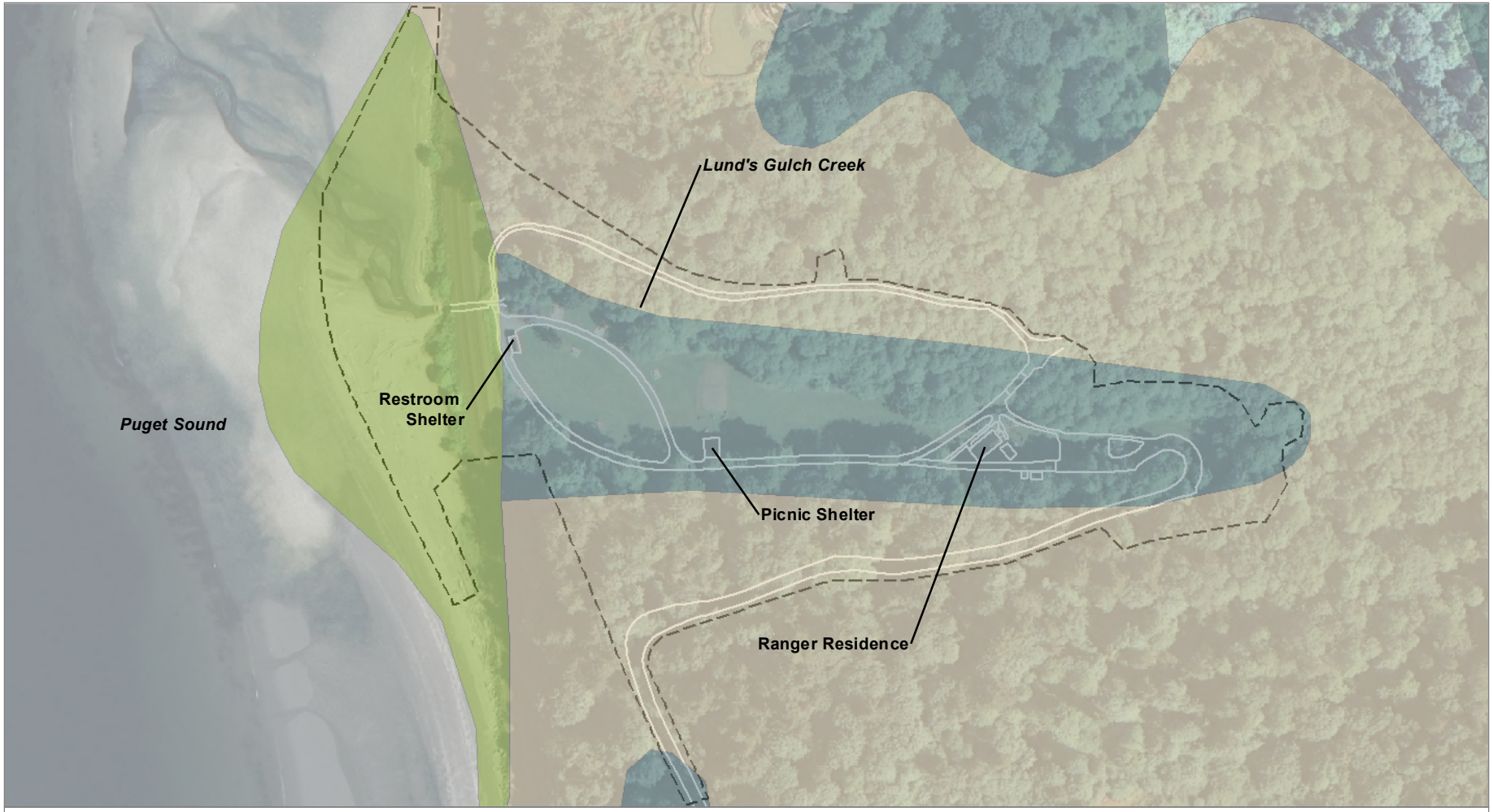
0 300
Feet

Publish Date: 2017/05/22, 6:23 PM | User: bsevertsen
Filepath: Q:\Jobs\SnohomishCounty_0723\MeadowdaleBeachPark\Maps\2017_05\SitePlan_ProjectArea.mxd

ANCHOR QEA

Figure 2
Project Area and Existing Park Features
Wetland and Stream Delineation Report
Meadowdale Beach Park Recreation and Habitat Improvements Project

This page intentionally left blank.



LEGEND:

Soil Types

- Alderwood
- Alderwood-Everett-Complex
- Fluvaquents

Project Area

SOURCE: USDS NRCS Web Soil Survey

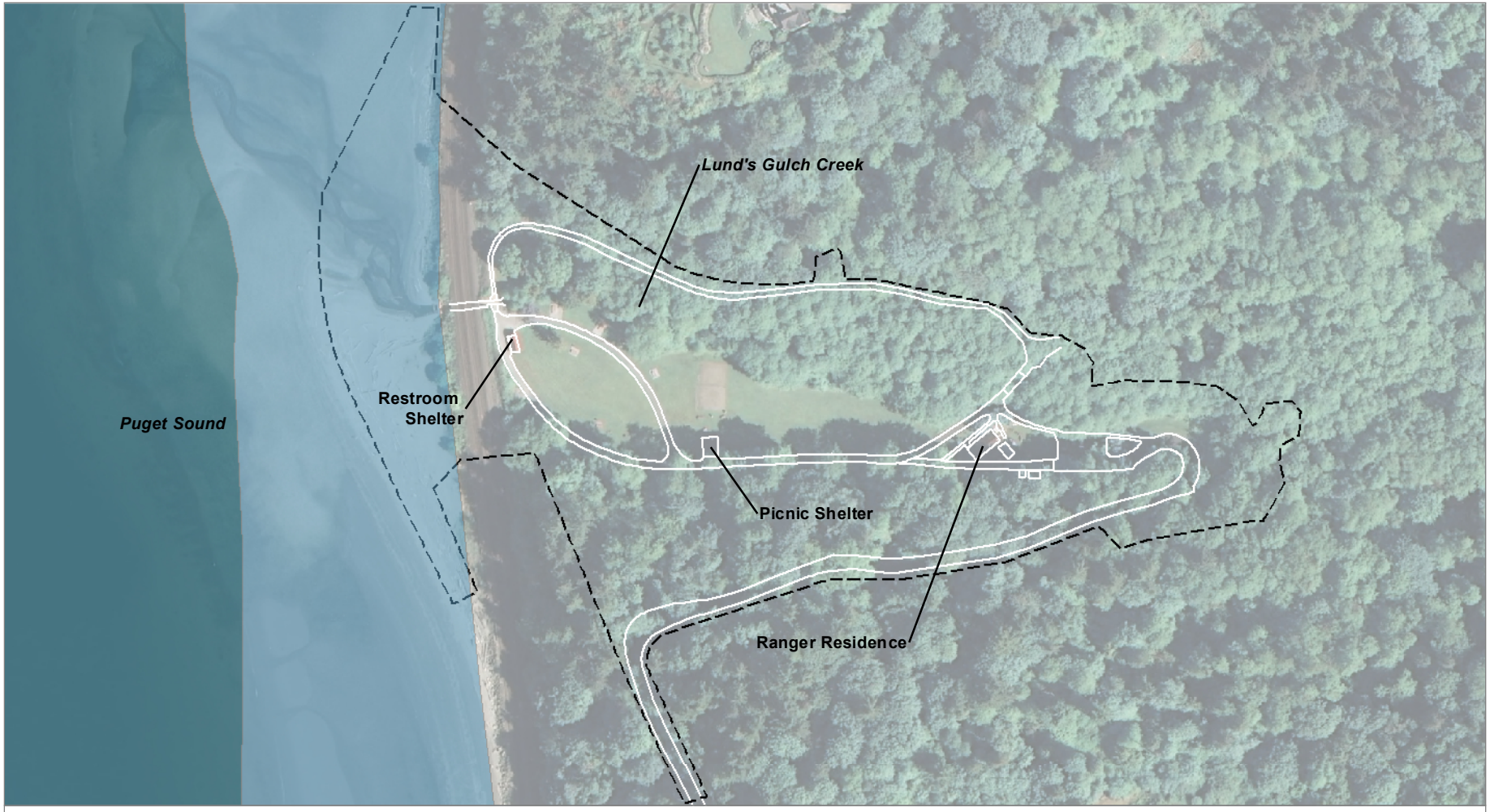
0 300
Feet

Publish Date: 2017/02/21, 10:30 AM | User: bsevertsen
Filepath: Q:\Jobs\SnohomishCounty_0723\MeadowdaleBeachPark\Maps\2017_01\SitePlan_Soils.mxd

ANCHOR QEA

Figure 3
Soil Types within Project Area
Wetland and Stream Delineation Report
Meadowdale Beach Park Recreation and Habitat Improvements Project

This page intentionally left blank.



LEGEND:

NWI Wetlands

Estuarine and Marine Deepwater

Estuarine and Marine Wetland

Project Area

0 300

Feet

Publish Date: 2017/02/21, 10:31 AM | User: bsevertsen
Filepath: Q:\Jobs\SnohomishCounty_0723\MeadowdaleBeachPark\Maps\2017_01\SitePlan_NWI.mxd

ANCHOR QEA

Figure 4
Existing National Wetland Inventory Mapping Data
Wetland and Stream Delineation Report
Meadowdale Beach Park Recreation and Habitat Improvements Project

This page intentionally left blank.

3 Wetland Delineation

On October 19, November 1, and December 19, 2016, Anchor QEA ecologists performed a wetland delineation and wetland rating analysis of wetland habitat in the Project area. Nine wetlands (Wetlands A, B, C, D, E, F, G, H, and I) were identified (Figure 5). Eight of the nine wetlands (Wetlands A, B, C, D, E, F, G, and H) were delineated. Wetland habitats include Depressional, Riverine, and Slope wetland systems. The ninth wetland (Wetland I), is located at the top of the slope on the south side of the Project area, outside of the Project area boundary. A description based on visual observations of Wetland I is provided in this report. The description of Wetland I is included even though it is located outside the Project area because water from the wetland was flowing from the wetland down the hillside, along the road, and into Wetland D at the time of the site visits. Thus, the source of the hydrology flowing into the Project area was documented. A County representative was present during the December 19 site visit and confirmed the wetland boundaries and the decision not to delineate Wetland I.

A complete description of Wetlands A, B, C, D, E, F, G, and H is provided in Section 3.2, Wetland Delineation Results. Wetland I is also described based on visual observations. As described above, no sample plot data were collected at Wetland I. A summary of vegetation, soils, and hydrology data collected at each sampling plot is presented in Appendix A and in the field data forms in Appendix B.

3.1 Methods

This subsection describes the methodology used to perform the wetland delineation, including the review of existing information (described in Section 1.1) and field investigation procedures. These methods are consistent with current federal and state agency requirements, as well as local jurisdiction requirements, for performing wetland delineations and identifying protective wetland buffer widths.

3.1.1 Data Collection

As specified by the SCC (Snohomish County 2016), the wetland delineation was conducted according to the methods defined in the *U.S. Army Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987), the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0)* (Corps 2010), and Ecology's *Washington State Wetland Identification and Delineation Manual* (Ecology 1997). Soil colors were classified by their numerical description, as identified on a Munsell Soil Color Chart (Munsell 1994).

The U.S. Army Corps of Engineers (Corps; Environmental Laboratory 1987) defines wetlands as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." The method for delineating wetlands is based on the presence of three parameters: hydrophytic vegetation, hydric soils, and wetland hydrology. Hydrophytic vegetation is

"the macrophytic plant life that occurs in areas where the frequency and duration of inundation or soil saturation produce permanently or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present." Hydric soils are "formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part." Wetland hydrology "encompasses all hydrologic characteristics of areas that are periodically inundated or have soils saturated to the surface for a sufficient duration during the growing season" (Ecology 1997). Data collection methods for each of these parameters are described in the following subsections.

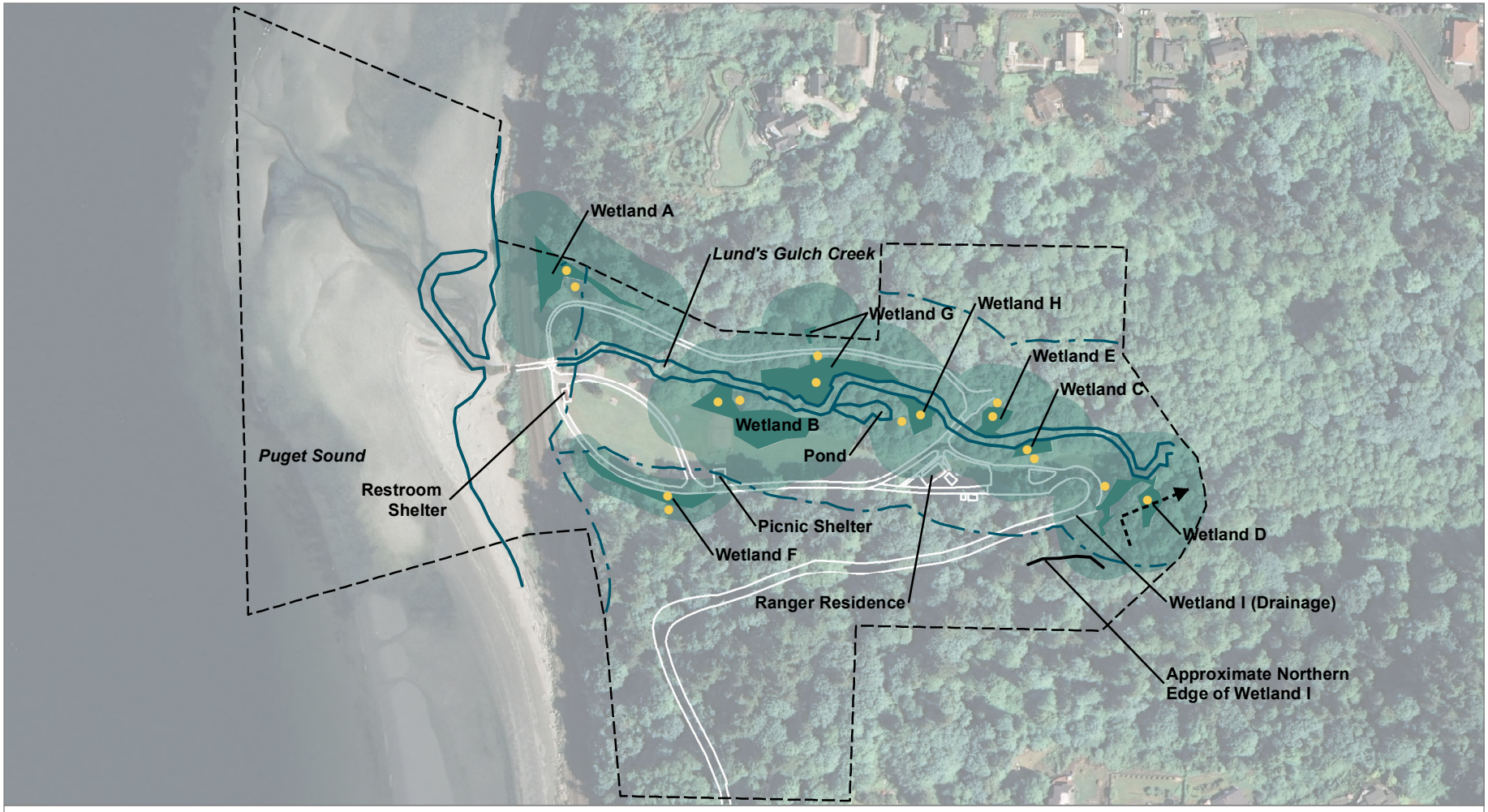
A total of 16 data plots were sampled and recorded, and each sample plot was identified numerically as either wetland or upland (e.g., SP1Wet, SP2Up, SP3Wet, SP4Up). Vegetation, soils, and hydrology information were collected at each of the plots and recorded on field datasheets. A summary of sample plot data is presented in Appendix A, and the field data forms are provided in Appendix B. Wetland boundaries were determined based on plot data and visual observations of the wetland. Each wetland location, wetland boundary, and data plot location was flagged for survey.

3.1.2 Wetland Delineation Results

Plant species occurring in each plot were recorded on field data forms, with one data form per plot (Appendix B). Percent cover for each plant species was estimated in the plot, and dominant plant species were identified. At each plot, trees within a 30-foot radius, shrubs within a 15-foot radius, and emergents within a 3-foot radius from the center of the plot were identified and recorded. A plant indicator status, designated by USFWS (Reed 1988, 1993), was assigned to each species, and a determination was made as to whether the vegetation in the plot was hydrophytic. To meet the hydrophytic parameter, more than 50% of the dominant species, with 20% or greater cover, must have an indicator of obligate wetland (OBL), facultative wetland (FACW), or facultative (FAC). Table 1 shows the wetland indicator status categories.

Table 1
Wetland Plant Indicator Definitions

Indicator Status	Description
Obligate Wetland (OBL)	Plant species occur almost always in wetlands (estimated probability greater than 99%) under natural conditions.
Facultative Wetland (FACW)	Plant species usually occur in wetlands (estimated probability 67% to 99%) but are occasionally found in non-wetlands.
Facultative (FAC)	Plant species are equally likely to occur in wetlands or non-wetlands (estimated probability 34% to 66%).
Facultative Upland (FACU)	Plant species usually occur in non-wetlands (estimated probability 67% to 99%) but are occasionally found in wetlands.
Obligate Upland (UPL)	Plant species occur almost always in non-wetlands (estimated probability greater than 99%) under natural conditions.



LEGEND:

- OHWM
- OHWM Buffer
- Wetland
- Wetland Buffer
- Soil Pit Location
- Project Area

0 300
Feet

Publish Date: 2017/05/24, 10:34 AM | User: bsevertsen
Filepath: Q:\Jobs\SnohomishCounty_0723\MeadowdaleBeachPark\Maps\2017_05\SitePlan_Critical_Areas_rev1.mxd

ANCHOR QEA

Figure 5
Wetland and Stream Delineation Results
Wetland and Stream Delineation Report
Meadowdale Beach Park Recreation and Habitat Improvements Project

This page intentionally left blank.

3.1.3 Soils

Soils were sampled in each plot and evaluated for hydric soil indicators. Soil pits were dug to a depth of 18 inches, unless prevented by impenetrable substrate. Hydric soil indicators include low soil matrix chroma, gleying, and redoximorphic (or "redox") features. Redox features are spots of contrasting color that occur within the soil matrix (the predominant soil color). Gleyed soils are predominantly bluish, greenish, or grayish in color. Soils having a chroma of 2 or less are positive indicators of hydric soils (Environmental Laboratory 1987; Corps 2010).

3.1.4 Hydrology

Wetland hydrology was evaluated at each plot to determine whether it, "encompasses all hydrologic characteristics of areas that are periodically inundated or have soils saturated to the surface for a sufficient duration during the growing season" (Ecology 1997). Field observations of saturation, inundation, and other indicators of wetland hydrology, such as water-stained leaves and drainage patterns in wetlands, were recorded.

3.1.5 Other Data Sources

Existing information was referenced to identify potential wetlands or site characteristics indicative of wetlands in the Project area. The sources of reference information that supported field observations are identified in Section 1.1, Review of Existing Information.

3.1.6 Wetland Classifications

Wetland community types are discussed according to the USFWS classification developed by Cowardin et al. (1979) for use in the NWI. This system, published in 1979 by a team of USFWS scientists led by L.M. Cowardin, bases the classification of wetlands on their physical characteristics, such as the general type of vegetation in the wetland (e.g., trees, shrubs, grass) and how much, and where, water is present in the wetland. The Cowardin system provides a classification for every known wetland type that occurs throughout the United States and, under this system, a wetland can be classified as having one or more wetland classification types. The following community types were found during this investigation:

- **Palustrine forested (PFO):** These wetlands have at least 30% cover of woody vegetation that is more than 20 feet high.
- **Palustrine scrub-shrub (PSS):** These wetlands have at least 30% cover of woody vegetation that is less than 20 feet high.
- **Palustrine emergent (PEM):** These wetlands have erect, rooted, herbaceous vegetation present for most of the growing season in most years.

3.1.7 Wetland Ratings

Wetland ratings were determined using the most current version of Ecology guidance in the *Washington State Wetland Rating System – Western Washington: 2014 Update* (Hruby 2014) and according to Snohomish County wetland rating criteria, as defined in the SCC (Snohomish County 2016). The Ecology wetland rating system was updated as of January 1, 2015.

The system developed by Ecology is used to differentiate wetlands based on their sensitivity to disturbance, their significance in the watershed, their rarity, ability to be replaced, and the beneficial functions they provide to society. The Ecology rating system requires the user to collect specific information about the wetland in a step-by-step process. Three major functions are analyzed (water quality improvement, hydrologic functions, and wildlife habitat). Ratings are based on a point system, where points are given if a wetland meets specific criteria related to the wetland's potential and the opportunity to provide certain benefits.

Per Ecology's rating system, wetlands are categorized according to the following criteria and to points given:

- **Category I wetlands (23 or more points)** represent a unique or rare wetland type, are more sensitive to disturbance, or are relatively undisturbed and contain ecological attributes that are impossible to replace within a human lifetime.
- **Category II wetlands (20 to 22 points)** are difficult, though not impossible, to replace, and provide high levels of some functions.
- **Category III wetlands (16 to 19 points)** have moderate levels of functions. They have been disturbed in some ways and are often less diverse or more isolated from other natural resources in the landscape than Category II wetlands.
- **Category IV wetlands (less than 16 points)** have the lowest levels of functions and are often heavily disturbed.

The SCC classifies wetlands into four categories (Categories I, II, III, and IV) based on the updated 2014 Washington State Wetland Rating System for Western Washington, Ecology (Snohomish County 2016).

3.1.8 Wetland Functions Assessment

The functional values of wetlands were rated according to *Washington State Wetland Rating System – Western Washington: 2014 Update* (Hruby 2014). Using Ecology's system, wetlands were rated based on a point system where points were awarded to three functional value categories (water quality, hydrologic functions, and wildlife habitat). Detailed scoring, based on Ecology wetland rating forms, is provided in Appendix C.

3.1.9 State Hydrogeomorphic Classification System

Scientists have come to understand that wetlands can perform functions in different ways. The way a wetland functions depends to a large degree on hydrologic and geomorphic conditions. To recognize these differences among wetlands, a way to group or classify them has been developed. This classification system, called the Hydrogeomorphic (HGM) Classification, groups wetlands into categories based on the geomorphic and hydrologic characteristics that control many functions. The *Washington State Wetland Rating System – Western Washington: 2014 Update* (Hruby 2014) incorporates the HGM Classification system as part of the questionnaire for characterizing a wetland's functions. The rating system uses only the highest grouping in the classification, i.e., wetland class. Wetland classes are based on geomorphic settings, such as Riverine, Slope, Lake-fringe, or Depressional. A classification key is provided within the rating form to help identify which of the following HGM Classifications apply to the wetland: Riverine; Depressional; Slope; Lake-fringe; Tidal Fringe; or Flats.

3.2 Wetland Delineation Results

3.2.1 Wetland A

Wetland A is an approximately 0.13-acre (5,470-square-foot [sf]) wetland with a PFO and PEM vegetation classes and a depressional HGM class. Wetland A is located adjacent to the railroad track berm and the toe of slope of the hillside to the north (Figure 5). The entire boundary of Wetland A was delineated within the Project area. Wetland vegetation is dominated by black cottonwood (*Populus trichocarpa*, red alder (*Alnus rubra*), salmonberry (*Rubus spectabilis*), and reed canarygrass (*Phalaris arundinacea*).

Dominant buffer vegetation of Wetland A includes big-leaf maple (*Acer macrophyllum*), red alder, salmonberry, sword fern (*Polystichum munitum*), and piggyback plant (*Tolmiea menziesii*).

Soils typically consisted of dark brown loam in the upper few inches with grayish brown clay loam with yellowish brown to brownish yellow redox features below about 3 inches. Soils in the upland plot were dark yellowish loam with no redox features within 18 inches of the surface.

In the Wetland A sample plot, soil saturation was at the surface, with the water table typically at about 3 inches from the surface. In the upland plot, saturation was absent below 18 inches from the surface.

Data were collected at two sample plots: SP1Wet and SP2Up (Appendix A). The wetland plot (SP1Wet) contained indicators of hydrophytic vegetation, wetland hydrology, and hydric soils. The upland plot (SP2Up) had indicators of hydrophytic vegetation and lacked indicators of wetland hydrology and hydric soils.

3.2.2 Wetland B

Wetland B is an approximately 0.21-acre (9,180-sf) wetland with a PFO and PSS vegetation classes and Slope and Riverine HGM classes. Wetland B is located adjacent to the left bank of Lund's Gulch Creek and includes some of the mowed grass area to the south (Figure 5). The entire boundary of Wetland B was delineated within the Project area. Wetland vegetation is dominated by red alder, salmonberry, creeping buttercup *(Ranunculus repens)*, piggyback plant, and reed canarygrass.

Dominant buffer vegetation of Wetland B includes Oregon ash (*Fraxinus latifolia*), salmonberry, Himalayan blackberry (*Rubus armeniacus*), piggyback plant, sword fern, and mowed grass.

Soils typically consisted of very dark grayish brown to dark gray sandy loam with gravel with dark yellowish brown redox features below about 5 inches. Soils in the upland plot were very dark grayish brown sandy loam with gravel with no redox features within 18 inches of the surface.

In the Wetland B sample plot, soil saturation was at the surface, with the water table typically at about 10 inches from the surface. In the upland plot, saturation was absent below 18 inches from the surface.

Data were collected at two sample plots: SP3Wet and SP4Up (Appendix A). The wetland plot (SP3Wet) contained indicators of hydrophytic vegetation, wetland hydrology, and hydric soils. The upland plot (SP4Up) had indicators of hydrophytic vegetation and lacked indicators of wetland hydrology and hydric soils.

3.2.3 Wetland C

Wetland C is an approximately 0.03-acre (1,140-sf) wetland with a PFO and PSS vegetation classes and Slope and Riverine HGM classes. Wetland C is located adjacent to the left bank of Lund's Gulch Creek and is also adjacent to the turn in the access road (Figure 5). The entire boundary of Wetland C was delineated within the Project area. Wetland vegetation is dominated by red alder, salmonberry, and piggyback plant.

Dominant buffer vegetation of Wetland C includes red alder, salmonberry, creeping buttercup, and sword fern.

Soils typically consisted of very dark grayish brown silt loam and gley soils with dark yellowish brown redox features below about 12 inches. Soils in the upland plot were very dark grayish brown loam to dark grayish brown with sandy loam with gravel with no redox features within 18 inches of the surface.

In the Wetland C sample plot, soil saturation was at the surface, with no water table observed to 18 inches. In the upland plot, saturation was absent below 18 inches from the surface.

Data were collected at two sample plots: SP5Wet and SP6Up (Appendix A). The wetland plot (SP3Wet) contained indicators of hydrophytic vegetation, wetland hydrology, and hydric soils. The

upland plot (SP4Up) had indicators of hydrophytic vegetation and lacked indicators of wetland hydrology and hydric soils.

3.2.4 Wetland D

Wetland D is an approximately 0.10-acre (4,140-sf) wetland with a PFO and PSS vegetation classes and a Slope HGM class. Wetland D is located adjacent to the left bank of Lund's Gulch Creek but the bank is a few feet high, preventing overbank flooding from the stream to enter the wetland (Figure 5). The entire boundary of Wetland D was delineated within the Project area. Wetland vegetation is dominated by red alder, salmonberry, creeping buttercup, piggyback plant, and lady fern (*Athyrium filix-femina*).

Dominant buffer vegetation of Wetland D includes red alder, salmonberry, and piggyback plant. Wetland D is also located adjacent to the paved access road.

Soils typically consisted of dark gray silty sand with gravel below about 8 inches. Dark brown to light olive brown redox features were present throughout the sample plot. Soils in the upland plot were dark grayish brown loam to grayish brown silty sand. Rock, cobble, and sand material was located below about 14 inches from the surface.

In the Wetland D sample plot, soil saturation was at the surface and the water table was typically located at about 10 inches from the surface. Surface water that collects in the access road ditch also flows into Wetland D. In the upland plot, saturation was absent below 18 inches from the surface.

Data were collected at two sample plots: SP7Wet and SP8Up (Appendix A). The wetland plot (SP7Wet) contained indicators of hydrophytic vegetation, wetland hydrology, and hydric soils. The upland plot (SP8Up) had indicators of hydrophytic vegetation and lacked indicators of wetland hydrology and hydric soils.

3.2.5 Wetland E

Wetland E is an approximately 0.05-acre (2,060-sf) wetland with a PFO and PSS vegetation classes and depressional and Riverine HGM classes. Wetland E is located adjacent to the right bank of Lund's Gulch Creek, and a walking trail is located north of the wetland (Figure 5). The entire boundary of Wetland E was delineated within the Project area. Wetland vegetation is dominated by red alder, salmonberry, piggyback plant, and field horsetail *(Equisitum arvense)*.

Dominant buffer vegetation of Wetland E includes red alder, salmonberry, piggyback plant, and English ivy *(Hedera helix)*.

Soils typically consisted of very dark gray silt loam with dark grayish brown redox features below about 6 inches. Gley silty sand soils with dark grayish brown redox features were located about

14 inches below the surface. Soils in the upland plot were very dark grayish brown loam with no redox features within 18 inches of the surface.

In the Wetland E sample plot, soil saturation was at the surface and the water table was typically located at about 10 inches from the surface. In the upland plot, saturation was absent below 18 inches from the surface.

Data were collected at two sample plots: SP9Wet and SP10Up (Appendix A). The wetland plot (SP9Wet) contained indicators of hydrophytic vegetation, wetland hydrology, and hydric soils. The upland plot (SP10Up) had indicators of hydrophytic vegetation and lacked indicators of wetland hydrology and hydric soils.

3.2.6 Wetland F

Wetland F is an approximately 0.08-acre (3,440-sf) wetland with a PSS and PEM vegetation classes and a Slope HGM class. Wetland F is located adjacent to the access road where the mowed grass is located to the north (Figure 5). The entire boundary of Wetland F was delineated within the Project area. Wetland vegetation is dominated by salmonberry and piggyback plant.

Dominant buffer vegetation of Wetland F includes big-leaf maple, red alder, salmonberry, sword fern, and piggyback plant.

Soils typically consisted of very dark gray to dark gray silt with gray to yellowish brown redox features below about 6 inches. Soils in the upland plot were very dark brown loam with no redox features within 18 inches of the surface.

In the Wetland F sample plot, standing water was 1 to 2 inches deep with soil saturation, and the water table was typically at the surface. In the upland plot, saturation was absent below 18 inches from the surface.

Data were collected at two sample plots: SP11Wet and SP12Up (Appendix A). The wetland plot (SP11Wet) contained indicators of hydrophytic vegetation, wetland hydrology, and hydric soils. The upland plot (SP12Up) had indicators of hydrophytic vegetation and lacked indicators of wetland hydrology and hydric soils.

3.2.7 Wetland G

Wetland G is an approximately 0.22-acre (9,400-sf) wetland with a PFO and PSS vegetation classes and depressional, Riverine, and Slope HGM classes. Wetland G is located adjacent to the right bank of Lund's Gulch Creek, and a walking trail is located north of the wetland (Figure 5). The entire boundary of Wetland G was delineated within the Project area. Wetland vegetation is dominated by red alder, salmonberry, and piggyback plant.

Dominant buffer vegetation of Wetland G includes red alder, salmonberry, Himalayan blackberry, and sword fern.

Soils typically consisted of very dark gray sandy silt to silty sand to about 14 inches. Gley sand with gravel soils were located about 16 inches below the surface. Soils in the upland plot were dark brown loam with gravel to dark grayish brown sandy loam with no redox features within 18 inches of the surface.

In the Wetland G sample plot, soil saturation was at the surface and the water table was typically located at about 16 inches from the surface. In the upland plot, saturation was absent below 18 inches from the surface.

Data were collected at two sample plots: SP13Wet and SP14Up (Appendix A). The wetland plot (SP13Wet) contained indicators of hydrophytic vegetation, wetland hydrology, and hydric soils. The upland plot (SP14Up) had indicators of hydrophytic vegetation and lacked indicators of wetland hydrology and hydric soils.

3.2.8 Wetland H

Wetland H is an approximately 0.05-acre (2,210-sf) wetland with a PFO and PSS vegetation classes and Slope and Riverine HGM classes. Wetland H is located adjacent to the left bank of Lund's Gulch Creek and the ponded area of the creek (Figure 5). The mowed grass area is located to the south of the wetland. The entire boundary of Wetland H was delineated within the Project area. Wetland vegetation is dominated by red alder, salmonberry, and piggyback plant.

Dominant buffer vegetation of Wetland H includes big-leaf maple, red alder, salmonberry, and piggyback plant.

Soils typically consisted of very dark brown to very dark gray sandy silt and gley soils with yellowish brown redox features below about 9 inches. Soils in the upland plot were very dark grayish brown loam to silt loam with gravel with no redox features within 18 inches of the surface.

In the Wetland H sample plot, soil saturation was at the surface, with the water table observed at about 9 inches. In the upland plot, saturation was absent below 18 inches from the surface.

Data were collected at two sample plots: SP15Wet and SP16Up (Appendix A). The wetland plot (SP15Wet) contained indicators of hydrophytic vegetation, wetland hydrology, and hydric soils. The upland plot (SP16Up) had indicators of hydrophytic vegetation and lacked indicators of wetland hydrology and hydric soils.

3.2.9 Wetland I

A wetland identified as Wetland I is located at the top of the slope on the south side of the Project area, outside of the Project area boundary. Wetland I was not delineated, and no sample plot data was collected. Wetland I is described based on visual observations. Access to observe Wetland I was difficult due to the steep slope conditions, including erosion and landslide conditions. The wetland is located on a plateau at the top of the slope above the access road. Another uphill slope is located south of the wetland.

Wetland I was similar to the conditions in the delineated wetlands in the Project area. Dominant vegetation includes red alder, salmonberry, creeping buttercup, and piggyback plant. Buffer vegetation included salmonberry, creeping buttercup, piggyback plant, and sword fern.

Water was observed flowing into Wetland I from seeps in the uphill slope, through landslide soil debris. Standing water was present within the wetland, and water was flowing down the slope from the wetland to the access road where it flowed in a ditch with a paved bottom into Wetland D, as described above in the Wetland D discussion. Flow from Wetland I down the slope to the access road is a narrow drainage, less than 12 inches wide. The drainage from Wetland I is shown on Figure 1. Overall, Wetland I has similar characteristics to the wetlands delineated within the Project area.

3.3 Regulatory Framework

Guidance from USFWS, Ecology, and Snohomish County was used to determine the wetland classifications. Information and excerpts from the specific guidance language are provided in the following subsections.

3.3.1 USFWS Classification

The wetlands identified in the Project area have been classified using the system developed by Cowardin et al. (1979) for use in the NWI. Table 2 lists the USFWS classifications for the wetlands and their connections to surface water.

Table 2
U.S. Fish and Wildlife Service Wetland Classifications

Wetland	USFWS Classification	Surface Water Connection
Wetland A	PFO & PEM	None
Wetland B	PFO & PSS	Lund's Gulch Creek
Wetland C	PFO & PSS	Lund's Gulch Creek
Wetland D	PFO & PSS	Lund's Gulch Creek
Wetland E	PFO & PSS	Lund's Gulch Creek
Wetland F	PSS & PEM	None

Wetland	USFWS Classification	Surface Water Connection
Wetland G	PFO & PSS	Lund's Gulch Creek
Wetland H	PFO & PSS	Lund's Gulch Creek

PEM: Palustrine emergent
PFO: Palustrine forested
PSS: Palustrine scrub-shrub
USFWS: U.S. Fish and Wildlife Service

3.3.2 Ecology Rating, Classification, and Functions and Values Scores

Per the SCC (Snohomish County 2016), wetland ratings are determined using Ecology's *Washington State Wetlands Rating System – Western Washington: 2014 Update* (Hruby 2014). Under the updated 2014 Ecology (Hruby 2014) wetland rating systems, Wetlands B, C, and D are rated as Category III wetlands. Table 3 lists the 2014 Ecology and local (Snohomish County) wetland rating and classification.

Table 3
Summary of Wetland Classes and Ratings Using Ecology 2014 Wetlands Rating Systems

Wetland	Area (acres)	Hydrogeomorphic Classification	2014[1] State Rating (Ecology)	Local Rating (Snohomish County)[2]
Wetland A	0.13	Depressional	III	III
Wetland B	0.21	Slope and Riverine	II	II
Wetland C	0.03	Slope and Riverine	II	II
Wetland D	0.10	Slope	III	III
Wetland E	0.05	Depressional and Riverine	III	III
Wetland F	0.08	Slope	IV	IV
Wetland G	0.22	Depressional, Slope, and Riverine	III	III
Wetland H	0.05	Slope and Riverine	II	II

Notes:
1. Hruby, T., 2014. Washington State Wetlands Rating System for Western Washington: 2014 Update. Publication No. 14-06-029. Olympia, WA: Washington State Department of Ecology.
2. Snohomish County 2016. Snohomish County Code. Cited: November 12, 2016. Available from: http://www.codepublishing.com/wa/snohomishcounty/.

For the 2014 Ecology wetland rating system (Hruby 2014), a low, moderate, or high rating is based on three functions: 1) Improving Water Quality; 2) Hydrologic; and 3) Habitat. Within each of these three functions are three sub-function categories: 1) Site Potential; 2) Landscape Potential; and 3) Value. Each of these sub-function categories is rated as low, moderate, or high. Wetland functional values and scores for Wetlands A, B, C, D, E, F, G, and H under the 2014 Ecology rating system are shown in Table 4. The 2014 Ecology wetland rating forms are provided in Appendix C.

Table 4
Summary of Functions and Values 2014 Wetland Rating Scores

Wetland and Function	Improving Water Quality	Hydrologic	Habitat	Total Functions Score[1]
Wetland A				
Site Potential	Moderate	Moderate	Moderate	
Landscape Potential	Moderate	Moderate	Moderate	
Value	High	Low	High	
Score Based on Rating[1]	7	5	7	19
Wetland B				
Site Potential	Moderate	Moderate	Moderate	
Landscape Potential	High	High	Moderate	
Value	Moderate	Low	High	
Score Based on Rating[1]	7	6	7	20
Wetland C				
Site Potential	Moderate	Moderate	Moderate	
Landscape Potential	High	High	Moderate	
Value	Moderate	Low	High	
Score Based on Rating[1]	7	6	7	20
Wetland D				
Site Potential	Low	Low	Moderate	
Landscape Potential	Moderate	Low	Moderate	
Value	High	Low	High	
Score Based on Rating[1]	6	3	7	16
Wetland E				
Site Potential	Moderate	Low	Moderate	
Landscape Potential	Moderate	Moderate	Moderate	
Value	High	Low	High	
Score Based on Rating[1]	7	4	7	18
Wetland F				
Site Potential	Low	Low	Low	
Landscape Potential	Moderate	Low	Moderate	
Value	High	Low	High	
Score Based on Rating[1]	6	3	6	15
Wetland G				
Site Potential	Moderate	Low	Moderate	
Landscape Potential	Moderate	Moderate	Moderate	
Value	High	Low	High	

Wetland and Function	Improving Water Quality	Hydrologic	Habitat	Total Functions Score[1]
Score Based on Rating[1]	7	4	7	18
Wetland H				
Site Potential	Moderate	Moderate	Moderate	
Landscape Potential	High	High	Moderate	
Value	Moderate	Low	High	
Score Based on Rating[1]	7	6	7	20

Notes:
1. Potential total score per function is 9, for a potential total score of 27.

3.4 Wetland Functional Assessment

The following subsections provide a description of the functions of Wetlands A, B, C, D, E, F, G, and H based on the 2014 Ecology wetland rating system.

3.4.1 Improving Water Quality Functions

All eight wetlands have the opportunity to improve water quality based on their location within a park located within an urban environment and the presence of developed residential areas outside the park.

Wetlands A, B, C, E, G, and H have moderate function scores for the site potential to improve water quality functions due to the characteristics of surface water outflows from the wetland and the relative area of depressions within the wetland that influences its ability to trap sediments during a flooding event. Wetlands D and F have low function scores because the slope characteristics of these wetlands reduces the ability to trap sediments. None of the wetlands have soil characteristics that include clay or organic material, which contributes to the moderate or low function scores. The characteristic of vegetation within the wetlands to restrict flow and trap sediments and pollutants also contributes to the moderate or low function scores. Wetlands with a moderate function score have a higher relative area of depressions within the wetland that influences its ability to trap sediments.

Wetlands B, C, and H have high function scores, and Wetlands A, D, E, F, and G have moderate functions scores for the landscape potential to support water quality functions of the site because of the potential of the surrounding land uses to generate pollutants and discharge stormwater to the wetlands. Wetlands B, C, and H have high function scores compared to the other wetlands because they were rated under the Riverine hydrogeomorphic classification, which has different rating criteria than the Slope and Depressional rating classifications.

Wetlands A, D, E, F, and G have high function scores, and Wetlands B, C, and H have moderate function scores to provide water quality improvement valuable to society because they are located in the vicinity of aquatic resources that are on the Ecology 303(d) list. Wetlands B, C, and H have moderate function scores compared to the other wetlands because they were rated under the

Riverine hydrogeomorphic classification, which has different rating criteria than the Slope and Depressional rating classifications.

3.4.2 Hydrologic Functions

Wetlands A, B, C, and H provide moderate function scores, and Wetlands D, E, F, and G provide low function scores for potential to reduce flooding and erosion based on the specific characteristics of the surface water outflows from the wetlands, the depth of storage provided by the wetlands during wet periods, and the contribution of the wetland to storage in the watershed.

The wetlands vary in potential to support hydrologic functions at the site based on the hydrogeomorphic classification used to rate the wetlands. Riverine, slope, and depressional rating classifications have slightly different rating criteria regarding the potential of the surrounding land uses to generate pollutants and discharge stormwater to the wetlands. Wetlands B, C, and H provide high function scores, Wetlands A, E, and G provide moderate function scores, and Wetlands D and F provide low function scores.

Wetlands A, B, C, D, E, F, G, and H have low function scores to provide hydrologic functions valuable to society because they are located in a landscape where they do not flow downgradient into areas where flooding has damaged human or natural resources.

3.4.3 Habitat Functions

All of the wetlands, with the exception of Wetland F, have moderate function scores for the potential to provide habitat due to the diverse vegetative structure (more than one Cowardin [1979] vegetation class), the number of water regimes or hydroperiods, the limited plant richness (between 5 and 19 native species observed), the habitat diversity, and special habitat features present. Wetland F has a low function score because it is not adjacent to the creek and has fewer special habitat features than the other wetlands.

All eight wetlands have moderate scores for the landscape potential to support habitat functions of the site because of the characteristics of disturbed and undisturbed habitats surrounding the wetlands and the land-use intensity of the surrounding area.

All eight wetlands have high function scores to provide habitat functions valuable to society because of the proximity of WDFW priority habitats in the vicinity of the wetlands, including snags and logs, and riparian, instream, and marine nearshore habitats. The Project area is also identified as a biodiversity area and corridor based on WDFW PHS maps (WDFW 2016a).

3.5 Snohomish County Wetland Buffer Guidance

Required wetland buffers have been identified according to the current SCC (Snohomish County 2016). The SCC identifies minimum protective buffer widths based on the wetland category, land use intensity, and the Ecology habitat rating score, per the 2014 Ecology rating system. Accordingly, Wetlands A, B, C, D, E, G, and H require 75-foot buffers for low-intensity land use because they are Category II or Category III wetlands with a habitat function score of 5 to 7. Wetland F requires a 25-foot buffers for low-intensity land use as a Category IV wetland. Table 5 summarizes SCC ratings and buffer widths based on the 2014 Ecology rating system.

Table 5
Snohomish County Code Wetland Rating and Standard Buffer Width

Wetland	2014 State Rating (Ecology)	Local Rating (Snohomish County)	Ecology Habitat Rating Score	Snohomish County Code Buffer Width (feet)[1]
Wetland A	III	III	7	75
Wetland B	II	II	7	75
Wetland C	II	II	7	75
Wetland D	III	III	7	75
Wetland E	III	III	7	75
Wetland F	IV	IV	6	25
Wetland G	III	III	7	75
Wetland H	II	II	7	75

Note:
1. Buffer based on Low Intensity Land Use. Snohomish County 2016. Snohomish County Code. Cited: November 12, 2016. Available from: http://www.codepublishing.com/wa/snohomishcounty/.

3.6 Wetland Delineation and Typing Limitations

Wetland identification is an inexact science, and differences of professional opinion often occur between trained individuals. Final determinations for wetland boundaries and typing concurrence or adjustments to these are the responsibility of the regulating resource agency. Wetlands are, by definition, transitional areas; their boundaries can be altered by changes in hydrology or land use. In addition, the definition of jurisdictional wetlands may change. If a physical change occurs in the basin, or if 3 years pass before the proposed project is undertaken, another wetland survey should be conducted. The results and conclusions expressed herein represent Anchor QEA's professional judgment based on the information available. No other warranty, expressed or implied, is made.

4 Stream and Marine Ordinary High Water Mark Delineation

Anchor QEA ecologists identified and delineated the OHWM of two waterbodies within the Project area: Lund's Gulch Creek and the marine shoreline of Puget Sound. The OHWM delineation methods and results are described in the following sections.

4.1 Methods

To document the OHWM of Lund's Gulch Creek and the marine shoreline within the Project area, Anchor QEA ecologists reviewed existing information (described in Section 1.1), performed an aerial photograph analysis, and conducted a site visit on November 19, 2016. The OHWM delineation was completed by walking the stream and marine shorelines and identifying the OHWM with flagging. Flagging was then documented on an aerial photograph for survey.

Anchor QEA ecologists identified the stream and marine OHWM boundaries consistent with Chapter 90.58 of the Revised Code of Washington (RCW) and Chapter 173-22 of the Washington Administrative Code (WAC). The WAC defines the OHWM as:

> "'Ordinary high water line'" means the mark on the shores of all waters that will be found by examining the bed and banks and ascertaining where the presence and action of waters are so common and usual and so long continued in ordinary years, as to mark upon the soil or vegetation a character distinct from that of the abutting upland: Provided, that in any area where the ordinary high water line cannot be found the ordinary high water line adjoining saltwater shall be the line of mean higher high water and the ordinary high water line adjoining freshwater shall be the elevation of the mean annual flood."

The following criteria clarify this mark on tidal waters:

(a) "Tidal waters.

(i) In high energy environments where the action of waves or currents is sufficient to prevent vegetation establishment below mean higher high tide, the ordinary high water mark is coincident with the line of vegetation. Where there is no vegetative cover for less than one hundred feet parallel to the shoreline, the ordinary high water mark is the average tidal elevation of the adjacent lines of vegetation. Where the ordinary high water mark cannot be found, it is the elevation of mean higher high tide;

(ii) In low energy environments where the action of waves and currents is not sufficient to prevent vegetation establishment below mean higher high tide, the ordinary high water mark is coincident with the landward limit of salt tolerant vegetation. 'Salt tolerant

vegetation' means vegetation which is tolerant of interstitial soil salinities greater than or equal to 0.5 parts per thousand."

The marine shoreline of Puget Sound within the Project area is a high-energy environment.

4.2 Ordinary High Water Mark Results

4.2.1 Lund's Gulch Creek

The OHWM of one stream system, Lund's Gulch Creek, was delineated within the Project area. Lund's Gulch Creek is also associated with several of the wetlands that were delineated as part of the investigation (Section 3) and flows into Puget Sound after flowing through a box culvert located below the railroad tracks berm. The stream OHWM delineation began at the box culvert and ended at the upstream end of the Project area (Figure 5).

The OHWM boundary of Lund's Gulch Creek was marked with flags in parallel formation on both banks, as in LB-1 (left bank) and RB-1 (right bank), LB-2 and RB-2, etc. A total of 105 flags were used to delineate the Lund's Gulch Creek OHWM (LB-1 through LB-54 and RB-1 through RB-51). Lund's Gulch Creek is associated with six wetlands, Wetlands B, C, D, E, G, and H. A 1,230-foot reach of Lund's Gulch Creek was delineated within the Project area. A small ponded area associated with the creek was also delineated. The ponded area is located off the left bank of the creek near Wetland H. The ponded area appears to have been an excavated feature. The delineated length of the ponded area was about 240 feet. The Lund's Gulch Creek OHWM delineation results are shown on Figure 5.

Lund's Gulch Creek appears to meet the criteria of a Type F Water, perennial flow with potential fish habitat characteristics. Stream classifications and protective buffer widths for Lund's Gulch Creek, per Chapter 30.62A.320 of the SCC (Snohomish County 2016), are provided in Table 6.

Table 6
Snohomish County Code Stream Classification and Standard Buffer Distance

Stream	Snohomish County Water Typing System Rating	Snohomish County Buffer Width (feet)[1]
Lund's Gulch Creek	Type F	150

Note:
1. Snohomish County 2016. Snohomish County Code. Cited: November 12, 2016. Available from: http://www.codepublishing.com/wa/snohomishcounty/.

4.2.2 Marine Shoreline

The marine OHWM delineation within the Project area included a 1,440-foot reach of shoreline. Lund's Gulch Creek flows from the box culvert at about the midpoint of the marine OHWM

delineation. The marine OHWM delineation results are shown on Figure 5. The protective buffer width for the marine waters within the Project area, per Chapter 30.62A.320 of the SCC (Snohomish County 2016), is provided in Table 7.

Table 7
Snohomish County Code Marine Waters Standard Buffer Distance

Waterbody	Snohomish County Marine Waters Buffer Width (feet)[1]
Puget Sound	150

Note:
1. Snohomish County 2016. Snohomish County Code. Cited: November 12, 2016. Available from: http://www.codepublishing.com/wa/snohomishcounty/.

5 References

Anchor QEA (Anchor QEA, LLC), 2015. *Meadowdale Beach County Park Feasibility Study*. Prepared for Snohomish County Department of Parks and Recreation. August 2015.

Corps (U.S. Army Corps of Engineers), 2010. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0)*. J.S. Wakeley, R.W. Lichvar, and C.V. Noble (eds.). ERDC/EL TR-10-3. Vicksburg, Mississippi: U.S. Army Engineer Research and Development Center.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe, 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. Washington, D.C.: U.S. Fish and Wildlife Service.

Ecology (Washington State Department of Ecology), 1997. *Washington State Wetland Identification and Delineation Manual*. Publication No. 96-94. Olympia, Washington.

Ecology, 2016. Environmental Information; Watersheds; Cedar-Sammamish Water Resource Inventory Area (WRIA) 8. Cited: November 11, 2016. Available from: http://www.ecy.wa.gov/water/wria/08.html.

Environmental Laboratory, 1987. *U.S. Army Corps of Engineers Wetland Delineation Manual*. Technical Report Y-87-1. Vicksburg, Mississippi: U.S. Army Corps of Engineers Waterways Experiment Station.

Hruby, T., 2014. *Washington State Wetlands Rating System – Western Washington: 2014 Update*. Washington State Department of Ecology Publication No. 14-06-029.

Munsell, 1994. *Munsell Soil Color Charts*. Kollmorgen Corporation, Baltimore, Maryland.

Reed, P.B., Jr., 1988. *National List of Plant Species that Occur in Wetlands: 1988 National Summary*. U.S. Fish and Wildlife Service. Biological Report 88 (26.9).

Reed, P., Jr., 1993. *Supplement to List of Plant Species that Occur in Wetlands: Northwest (Region 9)*. U.S. Fish and Wildlife Service. Supplement to Biological Report 88 (26.9).

Snohomish County, 2016. Snohomish County Code. Cited: November 11, 2016. Available from: http://www.codepublishing.com/wa/snohomishcounty/.

USDA (U.S. Department of Agriculture), 2016a. *Natural Resource Conservation Service (NRCS) Web Soil Survey*. Cited: November 11, 2016. Available from: http://websoilsurvey.nrcs.usda.gov/app.

USDA, 2016b. *Hydric Soil List for Snohomish County Area, Washington.* USDA Soil Conservation Service. Cited: November 11, 2016. Available from: http://www.nrcs.usda.gov/wps/portal/nrcs/surveylist/soils/survey/state/?stateId=WA.

USFWS (U.S. Fish and Wildlife Service), 2016. U.S. Fish and Wildlife Service Wetlands Mapper for National Wetlands Inventory Map Information. Cited: November 11, 2016. Available from: https://www.fws.gov/wetlands

WDFW (Washington Department of Fish and Wildlife), 2016a. Priority Habitats and Species Maps. Cited: November 11, 2016. Available from: http://wdfw.wa.gov/mapping/phs/.

WDFW, 2016b. SalmonScape. Cited: November 11, 2016. Available from: http://apps.wdfw.wa.gov/salmonscape/.

Appendix A
Wetland Delineation Data

Table A-1
Plant Species Observed During the Investigation

Scientific Name	Common Name	Indicator
Trees		
Acer macrophylum	Big-leaf maple	FACU
Alnus rubra	Red alder	FAC
Crataegus douglasii	Douglas hawthorne	FAC
Fraxinus latifolia	Oregon ash	FACW
Picea sitchensis	Sitka spruce	FAC
Populus trichocarpa	Black cottonwood	FAC
Pseudotsuga menziesii	Douglas fir	FACU
Salix lasiandra	Pacific willow	FACW+
Salix scouleriana	Scouler willow	FAC
Thuja plicata	Western red cedar	FAC
Tsuga heterophylla	Western hemlock	FACU-
Shrubs		
Acer circinatum	Vine maple	FAC-
Cornus sericea	Red-osier dogwood	FACW
Corylus cornuta	Beaked hazelnut	FACU
Hedera helix	English ivy	UPL
Ilex aquifolium	Holly	FACU
Mahonia nervosa	Low Oregon grape	FACU
Oemleria cerasiformis	Indian plum	FACU
Rhododendron occidentale	Western azalea	FAC
Ribes lacustre	Prickly currant	FAC+
Rubus armeniacus	Himalayan blackberry	FAC
Rubus parviflorus	Western thimbleberry	FAC-
Rubus spectabilis	Salmonberry	FAC+
Rubus ursinus	Trailing blackberry	FACU
Sambucus racemosa	Red elderberry	FACU
Grass, Ferns, & Herbaceous		
Athyrium filix-femina	Lady fern	FAC+
Convolvulvus arvensis	Orchard morning glory	UPL
Equisetum arvense	Field horsetail	FAC
Geranium robertianum	Stinky bob	UPL
Grass spp.	Mowed Grass	NI
Hedera helix	English ivy	UPL
Juncus effusus	Soft rush	FACW
Phalaris arundinacea	Reed canarygrass	FACW
Plantago lanceolata	English plantain	FAC
Polystichum munitum	Sword fern	FACU
Pteridium aquilinum	Bracken fern	FACU
Ranunculus repens	Creeping buttercup	FACW
Taraxacum officinale	Common dandelion	FACU
Tolmiea menziesii	Piggyback plant	FAC
Trifolium pratense	Red clover	FACU
Urtica dioica	Stinging nettle	FAC+

Note:
1 These categories, referred to as the "wetland indicator status" (from the wettest to driest habitats), are as follows: obligate wetland (OBL) plants; facultative wetland (FACW) plants; facultative (FAC) plants; facultative upland (FACU) plants; and obligate upland (UPL) plants.

Table A-2
Summary of Wetland Sample Plot Vegetation Data

Wet	SP	Scientific Name	Common Name	Indicator	Cover %
A	1Wet	*Alnus rubra*	Red alder	FAC	20
		Equisetum arvense	Field horsetail	FAC	5
		Juncus effusus	Soft rush	FACW	20
		Populus trichocarpa	Black cottonwood	FAC	90
		Rubus spectabilis	Salmonberry	FAC+	15
		Rubus ursinus	Trailing blackberry	FACU	5
	2Up	*Acer macrophylum*	Big-leaf maple	FACU	15
		Alnus rubra	Red alder	FAC	35
		Corylus cornuta	Beaked hazelnut	FACU	40
		Crataegus douglasii	Douglas hawthorne	FAC	25
		Equisetum arvense	Field horsetail	FAC	5
		Polystichum munitum	Sword fern	FACU	20
		Populus trichocarpa	Black cottonwood	FAC	25
		Rubus spectabilis	Salmonberry	FAC+	60
		Rubus ursinus	Trailing blackberry	FACU	60
		Tolmiea menziesii	Piggyback plant	FAC	30
B	3Wet	*Alnus rubra*	Red alder	FAC	70
		Athyrium filix-femina	Lady fern	FAC+	5
		Cornus sericea	Red-osier dogwood	FACW	10
		Fraxinus latifolia	Oregon ash	FACW	15
		Phalaris arundinacea	Reed canarygrass	FACW	60
		Ranunculus repens	Creeping buttercup	FACW	90
		Rubus armeniacus	Himalayan blackberry	FAC	5
		Rubus spectabilis	Salmonberry	FAC+	30
		Salix scouleriana	Scouler willow	FAC	15
		Tolmiea menziesii	Piggyback plant	FAC	40
		Urtica dioica	Stinging nettle	FAC+	10
	4Up	*Acer macrophylum*	Big-leaf maple	FACU	10
		Athyrium filix-femina	Lady fern	FAC+	5
		Convolvulvus arvensis	Orchard morning glory	UPL	30
		Fraxinus latifolia	Oregon ash	FACW	40
		Phalaris arundinacea	Reed canarygrass	FACW	5
		Picea sitchensis	Sitka spruce	FAC	15
		Rubus armeniacus	Himalayan blackberry	FAC	35
		Rubus spectabilis	Salmonberry	FAC+	60
C	5Wet	*Alnus rubra*	Red alder	FAC	90
		Rubus spectabilis	Salmonberry	FAC+	85
		Rubus ursinus	Trailing blackberry	FACU	5
		Thuja plicata	Western red cedar	FAC	5
		Tolmiea menziesii	Piggyback plant	FAC	5
	6Up	*Acer macrophylum*	Big-leaf maple	FACU	15
		Alnus rubra	Red alder	FAC	70
		Cornus sericea	Red-osier dogwood	FACW	10
		Rubus spectabilis	Salmonberry	FAC+	50
		Thuja plicata	Western red cedar	FAC	10
		Ranunculus repens	Creeping buttercup	FACW	20
		Polystichum munitum	Sword fern	FACU	20

Table A-2
Summary of Wetland Sample Plot Vegetation Data

Wet	SP	Scientific Name	Common Name	Indicator	Cover %
D	7Wet	*Alnus rubra*	Red alder	FAC	75
		Athyrium filix-femina	Lady fern	FAC+	10
		Equisetum arvense	Field horsetail	FAC	10
		Polystichum munitum	Sword fern	FACU	1
		Ranunculus repens	Creeping buttercup	FACW	15
		Ribes lacustre	Prickly currant	FAC+	5
		Rubus spectabilis	Salmonberry	FAC+	80
		Thuja plicata	Western red cedar	FAC	1
		Thuja plicata	Western red cedar	FAC	1
		Tolmiea menziesii	Piggyback plant	FAC	90
	8Up	*Alnus rubra*	Red alder	FAC	85
		Corylus cornuta	Beaked hazelnut	FACU	5
		Equisetum arvense	Field horsetail	FAC	1
		Polystichum munitum	Sword fern	FACU	5
		Rubus spectabilis	Salmonberry	FAC+	80
		Rubus ursinus	Trailing blackberry	FACU	5
		Thuja plicata	Western red cedar	FAC	1
		Tolmiea menziesii	Piggyback plant	FAC	95
E	9Wet	*Acer macrophylum*	Big-leaf maple	FACU	5
		Alnus rubra	Red alder	FAC	90
		Athyrium filix-femina	Lady fern	FAC+	2
		Cornus sericea	Red-osier dogwood	FACW	10
		Equisetum arvense	Field horsetail	FAC	15
		Picea sitchensis	Sitka spruce	FAC	5
		Rubus spectabilis	Salmonberry	FAC+	60
		Thuja plicata	Western red cedar	FAC	2
		Tolmiea menziesii	Piggyback plant	FAC	70
	10Up	*Alnus rubra*	Red alder	FAC	95
		Hedera helix	English ivy	UPL	15
		Picea sitchensis	Sitka spruce	FAC	15
		Polystichum munitum	Sword fern	FACU	5
		Rubus spectabilis	Salmonberry	FAC+	60
		Rubus ursinus	Trailing blackberry	FACU	5
		Tolmiea menziesii	Piggyback plant	FAC	25
F	11Wet	*Alnus rubra*	Red alder	FAC	90
		Equisetum arvense	Field horsetail	FAC	1
		Ranunculus repens	Creeping buttercup	FACW	1
		Rubus spectabilis	Salmonberry	FAC+	75
		Sambucus racemosa	Red elderberry	FACU	5
		Tolmiea menziesii	Piggyback plant	FAC	40
	12Up	*Acer macrophylum*	Big-leaf maple	FACU	20
		Alnus rubra	Red alder	FAC	30
		Alnus rubra	Red alder	FAC	1
		Geranium robertianum	Stinky bob	UPL	1
		Polystichum munitum	Sword fern	FACU	40
		Rubus spectabilis	Salmonberry	FAC+	60
		Sambucus racemosa	Red elderberry	FACU	10
		Tolmiea menziesii	Piggyback plant	FAC	35

Table A-2
Summary of Wetland Sample Plot Vegetation Data

Wet	SP	Scientific Name	Common Name	Indicator	Cover %
G	13Wet	*Acer macrophylum*	Big-leaf maple	FACU	5
		Alnus rubra	Red alder	FAC	100
		Equisetum arvense	Field horsetail	FAC	1
		Rubus armeniacus	Himalayan blackberry	FAC	5
		Rubus spectabilis	Salmonberry	FAC+	75
		Thuja plicata	Western red cedar	FAC	10
		Tolmiea menziesii	Piggyback plant	FAC	95
	14Up	*Acer macrophylum*	Big-leaf maple	FACU	5
		Alnus rubra	Red alder	FAC	100
		Equisetum arvense	Field horsetail	FAC	1
		Polystichum munitum	Sword fern	FACU	35
		Rubus armeniacus	Himalayan blackberry	FAC	20
		Rubus spectabilis	Salmonberry	FAC+	25
		Thuja plicata	Western red cedar	FAC	5
		Tolmiea menziesii	Piggyback plant	FAC	5
H	15Wet	*Acer macrophylum*	Big-leaf maple	FACU	5
		Acer macrophylum	Big-leaf maple	FACU	5
		Alnus rubra	Red alder	FAC	90
		Equisetum arvense	Field horsetail	FAC	5
		Rubus spectabilis	Salmonberry	FAC+	90
		Thuja plicata	Western red cedar	FAC	10
		Tolmiea menziesii	Piggyback plant	FAC	25
		Tsuga heterophylla	Western hemlock	FACU-	5
	16Up	*Acer macrophylum*	Big-leaf maple	FACU	90
		Alnus rubra	Red alder	FAC	5
		Athyrium filix-femina	Lady fern	FAC+	2
		Cornus sericea	Red-osier dogwood	FACW	10
		Equisetum arvense	Field horsetail	FAC	15
		Picea sitchensis	Sitka spruce	FAC	5
		Rubus spectabilis	Salmonberry	FAC+	60
		Thuja plicata	Western red cedar	FAC	2
		Tolmiea menziesii	Piggyback plant	FAC	70

Table A-3
Summary of Wetland Sample Plot Soils Data

Wet	SP	Soil Horizon (inch)	Matrix Color	Redox Color	Redox Abundance (%)	Texture
A	1Wet	0 to 1	NA	NA	NA	Leaf Litter
		1 to 3	10YR 3/3	None	0	Loam
		3 to 18+	10YR 5/2	10YR 5/6 & 10YR 6/6	10	Clay loam
	2Up	0 to 18+	10YR 3/4	None	0	Loam
B	3Wet	0 to 5	10YR 3/2	None	0	Sandy loam with gravel
		5 to 8	10YR 3/2	10YR 4/6	5	Sandy loam with gravel
		8 to 18+	10YR 4/1	10YR 4/4	5	Sandy loam with gravel
	4Up	0 to 18+	10YR 3/2	None	0	Sandy loam with gravel
C	5Wet	0 to 12	10YR 3/2	None	0	Silty loam
		12 to 18+	Gley1 4/10Y	10YR 4/4	20	Silty sand with cobble and gravel
	6Up	0 to 8	10YR 3/2	None	0	Loam
		8 to 18+	2.5Y 3/2	None	0	Sandy loam with gravel
D	7Wet	0 to 7	10YR 4/1	10YR 5/8	2	Silty sand
		7 to 8	10YR 4/1	None	0	Organics
		8 to 18+	2.5Y 4/1	2.5Y 5/4	20	Silty sand with gravel
	8Up	0 to 10	10YR 4/2	None	0	Loam
		10 to 14	10YR 5/2	0	0	Silty sand
		14 to 18+	10YR 5/2	None	0	Rock, cobble, sand
E	9Wet	0 to 5	10YR 3/1	None	0	Silt loam
		5 to 6	10YR 3/1	None	0	Organics
		6 to 14	10YR 3/1	2.5Y 4/2	20	Silt loam
		14 to 18+	Gley1 4/5G	2.5Y 4/2	50	Silty sand
	10Up	0 to 18+	10YR 3/2	None	0	Loam
F	11Wet	0 to 6	10YR 3/1	None	0	Silt
		6 to 10	10YR 3/2	10YR 5/1	60	Silt
		10 to 18+	10YR 4/1	10YR 5/6	10	Silt
	12Up	0 to 18+	10YR 3/3	None	0	Loam
G	13Wet	0 to 12	10YR 3/1	None	0	Sandy silt
		12 to 16	2.5Y 3/1	None	0	Silty sand
		16 to 18+	Gley1 4/10Y	None	0	Sand with gravel
	14Up	0 to 14	10YR 3/3	None	0	Loam with gravel
		14 to 18+	2.5Y 4/2	None	0	Sandy loam

Table A-3
Summary of Wetland Sample Plot Soils Data

Wet	SP	Soil Horizon (inch)	Matrix Color	Redox Color	Redox Abundance (%)	Texture
H	15Wet	0 to 3	10YR 2/2	None	0	Sandy silt
		3 to 5	Gley1 4/10Y	None	0	Sand
		5 to 9	10YR 3/1	None	0	Sandy silt
		9 to 18+	Gley1 4/10Y	10YR 5/6	5	Silty sand
	16Up	0 to 9	10YR 3/2	None	0	Loam
		9 to 12	10YR 3/2	None	0	Loam with gravel and brick pieces
		12 to 18+	10YR 3/2	None	0	Silt loam with gravel

Table A-4
Summary of Wetland Sample Plot Hydrology Data

Wet	SP	Hydrology
A	1Wet	Saturation at surface, water table observed at 3 inches from surface
	2Up	No saturation or water table observed within sample plot
B	3Wet	Saturation at surface, water table observed at 10 inches from surface
	4Up	No saturation or water table observed within sample plot
C	5Wet	Saturation at surface, no water table observed
	6Up	No saturation or water table observed within sample plot
D	7Wet	Saturation at the surface and water table observed at 10 inches from surface
	8Up	No saturation or water table observed within sample plot
E	9Wet	Saturation at surface and water table observed at 14 inches from surface
	10Up	No saturation or water table observed within sample plot
F	11Wet	Surface water 1 to 2 inches deep, saturation and water table at surface
	12Up	No saturation or water table observed within sample plot
G	13Wet	Saturation at surface and water table observed at 16 inches from surface
	14Up	No saturation or water table observed within sample plot
H	15Wet	Saturation at 9 inches and water table observed at 9 inches from surface
	16Up	No saturation or water table observed within sample plot

Table A-5
Summary of Wetland Sample Plot Data and Wetland Determination

Wet	SP	Vegetation	Soils	Hydrology	Determination
A	1Wet	Hydrophytic	Hydric	Positive	Wetland
	2Up	Hydrophytic	Non-hydric	Negative	Upland
B	3Wet	Hydrophytic	Hydric	Positive	Wetland
	4Up	Hydrophytic	Non-hydric	Negative	Upland
C	5Wet	Hydrophytic	Hydric	Positive	Wetland
	6Up	Hydrophytic	Non-hydric	Negative	Upland
D	7Wet	Hydrophytic	Hydric	Positive	Wetland
	8Up	Hydrophytic	Non-hydric	Negative	Upland
E	9Wet	Hydrophytic	Hydric	Positive	Wetland
	10Up	Hydrophytic	Non-hydric	Negative	Upland
F	11Wet	Hydrophytic	Hydric	Positive	Wetland
	12Up	Hydrophytic	Non-hydric	Negative	Upland
G	13Wet	Hydrophytic	Hydric	Positive	Wetland
	14Up	Hydrophytic	Non-hydric	Negative	Upland
H	15Wet	Hydrophytic	Hydric	Positive	Wetland
	16Up	Hydrophytic	Non-hydric	Negative	Upland

Appendix B
Field Data Forms

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

Project/Site: Meadowdale Park Project City/County: Edmonds/Snohomish Sampling Date: 10/19/16
Applicant/Owner: Snohomish Co. Parks & Rec Department State: WA Sampling Point: We SP1
Investigator(s): C. Douglas & B. Severtsen Section, Township, Range: S5 T27N R4E
Landform (hillslope, terrace, etc.): Forest, ravine Local relief (concave, convex, none): Concave Slope (%): 1%
Subregion (LRR): A Lat: 47.85N Long: -122.32W Datum: NAD83
Soil Map Unit Name: Alderwood Gravelly Sandy Loam NWI classification: None Mapped
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)
Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X 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	X	No	___
Hydric Soil Present?	Yes	X	No	___
Wetland Hydrology Present?	Yes	X	No	___

Is the Sampled Area within a Wetland? Yes X No ___

Remarks: Site is a public park. Wetland A wetland sample plot is located about 3 feet from the edge of flagged wetland boundary.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30 ft)	Absolute % Cover	Dominant Species?	Indicator Status
1. Alnus rubra	20	Yes	FAC
2. Populus trichocarpa	90	Yes	FAC
3.			
4.			
	100	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15 ft)			
1. *Rubus spectabilis*	15	Yes	FAC+
2. Rubus ursinus	5	No	FACU
3.			
4.			
5.			
	20	= Total Cover	

Herb Stratum (Plot size: 5 ft)			
1. *Equisetum arvense*	5	Yes	FAC
2. *Juncus effusus*	5	Yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	10	= Total Cover	

Woody Vine Stratum (Plot size: ___)			
1.			
2.			
	0	= Total Cover	

% Bare Ground in Herb Stratum 90

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	5	(A)
Total Number of Dominant Species Across All Strata:	5	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - 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 X No ___

Remarks:100% FAC or wetter vegetation per the Dominance Test

SOIL

Sampling Point: Wet SP2

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0 to 1	NA	100	NA	NA	NA	NA	Leaf Litter	
1 to 3	10YR 3/3	100	None	0	NA	NA	Loam	
3 to 18+	10YR 5/2	90	10YR 5/6 & 10YR 6/6	10	D	M	Clay loam	

[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)
- X 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)
- ___ Very Shallow Dark Surface (TF12)
- ___ 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 Soil Present? **Yes** X **No** ___

Remarks: 2 chroma with redox features

HYDROLOGY

Wetland Hydrology Indicators:

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

- ___ Surface Water (A1)
- X High Water Table (A2)
- X 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 Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- X 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	X	Depth (inches): ___
Water Table Present?	Yes	X	No	___	Depth (inches): 3
Saturation Present? (includes capillary fringe)	Yes	X	No	___	Depth (inches): surface

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Saturation and standing water present

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

Project/Site: Meadowdale Park Project City/County: Edmonds/Snohomish Sampling Date: 10/19/16
Applicant/Owner: Snohomish Co. Parks & Rec Department State: WA Sampling Point: Up SP2
Investigator(s): C. Douglas & B. Severtsen Section, Township, Range: S5 T27N R4E
Landform (hillslope, terrace, etc.): Forest, ravine Local relief (concave, convex, none): Concave Slope (%): 1%
Subregion (LRR): A Lat: 47.85N Long: -122.32W Datum: NAD83
Soil Map Unit Name: Alderwood Gravelly Sandy Loam NWI classification: None Mapped
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)
Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X 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 X	No ___	**Is the Sampled Area within a Wetland?** **Yes** ___ **No** X
Hydric Soil Present?	Yes ___	No X	
Wetland Hydrology Present?	Yes ___	No X	

Remarks: Site is a public park. Wetland A upland soil plot is located about 4 feet from the edge of flagged wetland boundary.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30 ft)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer macrophylum*	15	No	FACU
2. *Alnus rubra*	35	Yes	FAC
3. *Crataegus douglasii*	25	Yes	FAC
4. *Populus trichocarpa*	25	Yes	FAC
	100	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15 ft)			
1. *Corylus cornuta*	40	Yes	FACU
2. *Rubus spectabilis*	60	Yes	FAC+
3. *Rubus ursinus*	60	Yes	FACU
4.			
5.			
	100	= Total Cover	

Herb Stratum (Plot size: 5 ft)			
1. *Equisetum arvense*	5	No	FAC
2. *Polystichum munitum*	20	Yes	FACU
3. *Tolmiea menziesii*	30	Yes	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	55	= Total Cover	

Woody Vine Stratum (Plot size: ___)			
1.			
2.			
	0	= Total Cover	

% Bare Ground in Herb Stratum 45

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)
Total Number of Dominant Species Across All Strata: 8 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 63 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - 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** X **No** ___

Remarks:63% FAC or wetter vegetation per the Dominance Test

SOIL

Sampling Point: Up SP2

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0 to 18+	10 YR 3/4	100	None	0	NA	NA	Loam	

[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)
___ Very Shallow Dark Surface (TF12)
___ 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 Soil Present? **Yes** ___ **No** **X**

Remarks: 4 chroma with no redox features

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 Stressed 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 X Depth (inches): _____
Water Table Present? Yes ___ No X Depth (inches): _____
Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): _____

Wetland Hydrology Present? **Yes** ___ **No** **X**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: No saturation or standing water

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

Project/Site: Meadowdale Park Project City/County: Edmonds/Snohomish Sampling Date: 10/19/16
Applicant/Owner: Snohomish Co. Parks & Rec Department State: WA Sampling Point: Wet SP3
Investigator(s): C. Douglas & B. Severtsen Section, Township, Range: S5 T27N R4E
Landform (hillslope, terrace, etc.): Riparian Local relief (concave, convex, none): Concave Slope (%): 1%
Subregion (LRR): A Lat: 47.85N Long: -122.32W Datum: NAD83
Soil Map Unit Name: Alderwood Gravelly Sandy Loam NWI classification: None Mapped
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)
Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X 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	X	No	
Hydric Soil Present?	Yes	X	No	
Wetland Hydrology Present?	Yes	X	No	

Is the Sampled Area within a Wetland? Yes X No ___

Remarks: Site is a public park. Wetland B wetland sample plot is located about 4 feet from the edge of flagged wetland boundary.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30 ft)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Alnus rubra*	70	Yes	FAC
2. *Fraxinus latifolia*	15	No	FACW
3. *Salix scouleriana*	15	No	FAC
4.			
	100	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15 ft)			
1. *Cornus sericea*	10	Yes	FACW
2. *Rubus armeniacus*	5	No	FAC
3. *Rubus spectabilis*	30	Yes	FAC+
4.			
5.			
	45	= Total Cover	

Herb Stratum (Plot size: 5 ft)			
1. *Athyrium filix-femina*	5	No	FAC+
2. *Phalaris arundinacea*	60	Yes	FACW
3. *Ranunculus repens*	90	Yes	FACW
4. *Tolmiea menziesii*	40	No	FAC
5. *Urtica dioica*	10	No	FAC+
6.			
7.			
8.			
9.			
10.			
11.			
	100	= Total Cover	

Woody Vine Stratum (Plot size: ___)			
1.			
2.			
	0	= Total Cover	

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)
Total Number of Dominant Species Across All Strata: 5 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - 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 X No ___

Remarks:100% FAC or wetter vegetation

SOIL

Sampling Point: Wet SP3

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0 to 5	10YR 3/2	100	None	0	NA	NA	Sandy loam	w/gravel
5 to 8	10YR 3/2	100	10YR 4/6	5	D	M	Sandy loam	w/gravel
8 to 18+	10YR 4/1	90	10YR 4/4	5	D	M	Sandy loam	w/gravel

[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)
- X 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)
- ___ Very Shallow Dark Surface (TF12)
- ___ 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 Soil Present? **Yes** X **No** ___

Remarks: 1 and 2 chroma with redox features

HYDROLOGY

Wetland Hydrology Indicators:

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

- ___ Surface Water (A1)
- X High Water Table (A2)
- X 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 Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- X 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	X	Depth (inches):
Water Table Present?	Yes	X	No		Depth (inches): 10
Saturation Present? (includes capillary fringe)	Yes	X	No		Depth (inches): surface

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Saturation and standing water present

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

Project/Site: Meadowdale Park Project City/County: Edmonds/Snohomish Sampling Date: 10/19/16
Applicant/Owner: Snohomish Co. Parks & Rec Department State: WA Sampling Point: Up SP4
Investigator(s): C. Douglas & B. Severtsen Section, Township, Range: S5 T27N R4E
Landform (hillslope, terrace, etc.): Riparian Local relief (concave, convex, none): Concave Slope (%): 1%
Subregion (LRR): A Lat: 47.85N Long: -122.32W Datum: NAD83
Soil Map Unit Name: Alderwood Gravelly Sandy Loam NWI classification: None Mapped
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)
Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X 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 X	No ___	**Is the Sampled Area within a Wetland?** **Yes** ___ **No** X
Hydric Soil Present?	Yes ___	No X	
Wetland Hydrology Present?	Yes ___	No X	

Remarks: Site is a public park. Wetland A upland soil plot is located about 4 feet from the edge of flagged wetland boundary.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30 ft)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer macrophylum*	10	No	FACU
2. *Fraxinus latifolia*	40	Yes	FACW
3. *Picea sitchensis*	15	Yes	FAC
4.			
	65	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15 ft)			
1. *Rubus armeniacus*	35	Yes	FAC
2. *Rubus spectabilis*	60	Yes	FAC+
3.			
4.			
5.			
	95	= Total Cover	

Herb Stratum (Plot size: 5 ft)			
1. *Athyrium filix-femina*	5	No	FAC+
2. *Convolvulvus arvensis*	30	Yes	UPL
3. *Phalaris arundinacea*	5	No	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	40	= Total Cover	

Woody Vine Stratum (Plot size: ___)			
1.			
2.			
	0	= Total Cover	

% Bare Ground in Herb Stratum 60

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	4	(A)
Total Number of Dominant Species Across All Strata:	5	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	80	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - 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** X **No** ___

Remarks:80% FAC or wetter vegetation

SOIL

Sampling Point: Up SP4

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0 to 18+	10 YR 3/2	100	None	0	NA	NA	Sandy loam	w/gravel

[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)
___ Very Shallow Dark Surface (TF12)
___ 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 Soil Present? **Yes** ___ **No** **X**

Remarks: 2 chroma with no redox features

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 Stressed 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 X Depth (inches): _____
Water Table Present? Yes ___ No X Depth (inches): _____
Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): _____

Wetland Hydrology Present? **Yes** ___ **No** **X**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: No saturation or standing water

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

Project Site: Meadowdale Park | City/County: Edmonds /Snohomish | Sampling Date: Dec. 19, 2016

Applicant/Owner: Snohomish County | State: WA | Sampling Point: SP5 W Wet C

Investigator(s): J. Pursley & B. Severtsen | Section, Township, Range: S5 T27N R4E

Landform (hillslope, terrace, etc.): Riparian | Local relief (concave, convex, none): concave | Slope (%): 1% to 2%

Subregion (LRR): A | Lat: 47.85N | Long: -122.32W | Datum: _____

Soil Map Unit Name: _____ | NWI classification: None

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

Remarks: **The** Wetland C wet soil plot is located 4' from the edge of the flagged wetland.

VEGETATION – Use scientific names of plants

Tree Stratum (Plot size: 30 foot radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Alnus rubra*	90	yes	FAC
2.			
3.			
4.			
50% = 45, 20% = 18	90	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 foot radius)			
1. *Rubus ursinus*	5	no	FACU
2. *Rubus spectabilis*	85	yes	FAC
3. *Thuja plicata*	5	no	FAC
4.			
5.			
50% = 47.5, 20% = 19	95	= Total Cover	
Herb Stratum (Plot size: 3 foot radius)			
1. *Tolmiea menziesii*	5	yes	FAC
2. .			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
50% = 2.5, 20% = 1	5	= Total Cover	
Woody Vine Stratum (Plot size: 3 foot radius)			
1.			-
2.			
50% = _____, 20% = _____		= Total Cover	

% Bare Ground in Herb Stratum 95

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100	(A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:	
OBL species	0	x1 =	0
FACW species	0	x2 =	0
FAC species	185	x3 =	555
FACU species	5	x4 =	20
UPL species	0	x5 =	0
Column Totals:	190 (A)		575 (B)

Prevalence Index = B/A = 3.0

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☒ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 5 - 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: 100% dominant wetland vegetation per the Dominance Test.

Project Site: Meadowdale Park

SOIL

Sampling Point: SP5 W Wet C

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 to 12	10YR 3/2	100	None	None	None	None	Silty loam	oxidized rhizo. 2- 5%
12 to 18+	Gley1 4/10Y	80	10YR 4/4	20	None	None	Silty sand	oxidized rhizo. small cobble and gravel

[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)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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: Gley soils at 12" and oxidized root channels throughout..

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):	18

Wetland Hydrology Present? **Yes** ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Very saturated soils. Water stained leaves from past over bank events from the stream.

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

Project Site: Meadowdale Park | City/County: Edmonds /Snohomish | Sampling Date: Dec. 19, 2016

Applicant/Owner: Snohomish County | State: WA | Sampling Point: SP6 Up Wet C

Investigator(s): J. Pursley & B. Severtsen | Section, Township, Range: S5 T27N R4E

Landform (hillslope, terrace, etc.): Riparian | Local relief (concave, convex, none): convex | Slope (%): 0% to 2%

Subregion (LRR): A | Lat: 47.85N | Long: -122.32W | Datum: _____

Soil Map Unit Name: _____ | NWI classification: None

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

Remarks: **The** Wetland C Upland soil plot is located 3' from the edge of the flagged wetland.

VEGETATION – Use scientific names of plants

Tree Stratum (Plot size: 30 foot radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Alnus rubra*	70	yes	FAC
2. *Acer macrophyllum*	15	no	FACU
3. _____	_____	____	____
4. _____	_____	____	____
50% = 42.5, 20% = 17	85	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 foot radius)			
1. *Cornus sericea*	10	no	FACW
2. *Rubus spectabilis*	50	yes	FAC
3. *Thuja plicata*	10	no	FAC
4. _____	_____	____	____
5.	_____	____	____
50% = 35, 20% = 14	70	= Total Cover	
Herb Stratum (Plot size: 3 foot radius)			
1. *Ranunculus repens*	20	yes	FAC
2. *Polystichum munitum*	20	yes	FACU
3. _____	_____	____	____
4. _____	_____	____	____
5. _____	_____	____	____
6. _____	_____	____	____
7. _____	_____	____	____
8. _____	_____	____	____
9. _____	_____	____	____
10. _____	_____	____	____
11. _____	_____	____	____
50% = 20, 20% = 8	40	= Total Cover	
Woody Vine Stratum (Plot size: 3 foot radius)			
1. _____	_____	____	-
2. _____	_____	____	____
50% = _____, 20% = _____	_____	= Total Cover	

% Bare Ground in Herb Stratum 60

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	4	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	75	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	0	x1 =	0
FACW species	10	x2 =	20
FAC species	150	x3 =	450
FACU species	35	x4 =	140
UPL species	0	x5 =	0
Column Totals:	195 (A)		610 (B)

Prevalence Index = B/A = 3.1

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☒ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 5 - 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: 75% dominant wetland vegetation per the Dominance Test.

Project Site: Meadowdale Park

SOIL

Sampling Point: SP6 Up Wet C

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 to 8	10YR 3/2	100	None	None	None	None	Loam	
8 to 18+	2.5Y 3/2	100	None	None	None	None	Loam	gravel, rock, and sand

[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)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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: The soil profile has a lot of rock, gravel, and sand below 8 inches.

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:

Remarks: The surface of the soil was damp due to recent rains but no saturation was noted.

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

Project Site: Meadowdale Park City/County: Edmonds /Snohomish Sampling Date: Nov. 1, 2016

Applicant/Owner: Snohomish County State: WA Sampling Point: SP7W Wet D

Investigator(s): J. Pursley & B. Severtsen Section, Township, Range: S5 T27N R4E

Landform (hillslope, terrace, etc.): Hillslope/Riparian Local relief (concave, convex, none): concave Slope (%): 2% to 25%

Subregion (LRR): A Lat: 47.85N Long: -122.32W Datum: _____

Soil Map Unit Name: _____ NWI classification: None

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

Remarks: **The** Wetland D wetland soil plot is located 6' from the edge of the flagged wetland on a forested slope.

VEGETATION – Use scientific names of plants

Tree Stratum (Plot size: 30 foot radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Thuja plicata*	1	no	FAC
2. *Alnus rubra*	75	yes	FAC
3. _____	_____	____	____
4. _____	_____	____	____
50% = 38, 20% = 15.2	76	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 foot radius)			
1. *Thuja plicata*	1	no	FAC
2. *Rubus spectabilis*	80	yes	FAC
3. *Polystichum munitum*	1	no	FACU
4. *Athyrium filix-femina*	10	no	FAC
5. *Ribes lacustre*	5	no	FAC
50% = 48.5, 20% = 19.4	97	= Total Cover	
Herb Stratum (Plot size: 3 foot radius)			
1. *Tolmiea menziesii*	90	yes	FAC
2. *Equisetum arvense.*	10	no	FAC
3. *Ranunculus repens*	15	no	FAC
4. _____	_____	____	____
5. _____	_____	____	____
6. _____	_____	____	____
7. _____	_____	____	____
8. _____	_____	____	____
9. _____	_____	____	____
10. _____	_____	____	____
11. _____	_____	____	____
50% = 57.5, 20% = 23	90	= Total Cover	
Woody Vine Stratum (Plot size: 3 foot radius)			
1. _____	_____	____	-
2. _____	_____	____	____
50% = _____, 20% = _____	_____	= Total Cover	

% Bare Ground in Herb Stratum 4

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100	(A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:	
OBL species	0	x1 =	0
FACW species	0	x2 =	0
FAC species	287	x3 =	861
FACU species	1	x4 =	4
UPL species	0	x5 =	0
Column Totals:	288 (A)		865 (B)

Prevalence Index = B/A = 3.0

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☒ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 5 - 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: 100% dominant wetland vegetation per the Dominance Test.

Project Site: Meadowdale Park

SOIL

Sampling Point: SP7W Wet D

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 to 7	10YR 4/1	98	10YR 5/8	2	None	PL	Silty sand	
7 to 8	10YR 4/1	100	None	None	None	None	Organics	Buried coarse organics
8 to 18+	2.5Y 411	80	2.5Y 5/4	15 - 20	None	PL	Silty sand	gravel 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)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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: Much of this wetland is a result of small landslides from the upslope hillside seep.

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):	10
Saturation Present? (includes capillary fringe)	Yes	☒	No	☐	Depth (inches):	surface

Wetland Hydrology Present? **Yes** ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Hillside seep present at upper elevation of the wetland. Stormwater from the adjacent road is diverted into the wetland

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

Project Site: Meadowdale Park City/County: Edmonds /Snohomish Sampling Date: Nov. 1, 2016

Applicant/Owner: Snohomish County State: WA Sampling Point: SP8Up Wet D

Investigator(s): J. Pursley & B. Severtsen Section, Township, Range: S5 T27N R4E

Landform (hillslope, terrace, etc.): Hillslope/Riparian Local relief (concave, convex, none): concave Slope (%): 2% to 25%

Subregion (LRR): A Lat: 47.85N Long: -122.32W Datum: _____

Soil Map Unit Name: _____ NWI classification: None

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

Remarks: **The** Wetland D upland soil plot is located 3' from the edge of the flagged wetland on a forested slope.

VEGETATION – Use scientific names of plants

Tree Stratum (Plot size: 30 foot radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Alnus rubra*	85	yes	FAC
2. _____	_____	yes	FAC
3. _____	_____	____	____
4. _____	_____	____	____
50% = 42.5, 20% = 17	85	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 foot radius)			
1. *Thuja plicata*	1	no	FAC
2. *Rubus spectabilis*	80	yes	FAC
3. *Polystichum munitum*	5	no	FACU
4. *Rubus ursinus*	5	no	FACU
5. *Corylus cornuta*	5	no	FACU
50% = 48, 20% = 19.2	96	= Total Cover	
Herb Stratum (Plot size: 3 foot radius)			
1. *Tolmiea menziesii*	95	yes	FAC
2. *Equisetum arvense.*	1	no	FAC
3. _____	_____	____	____
4. _____	_____	____	____
5. _____	_____	____	____
6. _____	_____	____	____
7. _____	_____	____	____
8. _____	_____	____	____
9. _____	_____	____	____
10. _____	_____	____	____
11. _____	_____	____	____
50% = 48, 20% = 19.2	96	= Total Cover	
Woody Vine Stratum (Plot size: 3 foot radius)			
1. _____	_____	____	-
2. _____	_____	____	____
50% = _____, 20% = _____	_____	= Total Cover	

% Bare Ground in Herb Stratum 4

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100	(A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:	
OBL species	0	x1 =	0
FACW species	0	x2 =	0
FAC species	262	x3 =	786
FACU species	15	x4 =	60
UPL species	0	x5 =	0
Column Totals:	277 (A)		846 (B)

Prevalence Index = B/A = 3.1

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☒ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is $\leq$3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 5 - 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: Hydrophytic vegetation is present but that may be due to the sample plot being very close to the edge of the wetland. No hydric soils were found or hydrology.

Project Site: Meadowdale Park

SOIL

Sampling Point: SP8Up Wet D

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 to 10	10YR 4/2	100	None	None	None	None	Loam	Coarse roots.
10 to 14	10YR 5/2	100	None	None	None	None	silty sand	gravel in silty sand
14 to 18+	10YR 5/2	100	None	None	None	None	Rock/cobble /sand	Rock, cobbl;e and sand layer

[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)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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: Soil plot is upslope of the landslide depression.

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:

Remarks: Soil is moist but not saturated. Sand in the soil provides drainage.

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

Project Site: Meadowdale Park | City/County: Edmonds /Snohomish | Sampling Date: Nov. 1, 2016

Applicant/Owner: Snohomish County | State: WA | Sampling Point: SP9 W Wet E

Investigator(s): J. Pursley & B. Severtsen | Section, Township, Range: S5 T27N R4E

Landform (hillslope, terrace, etc.): Riparian | Local relief (concave, convex, none): concave | Slope (%): 0% to 2%

Subregion (LRR): A | Lat: 47.85N | Long: -122.32W | Datum: _____

Soil Map Unit Name: _____ | NWI classification: None

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

Remarks: **The** Wetland E wet soil plot is located 6' from the edge of the flagged wetland within the stream floodplain near the trail complex.

VEGETATION – Use scientific names of plants

Tree Stratum (Plot size: 30 foot radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Alnus rubra*	90	yes	FAC
2. *Acer macrophyllum*	5	no	FACU
3. _____	_____	____	____
4. _____	_____	____	____
50% = 47.5, 20% = 19	95	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 foot radius)			
1. *Picea sitchensis*	5	no	FAC
2. *Rubus spectabilis*	60	yes	FAC
3. *Thuja plicata*	2	no	FAC
4. *Athyrium filix-femina*	2	no	FAC
5. *Cornus sericia*	10	no	FACW
50% = 39.5, 20% = 15.8	79	= Total Cover	
Herb Stratum (Plot size: 3 foot radius)			
1. *Tolmiea menziesii*	70	yes	FAC
2. *Equisetum arvense.*	15	no	FAC
3. _____	_____	____	____
4. _____	_____	____	____
5. _____	_____	____	____
6. _____	_____	____	____
7. _____	_____	____	____
8. _____	_____	____	____
9. _____	_____	____	____
10. _____	_____	____	____
11. _____	_____	____	____
50% = 42.5, 20% = 17	85	= Total Cover	
Woody Vine Stratum (Plot size: 3 foot radius)			
1. _____	_____	____	-
2. _____	_____	____	____
50% = _____, 20% = _____	_____	= Total Cover	
% Bare Ground in Herb Stratum 15			

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	0	x1 =	0
FACW species	10	x2 =	20
FAC species	244	x3 =	732
FACU species	5	x4 =	20
UPL species	0	x5 =	0
Column Totals:	259 (A)		772 (B)

Prevalence Index = B/A = 3.0

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☒ 2 - Dominance Test is >50%
- ☒ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 5 - 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: 100% dominant wetland vegetation per the Dominance Test.

Project Site: Meadowdale Park

SOIL

Sampling Point: SP9 W Wet E

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 to 5	10YR 3/1	100	None	None	None	None	Silty loam	
5 to 6	10YR 3/1	100	None	None	None	None	Organics	Buried coarse organics
6 to 14	10YR 3/1	80	2.5Y 4/2	20	D	None	Silty loam	
14 to 18+	Gley1 4/5G	50	2.5Y 4/2	50	D	M	Silty sand	sand tubes within the dense silt

[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)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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: The lower depths of the soil sho frequent rise and fall of the water table based on the adjacet stream discharge.

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):	14
Saturation Present? (includes capillary fringe)	Yes	☒	No	☐	Depth (inches):	surface

Wetland Hydrology Present? **Yes** ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Edge of floodplain depression hold precipitation and overbank events from the adjacent stream.

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

Project Site: Meadowdale Park | City/County: Edmonds /Snohomish | Sampling Date: Nov. 1, 2016

Applicant/Owner: Snohomish County | State: WA | Sampling Point: SP10 Up Wet E

Investigator(s): J. Pursley & B. Severtsen | Section, Township, Range: S5 T27N R4E

Landform (hillslope, terrace, etc.): Riparian | Local relief (concave, convex, none): convex | Slope (%): 0% to 2%

Subregion (LRR): A | Lat: 47.85N | Long: -122.32W | Datum: _____

Soil Map Unit Name: _____ | NWI classification: None

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

Remarks: **The** Wetland E Upland soil plot is located 3' from the edge of the flagged wetland near the park trail complex.

VEGETATION – Use scientific names of plants

Tree Stratum (Plot size: 30 foot radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Alnus rubra*	95	yes	FAC
2. _____	_____	____	____
3. _____	_____	____	____
4. _____	_____	____	____
50% = 47.5, 20% = 19	95	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 foot radius)			
1. *Picea sitchensis*	15	no	FAC
2. *Rubus spectabilis*	60	yes	FAC
3. *Hedera helix*	15	no	FACU
4. *Polystitchum munitum*	5	no	FACU
5. *Rubus ursinus*	5	no	FACU
50% = 50, 20% = 20	100	= Total Cover	
Herb Stratum (Plot size: 3 foot radius)			
1. *Tolmiea menziesii*	25	yes	FAC
2. .	_____	____	____
3. _____	_____	____	____
4. _____	_____	____	____
5. _____	_____	____	____
6. _____	_____	____	____
7. _____	_____	____	____
8. _____	_____	____	____
9. _____	_____	____	____
10. _____	_____	____	____
11. _____	_____	____	____
50% = 12.5, 20% = 5	25	= Total Cover	
Woody Vine Stratum (Plot size: 3 foot radius)			
1. _____	_____	____	-
2. _____	_____	____	____
50% = _____, 20% = _____	_____	= Total Cover	

% Bare Ground in Herb Stratum 15

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	0	x1 =	0
FACW species	0	x2 =	0
FAC species	190	x3 =	570
FACU species	30	x4 =	120
UPL species	0	x5 =	0
Column Totals:	220 (A)		690 (B)

Prevalence Index = B/A = 3.1

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☒ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 5 - 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: 100% dominant wetland vegetation per the Dominance Test.

Project Site: Meadowdale Park

SOIL

Sampling Point: SP10 Up Wet E

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 to 18+	10YR 3/2	100	None	None	None	None	Loam	

[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)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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: The soil is slightly damp and vey consistant throughout.

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:

Remarks: No hydrology indicators. Soil is slightly damp from recent rain events.

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

Project Site: Meadowdale Park | City/County: Edmonds /Snohomish | Sampling Date: Nov. 1, 2016

Applicant/Owner: Snohomish County | State: WA | Sampling Point: SP11 W Wet F

Investigator(s): J. Pursley & B. Severtsen | Section, Township, Range: S5 T27N R4E

Landform (hillslope, terrace, etc.): Toe of slope | Local relief (concave, convex, none): concave | Slope (%): 0% to 2%

Subregion (LRR): A | Lat: 47.85N | Long: -122.32W | Datum: _____

Soil Map Unit Name: _____ | NWI classification: None

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

Remarks: **The** Wetland F wet soil plot is located 3' from the edge of the flagged wetland.

VEGETATION – Use scientific names of plants

Tree Stratum (Plot size: 30 foot radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Alnus rubra*	90	yes	FAC
2.			
3.			
4.			
50% = 47.5, 20% = 19	90	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 foot radius)			
1. *Sambucus racemosa*	5	no	FACU
2. *Rubus spectabilis*	75	yes	FAC
3.			
4.			
5.			
50% = 55, 20% = 22	80	= Total Cover	
Herb Stratum (Plot size: 3 foot radius)			
1. *Tolmiea menziesii*	40	yes	FAC
2. *Equisetum arvens.*	1	no	FAC
3. *Ranunculus repens*	1	no	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
50% = 15, 20% = 6	42	= Total Cover	
Woody Vine Stratum (Plot size: 3 foot radius)			
1.			-
2.			
50% = _____, 20% = _____		= Total Cover	
% Bare Ground in Herb Stratum 58			

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	0	x1 =	0
FACW species	0	x2 =	0
FAC species	207	x3 =	621
FACU species	5	x4 =	20
UPL species	0	x5 =	0
Column Totals:	212 (A)		641 (B)

Prevalence Index = B/A = 3.0

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☒ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 5 - 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: 100% dominant wetland vegetation per the Dominance Test.

Project Site: Meadowdale Park

SOIL

Sampling Point: SP11 W Wet F

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 to 6	10YR 3/1	100	None	None	None	None	Silt	
6 to 10	10YR 3/2	40	10YR 5/1	60	D	PL	Silt	50% redox on pore linings
10 to 18+	10YR 4/1	90	10YR 5/6	10	None	PL	Silt	oxidized rhizoshperes.

[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)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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: Redox and depleted matrix 6" and below.

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):	1 to 2 "
Water Table Present?	Yes	☒	No	☐	Depth (inches):	surface
Saturation Present? (includes capillary fringe)	Yes	☒	No	☐	Depth (inches):	surface

Wetland Hydrology Present? **Yes** ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Standing water in a few places is only 1-2 inches..

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

Project Site: Meadowdale Park | City/County: Edmonds /Snohomish | Sampling Date: Nov. 1, 2016

Applicant/Owner: Snohomish County | State: WA | Sampling Point: SP12 Up Wet F

Investigator(s): J. Pursley & B. Severtsen | Section, Township, Range: S5 T27N R4E

Landform (hillslope, terrace, etc.): Hillslope | Local relief (concave, convex, none): concave | Slope (%): 0% to 2%

Subregion (LRR): A | Lat: 47.85N | Long: -122.32W | Datum: _____

Soil Map Unit Name: _____ | NWI classification: None

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

Remarks: **The** Wetland H Upland soil plot is located 6' from the edge of the flagged wetland.

VEGETATION – Use scientific names of plants

Tree Stratum (Plot size: 30 foot radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Alnus rubra*	30	yes	FAC
2. *Acer macrophyllum*	20	yes	FACU
3. _____	_____	____	____
4. _____	_____	____	____
50% = 25, 20% = 10	50	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 foot radius)			
1. *Alnus rubra*	1	no	FAC
2. *Rubus spectabilis*	60	yes	FAC
3. *Sambucus racemosa*	10	no	FACU
4. _____	_____	____	____
5.	_____	____	____
50% = 35.5, 20% = 14.2	71	= Total Cover	
Herb Stratum (Plot size: 3 foot radius)			
1. *Tolmiea menziesii*	35	yes	FAC
2. *Polystichum munitum.*	40	yes	FACU
3. *Geranium robertainium*	1	no	FACU
4. _____	_____	____	____
5. _____	_____	____	____
6. _____	_____	____	____
7. _____	_____	____	____
8. _____	_____	____	____
9. _____	_____	____	____
10. _____	_____	____	____
11. _____	_____	____	____
50% = 38, 20% = 15.2	76	= Total Cover	
Woody Vine Stratum (Plot size: 3 foot radius)			
1. _____	_____	____	-
2. _____	_____	____	____
50% = _____, 20% = _____	_____	= Total Cover	
% Bare Ground in Herb Stratum 24			

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	5	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	60	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x1 =	0
FACW species	0	x2 =	0
FAC species	126	x3 =	378
FACU species	71	x4 =	284
UPL species	0	x5 =	0
Column Totals:	197 (A)		662 (B)

Prevalence Index = B/A = 3.4

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☒ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 5 - 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: 60% dominant wetland vegetation per the Dominance Test.

Project Site: Meadowdale Park

SOIL

Sampling Point: SP12 Up Wet F

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 to 18	10YR 3/3	100	None	None	None	None	Loam	

[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)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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: Very reddish brown soil..

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:

Remarks: No hydrology present.

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

Project Site: Meadowdale Park | City/County: Edmonds /Snohomish | Sampling Date: Dec. 19, 2016

Applicant/Owner: Snohomish County | State: WA | Sampling Point: SP13 W Wet G

Investigator(s): J. Pursley & B. Severtsen | Section, Township, Range: S5 T27N R4E

Landform (hillslope, terrace, etc.): Riparian | Local relief (concave, convex, none): concave | Slope (%): 1% to 2%

Subregion (LRR): A | Lat: 47.85N | Long: -122.32W | Datum: _____

Soil Map Unit Name: _____ | NWI classification: None

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

Remarks: **The** Wetland G wet soil plot is located 3' from the edge of the flagged wetland near the gravel hiking trail.

VEGETATION – Use scientific names of plants

Tree Stratum (Plot size: 30 foot radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Alnus rubra*	100	yes	FAC
2.			
3.			
4.			
50% = 50, 20% = 20	50	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 foot radius)			
1. *Rubus armeniacus*	5	no	FAC
2. *Rubus spectabilis*	75	yes	FAC
3. *Thuja plicata*	10	no	FAC
4. *Acer macrophyllum*	5	no	FACU
5.			
50% = 47.5, 20% = 19	95	= Total Cover	
Herb Stratum (Plot size: 3 foot radius)			
1. *Tolmiea menziesii*	95	yes	FAC
2. *Equisetum arvens.*	1	no	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
50% = 48, 20% = 19.2	96	= Total Cover	
Woody Vine Stratum (Plot size: 3 foot radius)			
1.			-
2.			
50% = _____, 20% = _____		= Total Cover	
% Bare Ground in Herb Stratum 4			

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x1 =	0
FACW species	0	x2 =	0
FAC species	286	x3 =	858
FACU species	5	x4 =	20
UPL species	0	x5 =	0
Column Totals:	291 (A)		878 (B)

Prevalence Index = B/A = 3.0

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☒ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 5 - 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: 100% dominant wetland vegetation per the Dominance Test.

Project Site: Meadowdale Park

SOIL

Sampling Point: SP13 W Wet G

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 to 12	10YR 3/1	100	None	None	None	None	Sandy silt	
12 to 16	2.5Y 3/1	100	None	None	None	None	Silty Sand	
16 to 18	Gley1 4/10	100	None	None	None	None	Sand	with fine gravel

[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)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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: layers of silty sand from overbanking events.

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):	16
Saturation Present? (includes capillary fringe)	Yes	☒	No	☐	Depth (inches):	surface

Wetland Hydrology Present? **Yes** ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Very saturated upper 16" with water at 16". Soil plot was 3' from the edge of the wetland edge and the gravel trail.

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

Project Site: Meadowdale Park | City/County: Edmonds /Snohomish | Sampling Date: Dec. 19, 2016

Applicant/Owner: Snohomish County | State: WA | Sampling Point: SP14Up Wet G

Investigator(s): J. Pursley & B. Severtsen | Section, Township, Range: S5 T27N R4E

Landform (hillslope, terrace, etc.): Riparian | Local relief (concave, convex, none): none | Slope (%): 0% to 2%

Subregion (LRR): A | Lat: 47.85N | Long: -122.32W | Datum: _____

Soil Map Unit Name: _____ | NWI classification: None

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

Remarks: **The** Wetland G Upland soil plot is located 3' from the edge of the flagged wetland and 3' from the gravel hiking trail..

VEGETATION – Use scientific names of plants

Tree Stratum (Plot size: 30 foot radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Alnus rubra*	100	yes	FAC
2. _____	_____	____	____
3. _____	_____	____	____
4. _____	_____	____	____
50% = 50, 20% = 20	100	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 foot radius)			
1. *Acer macrophyllum*	5	no	FACU
2. *Rubus spectabilis*	25	yes	FAC
3. *Thuja plicata*	5	no	FAC
4. *Rubus armeniacus*	20	yes	FAC
5. _____	_____	____	____
50% = 27.5, 20% = 11	55	= Total Cover	
Herb Stratum (Plot size: 3 foot radius)			
1. *Tolmiea menziesii*	5	no	FAC
2. *Equisetum arvense.*	1	no	FAC
3. *Polystichum munitum*	33	yes	FACU
4. _____	_____	____	____
5. _____	_____	____	____
6. _____	_____	____	____
7. _____	_____	____	____
8. _____	_____	____	____
9. _____	_____	____	____
10. _____	_____	____	____
11. _____	_____	____	____
50% = 19.5, 20% = 17	39	= Total Cover	
Woody Vine Stratum (Plot size: 3 foot radius)			
1. _____	_____	____	-
2. _____	_____	____	____
50% = _____, 20% = _____	_____	= Total Cover	

% Bare Ground in Herb Stratum 61

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	4	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	75	(A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	0	x1 =	0
FACW species	0	x2 =	0
FAC species	156	x3 =	468
FACU species	38	x4 =	152
UPL species	0	x5 =	0
Column Totals:	194 (A)		620 (B)

Prevalence Index = B/A = 3.2

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☒ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 5 - 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: >50% wetland vegetation per the Dominance Test.

Project Site: Meadowdale Park

SOIL

Sampling Point: SP14Up Wet G

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 to 14	10YR 3/3	100	None	None	None	None	Loam	rock and gravel
14 to 18	2.5Y 4/2	100	None	None	None	None	Sandy Loam	

[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)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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: The soil profile has a layer of rock and gravel in the upper 14 inches likely associated with the trail construction.

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:

Remarks: No hydrology present except for damp soils from recent rains.

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

Project Site: Meadowdale Park | City/County: Edmonds /Snohomish | Sampling Date: Nov. 1, 2016

Applicant/Owner: Snohomish County | State: WA | Sampling Point: SP15 W Wet H

Investigator(s): J. Pursley & B. Severtsen | Section, Township, Range: S5 T27N R4E

Landform (hillslope, terrace, etc.): Riparian | Local relief (concave, convex, none): none | Slope (%): 1% to 2%

Subregion (LRR): A | Lat: 47.85N | Long: -122.32W | Datum: _____

Soil Map Unit Name: _____ | NWI classification: None

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

Remarks: **The** Wetland H wet soil plot is located 6' from the edge of the flagged wetland.

VEGETATION – Use scientific names of plants

Tree Stratum (Plot size: 30 foot radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Alnus rubra*	90	yes	FAC
2. *Acer macrophyllum*	5	no	FACU
3. _____	_____	____	____
4. _____	_____	____	____
50% = 47.5, 20% = 19	95	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 foot radius)			
1. *Tsuga heterophylla*	5	no	FACU
2. *Rubus spectabilis*	90	yes	FAC
3. *Thuja plicata*	10	no	FACU
4. *Acer macrophyllum*	5	no	FACU
5. _____	_____	____	____
50% = 55, 20% = 22	110	= Total Cover	
Herb Stratum (Plot size: 3 foot radius)			
1. *Tolmiea menziesii*	25	yes	FAC
2. *Equisetum arvens.*	5	no	FAC
3. _____	_____	____	____
4. _____	_____	____	____
5. _____	_____	____	____
6. _____	_____	____	____
7. _____	_____	____	____
8. _____	_____	____	____
9. _____	_____	____	____
10. _____	_____	____	____
11. _____	_____	____	____
50% = 15, 20% = 6	30	= Total Cover	
Woody Vine Stratum (Plot size: 3 foot radius)			
1. _____	_____	____	-
2. _____	_____	____	____
50% = _____, 20% = _____	_____	= Total Cover	
% Bare Ground in Herb Stratum 70			

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x1 =	0
FACW species	0	x2 =	0
FAC species	220	x3 =	660
FACU species	15	x4 =	60
UPL species	0	x5 =	0
Column Totals:	235 (A)		720 (B)

Prevalence Index = B/A = 3.1

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☒ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 5 - 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: 100% dominant wetland vegetation per the Dominance Test.

Project Site: Meadowdale Park

SOIL

Sampling Point: SP15 W Wet H

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 to 3	10YR 2/2	100	None	None	None	None	Sandy silt	
3 to 5	Gley1 4/10Y	100	None	None	None	None	Sand	
5 to 9	10YR 3/1	100	None	None	None	None	Sandy silt	
9 to 18+	Gley1 4/10	95	10YR 5/6	5	None	PL	silty sand	Oxidized root pores

[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)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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: layers of silty sand from overbanking events.

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):	9
Saturation Present? (includes capillary fringe)	Yes	☒	No	☐	Depth (inches):	9

Wetland Hydrology Present? **Yes** ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Very saturated upper 9" with water at 9". Soil plot was 20' from the edge of the OHWM of the stream.

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

Project Site: Meadowdale Park City/County: Edmonds /Snohomish Sampling Date: Nov. 1, 2016

Applicant/Owner: Snohomish County State: WA Sampling Point: SP16 Up Wet H

Investigator(s): J. Pursley & B. Severtsen Section, Township, Range: S5 T27N R4E

Landform (hillslope, terrace, etc.): Riparian Local relief (concave, convex, none): none Slope (%): 0% to 2%

Subregion (LRR): A Lat: 47.85N Long: -122.32W Datum: _____

Soil Map Unit Name: _____ NWI classification: None

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

Remarks: **The** Wetland H Upland soil plot is located 6' from the edge of the flagged wetland.

VEGETATION – Use scientific names of plants

Tree Stratum (Plot size: 30 foot radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Alnus rubra*	90	yes	FAC
2. *Acer macrophyllum*	5	no	FACU
3. _____	_____	____	____
4. _____	_____	____	____
50% = 47.5, 20% = 19	95	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 foot radius)			
1. *Picea sitchensis*	5	no	FAC
2. *Rubus spectabilis*	60	yes	FAC
3. *Thuja plicata*	2	no	FAC
4. *Athyrium filix-femina*	2	no	FAC
5. *Cornus sericea*	10	no	FACW
50% = 39.5, 20% = 15.8	79	= Total Cover	
Herb Stratum (Plot size: 3 foot radius)			
1. *Tolmiea menziesii*	70	yes	FAC
2. *Equisetum arvense.*	15	no	FAC
3. _____	_____	____	____
4. _____	_____	____	____
5. _____	_____	____	____
6. _____	_____	____	____
7. _____	_____	____	____
8. _____	_____	____	____
9. _____	_____	____	____
10. _____	_____	____	____
11. _____	_____	____	____
50% = 42.5, 20% = 17	85	= Total Cover	
Woody Vine Stratum (Plot size: 3 foot radius)			
1. _____	_____	____	-
2. _____	_____	____	____
50% = _____, 20% = _____	_____	= Total Cover	
% Bare Ground in Herb Stratum 15			

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100	(A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:	
OBL species	0	x1 =	0
FACW species	10	x2 =	20
FAC species	244	x3 =	732
FACU species	5	x4 =	20
UPL species	0	x5 =	0
Column Totals:	259 (A)		772 (B)

Prevalence Index = B/A = 3.0

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☒ 2 - Dominance Test is >50%
- ☒ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 5 - 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: 100% dominant wetland vegetation per the Dominance Test.

Project Site: Meadowdale Park

SOIL

Sampling Point: SP16 Up Wet H

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 to 9	10YR 3/2	100	None	None	None	None	Loam	
9 to 12	10YR 3/2	100	None	None	None	None	Loam	gravel, rock, and brick
12 to 18+	10YR 3/2	100	None	None	None	None	Silt loam	Rounded gravel

[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)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ 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: The soil profile has a layer of rock and brick from 9-12 inches likely from past site development..

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:

Remarks: .

Appendix C
Ecology Wetland Ratings Forms

Wetland name or number A

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Meadowdale Park Wetland A Date of site visit: 10/19/2016

Rated by C. Douglas Trained by Ecology? ☒ Yes ☐ No Date of training 2007

HGM Class used for rating Depressional Wetland has multiple HGM classes? ☐ Y ☒ N

NOTE: **Form is not complete without the figures requested** *(figures can be combined)*.
Source of base aerial photo/map _____

OVERALL WETLAND CATEGORY III (based on functions ☒ or special characteristics ☐)

1. Category of wetland based on FUNCTIONS

_____**Category I** – Total score = 23 - 27

_____**Category II** – Total score = 20 - 22

X **Category III** – Total score = 16 - 19

_____**Category IV** – Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
	Circle the appropriate ratings			
Site Potential	H (M) L	H (M) L	H (M) L	
Landscape Potential	H (M) L	H (M) L	H (M) L	
Value	(H) M L	H M (L)	(H) M L	**TOTAL**
Score Based on Ratings	7	5	7	**19**

Score for each function based on three ratings *(order of ratings is not important)*

9 = H,H,H
8 = H,H,M
7 = H,H,L
7 = H,M,M
6 = H,M,L
6 = M,M,M
5 = H,L,L
5 = M,M,L
4 = M,L,L
3 = L,L,L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	CATEGORY
Estuarine	I II
Wetland of High Conservation Value	I
Bog	I
Mature Forest	I
Old Growth Forest	I
Coastal Lagoon	I II
Interdunal	I II III IV
None of the above	X

Wetland name or number A

Maps and figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	
Hydroperiods	D 1.4, H 1.2	
Location of outlet (*can be added to map of hydroperiods)*	D 1.1, D 4.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	D 2.2, D 5.2	
Map of the contributing basin	D 4.3, D 5.3	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream *(can be added to another figure)*	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to figure above)*	S 4.1	
Boundary of 150 ft buffer (can be added to another figure)	S 2.1, S 5.1	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	

Wetland name or number A

HGM Classification of Wetlands in Western Washington

For questions 1-7, the criteria described must apply to the entire unit being rated.

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 except during floods?

(●) NO – go to 2 ( ) **YES** – the wetland class is **Tidal Fringe** – go to 1.1

1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

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

*If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe it is an **Estuarine** wetland and is not scored. This method **cannot** be used to score functions for estuarine wetlands.*

2. The entire wetland unit is flat and precipitation is the 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 unit **meet all** of the following criteria?
   ☐ The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size;
   ☐ At least 30% of the open water area is deeper than 6.6 ft (2 m).

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

4. Does the entire wetland unit **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**.

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

NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

5. Does the entire wetland unit **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 2 years.

Wetland name or number A

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

NOTE: The Riverine unit can contain depressions that are filled with water when the river is not flooding

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during 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 unit 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 the wetland unit being scored.

   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 HGM 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 of depression	Depressional
Depressional + Lake Fringe	Depressional
Riverine + Lake Fringe	Riverine
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE

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

Wetland name or number A

DEPRESSIONAL AND FLATS WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

D 1.0. Does the site have the potential to improve water quality?	
D 1.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression (QUESTION 7 on key) with no surface water leaving it (no outlet). points = 3 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet. points = 2 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 1 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch. points = 1	3
D 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic *(use NRCS definitions)*. Yes = 4 No = 0	0
D 1.3. Characteristics and distribution of persistent plants (Emergent, Scrub-shrub, and/or Forested Cowardin classes): Wetland has persistent, ungrazed, plants > 95% of area points = 5 Wetland has persistent, ungrazed, plants > ½ of area points = 3 Wetland has persistent, ungrazed plants > $^{1}/_{10}$ of area points = 1 Wetland has persistent, ungrazed plants < $^{1}/_{10}$ of area points = 0	3
D 1.4. Characteristics of seasonal ponding or inundation: *This is the area that is ponded for at least 2 months. See description in manual.* Area seasonally ponded is > ½ total area of wetland points = 4 Area seasonally ponded is > ¼ total area of wetland points = 2 Area seasonally ponded is < ¼ total area of wetland points = 0	2
Total for D 1 Add the points in the boxes above	**8**

Rating of Site Potential If score is: ☐ **12-16 = H** ☒ **6-11 = M** ☐ **0-5 = L** *Record the rating on the first page*

D 2.0. Does the landscape have the potential to support the water quality function of the site?	
D 2.1. Does the wetland unit receive stormwater discharges? Yes = 1 No = 0	0
D 2.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants? Yes = 1 No = 0	1
D 2.3. Are there septic systems within 250 ft of the wetland? Yes = 1 No = 0	0
D 2.4. Are there other sources of pollutants coming into the wetland that are not listed in questions D 2.1-D 2.3? Source_____ Yes = 1 No = 0	0
Total for D 2 Add the points in the boxes above	**1**

Rating of Landscape Potential If score is: ☐ **3 or 4 = H** ☒ **1 or 2 = M** ☐ **0 = L** *Record the rating on the first page*

D 3.0. Is the water quality improvement provided by the site valuable to society?	
D 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, lake, or marine water that is on the 303(d) list? Yes = 1 No = 0	1
D 3.2. Is the wetland in a basin or sub-basin where an aquatic resource is on the 303(d) list? Yes = 1 No = 0	1
D 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality (*answer YES if there is a TMDL for the basin in which the unit is found*)? Yes = 2 No = 0	0
Total for D 3 Add the points in the boxes above	**2**

Rating of Value If score is: ☒ **2-4 = H** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

Wetland name or number A

DEPRESSIONAL AND FLATS WETLANDS

Hydrologic Functions - Indicators that the site functions to reduce flooding and stream degradation

D 4.0. Does the site have the potential to reduce flooding and erosion?	
D 4.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression with no surface water leaving it (no outlet) points = 4 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet points = 2 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch points = 1 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 0	4
D 4.2. Depth of storage during wet periods: *Estimate the height of ponding above the bottom of the outlet. For wetlands with no outlet, measure from the surface of permanent water or if dry, the deepest part.* Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7 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 The wetland is a "headwater" wetland points = 3 Wetland is flat but has small depressions on the surface that trap water points = 1 Marks of ponding less than 0.5 ft (6 in) points = 0	3
D 4.3. Contribution of the wetland 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 the 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 wetland is in the Flats class points = 5	0
Total for D 4 Add the points in the boxes above	**7**

Rating of Site Potential If score is: ☐ **12-16 = H** ☒ **6-11 = M** ☐ **0-5 = L** *Record the rating on the first page*

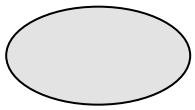
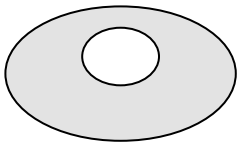
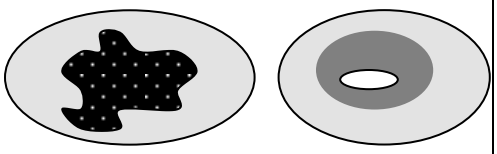
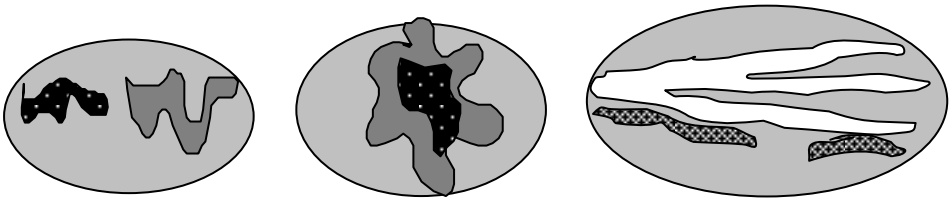
D 5.0. Does the landscape have the potential to support hydrologic functions of the site?	
D 5.1. Does the wetland receive stormwater discharges? Yes = 1 No = 0	0
D 5.2. Is >10% of the area within 150 ft of the wetland in land uses that generate excess runoff? Yes = 1 No = 0	1
D 5.3. Is more than 25% of the contributing basin of the wetland covered with intensive human land uses (residential at >1 residence/ac, urban, commercial, agriculture, etc.)? Yes = 1 No = 0	1
Total for D 5 Add the points in the boxes above	**2**

Rating of Landscape Potential If score is: ☐ **3 = H** ☒ **1 or 2 = M** ☐ **0 = L** *Record the rating on the first page*

D 6.0. Are the hydrologic functions provided by the site valuable to society?	
D 6.1. The unit is in a landscape that has flooding problems. *Choose the description that best matches conditions around the wetland unit being rated. Do not add points. Choose the highest score if more than one condition is met.* The wetland captures surface water that would otherwise flow down-gradient into areas where flooding has damaged human or natural resources (e.g., houses or salmon redds): • Flooding occurs in a sub-basin that is immediately down-gradient of unit. points = 2 • Surface flooding problems are in a sub-basin farther down-gradient. points = 1 Flooding from groundwater is an issue in the sub-basin. points = 1 The existing or potential outflow from the wetland is so constrained by human or natural conditions that the water stored by the wetland cannot reach areas that flood. *Explain why* _____ points = 0 There are no problems with flooding downstream of the wetland. points = 0	0
D 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	0
Total for D 6 Add the points in the boxes above	**0**

Rating of Value If score is: ☐ **2-4 = H** ☐ **1 = M** ☒ **0 = L** *Record the rating on the first page*

Wetland name or number A

These questions apply to wetlands of all HGM classes. **HABITAT FUNCTIONS** - Indicators that site functions to provide important habitat	
H 1.0. Does the site have the potential to provide habitat?	
H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.* ____Aquatic bed — 4 structures or more: points = 4 _X_Emergent — 3 structures: points = 2 ____Scrub-shrub (areas where shrubs have > 30% cover) — 2 structures: points = 1 _X_Forested (areas where trees have > 30% cover) — 1 structure: points = 0 *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	1
H 1.2. Hydroperiods Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*). ____Permanently flooded or inundated — 4 or more types present: points = 3 _X_Seasonally flooded or inundated — 3 types present: points = 2 ____Occasionally flooded or inundated — 2 types present: points = 1 _X_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**	1
H 1.3. Richness of plant species 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 and 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 < 5 species — points = 0	1
H 1.4. Interspersion of habitats Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.*  **None** = 0 points  **Low** = 1 point  **Moderate** = 2 points All three diagrams in this row are **HIGH** = 3points 	2

Wetland name or number A

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* X Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long). ____Standing snags (dbh > 4 in) within the wetland ____Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ____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 weathered where wood is exposed)* ____At least ¼ ac of thin-stemmed persistent plants 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 every stratum of plants (*see H 1.1 for list of strata*)	1
Total for H 1 — Add the points in the boxes above	**6**

Rating of Site Potential If score is: ☐ **15-18 = H** ☒ **7-14 = M** ☐ **0-6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat functions of the site?	
H 2.1. Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate:* % undisturbed habitat 10 **+** [(% moderate and low intensity land uses)/2] 2 **=** 12 % If total accessible habitat is: > $^1/_3$ (33.3%) of 1 km Polygon — points = 3 20-33% of 1 km Polygon — points = 2 10-19% of 1 km Polygon — points = 1 < 10% of 1 km Polygon — points = 0	1
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* % undisturbed habitat 25 **+** [(% moderate and low intensity land uses)/2] 5 **=** 30 % Undisturbed habitat > 50% of Polygon — points = 3 Undisturbed habitat 10-50% and in 1-3 patches — points = 2 Undisturbed habitat 10-50% and > 3 patches — points = 1 Undisturbed habitat < 10% of 1 km Polygon — points = 0	1
H 2.3. Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use — points = (- 2) ≤ 50% of 1 km Polygon is high intensity — points = 0	0
Total for H 2 — Add the points in the boxes above	**2**

Rating of Landscape Potential If score is: ☐ **4-6 = H** ☒ **1-3 = M** ☐ **< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated.* Site meets ANY of the following criteria: — points = 2 — It has 3 or more priority habitats within 100 m (see next page) — It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) — It is mapped as a location for an individual WDFW priority species — It is a Wetland of High Conservation Value as determined by the Department of Natural Resources — It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 priority habitats (listed on next page) within 100 m — points = 1 Site does not meet any of the criteria above — points = 0	**2**

Rating of Value If score is: ☒ **2 = H** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

Wetland name or number A

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp. http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here: http://wdfw.wa.gov/conservation/phs/list/)

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE:*** *This question is independent of the land use between the wetland unit and the priority habitat.*

— **Aspen Stands:** Pure or mixed stands of aspen greater than 1 ac (0.4 ha).

X **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*).

— **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 8 trees/ac (20 trees/ha) > 32 in (81 cm) dbh or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in (53 cm) dbh; 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; 80-200 years old west of the Cascade crest.

— **Oregon White Oak:** Woodland 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 – see web link above*).

X **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 – see web link above*).

X **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.

X **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 – see web link on previous page).*

— **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 25 ft (7.6 m) high and occurring below 5000 ft elevation.

— **Talus:** Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

X **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 > 20 in (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

Wetland name or number A

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine wetlands Does the wetland 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= **Not an estuarine wetland**	
SC 1.1. Is the wetland 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. I**
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina*, see page 25) — At least ¾ 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 two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. ○ Yes = **Category I** ○ No = **Category II**	○ **Cat. I** ○ **Cat. II**
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? ○ Yes – Go to **SC 2.2** ○ No – Go to **SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? ○ Yes = **Category I** ○ No = **Not a WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf ○ Yes – **Contact WNHP/WDNR and go to SC 2.4** ○ No = **Not a WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? ○ Yes = **Category I** ● No = **Not a WHCV**	○ **Cat. I**
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES you will still need to rate the wetland based on its functions.*** SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? ○ Yes – Go to **SC 3.3** ○ No – Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? ○ Yes – Go to **SC 3.3** ○ No = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? ○ Yes = **Is a Category I bog** ○ No – Go to **SC 3.4** **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 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? ○ Yes = **Is a Category I bog** ● No = **Is not a bog**	○ **Cat. I**

Wetland name or number A

SC 4.0. Forested Wetlands Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA 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 functions.*** — **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in (81 cm) or more. — **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80- 200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in (53 cm). ○ Yes = **Category I** ● No = **Not a forested wetland for this section**	○ **Cat. I**
SC 5.0. Wetlands in Coastal Lagoons 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 ponded 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 = **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 aggressive, opportunistic plant species (see list of species on p. 100). — At least ¾ 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 $^{1}/_{10}$ ac (4350 ft^2) ○ Yes = **Category I** ● No = **Category II**	○ **Cat. I** ○ **Cat. II**
SC 6.0. Interdunal Wetlands Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ***If you answer yes you will still need to rate the wetland based on its habitat 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 ○ Yes – Go to **SC 6.1** ● No = **not an interdunal wetland for rating** SC 6.1. Is the wetland 1 ac or larger and scores an 8 or 9 for the habitat functions on the form (rates H,H,H or H,H,M for the three aspects of function)? ○ Yes = **Category I** ○ No – Go to **SC 6.2** SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger? ○ Yes = **Category II** ○ No – Go to **SC 6.3** SC 6.3. Is the unit between 0.1 and 1 ac, or is it in a mosaic of wetlands that is between 0.1 and 1 ac? ○ Yes = **Category III** ○ No = **Category IV**	○ **Cat I** ○ **Cat. II** ○ **Cat. III** ○ **Cat. IV**
Category of wetland based on Special Characteristics If you answered No for all types, enter "Not Applicable" on Summary Form	NA

Wetland name or number B

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Meadowdale Park Wetland B Date of site visit: 10/19/2016

Rated by C. Douglas Trained by Ecology? ☒ Yes ☐ No Date of training 2007

HGM Class used for rating Riverine Wetland has multiple HGM classes? ☒ Y ☐ N

NOTE: **Form is not complete without the figures requested** *(figures can be combined)*.
Source of base aerial photo/map _____

OVERALL WETLAND CATEGORY II (based on functions ☒ or special characteristics ☐)

1. Category of wetland based on FUNCTIONS

_____**Category I** – Total score = 23 - 27

X **Category II** – Total score = 20 - 22

_____**Category III** – Total score = 16 - 19

_____**Category IV** – Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
		Circle the appropriate ratings		
Site Potential	H (M) L	H (M) L	H (M) L	
Landscape Potential	(H) M L	(H) M L	H (M) L	
Value	H (M) L	H M (L)	(H) M L	**TOTAL**
Score Based on Ratings	7	6	7	**20**

Score for each function based on three ratings *(order of ratings is not important)*

9 = H,H,H
8 = H,H,M
7 = H,H,L
7 = H,M,M
6 = H,M,L
6 = M,M,M
5 = H,L,L
5 = M,M,L
4 = M,L,L
3 = L,L,L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	CATEGORY
Estuarine	I II
Wetland of High Conservation Value	I
Bog	I
Mature Forest	I
Old Growth Forest	I
Coastal Lagoon	I II
Interdunal	I II III IV
None of the above	X

Wetland name or number B

Maps and figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	
Hydroperiods	D 1.4, H 1.2	
Location of outlet (*can be added to map of hydroperiods)*	D 1.1, D 4.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	D 2.2, D 5.2	
Map of the contributing basin	D 4.3, D 5.3	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream *(can be added to another figure)*	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to figure above)*	S 4.1	
Boundary of 150 ft buffer (can be added to another figure)	S 2.1, S 5.1	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	

Wetland name or number B

HGM Classification of Wetlands in Western Washington

For questions 1-7, the criteria described must apply to the entire unit being rated.

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 except during floods?

(●) NO – go to 2 ( ) **YES** – the wetland class is **Tidal Fringe** – go to 1.1

1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

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

*If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe it is an **Estuarine** wetland and is not scored. This method **cannot** be used to score functions for estuarine wetlands.*

2. The entire wetland unit is flat and precipitation is the 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 unit **meet all** of the following criteria?
   - ☐ The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size;
   - ☐ At least 30% of the open water area is deeper than 6.6 ft (2 m).

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

4. Does the entire wetland unit **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**.

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

NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

5. Does the entire wetland unit **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 2 years.

Wetland name or number B

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

NOTE: The Riverine unit can contain depressions that are filled with water when the river is not flooding

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during 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 unit 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 the wetland unit being scored.

   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 HGM 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 of depression	Depressional
Depressional + Lake Fringe	Depressional
Riverine + Lake Fringe	Riverine
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE

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

Wetland name or number B

RIVERINE AND FRESHWATER TIDAL FRINGE WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

R 1.0. Does the site have the potential to improve water quality?	
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 > ½ area of wetland points = 4 Depressions present but cover < ½ area of wetland points = 2 No depressions present points = 0	2
R 1.2. Structure of plants in the wetland (areas with >90% cover at person height, **not** Cowardin classes) Trees or shrubs > $^2/_3$ area of the wetland points = 8 Trees or shrubs > $^1/_3$ area of the wetland points = 6 Herbaceous plants (> 6 in high) > $^2/_3$ area of the wetland points = 6 Herbaceous plants (> 6 in high) > $^1/_3$ area of the wetland points = 3 Trees, shrubs, and ungrazed herbaceous < $^1/_3$ area of the wetland points = 0	6
Total for R 1 Add the points in the boxes above	**8**

Rating of Site Potential If score is: ☐ **12-16 = H** ☒ **6-11 = M** ☐ **0-5 = L** *Record the rating on the first page*

R 2.0. Does the landscape have the potential to support the water quality function of the site?	
R 2.1. Is the wetland within an incorporated city or within its UGA? Yes = 2 No = 0	2
R 2.2. Does the contributing basin to the wetland include a UGA or incorporated area? Yes = 1 No = 0	1
R 2.3. Does at least 10% of the contributing basin contain tilled fields, pastures, or forests that have been clearcut within the last 5 years? Yes = 1 No = 0	0
R 2.4. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants? Yes = 1 No = 0	1
R 2.5. Are there other sources of pollutants coming into the wetland that are not listed in questions R 2.1-R 2.4 Other sources _____ Yes = 1 No = 0	0
Total for R 2 Add the points in the boxes above	**4**

Rating of Landscape Potential If score is: ☒ **3-6 = H** ☐ **1 or 2 = M** ☐ **0 = L** *Record the rating on the first page*

R 3.0. Is the water quality improvement provided by the site valuable to society?	
R 3.1. Is the wetland along a stream or river that is on the 303(d) list or on a tributary that drains to one within 1 mi? Yes = 1 No = 0 R 3.2. Is the wetland along a stream or river that has TMDL limits for nutrients, toxics, or pathogens? Yes = 1 No = 0	1 & 0
R 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality? (*answer YES if there is a TMDL for the drainage in which the unit is found*) Yes = 2 No = 0	0
Total for R 3 Add the points in the boxes above	**1**

Rating of Value If score is: ☐ **2-4 = H** ☒ **1 = M** ☐ **0 = L** *Record the rating on the first page*

Wetland name or number B

RIVERINE AND FRESHWATER TIDAL FRINGE WETLANDS

Hydrologic Functions - Indicators that site functions to reduce flooding and stream erosion

R 4.0. Does the site have the potential to reduce flooding and erosion?	
R 4.1. 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 wetland)/(average width of stream between banks).* If the ratio is more than 20 points = 9 If the ratio is 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	4
R 4.2. Characteristics of plants 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. These are NOT Cowardin classes).* Forest or shrub for >$^{1}/_{3}$ area OR emergent plants > $^{2}/_{3}$ area points = 7 Forest or shrub for > $^{1}/_{10}$ area OR emergent plants > $^{1}/_{3}$ area points = 4 Plants do not meet above criteria points = 0	7
Total for R 4 Add the points in the boxes above	**11**

Rating of Site Potential If score is: ☐ **12-16 = H** ☒ **6-11 = M** ☐ **0-5 = L** *Record the rating on the first page*

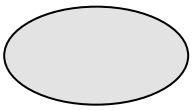
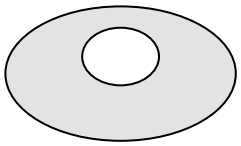
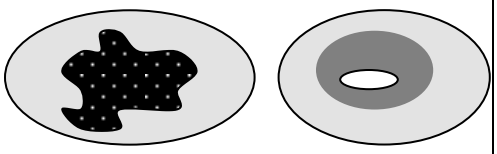
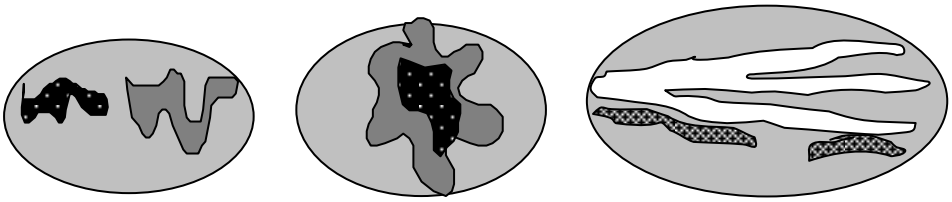
R 5.0. Does the landscape have the potential to support the hydrologic functions of the site?	
R 5.1. Is the stream or river adjacent to the wetland downcut? Yes = 0 No = 1	1
R 5.2. Does the up-gradient watershed include a UGA or incorporated area? Yes = 1 No = 0	1
R 5.3. Is the up-gradient stream or river controlled by dams? Yes = 0 No = 1	1
Total for R 5 Add the points in the boxes above	**3**

Rating of Landscape Potential If score is: ☒ **3 = H** ☐ **1 or 2 = M** ☐ **0 = L** *Record the rating on the first page*

R 6.0. Are the hydrologic functions provided by the site valuable to society?	
R 6.1. Distance to the nearest areas downstream that have flooding problems? *Choose the description that best fits the site.* The sub-basin immediately down-gradient of the wetland has flooding problems that result in damage to human or natural resources (e.g., houses or salmon redds) points = 2 Surface flooding problems are in a sub-basin farther down-gradient points = 1 No flooding problems anywhere downstream points = 0	0
R 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	0
Total for R 6 Add the points in the boxes above	**0**

Rating of Value If score is: ☐ **2-4 = H** ☐ **1 = M** ☒ **0 = L** *Record the rating on the first page*

Wetland name or number B

These questions apply to wetlands of all HGM classes. **HABITAT FUNCTIONS** - Indicators that site functions to provide important habitat	
H 1.0. Does the site have the potential to provide habitat?	
H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.* ____Aquatic bed — 4 structures or more: points = 4 ____Emergent — 3 structures: points = 2 _X_Scrub-shrub (areas where shrubs have > 30% cover) — 2 structures: points = 1 _X_Forested (areas where trees have > 30% cover) — 1 structure: points = 0 *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	1
H 1.2. Hydroperiods Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*). ____Permanently flooded or inundated — 4 or more types present: points = 3 _X_Seasonally flooded or inundated — 3 types present: points = 2 ____Occasionally flooded or inundated — 2 types present: points = 1 _X_Saturated only — 1 type present: points = 0 _X_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**	2
H 1.3. Richness of plant species 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 and 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 < 5 species — points = 0	1
H 1.4. Interspersion of habitats Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.*  **None** = 0 points  **Low** = 1 point  **Moderate** = 2 points All three diagrams in this row are **HIGH** = 3points 	2

Wetland name or number B

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* X Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long). ____Standing snags (dbh > 4 in) within the wetland ____Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ____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 weathered where wood is exposed)* ____At least ¼ ac of thin-stemmed persistent plants 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 every stratum of plants (*see H 1.1 for list of strata*)	1
Total for H 1 — Add the points in the boxes above	**7**

Rating of Site Potential If score is: ☐ **15-18 = H** ☒ **7-14 = M** ☐ **0-6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat functions of the site?	
H 2.1. Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate:* % undisturbed habitat 5 + [(% moderate and low intensity land uses)/2] 1 = 6 % If total accessible habitat is: > $^1/_3$ (33.3%) of 1 km Polygon — points = 3 20-33% of 1 km Polygon — points = 2 10-19% of 1 km Polygon — points = 1 < 10% of 1 km Polygon — points = 0	0
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* % undisturbed habitat 25 + [(% moderate and low intensity land uses)/2] 5 = 30 % Undisturbed habitat > 50% of Polygon — points = 3 Undisturbed habitat 10-50% and in 1-3 patches — points = 2 Undisturbed habitat 10-50% and > 3 patches — points = 1 Undisturbed habitat < 10% of 1 km Polygon — points = 0	1
H 2.3. Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use — points = (- 2) ≤ 50% of 1 km Polygon is high intensity — points = 0	0
Total for H 2 — Add the points in the boxes above	**1**

Rating of Landscape Potential If score is: ☐ **4-6 = H** ☒ **1-3 = M** ☐ **< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated.* Site meets ANY of the following criteria: — points = 2 X It has 3 or more priority habitats within 100 m (see next page) — It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) — It is mapped as a location for an individual WDFW priority species — It is a Wetland of High Conservation Value as determined by the Department of Natural Resources — It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 priority habitats (listed on next page) within 100 m — points = 1 Site does not meet any of the criteria above — points = 0	**2**

Rating of Value If score is: ☒ **2 = H** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

Wetland name or number B

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp. http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here: http://wdfw.wa.gov/conservation/phs/list/)

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE:*** *This question is independent of the land use between the wetland unit and the priority habitat.*

— **Aspen Stands:** Pure or mixed stands of aspen greater than 1 ac (0.4 ha).

X **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*).

— **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 8 trees/ac (20 trees/ha) > 32 in (81 cm) dbh or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in (53 cm) dbh; 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; 80-200 years old west of the Cascade crest.

— **Oregon White Oak:** Woodland 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 – see web link above*).

X **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 – see web link above*).

X **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.

X **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 – see web link on previous page).*

— **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 25 ft (7.6 m) high and occurring below 5000 ft elevation.

— **Talus:** Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

X **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 > 20 in (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

Wetland name or number B

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine wetlands Does the wetland 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= **Not an estuarine wetland**	
SC 1.1. Is the wetland 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. I**
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina*, see page 25) — At least ¾ 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 two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. ○ Yes = **Category I** ○ No = **Category II**	○ **Cat. I** ○ **Cat. II**
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? ○ Yes – Go to **SC 2.2** ○ No – Go to **SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? ○ Yes = **Category I** ○ No = **Not a WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf ○ Yes – **Contact WNHP/WDNR and go to SC 2.4** ○ No = **Not a WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? ○ Yes = **Category I** ● No = **Not a WHCV**	○ **Cat. I**
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES you will still need to rate the wetland based on its functions.*** SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? ○ Yes – Go to **SC 3.3** ○ No – Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? ○ Yes – Go to **SC 3.3** ○ No = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? ○ Yes = **Is a Category I bog** ○ No – Go to **SC 3.4** **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 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? ○ Yes = **Is a Category I bog** ● No = **Is not a bog**	○ **Cat. I**

Wetland name or number B

SC 4.0. Forested Wetlands Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA 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 functions.*** — **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in (81 cm) or more. — **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80- 200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in (53 cm). ○ Yes = **Category I** ● No = **Not a forested wetland for this section**	○ **Cat. I**
SC 5.0. Wetlands in Coastal Lagoons 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 ponded 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 = **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 aggressive, opportunistic plant species (see list of species on p. 100). — At least ¾ 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 $^{1}/_{10}$ ac (4350 ft^2) ○ Yes = **Category I** ● No = **Category II**	○ **Cat. I** ○ **Cat. II**
SC 6.0. Interdunal Wetlands Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ***If you answer yes you will still need to rate the wetland based on its habitat 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 ○ Yes – Go to **SC 6.1** ● No = **not an interdunal wetland for rating** SC 6.1. Is the wetland 1 ac or larger and scores an 8 or 9 for the habitat functions on the form (rates H,H,H or H,H,M for the three aspects of function)? ○ Yes = **Category I** ○ No – Go to **SC 6.2** SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger? ○ Yes = **Category II** ○ No – Go to **SC 6.3** SC 6.3. Is the unit between 0.1 and 1 ac, or is it in a mosaic of wetlands that is between 0.1 and 1 ac? ○ Yes = **Category III** ○ No = **Category IV**	○ **Cat I** ○ **Cat. II** ○ **Cat. III** ○ **Cat. IV**
Category of wetland based on Special Characteristics If you answered No for all types, enter "Not Applicable" on Summary Form	NA

Wetland name or number C

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Meadowdale Park Wetland C Date of site visit: 12/19/2016

Rated by C. Douglas Trained by Ecology? ☒ Yes ☐ No Date of training 2007

HGM Class used for rating Riverine Wetland has multiple HGM classes? ☒ Y ☐ N

NOTE: **Form is not complete without the figures requested** *(figures can be combined)*.
Source of base aerial photo/map _____

OVERALL WETLAND CATEGORY II (based on functions ☒ or special characteristics ☐)

1. Category of wetland based on FUNCTIONS

_____**Category I** – Total score = 23 - 27

X **Category II** – Total score = 20 - 22

_____**Category III** – Total score = 16 - 19

_____**Category IV** – Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
	Circle the appropriate ratings			
Site Potential	H (M) L	H (M) L	H (M) L	
Landscape Potential	(H) M L	(H) M L	H (M) L	
Value	H (M) L	H M (L)	(H) M L	TOTAL
Score Based on Ratings	7	6	7	**20**

Score for each function based on three ratings *(order of ratings is not important)*

9 = H,H,H
8 = H,H,M
7 = H,H,L
7 = H,M,M
6 = H,M,L
6 = M,M,M
5 = H,L,L
5 = M,M,L
4 = M,L,L
3 = L,L,L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	CATEGORY
Estuarine	I II
Wetland of High Conservation Value	I
Bog	I
Mature Forest	I
Old Growth Forest	I
Coastal Lagoon	I II
Interdunal	I II III IV
None of the above	X

Wetland name or number C

Maps and figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	
Hydroperiods	D 1.4, H 1.2	
Location of outlet (*can be added to map of hydroperiods)*	D 1.1, D 4.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	D 2.2, D 5.2	
Map of the contributing basin	D 4.3, D 5.3	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream *(can be added to another figure)*	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to figure above)*	S 4.1	
Boundary of 150 ft buffer (can be added to another figure)	S 2.1, S 5.1	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	

Wetland name or number C

HGM Classification of Wetlands in Western Washington

For questions 1-7, the criteria described must apply to the entire unit being rated.

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 except during floods?

(●) NO – go to 2 ( ) **YES** – the wetland class is **Tidal Fringe** – go to 1.1

1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

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

*If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe it is an **Estuarine** wetland and is not scored. This method **cannot** be used to score functions for estuarine wetlands.*

2. The entire wetland unit is flat and precipitation is the 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 unit **meet all** of the following criteria?
   - ☐ The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size;
   - ☐ At least 30% of the open water area is deeper than 6.6 ft (2 m).

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

4. Does the entire wetland unit **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**.

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

NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

5. Does the entire wetland unit **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 2 years.

Wetland name or number C

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

NOTE: The Riverine unit can contain depressions that are filled with water when the river is not flooding

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during 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 unit 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 the wetland unit being scored.

   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 HGM 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 of depression	Depressional
Depressional + Lake Fringe	Depressional
Riverine + Lake Fringe	Riverine
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE

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

Wetland name or number C

RIVERINE AND FRESHWATER TIDAL FRINGE WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

R 1.0. Does the site have the potential to improve water quality?	
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 > ½ area of wetland points = 4 Depressions present but cover < ½ area of wetland points = 2 No depressions present points = 0	2
R 1.2. Structure of plants in the wetland (areas with >90% cover at person height, **not** Cowardin classes) Trees or shrubs > $^2/_3$ area of the wetland points = 8 Trees or shrubs > $^1/_3$ area of the wetland points = 6 Herbaceous plants (> 6 in high) > $^2/_3$ area of the wetland points = 6 Herbaceous plants (> 6 in high) > $^1/_3$ area of the wetland points = 3 Trees, shrubs, and ungrazed herbaceous < $^1/_3$ area of the wetland points = 0	6
Total for R 1 Add the points in the boxes above	**8**

Rating of Site Potential If score is: ☐ **12-16 = H** ☒ **6-11 = M** ☐ **0-5 = L** *Record the rating on the first page*

R 2.0. Does the landscape have the potential to support the water quality function of the site?	
R 2.1. Is the wetland within an incorporated city or within its UGA? Yes = 2 No = 0	2
R 2.2. Does the contributing basin to the wetland include a UGA or incorporated area? Yes = 1 No = 0	1
R 2.3. Does at least 10% of the contributing basin contain tilled fields, pastures, or forests that have been clearcut within the last 5 years? Yes = 1 No = 0	0
R 2.4. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants? Yes = 1 No = 0	1
R 2.5. Are there other sources of pollutants coming into the wetland that are not listed in questions R 2.1-R 2.4 Other sources _____ Yes = 1 No = 0	0
Total for R 2 Add the points in the boxes above	**4**

Rating of Landscape Potential If score is: ☒ **3-6 = H** ☐ **1 or 2 = M** ☐ **0 = L** *Record the rating on the first page*

R 3.0. Is the water quality improvement provided by the site valuable to society?	
R 3.1. Is the wetland along a stream or river that is on the 303(d) list or on a tributary that drains to one within 1 mi? Yes = 1 No = 0 R 3.2. Is the wetland along a stream or river that has TMDL limits for nutrients, toxics, or pathogens? Yes = 1 No = 0	1 & 0
R 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality? (*answer YES if there is a TMDL for the drainage in which the unit is found*) Yes = 2 No = 0	0
Total for R 3 Add the points in the boxes above	**1**

Rating of Value If score is: ☐ **2-4 = H** ☒ **1 = M** ☐ **0 = L** *Record the rating on the first page*

Wetland name or number C

RIVERINE AND FRESHWATER TIDAL FRINGE WETLANDS

Hydrologic Functions - Indicators that site functions to reduce flooding and stream erosion

R 4.0. Does the site have the potential to reduce flooding and erosion?		
R 4.1. 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 wetland)/(average width of stream between banks).* If the ratio is more than 20 points = 9 If the ratio is 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		4
R 4.2. Characteristics of plants 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. These are NOT Cowardin classes).* Forest or shrub for >$^{1}/_{3}$ area OR emergent plants > $^{2}/_{3}$ area points = 7 Forest or shrub for > $^{1}/_{10}$ area OR emergent plants > $^{1}/_{3}$ area points = 4 Plants do not meet above criteria points = 0		7
Total for R 4	Add the points in the boxes above	**11**

Rating of Site Potential If score is: ☐ **12-16 = H** ☒ **6-11 = M** ☐ **0-5 = L** *Record the rating on the first page*

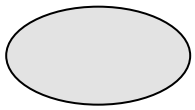
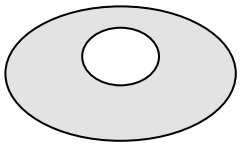
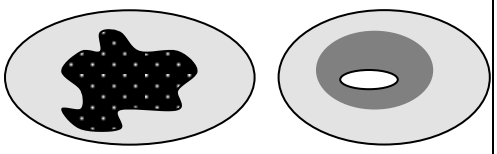
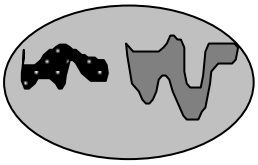
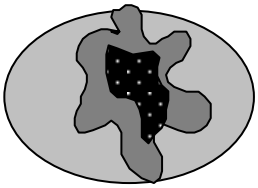
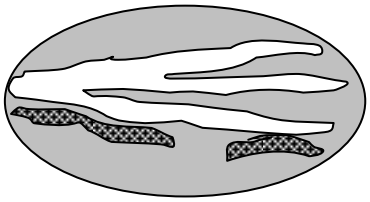
R 5.0. Does the landscape have the potential to support the hydrologic functions of the site?		
R 5.1. Is the stream or river adjacent to the wetland downcut?	Yes = 0 No = 1	1
R 5.2. Does the up-gradient watershed include a UGA or incorporated area?	Yes = 1 No = 0	1
R 5.3. Is the up-gradient stream or river controlled by dams?	Yes = 0 No = 1	1
Total for R 5	Add the points in the boxes above	**3**

Rating of Landscape Potential If score is: ☒ **3 = H** ☐ **1 or 2 = M** ☐ **0 = L** *Record the rating on the first page*

R 6.0. Are the hydrologic functions provided by the site valuable to society?		
R 6.1. Distance to the nearest areas downstream that have flooding problems? *Choose the description that best fits the site.* The sub-basin immediately down-gradient of the wetland has flooding problems that result in damage to human or natural resources (e.g., houses or salmon redds) points = 2 Surface flooding problems are in a sub-basin farther down-gradient points = 1 No flooding problems anywhere downstream points = 0		0
R 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan?	Yes = 2 No = 0	0
Total for R 6	Add the points in the boxes above	**0**

Rating of Value If score is: ☐ **2-4 = H** ☐ **1 = M** ☒ **0 = L** *Record the rating on the first page*

Wetland name or number C

These questions apply to wetlands of all HGM classes. **HABITAT FUNCTIONS** - Indicators that site functions to provide important habitat	
H 1.0. Does the site have the potential to provide habitat?	
H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.* ____Aquatic bed — 4 structures or more: points = 4 ____Emergent — 3 structures: points = 2 _X_Scrub-shrub (areas where shrubs have > 30% cover) — 2 structures: points = 1 _X_Forested (areas where trees have > 30% cover) — 1 structure: points = 0 *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	1
H 1.2. Hydroperiods Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*). ____Permanently flooded or inundated — 4 or more types present: points = 3 _X_Seasonally flooded or inundated — 3 types present: points = 2 ____Occasionally flooded or inundated — 2 types present: points = 1 _X_Saturated only — 1 type present: points = 0 _X_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**	2
H 1.3. Richness of plant species 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 and 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 < 5 species — points = 0	1
H 1.4. Interspersion of habitats Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.*  **None** = 0 points  **Low** = 1 point  **Moderate** = 2 points All three diagrams in this row are **HIGH** = 3points   	2

Wetland name or number C

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* X Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long). ____Standing snags (dbh > 4 in) within the wetland ____Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ____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 weathered where wood is exposed)* ____At least ¼ ac of thin-stemmed persistent plants 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 every stratum of plants (*see H 1.1 for list of strata*)	1
Total for H 1 — Add the points in the boxes above	**7**

Rating of Site Potential If score is: ☐ **15-18 = H** ☒ **7-14 = M** ☐ **0-6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat functions of the site?	
H 2.1. Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate:* % undisturbed habitat 1 **+** [(% moderate and low intensity land uses)/2] .5 **=** 1.5 % If total accessible habitat is: > $^1/_3$ (33.3%) of 1 km Polygon — points = 3 20-33% of 1 km Polygon — points = 2 10-19% of 1 km Polygon — points = 1 < 10% of 1 km Polygon — points = 0	0
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* % undisturbed habitat 25 **+** [(% moderate and low intensity land uses)/2] 5 **=** 30 % Undisturbed habitat > 50% of Polygon — points = 3 Undisturbed habitat 10-50% and in 1-3 patches — points = 2 Undisturbed habitat 10-50% and > 3 patches — points = 1 Undisturbed habitat < 10% of 1 km Polygon — points = 0	1
H 2.3. Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use — points = (- 2) ≤ 50% of 1 km Polygon is high intensity — points = 0	0
Total for H 2 — Add the points in the boxes above	**1**

Rating of Landscape Potential If score is: ☐ **4-6 = H** ☒ **1-3 = M** ☐ **< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated.* Site meets ANY of the following criteria: — points = 2 X It has 3 or more priority habitats within 100 m (see next page) — It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) — It is mapped as a location for an individual WDFW priority species — It is a Wetland of High Conservation Value as determined by the Department of Natural Resources — It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 priority habitats (listed on next page) within 100 m — points = 1 Site does not meet any of the criteria above — points = 0	**2**

Rating of Value If score is: ☒ **2 = H** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

Wetland name or number C

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp. http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here: http://wdfw.wa.gov/conservation/phs/list/)

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE:*** *This question is independent of the land use between the wetland unit and the priority habitat.*

— **Aspen Stands:** Pure or mixed stands of aspen greater than 1 ac (0.4 ha).

X **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*).

— **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 8 trees/ac (20 trees/ha) > 32 in (81 cm) dbh or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in (53 cm) dbh; 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; 80-200 years old west of the Cascade crest.

— **Oregon White Oak:** Woodland 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 – see web link above*).

X **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 – see web link above*).

X **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.

X **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 – see web link on previous page).*

— **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 25 ft (7.6 m) high and occurring below 5000 ft elevation.

— **Talus:** Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

X **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 > 20 in (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

Wetland name or number C

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine wetlands Does the wetland 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= **Not an estuarine wetland**	
SC 1.1. Is the wetland 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. I**
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina*, see page 25) — At least ¾ 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 two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. ○ Yes = **Category I** ○ No = **Category II**	○ **Cat. I** ○ **Cat. II**
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? ○ Yes – Go to **SC 2.2** ○ No – Go to **SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? ○ Yes = **Category I** ○ No = **Not a WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf ○ Yes – **Contact WNHP/WDNR and go to SC 2.4** ○ No = **Not a WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? ○ Yes = **Category I** ● No = **Not a WHCV**	○ **Cat. I**
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES you will still need to rate the wetland based on its functions.*** SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? ○ Yes – Go to **SC 3.3** ○ No – Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? ○ Yes – Go to **SC 3.3** ○ No = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? ○ Yes = **Is a Category I bog** ○ No – Go to **SC 3.4** **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 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? ○ Yes = **Is a Category I bog** ● No = **Is not a bog**	○ **Cat. I**

Wetland name or number C

SC 4.0. Forested Wetlands Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA 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 functions.*** — **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in (81 cm) or more. — **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80- 200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in (53 cm). ○ Yes = **Category I** ● No = **Not a forested wetland for this section**	○ **Cat. I**
SC 5.0. Wetlands in Coastal Lagoons 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 ponded 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 = **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 aggressive, opportunistic plant species (see list of species on p. 100). — At least ¾ 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 $^{1}/_{10}$ ac (4350 ft^2) ○ Yes = **Category I** ● No = **Category II**	○ **Cat. I** ○ **Cat. II**
SC 6.0. Interdunal Wetlands Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ***If you answer yes you will still need to rate the wetland based on its habitat 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 ○ Yes – Go to **SC 6.1** ● No = **not an interdunal wetland for rating** SC 6.1. Is the wetland 1 ac or larger and scores an 8 or 9 for the habitat functions on the form (rates H,H,H or H,H,M for the three aspects of function)? ○ Yes = **Category I** ○ No – Go to **SC 6.2** SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger? ○ Yes = **Category II** ○ No – Go to **SC 6.3** SC 6.3. Is the unit between 0.1 and 1 ac, or is it in a mosaic of wetlands that is between 0.1 and 1 ac? ○ Yes = **Category III** ○ No = **Category IV**	○ **Cat I** ○ **Cat. II** ○ **Cat. III** ○ **Cat. IV**
Category of wetland based on Special Characteristics If you answered No for all types, enter "Not Applicable" on Summary Form	NA

Wetland name or number D

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Meadowdale Park Wetland D Date of site visit: 11/1/2016

Rated by C. Douglas Trained by Ecology? ☒ Yes ☐ No Date of training 2007

HGM Class used for rating Slope Wetland has multiple HGM classes? ☐ Y ☒ N

NOTE: **Form is not complete without the figures requested** *(figures can be combined)*.
Source of base aerial photo/map _____

OVERALL WETLAND CATEGORY III (based on functions ☒ or special characteristics ☐)

1. Category of wetland based on FUNCTIONS

_____**Category I** – Total score = 23 - 27

_____**Category II** – Total score = 20 - 22

X **Category III** – Total score = 16 - 19

_____**Category IV** – Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
			Circle the appropriate ratings	
Site Potential	H M (L)	H M (L)	H (M) L	
Landscape Potential	H (M) L	H M (L)	H (M) L	
Value	(H) M L	H M (L)	(H) M L	**TOTAL**
Score Based on Ratings	6	3	7	**16**

Score for each function based on three ratings *(order of ratings is not important)*

9 = H,H,H
8 = H,H,M
7 = H,H,L
7 = H,M,M
6 = H,M,L
6 = M,M,M
5 = H,L,L
5 = M,M,L
4 = M,L,L
3 = L,L,L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	CATEGORY
Estuarine	I II
Wetland of High Conservation Value	I
Bog	I
Mature Forest	I
Old Growth Forest	I
Coastal Lagoon	I II
Interdunal	I II III IV
None of the above	X

Wetland name or number D

Maps and figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	
Hydroperiods	D 1.4, H 1.2	
Location of outlet (*can be added to map of hydroperiods)*	D 1.1, D 4.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	D 2.2, D 5.2	
Map of the contributing basin	D 4.3, D 5.3	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream *(can be added to another figure)*	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to figure above)*	S 4.1	
Boundary of 150 ft buffer (can be added to another figure)	S 2.1, S 5.1	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	

Wetland name or number D

HGM Classification of Wetlands in Western Washington

For questions 1-7, the criteria described must apply to the entire unit being rated.

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 except during floods?

(●) NO – go to 2 ( ) **YES** – the wetland class is **Tidal Fringe** – go to 1.1

1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

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

*If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe it is an **Estuarine** wetland and is not scored. This method **cannot** be used to score functions for estuarine wetlands.*

2. The entire wetland unit is flat and precipitation is the 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 unit **meet all** of the following criteria?
   - ☐ The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size;
   - ☐ At least 30% of the open water area is deeper than 6.6 ft (2 m).

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

4. Does the entire wetland unit **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**.

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

NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

5. Does the entire wetland unit **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 2 years.

Wetland name or number D

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

NOTE: The Riverine unit can contain depressions that are filled with water when the river is not flooding

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during 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 unit 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 the wetland unit being scored.

   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 HGM 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 of depression	Depressional
Depressional + Lake Fringe	Depressional
Riverine + Lake Fringe	Riverine
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE

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

Wetland name or number D

SLOPE WETLANDS **Water Quality Functions** - Indicators that the site functions to improve water quality	
S 1.0. Does the site have the potential to improve water quality?	
S 1.1. Characteristics of the average slope of the wetland: *(a 1% slope has a 1 ft vertical drop in elevation for every 100 ft of horizontal distance)* Slope is 1% or less points = 3 Slope is > 1%-2% points = 2 Slope is > 2%-5% points = 1 Slope is greater than 5% points = 0	1
S 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic *(use NRCS definitions)*: Yes = 3 No = 0	0
S 1.3. Characteristics of the plants in the wetland that trap sediments and pollutants: Choose the points appropriate for the description that best fits the plants in the wetland. *Dense means you have trouble seeing the soil surface (>75% cover), and uncut means not grazed or mowed and plants are higher than 6 in.* Dense, uncut, herbaceous plants > 90% of the wetland area points = 6 Dense, uncut, herbaceous plants > ½ of area points = 3 Dense, woody, plants > ½ of area points = 2 Dense, uncut, herbaceous plants > ¼ of area points = 1 Does not meet any of the criteria above for plants points = 0	2
Total for S 1 Add the points in the boxes above	**3**

Rating of Site Potential If score is: ☐ **12 = H** ☐ **6-11 = M** ☒ **0-5 = L** *Record the rating on the first page*

S 2.0. Does the landscape have the potential to support the water quality function of the site?	
S 2.1. Is > 10% of the area within 150 ft on the uphill side of the wetland in land uses that generate pollutants? Yes = 1 No = 0	1
S 2.2. Are there other sources of pollutants coming into the wetland that are not listed in question S 2.1? Other sources _____ Yes = 1 No = 0	0
Total for S 2 Add the points in the boxes above	**1**

Rating of Landscape Potential If score is: ☒ **1-2 = M** ☐ **0 = L** *Record the rating on the first page*

S 3.0. Is the water quality improvement provided by the site valuable to society?	
S 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, lake, or marine water that is on the 303(d) list? Yes = 1 No = 0	1
S 3.2. Is the wetland in a basin or sub-basin where water quality is an issue? *At least one aquatic resource in the basin is on the 303(d) list*. Yes = 1 No = 0	1
S 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality? *Answer YES if there is a TMDL for the basin in which unit is found.* Yes = 2 No = 0	0
Total for S 3 Add the points in the boxes above	**2**

Rating of Value If score is: ☒ **2-4 = H** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

Wetland name or number D

SLOPE WETLANDS

Hydrologic Functions - Indicators that the site functions to reduce flooding and stream erosion

S 4.0. Does the site have the potential to reduce flooding and stream erosion?	
S 4.1. Characteristics of plants 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 > $^{1}/_{8}$ in), or dense enough, to remain erect during surface flows.* Dense, uncut, **rigid** plants cover > 90% of the area of the wetland points = 1 All other conditions points = 0	0

Rating of Site Potential If score is: ☐ **1 = M** ☒ **0 = L** *Record the rating on the first page*

S 5.0. Does the landscape have the potential to support the hydrologic functions of the site?	
S 5.1. Is more than 25% of the area within 150 ft upslope of wetland in land uses or cover that generate excess surface runoff? Yes = 1 No = 0	0

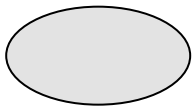
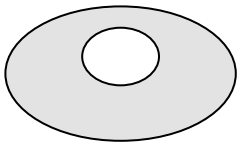
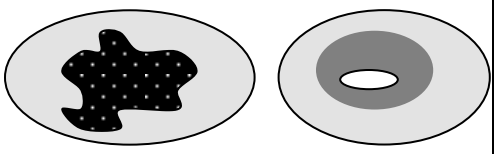
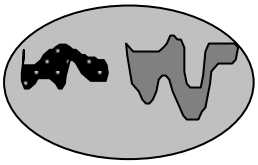
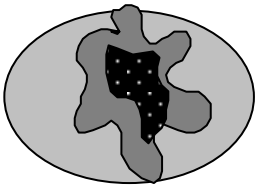
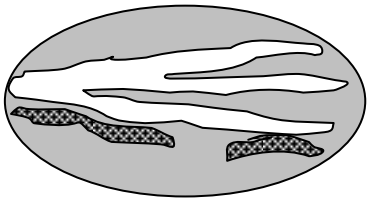
Rating of Landscape Potential If score is: ☐ **1 = M** ☒ **0 = L** *Record the rating on the first page*

S 6.0. Are the hydrologic functions provided by the site valuable to society?	
S 6.1. Distance to the nearest areas downstream that have flooding problems: The sub-basin immediately down-gradient of site has flooding problems that result in damage to human or natural resources (e.g., houses or salmon redds) points = 2 Surface flooding problems are in a sub-basin farther down-gradient points = 1 No flooding problems anywhere downstream points = 0	0
S 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	0
Total for S 6 Add the points in the boxes above	**0**

Rating of Value If score is: ☐ **2-4 = H** ☐ **1 = M** ☒ **0 = L** *Record the rating on the first page*

NOTES and FIELD OBSERVATIONS:

Wetland name or number D

These questions apply to wetlands of all HGM classes. **HABITAT FUNCTIONS** - Indicators that site functions to provide important habitat	
H 1.0. Does the site have the potential to provide habitat?	
H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.* ____Aquatic bed — 4 structures or more: points = 4 ____Emergent — 3 structures: points = 2 _X_Scrub-shrub (areas where shrubs have > 30% cover) — 2 structures: points = 1 _X_Forested (areas where trees have > 30% cover) — 1 structure: points = 0 *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	1
H 1.2. Hydroperiods Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*). ____Permanently flooded or inundated — 4 or more types present: points = 3 _X_Seasonally flooded or inundated — 3 types present: points = 2 ____Occasionally flooded or inundated — 2 types present: points = 1 _X_Saturated only — 1 type present: points = 0 _X_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**	2
H 1.3. Richness of plant species 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 and 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 < 5 species — points = 0	1
H 1.4. Interspersion of habitats Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.*  **None** = 0 points  **Low** = 1 point  **Moderate** = 2 points All three diagrams in this row are **HIGH** = 3points   	2

Wetland name or number D

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* X Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long). X Standing snags (dbh > 4 in) within the wetland ____Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ____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 weathered where wood is exposed)* ____At least ¼ ac of thin-stemmed persistent plants 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 every stratum of plants (*see H 1.1 for list of strata*)	2
Total for H 1 — Add the points in the boxes above	**8**

Rating of Site Potential If score is: ☐ **15-18 = H** ☒ **7-14 = M** ☐ **0-6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat functions of the site?	
H 2.1. Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate:* % undisturbed habitat 5 **+** [(% moderate and low intensity land uses)/2] 1 **=** 6 % If total accessible habitat is: > $^1/_3$ (33.3%) of 1 km Polygon — points = 3 20-33% of 1 km Polygon — points = 2 10-19% of 1 km Polygon — points = 1 < 10% of 1 km Polygon — points = 0	0
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* % undisturbed habitat 25 **+** [(% moderate and low intensity land uses)/2] 5 **=** 30 % Undisturbed habitat > 50% of Polygon — points = 3 Undisturbed habitat 10-50% and in 1-3 patches — points = 2 Undisturbed habitat 10-50% and > 3 patches — points = 1 Undisturbed habitat < 10% of 1 km Polygon — points = 0	1
H 2.3. Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use — points = (- 2) ≤ 50% of 1 km Polygon is high intensity — points = 0	0
Total for H 2 — Add the points in the boxes above	**1**

Rating of Landscape Potential If score is: ☐ **4-6 = H** ☒ **1-3 = M** ☐ **< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated.* Site meets ANY of the following criteria: — points = 2 X It has 3 or more priority habitats within 100 m (see next page) — It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) — It is mapped as a location for an individual WDFW priority species — It is a Wetland of High Conservation Value as determined by the Department of Natural Resources — It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 priority habitats (listed on next page) within 100 m — points = 1 Site does not meet any of the criteria above — points = 0	**2**

Rating of Value If score is: ☒ **2 = H** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

Wetland name or number D

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp. http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here: http://wdfw.wa.gov/conservation/phs/list/)

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE:*** *This question is independent of the land use between the wetland unit and the priority habitat.*

— **Aspen Stands:** Pure or mixed stands of aspen greater than 1 ac (0.4 ha).

X **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*).

— **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 8 trees/ac (20 trees/ha) > 32 in (81 cm) dbh or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in (53 cm) dbh; 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; 80-200 years old west of the Cascade crest.

— **Oregon White Oak:** Woodland 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 – see web link above*).

X **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 – see web link above*).

X **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.

X **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 – see web link on previous page).*

— **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 25 ft (7.6 m) high and occurring below 5000 ft elevation.

— **Talus:** Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

X **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 > 20 in (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

Wetland name or number D

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine wetlands Does the wetland 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= **Not an estuarine wetland**	
SC 1.1. Is the wetland 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. I**
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina*, see page 25) — At least ¾ 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 two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. ○ Yes = **Category I** ○ No = **Category II**	○ **Cat. I** ○ **Cat. II**
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? ○ Yes – Go to **SC 2.2** ○ No – Go to **SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? ○ Yes = **Category I** ○ No = **Not a WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf ○ Yes – **Contact WNHP/WDNR and go to SC 2.4** ○ No = **Not a WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? ○ Yes = **Category I** ● No = **Not a WHCV**	○ **Cat. I**
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES you will still need to rate the wetland based on its functions.*** SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? ○ Yes – Go to **SC 3.3** ○ No – Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? ○ Yes – Go to **SC 3.3** ○ No = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? ○ Yes = **Is a Category I bog** ○ No – Go to **SC 3.4** **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 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? ○ Yes = **Is a Category I bog** ● No = **Is not a bog**	○ **Cat. I**

Wetland name or number D

SC 4.0. Forested Wetlands Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA 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 functions.*** — **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in (81 cm) or more. — **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80- 200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in (53 cm). ○ Yes = **Category I** ● No = **Not a forested wetland for this section**	○ **Cat. I**
SC 5.0. Wetlands in Coastal Lagoons 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 ponded 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 = **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 aggressive, opportunistic plant species (see list of species on p. 100). — At least ¾ 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 $^{1}/_{10}$ ac (4350 ft^2) ○ Yes = **Category I** ● No = **Category II**	○ **Cat. I** ○ **Cat. II**
SC 6.0. Interdunal Wetlands Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ***If you answer yes you will still need to rate the wetland based on its habitat 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 ○ Yes – Go to **SC 6.1** ● No = **not an interdunal wetland for rating** SC 6.1. Is the wetland 1 ac or larger and scores an 8 or 9 for the habitat functions on the form (rates H,H,H or H,H,M for the three aspects of function)? ○ Yes = **Category I** ○ No – Go to **SC 6.2** SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger? ○ Yes = **Category II** ○ No – Go to **SC 6.3** SC 6.3. Is the unit between 0.1 and 1 ac, or is it in a mosaic of wetlands that is between 0.1 and 1 ac? ○ Yes = **Category III** ○ No = **Category IV**	○ **Cat I** ○ **Cat. II** ○ **Cat. III** ○ **Cat. IV**
Category of wetland based on Special Characteristics If you answered No for all types, enter "Not Applicable" on Summary Form	NA

Wetland name or number E

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Meadowdale Park Wetland E Date of site visit: 11/1/2016

Rated by C. Douglas Trained by Ecology? ☒ Yes ☐ No Date of training 2007

HGM Class used for rating Depressional Wetland has multiple HGM classes? ☒ Y ☐ N

NOTE: **Form is not complete without the figures requested** *(figures can be combined)*.
Source of base aerial photo/map _____

OVERALL WETLAND CATEGORY III (based on functions ☒ or special characteristics ☐)

1. Category of wetland based on FUNCTIONS

_____**Category I** – Total score = 23 - 27

_____**Category II** – Total score = 20 - 22

X **Category III** – Total score = 16 - 19

_____**Category IV** – Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
		Circle the appropriate ratings		
Site Potential	H (M) L	H M (L)	H (M) L	
Landscape Potential	H (M) L	H (M) L	H (M) L	
Value	(H) M L	H M (L)	(H) M L	**TOTAL**
Score Based on Ratings	7	4	7	**18**

Score for each function based on three ratings *(order of ratings is not important)*

9 = H,H,H
8 = H,H,M
7 = H,H,L
7 = H,M,M
6 = H,M,L
6 = M,M,M
5 = H,L,L
5 = M,M,L
4 = M,L,L
3 = L,L,L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	CATEGORY
Estuarine	I II
Wetland of High Conservation Value	I
Bog	I
Mature Forest	I
Old Growth Forest	I
Coastal Lagoon	I II
Interdunal	I II III IV
None of the above	X

Wetland name or number E

Maps and figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	
Hydroperiods	D 1.4, H 1.2	
Location of outlet (*can be added to map of hydroperiods)*	D 1.1, D 4.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	D 2.2, D 5.2	
Map of the contributing basin	D 4.3, D 5.3	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream *(can be added to another figure)*	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to figure above)*	S 4.1	
Boundary of 150 ft buffer (can be added to another figure)	S 2.1, S 5.1	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	

Wetland name or number E

HGM Classification of Wetlands in Western Washington

For questions 1-7, the criteria described must apply to the entire unit being rated.

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 except during floods?

(●) NO – go to 2 ( ) **YES** – the wetland class is **Tidal Fringe** – go to 1.1

1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

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

*If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe it is an **Estuarine** wetland and is not scored. This method **cannot** be used to score functions for estuarine wetlands.*

2. The entire wetland unit is flat and precipitation is the 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 unit **meet all** of the following criteria?
   - ☐ The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size;
   - ☐ At least 30% of the open water area is deeper than 6.6 ft (2 m).

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

4. Does the entire wetland unit **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**.

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

NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

5. Does the entire wetland unit **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 2 years.

Wetland name or number E

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

NOTE: The Riverine unit can contain depressions that are filled with water when the river is not flooding

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during 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 unit 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 the wetland unit being scored.

   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 HGM 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 of depression	Depressional
Depressional + Lake Fringe	Depressional
Riverine + Lake Fringe	Riverine
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE

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

Wetland name or number E

DEPRESSIONAL AND FLATS WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

D 1.0. Does the site have the potential to improve water quality?	
D 1.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression (QUESTION 7 on key) with no surface water leaving it (no outlet). points = 3 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet. points = 2 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 1 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch. points = 1	1
D 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic *(use NRCS definitions)*. Yes = 4 No = 0	0
D 1.3. Characteristics and distribution of persistent plants (Emergent, Scrub-shrub, and/or Forested Cowardin classes): Wetland has persistent, ungrazed, plants > 95% of area points = 5 Wetland has persistent, ungrazed, plants > ½ of area points = 3 Wetland has persistent, ungrazed plants > $^{1}/_{10}$ of area points = 1 Wetland has persistent, ungrazed plants < $^{1}/_{10}$ of area points = 0	3
D 1.4. Characteristics of seasonal ponding or inundation: *This is the area that is ponded for at least 2 months. See description in manual.* Area seasonally ponded is > ½ total area of wetland points = 4 Area seasonally ponded is > ¼ total area of wetland points = 2 Area seasonally ponded is < ¼ total area of wetland points = 0	2
Total for D 1 Add the points in the boxes above	**6**

Rating of Site Potential If score is: ☐ **12-16 = H** ☒ **6-11 = M** ☐ **0-5 = L** *Record the rating on the first page*

D 2.0. Does the landscape have the potential to support the water quality function of the site?	
D 2.1. Does the wetland unit receive stormwater discharges? Yes = 1 No = 0	0
D 2.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants? Yes = 1 No = 0	1
D 2.3. Are there septic systems within 250 ft of the wetland? Yes = 1 No = 0	0
D 2.4. Are there other sources of pollutants coming into the wetland that are not listed in questions D 2.1-D 2.3? Source_____ Yes = 1 No = 0	0
Total for D 2 Add the points in the boxes above	**1**

Rating of Landscape Potential If score is: ☐ **3 or 4 = H** ☒ **1 or 2 = M** ☐ **0 = L** *Record the rating on the first page*

D 3.0. Is the water quality improvement provided by the site valuable to society?	
D 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, lake, or marine water that is on the 303(d) list? Yes = 1 No = 0	1
D 3.2. Is the wetland in a basin or sub-basin where an aquatic resource is on the 303(d) list? Yes = 1 No = 0	1
D 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality (*answer YES if there is a TMDL for the basin in which the unit is found*)? Yes = 2 No = 0	0
Total for D 3 Add the points in the boxes above	**2**

Rating of Value If score is: ☒ **2-4 = H** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

Wetland name or number E

DEPRESSIONAL AND FLATS WETLANDS

Hydrologic Functions - Indicators that the site functions to reduce flooding and stream degradation

D 4.0. Does the site have the potential to reduce flooding and erosion?	
D 4.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression with no surface water leaving it (no outlet) points = 4 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet points = 2 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch points = 1 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 0	0
D 4.2. Depth of storage during wet periods: *Estimate the height of ponding above the bottom of the outlet. For wetlands with no outlet, measure from the surface of permanent water or if dry, the deepest part.* Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7 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 The wetland is a "headwater" wetland points = 3 Wetland is flat but has small depressions on the surface that trap water points = 1 Marks of ponding less than 0.5 ft (6 in) points = 0	1
D 4.3. Contribution of the wetland 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 the 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 wetland is in the Flats class points = 5	0
Total for D 4 Add the points in the boxes above	**1**

Rating of Site Potential If score is: ☐ **12-16 = H** ☐ **6-11 = M** ☒ **0-5 = L** *Record the rating on the first page*

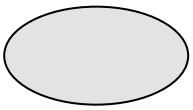
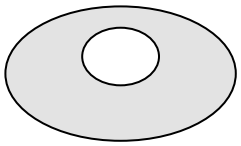
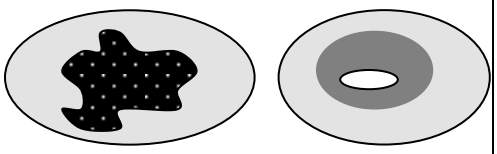
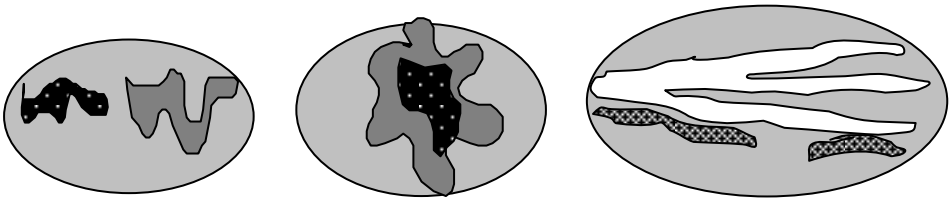
D 5.0. Does the landscape have the potential to support hydrologic functions of the site?	
D 5.1. Does the wetland receive stormwater discharges? Yes = 1 No = 0	0
D 5.2. Is >10% of the area within 150 ft of the wetland in land uses that generate excess runoff? Yes = 1 No = 0	1
D 5.3. Is more than 25% of the contributing basin of the wetland covered with intensive human land uses (residential at >1 residence/ac, urban, commercial, agriculture, etc.)? Yes = 1 No = 0	1
Total for D 5 Add the points in the boxes above	**2**

Rating of Landscape Potential If score is: ☐ **3 = H** ☒ **1 or 2 = M** ☐ **0 = L** *Record the rating on the first page*

D 6.0. Are the hydrologic functions provided by the site valuable to society?	
D 6.1. The unit is in a landscape that has flooding problems. *Choose the description that best matches conditions around the wetland unit being rated. Do not add points. Choose the highest score if more than one condition is met.* The wetland captures surface water that would otherwise flow down-gradient into areas where flooding has damaged human or natural resources (e.g., houses or salmon redds): • Flooding occurs in a sub-basin that is immediately down-gradient of unit. points = 2 • Surface flooding problems are in a sub-basin farther down-gradient. points = 1 Flooding from groundwater is an issue in the sub-basin. points = 1 The existing or potential outflow from the wetland is so constrained by human or natural conditions that the water stored by the wetland cannot reach areas that flood. *Explain why* _____ points = 0 There are no problems with flooding downstream of the wetland. points = 0	0
D 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	0
Total for D 6 Add the points in the boxes above	**0**

Rating of Value If score is: ☐ **2-4 = H** ☐ **1 = M** ☒ **0 = L** *Record the rating on the first page*

Wetland name or number E

These questions apply to wetlands of all HGM classes. **HABITAT FUNCTIONS** - Indicators that site functions to provide important habitat	
H 1.0. Does the site have the potential to provide habitat?	
H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.* ____Aquatic bed — 4 structures or more: points = 4 _X_Emergent — 3 structures: points = 2 ____Scrub-shrub (areas where shrubs have > 30% cover) — 2 structures: points = 1 _X_Forested (areas where trees have > 30% cover) — 1 structure: points = 0 *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	1
H 1.2. Hydroperiods Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*). ____Permanently flooded or inundated — 4 or more types present: points = 3 _X_Seasonally flooded or inundated — 3 types present: points = 2 ____Occasionally flooded or inundated — 2 types present: points = 1 _X_Saturated only — 1 type present: points = 0 _X_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**	2
H 1.3. Richness of plant species 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 and 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 < 5 species — points = 0	1
H 1.4. Interspersion of habitats Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.*  **None** = 0 points  **Low** = 1 point  **Moderate** = 2 points All three diagrams in this row are **HIGH** = 3points 	2

Wetland name or number E

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* X Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long). ____Standing snags (dbh > 4 in) within the wetland ____Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ____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 weathered where wood is exposed)* ____At least ¼ ac of thin-stemmed persistent plants 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 every stratum of plants (*see H 1.1 for list of strata*)	1
Total for H 1 — Add the points in the boxes above	**7**

Rating of Site Potential If score is: ☐ **15-18 = H** ☒ **7-14 = M** ☐ **0-6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat functions of the site?	
H 2.1. Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate:* % undisturbed habitat 5 **+** [(% moderate and low intensity land uses)/2] 1 **=** 6 % If total accessible habitat is: > $^1/_3$ (33.3%) of 1 km Polygon — points = 3 20-33% of 1 km Polygon — points = 2 10-19% of 1 km Polygon — points = 1 < 10% of 1 km Polygon — points = 0	0
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* % undisturbed habitat 25 **+** [(% moderate and low intensity land uses)/2] 5 **=** 30 % Undisturbed habitat > 50% of Polygon — points = 3 Undisturbed habitat 10-50% and in 1-3 patches — points = 2 Undisturbed habitat 10-50% and > 3 patches — points = 1 Undisturbed habitat < 10% of 1 km Polygon — points = 0	1
H 2.3. Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use — points = (- 2) ≤ 50% of 1 km Polygon is high intensity — points = 0	0
Total for H 2 — Add the points in the boxes above	**1**

Rating of Landscape Potential If score is: ☐ **4-6 = H** ☒ **1-3 = M** ☐ **< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated.* Site meets ANY of the following criteria: — points = 2 X It has 3 or more priority habitats within 100 m (see next page) — It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) — It is mapped as a location for an individual WDFW priority species — It is a Wetland of High Conservation Value as determined by the Department of Natural Resources — It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 priority habitats (listed on next page) within 100 m — points = 1 Site does not meet any of the criteria above — points = 0	**2**

Rating of Value If score is: ☒ **2 = H** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

Wetland name or number E

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp. http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here: http://wdfw.wa.gov/conservation/phs/list/)

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE:*** *This question is independent of the land use between the wetland unit and the priority habitat.*

— **Aspen Stands:** Pure or mixed stands of aspen greater than 1 ac (0.4 ha).

X **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*).

— **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 8 trees/ac (20 trees/ha) > 32 in (81 cm) dbh or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in (53 cm) dbh; 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; 80-200 years old west of the Cascade crest.

— **Oregon White Oak:** Woodland 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 – see web link above*).

X **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 – see web link above*).

X **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.

X **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 – see web link on previous page).*

— **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 25 ft (7.6 m) high and occurring below 5000 ft elevation.

— **Talus:** Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

X **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 > 20 in (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

Wetland name or number E

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine wetlands Does the wetland 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= **Not an estuarine wetland**	
SC 1.1. Is the wetland 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. I**
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina*, see page 25) — At least ¾ 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 two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. ○ Yes = **Category I** ○ No = **Category II**	○ **Cat. I** ○ **Cat. II**
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? ○ Yes – Go to **SC 2.2** ○ No – Go to **SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? ○ Yes = **Category I** ○ No = **Not a WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf ○ Yes – **Contact WNHP/WDNR and go to SC 2.4** ○ No = **Not a WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? ○ Yes = **Category I** ● No = **Not a WHCV**	○ **Cat. I**
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES you will still need to rate the wetland based on its functions.*** SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? ○ Yes – Go to **SC 3.3** ○ No – Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? ○ Yes – Go to **SC 3.3** ○ No = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? ○ Yes = **Is a Category I bog** ○ No – Go to **SC 3.4** **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 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? ○ Yes = **Is a Category I bog** ● No = **Is not a bog**	○ **Cat. I**

Wetland name or number E

SC 4.0. Forested Wetlands Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA 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 functions.*** — **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in (81 cm) or more. — **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80- 200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in (53 cm). ○ Yes = **Category I** ● No = **Not a forested wetland for this section**	○ **Cat. I**
SC 5.0. Wetlands in Coastal Lagoons 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 ponded 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 = **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 aggressive, opportunistic plant species (see list of species on p. 100). — At least ¾ 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 $^{1}/_{10}$ ac (4350 ft^2) ○ Yes = **Category I** ● No = **Category II**	○ **Cat. I** ○ **Cat. II**
SC 6.0. Interdunal Wetlands Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ***If you answer yes you will still need to rate the wetland based on its habitat 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 ○ Yes – Go to **SC 6.1** ● No = **not an interdunal wetland for rating** SC 6.1. Is the wetland 1 ac or larger and scores an 8 or 9 for the habitat functions on the form (rates H,H,H or H,H,M for the three aspects of function)? ○ Yes = **Category I** ○ No – Go to **SC 6.2** SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger? ○ Yes = **Category II** ○ No – Go to **SC 6.3** SC 6.3. Is the unit between 0.1 and 1 ac, or is it in a mosaic of wetlands that is between 0.1 and 1 ac? ○ Yes = **Category III** ○ No = **Category IV**	○ **Cat I** ○ **Cat. II** ○ **Cat. III** ○ **Cat. IV**
Category of wetland based on Special Characteristics If you answered No for all types, enter "Not Applicable" on Summary Form	NA

Wetland name or number F

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Meadowdale Park Wetland F Date of site visit: 11/1/2016

Rated by C. Douglas Trained by Ecology? ☒ Yes ☐ No Date of training 2007

HGM Class used for rating Slope Wetland has multiple HGM classes? ☐ Y ☒ N

NOTE: **Form is not complete without the figures requested** *(figures can be combined)*.
Source of base aerial photo/map _____

OVERALL WETLAND CATEGORY IV (based on functions ☒ or special characteristics ☐)

1. Category of wetland based on FUNCTIONS

_____**Category I** – Total score = 23 - 27

_____**Category II** – Total score = 20 - 22

_____**Category III** – Total score = 16 - 19

X **Category IV** – Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
			Circle the appropriate ratings	
Site Potential	H M (L)	H M (L)	H M (L)	
Landscape Potential	H (M) L	H M (L)	H (M) L	
Value	(H) M L	H M (L)	(H) M L	**TOTAL**
Score Based on Ratings	6	3	6	**15**

Score for each function based on three ratings *(order of ratings is not important)*

9 = H,H,H
8 = H,H,M
7 = H,H,L
7 = H,M,M
6 = H,M,L
6 = M,M,M
5 = H,L,L
5 = M,M,L
4 = M,L,L
3 = L,L,L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	CATEGORY
Estuarine	I II
Wetland of High Conservation Value	I
Bog	I
Mature Forest	I
Old Growth Forest	I
Coastal Lagoon	I II
Interdunal	I II III IV
None of the above	X

Wetland name or number F

Maps and figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	
Hydroperiods	D 1.4, H 1.2	
Location of outlet (*can be added to map of hydroperiods)*	D 1.1, D 4.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	D 2.2, D 5.2	
Map of the contributing basin	D 4.3, D 5.3	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream *(can be added to another figure)*	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to figure above)*	S 4.1	
Boundary of 150 ft buffer (can be added to another figure)	S 2.1, S 5.1	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	

Wetland name or number F

HGM Classification of Wetlands in Western Washington

For questions 1-7, the criteria described must apply to the entire unit being rated.

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 except during floods?

(●) NO – go to 2 ( ) **YES** – the wetland class is **Tidal Fringe** – go to 1.1

1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

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

*If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe it is an **Estuarine** wetland and is not scored. This method **cannot** be used to score functions for estuarine wetlands.*

2. The entire wetland unit is flat and precipitation is the 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 unit **meet all** of the following criteria?
   - ☐ The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size;
   - ☐ At least 30% of the open water area is deeper than 6.6 ft (2 m).

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

4. Does the entire wetland unit **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**.

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

NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

5. Does the entire wetland unit **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 2 years.

Wetland name or number F

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

NOTE: The Riverine unit can contain depressions that are filled with water when the river is not flooding

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during 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 unit 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 the wetland unit being scored.

   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 HGM 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 of depression	Depressional
Depressional + Lake Fringe	Depressional
Riverine + Lake Fringe	Riverine
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE

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

Wetland name or number F

SLOPE WETLANDS **Water Quality Functions** - Indicators that the site functions to improve water quality	
S 1.0. Does the site have the potential to improve water quality?	
S 1.1. Characteristics of the average slope of the wetland: *(a 1% slope has a 1 ft vertical drop in elevation for every 100 ft of horizontal distance)* Slope is 1% or less points = 3 Slope is > 1%-2% points = 2 Slope is > 2%-5% points = 1 Slope is greater than 5% points = 0	1
S 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic *(use NRCS definitions)*: Yes = 3 No = 0	0
S 1.3. Characteristics of the plants in the wetland that trap sediments and pollutants: Choose the points appropriate for the description that best fits the plants in the wetland. *Dense means you have trouble seeing the soil surface (>75% cover), and uncut means not grazed or mowed and plants are higher than 6 in.* Dense, uncut, herbaceous plants > 90% of the wetland area points = 6 Dense, uncut, herbaceous plants > ½ of area points = 3 Dense, woody, plants > ½ of area points = 2 Dense, uncut, herbaceous plants > ¼ of area points = 1 Does not meet any of the criteria above for plants points = 0	2
Total for S 1 Add the points in the boxes above	**3**

Rating of Site Potential If score is: ☐ **12 = H** ☐ **6-11 = M** ☒ **0-5 = L** *Record the rating on the first page*

S 2.0. Does the landscape have the potential to support the water quality function of the site?	
S 2.1. Is > 10% of the area within 150 ft on the uphill side of the wetland in land uses that generate pollutants? Yes = 1 No = 0	1
S 2.2. Are there other sources of pollutants coming into the wetland that are not listed in question S 2.1? Other sources _____ Yes = 1 No = 0	0
Total for S 2 Add the points in the boxes above	**1**

Rating of Landscape Potential If score is: ☒ **1-2 = M** ☐ **0 = L** *Record the rating on the first page*

S 3.0. Is the water quality improvement provided by the site valuable to society?	
S 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, lake, or marine water that is on the 303(d) list? Yes = 1 No = 0	1
S 3.2. Is the wetland in a basin or sub-basin where water quality is an issue? *At least one aquatic resource in the basin is on the 303(d) list*. Yes = 1 No = 0	1
S 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality? *Answer YES if there is a TMDL for the basin in which unit is found.* Yes = 2 No = 0	0
Total for S 3 Add the points in the boxes above	**2**

Rating of Value If score is: ☒ **2-4 = H** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

Wetland name or number F

SLOPE WETLANDS

Hydrologic Functions - Indicators that the site functions to reduce flooding and stream erosion

S 4.0. Does the site have the potential to reduce flooding and stream erosion?	
S 4.1. Characteristics of plants 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 > $^{1}/_{8}$ in), or dense enough, to remain erect during surface flows.* Dense, uncut, **rigid** plants cover > 90% of the area of the wetland points = 1 All other conditions points = 0	0

Rating of Site Potential If score is: ☐ **1 = M** ☒ **0 = L** *Record the rating on the first page*

S 5.0. Does the landscape have the potential to support the hydrologic functions of the site?	
S 5.1. Is more than 25% of the area within 150 ft upslope of wetland in land uses or cover that generate excess surface runoff? Yes = 1 No = 0	0

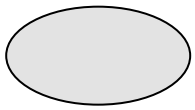
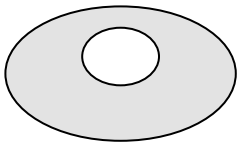
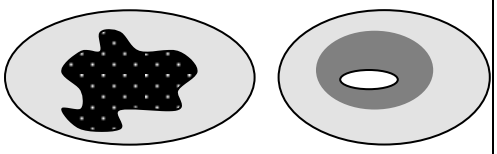
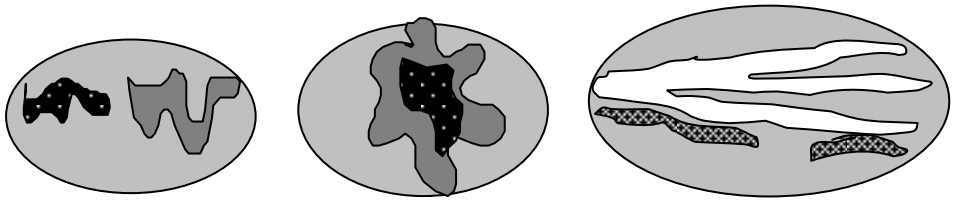
Rating of Landscape Potential If score is: ☐ **1 = M** ☒ **0 = L** *Record the rating on the first page*

S 6.0. Are the hydrologic functions provided by the site valuable to society?	
S 6.1. Distance to the nearest areas downstream that have flooding problems: The sub-basin immediately down-gradient of site has flooding problems that result in damage to human or natural resources (e.g., houses or salmon redds) points = 2 Surface flooding problems are in a sub-basin farther down-gradient points = 1 No flooding problems anywhere downstream points = 0	0
S 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	0
Total for S 6 Add the points in the boxes above	**0**

Rating of Value If score is: ☐ **2-4 = H** ☐ **1 = M** ☒ **0 = L** *Record the rating on the first page*

NOTES and FIELD OBSERVATIONS:

Wetland name or number F

These questions apply to wetlands of all HGM classes. **HABITAT FUNCTIONS** - Indicators that site functions to provide important habitat	
H 1.0. Does the site have the potential to provide habitat?	
H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.* ____Aquatic bed — 4 structures or more: points = 4 _X_Emergent — 3 structures: points = 2 _X_Scrub-shrub (areas where shrubs have > 30% cover) — 2 structures: points = 1 ____Forested (areas where trees have > 30% cover) — 1 structure: points = 0 *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	1
H 1.2. Hydroperiods Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*). ____Permanently flooded or inundated — 4 or more types present: points = 3 _X_Seasonally flooded or inundated — 3 types present: points = 2 ____Occasionally flooded or inundated — 2 types present: points = 1 _X_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**	1
H 1.3. Richness of plant species 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 and 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 < 5 species — points = 0	1
H 1.4. Interspersion of habitats Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.*  **None** = 0 points  **Low** = 1 point  **Moderate** = 2 points All three diagrams in this row are **HIGH** = 3points 	2

Wetland name or number F

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* X Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long). ____Standing snags (dbh > 4 in) within the wetland ____Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ____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 weathered where wood is exposed)* ____At least ¼ ac of thin-stemmed persistent plants 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 every stratum of plants (*see H 1.1 for list of strata*)	1
Total for H 1 — Add the points in the boxes above	**6**

Rating of Site Potential If score is: ☐ **15-18 = H** ☐ **7-14 = M** ☒ **0-6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat functions of the site?	
H 2.1. Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate:* % undisturbed habitat 1 **+** [(% moderate and low intensity land uses)/2] .5 **=** 1.5 % If total accessible habitat is: > $^1/_3$ (33.3%) of 1 km Polygon — points = 3 20-33% of 1 km Polygon — points = 2 10-19% of 1 km Polygon — points = 1 < 10% of 1 km Polygon — points = 0	0
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* % undisturbed habitat 25 **+** [(% moderate and low intensity land uses)/2] 5 **=** 30 % Undisturbed habitat > 50% of Polygon — points = 3 Undisturbed habitat 10-50% and in 1-3 patches — points = 2 Undisturbed habitat 10-50% and > 3 patches — points = 1 Undisturbed habitat < 10% of 1 km Polygon — points = 0	1
H 2.3. Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use — points = (- 2) ≤ 50% of 1 km Polygon is high intensity — points = 0	0
Total for H 2 — Add the points in the boxes above	**1**

Rating of Landscape Potential If score is: ☐ **4-6 = H** ☒ **1-3 = M** ☐ **< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated.* Site meets ANY of the following criteria: — points = 2 X It has 3 or more priority habitats within 100 m (see next page) — It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) — It is mapped as a location for an individual WDFW priority species — It is a Wetland of High Conservation Value as determined by the Department of Natural Resources — It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 priority habitats (listed on next page) within 100 m — points = 1 Site does not meet any of the criteria above — points = 0	**2**

Rating of Value If score is: ☒ **2 = H** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

Wetland name or number F

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp. http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here: http://wdfw.wa.gov/conservation/phs/list/)

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE:*** *This question is independent of the land use between the wetland unit and the priority habitat.*

— **Aspen Stands:** Pure or mixed stands of aspen greater than 1 ac (0.4 ha).

X **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*).

— **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 8 trees/ac (20 trees/ha) > 32 in (81 cm) dbh or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in (53 cm) dbh; 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; 80-200 years old west of the Cascade crest.

— **Oregon White Oak:** Woodland 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 – see web link above*).

X **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 – see web link above*).

X **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.

X **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 – see web link on previous page).*

— **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 25 ft (7.6 m) high and occurring below 5000 ft elevation.

— **Talus:** Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

X **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 > 20 in (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

Wetland name or number F

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine wetlands Does the wetland 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= **Not an estuarine wetland**	
SC 1.1. Is the wetland 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. I**
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina*, see page 25) — At least ¾ 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 two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. ○ Yes = **Category I** ○ No = **Category II**	○ **Cat. I** ○ **Cat. II**
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? ○ Yes – Go to **SC 2.2** ○ No – Go to **SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? ○ Yes = **Category I** ○ No = **Not a WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf ○ Yes – **Contact WNHP/WDNR and go to SC 2.4** ○ No = **Not a WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? ○ Yes = **Category I** ● No = **Not a WHCV**	○ **Cat. I**
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES you will still need to rate the wetland based on its functions.*** SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? ○ Yes – Go to **SC 3.3** ○ No – Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? ○ Yes – Go to **SC 3.3** ○ No = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? ○ Yes = **Is a Category I bog** ○ No – Go to **SC 3.4** **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 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? ○ Yes = **Is a Category I bog** ● No = **Is not a bog**	○ **Cat. I**

Wetland name or number F

SC 4.0. Forested Wetlands Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA 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 functions.*** — **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in (81 cm) or more. — **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80- 200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in (53 cm). ○ Yes = **Category I** ● No = **Not a forested wetland for this section**	○ **Cat. I**
SC 5.0. Wetlands in Coastal Lagoons 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 ponded 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 = **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 aggressive, opportunistic plant species (see list of species on p. 100). — At least ¾ 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 $^{1}/_{10}$ ac (4350 ft^2) ○ Yes = **Category I** ● No = **Category II**	○ **Cat. I** ○ **Cat. II**
SC 6.0. Interdunal Wetlands Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ***If you answer yes you will still need to rate the wetland based on its habitat 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 ○ Yes – Go to **SC 6.1** ● No = **not an interdunal wetland for rating** SC 6.1. Is the wetland 1 ac or larger and scores an 8 or 9 for the habitat functions on the form (rates H,H,H or H,H,M for the three aspects of function)? ○ Yes = **Category I** ○ No – Go to **SC 6.2** SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger? ○ Yes = **Category II** ○ No – Go to **SC 6.3** SC 6.3. Is the unit between 0.1 and 1 ac, or is it in a mosaic of wetlands that is between 0.1 and 1 ac? ○ Yes = **Category III** ○ No = **Category IV**	○ **Cat I** ○ **Cat. II** ○ **Cat. III** ○ **Cat. IV**
Category of wetland based on Special Characteristics If you answered No for all types, enter "Not Applicable" on Summary Form	NA

Wetland name or number G

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Meadowdale Park Wetland G Date of site visit: 12/19/2016

Rated by C. Douglas Trained by Ecology? ☒ Yes ☐ No Date of training 2007

HGM Class used for rating Depressional Wetland has multiple HGM classes? ☒ Y ☐ N

NOTE: **Form is not complete without the figures requested** *(figures can be combined)*.
Source of base aerial photo/map _____

OVERALL WETLAND CATEGORY III (based on functions ☒ or special characteristics ☐)

1. Category of wetland based on FUNCTIONS

_____**Category I** – Total score = 23 - 27

_____**Category II** – Total score = 20 - 22

X **Category III** – Total score = 16 - 19

_____**Category IV** – Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
		Circle the appropriate ratings		
Site Potential	H (M) L	H M (L)	H (M) L	
Landscape Potential	H (M) L	H (M) L	H (M) L	
Value	(H) M L	H M (L)	(H) M L	**TOTAL**
Score Based on Ratings	7	4	7	**18**

Score for each function based on three ratings *(order of ratings is not important)*

9 = H,H,H
8 = H,H,M
7 = H,H,L
7 = H,M,M
6 = H,M,L
6 = M,M,M
5 = H,L,L
5 = M,M,L
4 = M,L,L
3 = L,L,L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	CATEGORY
Estuarine	I II
Wetland of High Conservation Value	I
Bog	I
Mature Forest	I
Old Growth Forest	I
Coastal Lagoon	I II
Interdunal	I II III IV
None of the above	X

Wetland name or number G

Maps and figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	
Hydroperiods	D 1.4, H 1.2	
Location of outlet (*can be added to map of hydroperiods)*	D 1.1, D 4.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	D 2.2, D 5.2	
Map of the contributing basin	D 4.3, D 5.3	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream *(can be added to another figure)*	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to figure above)*	S 4.1	
Boundary of 150 ft buffer (can be added to another figure)	S 2.1, S 5.1	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	

Wetland name or number G

HGM Classification of Wetlands in Western Washington

For questions 1-7, the criteria described must apply to the entire unit being rated.

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 except during floods?

(●) NO – go to 2 ( ) **YES** – the wetland class is **Tidal Fringe** – go to 1.1

1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

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

*If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe it is an **Estuarine** wetland and is not scored. This method **cannot** be used to score functions for estuarine wetlands.*

2. The entire wetland unit is flat and precipitation is the 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 unit **meet all** of the following criteria?
   - ☐ The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size;
   - ☐ At least 30% of the open water area is deeper than 6.6 ft (2 m).

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

4. Does the entire wetland unit **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**.

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

NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

5. Does the entire wetland unit **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 2 years.

Wetland name or number G

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

NOTE: The Riverine unit can contain depressions that are filled with water when the river is not flooding

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during 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 unit 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 the wetland unit being scored.

   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 HGM 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 of depression	Depressional
Depressional + Lake Fringe	Depressional
Riverine + Lake Fringe	Riverine
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE

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

Wetland name or number G

DEPRESSIONAL AND FLATS WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

D 1.0. Does the site have the potential to improve water quality?	
D 1.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression (QUESTION 7 on key) with no surface water leaving it (no outlet). points = 3 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet. points = 2 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 1 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch. points = 1	1
D 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic *(use NRCS definitions)*. Yes = 4 No = 0	0
D 1.3. Characteristics and distribution of persistent plants (Emergent, Scrub-shrub, and/or Forested Cowardin classes): Wetland has persistent, ungrazed, plants > 95% of area points = 5 Wetland has persistent, ungrazed, plants > ½ of area points = 3 Wetland has persistent, ungrazed plants > $^{1}/_{10}$ of area points = 1 Wetland has persistent, ungrazed plants < $^{1}/_{10}$ of area points = 0	3
D 1.4. Characteristics of seasonal ponding or inundation: *This is the area that is ponded for at least 2 months. See description in manual.* Area seasonally ponded is > ½ total area of wetland points = 4 Area seasonally ponded is > ¼ total area of wetland points = 2 Area seasonally ponded is < ¼ total area of wetland points = 0	2
Total for D 1 Add the points in the boxes above	**6**

Rating of Site Potential If score is: ☐ **12-16 = H** ☒ **6-11 = M** ☐ **0-5 = L** *Record the rating on the first page*

D 2.0. Does the landscape have the potential to support the water quality function of the site?	
D 2.1. Does the wetland unit receive stormwater discharges? Yes = 1 No = 0	0
D 2.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants? Yes = 1 No = 0	1
D 2.3. Are there septic systems within 250 ft of the wetland? Yes = 1 No = 0	0
D 2.4. Are there other sources of pollutants coming into the wetland that are not listed in questions D 2.1-D 2.3? Source_____ Yes = 1 No = 0	0
Total for D 2 Add the points in the boxes above	**1**

Rating of Landscape Potential If score is: ☐ **3 or 4 = H** ☒ **1 or 2 = M** ☐ **0 = L** *Record the rating on the first page*

D 3.0. Is the water quality improvement provided by the site valuable to society?	
D 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, lake, or marine water that is on the 303(d) list? Yes = 1 No = 0	1
D 3.2. Is the wetland in a basin or sub-basin where an aquatic resource is on the 303(d) list? Yes = 1 No = 0	1
D 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality (*answer YES if there is a TMDL for the basin in which the unit is found*)? Yes = 2 No = 0	0
Total for D 3 Add the points in the boxes above	**2**

Rating of Value If score is: ☒ **2-4 = H** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

Wetland name or number G

DEPRESSIONAL AND FLATS WETLANDS

Hydrologic Functions - Indicators that the site functions to reduce flooding and stream degradation

D 4.0. Does the site have the potential to reduce flooding and erosion?	
D 4.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression with no surface water leaving it (no outlet) points = 4 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet points = 2 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch points = 1 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 0	0
D 4.2. Depth of storage during wet periods: *Estimate the height of ponding above the bottom of the outlet. For wetlands with no outlet, measure from the surface of permanent water or if dry, the deepest part.* Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7 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 The wetland is a "headwater" wetland points = 3 Wetland is flat but has small depressions on the surface that trap water points = 1 Marks of ponding less than 0.5 ft (6 in) points = 0	1
D 4.3. Contribution of the wetland 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 the 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 wetland is in the Flats class points = 5	0
Total for D 4 Add the points in the boxes above	**1**

Rating of Site Potential If score is: ☐ **12-16 = H** ☐ **6-11 = M** ☒ **0-5 = L** *Record the rating on the first page*

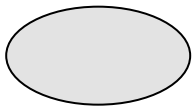
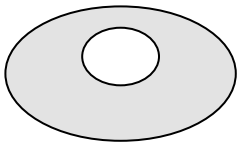
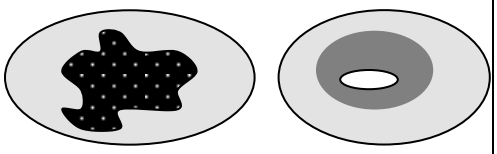
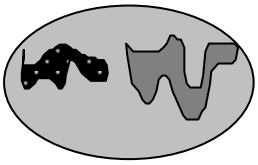
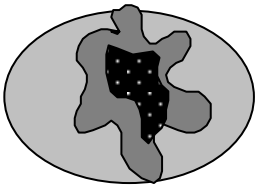
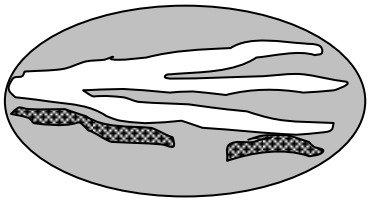
D 5.0. Does the landscape have the potential to support hydrologic functions of the site?	
D 5.1. Does the wetland receive stormwater discharges? Yes = 1 No = 0	0
D 5.2. Is >10% of the area within 150 ft of the wetland in land uses that generate excess runoff? Yes = 1 No = 0	1
D 5.3. Is more than 25% of the contributing basin of the wetland covered with intensive human land uses (residential at >1 residence/ac, urban, commercial, agriculture, etc.)? Yes = 1 No = 0	1
Total for D 5 Add the points in the boxes above	**2**

Rating of Landscape Potential If score is: ☐ **3 = H** ☒ **1 or 2 = M** ☐ **0 = L** *Record the rating on the first page*

D 6.0. Are the hydrologic functions provided by the site valuable to society?	
D 6.1. The unit is in a landscape that has flooding problems. *Choose the description that best matches conditions around the wetland unit being rated. Do not add points. Choose the highest score if more than one condition is met.* The wetland captures surface water that would otherwise flow down-gradient into areas where flooding has damaged human or natural resources (e.g., houses or salmon redds): • Flooding occurs in a sub-basin that is immediately down-gradient of unit. points = 2 • Surface flooding problems are in a sub-basin farther down-gradient. points = 1 Flooding from groundwater is an issue in the sub-basin. points = 1 The existing or potential outflow from the wetland is so constrained by human or natural conditions that the water stored by the wetland cannot reach areas that flood. *Explain why* _____ points = 0 There are no problems with flooding downstream of the wetland. points = 0	0
D 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	0
Total for D 6 Add the points in the boxes above	**0**

Rating of Value If score is: ☐ **2-4 = H** ☐ **1 = M** ☒ **0 = L** *Record the rating on the first page*

Wetland name or number G

These questions apply to wetlands of all HGM classes. **HABITAT FUNCTIONS** - Indicators that site functions to provide important habitat	
H 1.0. Does the site have the potential to provide habitat?	
H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.* ____Aquatic bed — 4 structures or more: points = 4 ____Emergent — 3 structures: points = 2 _X_Scrub-shrub (areas where shrubs have > 30% cover) — 2 structures: points = 1 _X_Forested (areas where trees have > 30% cover) — 1 structure: points = 0 *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	1
H 1.2. Hydroperiods Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*). ____Permanently flooded or inundated — 4 or more types present: points = 3 _X_Seasonally flooded or inundated — 3 types present: points = 2 ____Occasionally flooded or inundated — 2 types present: points = 1 _X_Saturated only — 1 type present: points = 0 _X_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**	2
H 1.3. Richness of plant species 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 and 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 < 5 species — points = 0	1
H 1.4. Interspersion of habitats Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.*  **None** = 0 points  **Low** = 1 point  **Moderate** = 2 points All three diagrams in this row are **HIGH** = 3points   	2

Wetland name or number G

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* X Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long). ____Standing snags (dbh > 4 in) within the wetland ____Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ____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 weathered where wood is exposed)* ____At least ¼ ac of thin-stemmed persistent plants 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 every stratum of plants (*see H 1.1 for list of strata*)	1
Total for H 1 — Add the points in the boxes above	**7**

Rating of Site Potential If score is: ☐ **15-18 = H** ☒ **7-14 = M** ☐ **0-6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat functions of the site?	
H 2.1. Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate:* % undisturbed habitat 1 **+** [(% moderate and low intensity land uses)/2] .5 **=** 1.5 % If total accessible habitat is: > $^1/_3$ (33.3%) of 1 km Polygon — points = 3 20-33% of 1 km Polygon — points = 2 10-19% of 1 km Polygon — points = 1 < 10% of 1 km Polygon — points = 0	0
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* % undisturbed habitat 25 **+** [(% moderate and low intensity land uses)/2] 5 **=** 30 % Undisturbed habitat > 50% of Polygon — points = 3 Undisturbed habitat 10-50% and in 1-3 patches — points = 2 Undisturbed habitat 10-50% and > 3 patches — points = 1 Undisturbed habitat < 10% of 1 km Polygon — points = 0	1
H 2.3. Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use — points = (- 2) ≤ 50% of 1 km Polygon is high intensity — points = 0	0
Total for H 2 — Add the points in the boxes above	**1**

Rating of Landscape Potential If score is: ☐ **4-6 = H** ☒ **1-3 = M** ☐ **< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated.* Site meets ANY of the following criteria: — points = 2 X It has 3 or more priority habitats within 100 m (see next page) — It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) — It is mapped as a location for an individual WDFW priority species — It is a Wetland of High Conservation Value as determined by the Department of Natural Resources — It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 priority habitats (listed on next page) within 100 m — points = 1 Site does not meet any of the criteria above — points = 0	**2**

Rating of Value If score is: ☒ **2 = H** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

Wetland name or number G

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp. http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here: http://wdfw.wa.gov/conservation/phs/list/)

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE:*** *This question is independent of the land use between the wetland unit and the priority habitat.*

— **Aspen Stands:** Pure or mixed stands of aspen greater than 1 ac (0.4 ha).

X **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*).

— **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 8 trees/ac (20 trees/ha) > 32 in (81 cm) dbh or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in (53 cm) dbh; 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; 80-200 years old west of the Cascade crest.

— **Oregon White Oak:** Woodland 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 – see web link above*).

X **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 – see web link above*).

X **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.

X **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 – see web link on previous page).*

— **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 25 ft (7.6 m) high and occurring below 5000 ft elevation.

— **Talus:** Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

X **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 > 20 in (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

Wetland name or number G

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine wetlands Does the wetland 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= **Not an estuarine wetland**	
SC 1.1. Is the wetland 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. I**
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina*, see page 25) — At least ¾ 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 two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. ○ Yes = **Category I** ○ No = **Category II**	○ **Cat. I** ○ **Cat. II**
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? ○ Yes – Go to **SC 2.2** ○ No – Go to **SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? ○ Yes = **Category I** ○ No = **Not a WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf ○ Yes – **Contact WNHP/WDNR and go to SC 2.4** ○ No = **Not a WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? ○ Yes = **Category I** ● No = **Not a WHCV**	○ **Cat. I**
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES you will still need to rate the wetland based on its functions.*** SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? ○ Yes – Go to **SC 3.3** ○ No – Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? ○ Yes – Go to **SC 3.3** ○ No = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? ○ Yes = **Is a Category I bog** ○ No – Go to **SC 3.4** **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 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? ○ Yes = **Is a Category I bog** ● No = **Is not a bog**	○ **Cat. I**

Wetland name or number G

SC 4.0. Forested Wetlands Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA 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 functions.*** — **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in (81 cm) or more. — **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80- 200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in (53 cm). ○ Yes = **Category I** ● No = **Not a forested wetland for this section**	○ **Cat. I**
SC 5.0. Wetlands in Coastal Lagoons 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 ponded 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 = **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 aggressive, opportunistic plant species (see list of species on p. 100). — At least ¾ 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 $^{1}/_{10}$ ac (4350 ft^2) ○ Yes = **Category I** ● No = **Category II**	○ **Cat. I** ○ **Cat. II**
SC 6.0. Interdunal Wetlands Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ***If you answer yes you will still need to rate the wetland based on its habitat 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 ○ Yes – Go to **SC 6.1** ● No = **not an interdunal wetland for rating** SC 6.1. Is the wetland 1 ac or larger and scores an 8 or 9 for the habitat functions on the form (rates H,H,H or H,H,M for the three aspects of function)? ○ Yes = **Category I** ○ No – Go to **SC 6.2** SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger? ○ Yes = **Category II** ○ No – Go to **SC 6.3** SC 6.3. Is the unit between 0.1 and 1 ac, or is it in a mosaic of wetlands that is between 0.1 and 1 ac? ○ Yes = **Category III** ○ No = **Category IV**	○ **Cat I** ○ **Cat. II** ○ **Cat. III** ○ **Cat. IV**
Category of wetland based on Special Characteristics If you answered No for all types, enter "Not Applicable" on Summary Form	NA

Wetland name or number H

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Meadowdale Park Wetland H Date of site visit: 11/1/2016

Rated by C. Douglas Trained by Ecology? ☒ Yes ☐ No Date of training 2007

HGM Class used for rating Riverine Wetland has multiple HGM classes? ☒ Y ☐ N

NOTE: **Form is not complete without the figures requested** *(figures can be combined)*.
Source of base aerial photo/map _____

OVERALL WETLAND CATEGORY II (based on functions ☒ or special characteristics ☐)

1. Category of wetland based on FUNCTIONS

_____**Category I** – Total score = 23 - 27

X **Category II** – Total score = 20 - 22

_____**Category III** – Total score = 16 - 19

_____**Category IV** – Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
	Circle the appropriate ratings			
Site Potential	H (M) L	H (M) L	H (M) L	
Landscape Potential	(H) M L	(H) M L	H (M) L	
Value	H (M) L	H M (L)	(H) M L	TOTAL
Score Based on Ratings	7	6	7	**20**

Score for each function based on three ratings *(order of ratings is not important)*

9 = H,H,H
8 = H,H,M
7 = H,H,L
7 = H,M,M
6 = H,M,L
6 = M,M,M
5 = H,L,L
5 = M,M,L
4 = M,L,L
3 = L,L,L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	CATEGORY
Estuarine	I II
Wetland of High Conservation Value	I
Bog	I
Mature Forest	I
Old Growth Forest	I
Coastal Lagoon	I II
Interdunal	I II III IV
None of the above	X

Wetland name or number H

Maps and figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	
Hydroperiods	D 1.4, H 1.2	
Location of outlet (*can be added to map of hydroperiods)*	D 1.1, D 4.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	D 2.2, D 5.2	
Map of the contributing basin	D 4.3, D 5.3	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream *(can be added to another figure)*	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to figure above)*	S 4.1	
Boundary of 150 ft buffer (can be added to another figure)	S 2.1, S 5.1	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	

Wetland name or number H

HGM Classification of Wetlands in Western Washington

For questions 1-7, the criteria described must apply to the entire unit being rated.

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 except during floods?

(●) NO – go to 2 ( ) **YES** – the wetland class is **Tidal Fringe** – go to 1.1

1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

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

*If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe it is an **Estuarine** wetland and is not scored. This method **cannot** be used to score functions for estuarine wetlands.*

2. The entire wetland unit is flat and precipitation is the 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 unit **meet all** of the following criteria?
   - ☐ The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size;
   - ☐ At least 30% of the open water area is deeper than 6.6 ft (2 m).

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

4. Does the entire wetland unit **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**.

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

NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

5. Does the entire wetland unit **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 2 years.

Wetland name or number H

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

NOTE: The Riverine unit can contain depressions that are filled with water when the river is not flooding

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during 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 unit 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 the wetland unit being scored.

   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 HGM 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 of depression	Depressional
Depressional + Lake Fringe	Depressional
Riverine + Lake Fringe	Riverine
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE

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

Wetland name or number H

RIVERINE AND FRESHWATER TIDAL FRINGE WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

R 1.0. Does the site have the potential to improve water quality?	
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 > ½ area of wetland points = 4 Depressions present but cover < ½ area of wetland points = 2 No depressions present points = 0	2
R 1.2. Structure of plants in the wetland (areas with >90% cover at person height, **not** Cowardin classes) Trees or shrubs > $^2/_3$ area of the wetland points = 8 Trees or shrubs > $^1/_3$ area of the wetland points = 6 Herbaceous plants (> 6 in high) > $^2/_3$ area of the wetland points = 6 Herbaceous plants (> 6 in high) > $^1/_3$ area of the wetland points = 3 Trees, shrubs, and ungrazed herbaceous < $^1/_3$ area of the wetland points = 0	6
Total for R 1 Add the points in the boxes above	**8**

Rating of Site Potential If score is: ☐ **12-16 = H** ☒ **6-11 = M** ☐ **0-5 = L** *Record the rating on the first page*

R 2.0. Does the landscape have the potential to support the water quality function of the site?	
R 2.1. Is the wetland within an incorporated city or within its UGA? Yes = 2 No = 0	2
R 2.2. Does the contributing basin to the wetland include a UGA or incorporated area? Yes = 1 No = 0	1
R 2.3. Does at least 10% of the contributing basin contain tilled fields, pastures, or forests that have been clearcut within the last 5 years? Yes = 1 No = 0	0
R 2.4. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants? Yes = 1 No = 0	1
R 2.5. Are there other sources of pollutants coming into the wetland that are not listed in questions R 2.1-R 2.4 Other sources _____ Yes = 1 No = 0	0
Total for R 2 Add the points in the boxes above	**4**

Rating of Landscape Potential If score is: ☒ **3-6 = H** ☐ **1 or 2 = M** ☐ **0 = L** *Record the rating on the first page*

R 3.0. Is the water quality improvement provided by the site valuable to society?	
R 3.1. Is the wetland along a stream or river that is on the 303(d) list or on a tributary that drains to one within 1 mi? Yes = 1 No = 0 R 3.2. Is the wetland along a stream or river that has TMDL limits for nutrients, toxics, or pathogens? Yes = 1 No = 0	1 & 0
R 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality? (*answer YES if there is a TMDL for the drainage in which the unit is found*) Yes = 2 No = 0	0
Total for R 3 Add the points in the boxes above	**1**

Rating of Value If score is: ☐ **2-4 = H** ☒ **1 = M** ☐ **0 = L** *Record the rating on the first page*

Wetland name or number H

RIVERINE AND FRESHWATER TIDAL FRINGE WETLANDS

Hydrologic Functions - Indicators that site functions to reduce flooding and stream erosion

R 4.0. Does the site have the potential to reduce flooding and erosion?		
R 4.1. 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 wetland)/(average width of stream between banks).* If the ratio is more than 20 If the ratio is 10-20 If the ratio is 5-<10 If the ratio is 1-<5 If the ratio is < 1	 points = 9 points = 6 points = 4 points = 2 points = 1	4
R 4.2. Characteristics of plants 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. These are NOT Cowardin classes).* Forest or shrub for >$^{1}/_{3}$ area OR emergent plants > $^{2}/_{3}$ area Forest or shrub for > $^{1}/_{10}$ area OR emergent plants > $^{1}/_{3}$ area Plants do not meet above criteria	 points = 7 points = 4 points = 0	7
Total for R 4	Add the points in the boxes above	**11**

Rating of Site Potential If score is: ☐ **12-16 = H** ☒ **6-11 = M** ☐ **0-5 = L** *Record the rating on the first page*

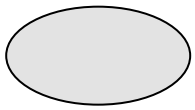
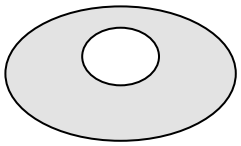
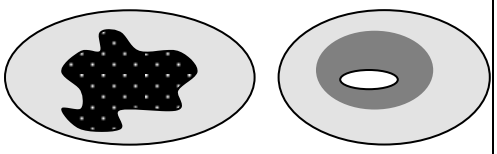
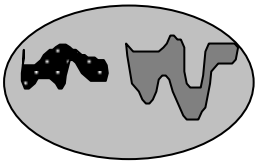
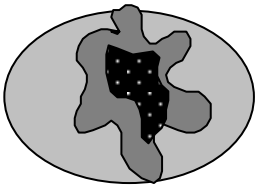
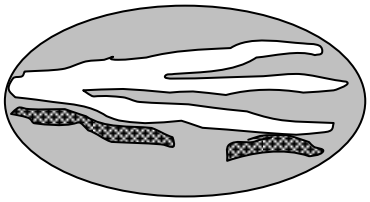
R 5.0. Does the landscape have the potential to support the hydrologic functions of the site?		
R 5.1. Is the stream or river adjacent to the wetland downcut?	Yes = 0 No = 1	1
R 5.2. Does the up-gradient watershed include a UGA or incorporated area?	Yes = 1 No = 0	1
R 5.3. Is the up-gradient stream or river controlled by dams?	Yes = 0 No = 1	1
Total for R 5	Add the points in the boxes above	**3**

Rating of Landscape Potential If score is: ☒ **3 = H** ☐ **1 or 2 = M** ☐ **0 = L** *Record the rating on the first page*

R 6.0. Are the hydrologic functions provided by the site valuable to society?		
R 6.1. Distance to the nearest areas downstream that have flooding problems? *Choose the description that best fits the site*. The sub-basin immediately down-gradient of the wetland has flooding problems that result in damage to human or natural resources (e.g., houses or salmon redds) Surface flooding problems are in a sub-basin farther down-gradient No flooding problems anywhere downstream	 points = 2 points = 1 points = 0	0
R 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan?	Yes = 2 No = 0	0
Total for R 6	Add the points in the boxes above	**0**

Rating of Value If score is: ☐ **2-4 = H** ☐ **1 = M** ☒ **0 = L** *Record the rating on the first page*

Wetland name or number H

These questions apply to wetlands of all HGM classes. **HABITAT FUNCTIONS** - Indicators that site functions to provide important habitat	
H 1.0. Does the site have the potential to provide habitat?	
H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.* ____Aquatic bed — 4 structures or more: points = 4 ____Emergent — 3 structures: points = 2 _X_Scrub-shrub (areas where shrubs have > 30% cover) — 2 structures: points = 1 _X_Forested (areas where trees have > 30% cover) — 1 structure: points = 0 *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	1
H 1.2. Hydroperiods Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*). ____Permanently flooded or inundated — 4 or more types present: points = 3 _X_Seasonally flooded or inundated — 3 types present: points = 2 ____Occasionally flooded or inundated — 2 types present: points = 1 _X_Saturated only — 1 type present: points = 0 _X_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**	2
H 1.3. Richness of plant species 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 and 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 < 5 species — points = 0	1
H 1.4. Interspersion of habitats Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.*  **None** = 0 points  **Low** = 1 point  **Moderate** = 2 points All three diagrams in this row are **HIGH** = 3points   	2

Wetland name or number H

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* X Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long). ____Standing snags (dbh > 4 in) within the wetland ____Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ____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 weathered where wood is exposed)* ____At least ¼ ac of thin-stemmed persistent plants 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 every stratum of plants (*see H 1.1 for list of strata*)	1
Total for H 1 — Add the points in the boxes above	**7**

Rating of Site Potential If score is: ☐ **15-18 = H** ☒ **7-14 = M** ☐ **0-6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat functions of the site?	
H 2.1. Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate:* % undisturbed habitat 1 **+** [(% moderate and low intensity land uses)/2] .5 **=** 1.5 % If total accessible habitat is: > $^1/_3$ (33.3%) of 1 km Polygon — points = 3 20-33% of 1 km Polygon — points = 2 10-19% of 1 km Polygon — points = 1 < 10% of 1 km Polygon — points = 0	0
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* % undisturbed habitat 25 **+** [(% moderate and low intensity land uses)/2] 5 **=** 30 % Undisturbed habitat > 50% of Polygon — points = 3 Undisturbed habitat 10-50% and in 1-3 patches — points = 2 Undisturbed habitat 10-50% and > 3 patches — points = 1 Undisturbed habitat < 10% of 1 km Polygon — points = 0	1
H 2.3. Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use — points = (- 2) ≤ 50% of 1 km Polygon is high intensity — points = 0	0
Total for H 2 — Add the points in the boxes above	**1**

Rating of Landscape Potential If score is: ☐ **4-6 = H** ☒ **1-3 = M** ☐ **< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated.* Site meets ANY of the following criteria: — points = 2 X It has 3 or more priority habitats within 100 m (see next page) — It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) — It is mapped as a location for an individual WDFW priority species — It is a Wetland of High Conservation Value as determined by the Department of Natural Resources — It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 priority habitats (listed on next page) within 100 m — points = 1 Site does not meet any of the criteria above — points = 0	**2**

Rating of Value If score is: ☒ **2 = H** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

Wetland name or number H

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp. http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here: http://wdfw.wa.gov/conservation/phs/list/)

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE:*** *This question is independent of the land use between the wetland unit and the priority habitat.*

— **Aspen Stands:** Pure or mixed stands of aspen greater than 1 ac (0.4 ha).

X **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*).

— **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 8 trees/ac (20 trees/ha) > 32 in (81 cm) dbh or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in (53 cm) dbh; 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; 80-200 years old west of the Cascade crest.

— **Oregon White Oak:** Woodland 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 – see web link above*).

X **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 – see web link above*).

X **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.

X **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 – see web link on previous page).*

— **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 25 ft (7.6 m) high and occurring below 5000 ft elevation.

— **Talus:** Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

X **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 > 20 in (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

Wetland name or number H

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine wetlands Does the wetland 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= **Not an estuarine wetland**	
SC 1.1. Is the wetland 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. I**
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina*, see page 25) — At least ¾ 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 two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. ○ Yes = **Category I** ○ No = **Category II**	○ **Cat. I** ○ **Cat. II**
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? ○ Yes – Go to **SC 2.2** ○ No – Go to **SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? ○ Yes = **Category I** ○ No = **Not a WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf ○ Yes – **Contact WNHP/WDNR and go to SC 2.4** ○ No = **Not a WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? ○ Yes = **Category I** ● No = **Not a WHCV**	○ **Cat. I**
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES you will still need to rate the wetland based on its functions.*** SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? ○ Yes – Go to **SC 3.3** ○ No – Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? ○ Yes – Go to **SC 3.3** ○ No = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? ○ Yes = **Is a Category I bog** ○ No – Go to **SC 3.4** **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 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? ○ Yes = **Is a Category I bog** ● No = **Is not a bog**	○ **Cat. I**

Wetland name or number H

SC 4.0. Forested Wetlands Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA 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 functions.*** — **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in (81 cm) or more. — **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80- 200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in (53 cm). ○ Yes = **Category I** ● No = **Not a forested wetland for this section**	○ **Cat. I**
SC 5.0. Wetlands in Coastal Lagoons 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 ponded 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 = **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 aggressive, opportunistic plant species (see list of species on p. 100). — At least ¾ 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 $^{1}/_{10}$ ac (4350 ft^2) ○ Yes = **Category I** ● No = **Category II**	○ **Cat. I** ○ **Cat. II**
SC 6.0. Interdunal Wetlands Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ***If you answer yes you will still need to rate the wetland based on its habitat 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 ○ Yes – Go to **SC 6.1** ● No = **not an interdunal wetland for rating** SC 6.1. Is the wetland 1 ac or larger and scores an 8 or 9 for the habitat functions on the form (rates H,H,H or H,H,M for the three aspects of function)? ○ Yes = **Category I** ○ No – Go to **SC 6.2** SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger? ○ Yes = **Category II** ○ No – Go to **SC 6.3** SC 6.3. Is the unit between 0.1 and 1 ac, or is it in a mosaic of wetlands that is between 0.1 and 1 ac? ○ Yes = **Category III** ○ No = **Category IV**	○ **Cat I** ○ **Cat. II** ○ **Cat. III** ○ **Cat. IV**
Category of wetland based on Special Characteristics If you answered No for all types, enter "Not Applicable" on Summary Form	NA

Appendix E
Memorandum: Geologically Hazardous Areas

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

April 6, 2017

Snohomish County Parks & Recreation
6705 Puget Park Drive
Snohomish, WA 98296

Attn: Ms. Logan Daniels, PE

RE: GEOLOGICALLY HAZARDOUS AREAS, MEADOWDALE BEACH PARK ESTUARY RESTORATION PROJECT, SNOHOMISH COUNTY, WASHINGTON

Draft

This letter report presents our site observations, publicly available information, and opinions regarding geologically hazardous areas as part of the proposed Meadowdale Beach Park Restoration and Estuary Restoration Project in Snohomish County, Washington. The purpose for this letter is to address Snohomish County Code (SCC) Critical Areas Regulations (Snohomish County Planning and Development Services, 2017), Chapter 30.62B – Geologically Hazardous Areas (GHA) as part of the project State Environmental Policy Act (SEPA) checklist.

The scope of our work for this aspect of the project included the following:

- Preparation of Light Detection and Ranging (LiDAR) maps for field use and analysis.
- Site reconnaissance on November 9, 2016.
- Analysis of information and site classification to satisfy GHA requirements.
- Preparation of this letter report.

SITE DESCRIPTION AND CLASSIFICATION

The project site is located on the north boundary of Edmonds, Washington, as shown in the Vicinity Map, Figure 1. The southwestern portion of the site, approximately defined as the area west of where 69th Avenue West would intersect Lunds Gulch Creek, and south of where 154th Street West would cross through the park, is within the Edmonds city limits. The park areas north and east of those approximate boundaries are in unincorporated Snohomish County.

400 NORTH 34TH STREET, SUITE 100
P.O. BOX 300303
SEATTLE, WASHINGTON 98103-8636
206-632-8020 FAX: 206-695-6777
www.shannonwilson.com

The site is accessible via a gated road (Figure 2), which extends north from 75th Place West. North of the park entrance gate, the road continues in a northern direction, paralleling the west-facing coastal bluff and shoreline for about 400 feet before turning sharply to the east on the slopes of Lund's Gulch. At the toe of this steep hillside, the road again turns sharply to the west to a parking lot. The park ranger's residence and a playfield with picnic shelters are located west of the parking lot. The western edge of the playfield is separated from the Puget Sound beach by a 15-foot-high embankment of the BNSF Railway Company (BNSF).

Impervious surfaces at the site include the access road, asphalt-paved walking paths in the lower park area, and associated paved surfaces (Figure 2). Buried utilities, such as fiber optics and electrical power, are located on the inboard side of the entrance road, beneath the drainage ditch.

Based on review of existing LiDAR topography (Figure 2) and SCC 30.91L.040, most of the slopes forming both the north and south flanks of Lund's Gulch, as well as the relatively flat park and stream areas between the slopes are classified as Landslide Hazard Areas (LHA), as defined in SCC 30.91L.040 because they have:

- Vertical height greater than 10 feet.
- Areas of historic and active landslides.
- Most of the slope areas are steeper than 33 percent.
- Slopes intersect geologic contacts between relatively permeable sediment overlying relatively impermeable sediment.
- Slopes contain springs and groundwater seeps.

The park and stream areas qualify as GHA because:

- They are in a canyon and an active alluvial fan, susceptible to inundation by debris flows or catastrophic flooding.
- They are entirely encompassed within the boundaries defined as twice the height of the steep slope measured from the toe of the slope.

Based on this site classification, Chapter 30.62B SCC requires a geotechnical report for any site development activity. Note that at the time this report was published, the design study for the proposed improvements was in progress, and geotechnical explorations and analyses had not been completed. This report describes site conditions and features specific to the GHA report

Draft

requirements. Design recommendations to address geologic hazards will be presented in the project design geotechnical report.

PROPOSED IMPROVEMENTS

Proposed improvement details will be presented in the project SEPA checklist and are beyond the scope of this report. In summary form, proposed improvements include:

- Constructing a 130-foot-long, four-span railroad bridge to replace the existing concrete culvert that serves as passage for Lund's Gulch Creek through the BNSF embankment.
- Site grading to widen the Lund's Gulch Creek channel meander zone, restore the former brackish wetland area, and restore the natural intertidal and delta reaches of Lund's Creek.
- Constructing an Americans with Disabilities Act-compliant walking path beneath the proposed bridge for pedestrian access between the park and beach areas.
- Constructing a pedestrian bridge across Lund's Gulch Creek near the upper reach of the proposed widened channel meander zone.
- Constructing a new restroom enclosure near the southwest corner of the site.

To construct the proposed bridge and site grading activities, it is anticipated that heavy equipment and materials ingress and egress would be via the existing access road. Based on the access road assessment provided during the project feasibility study (Shannon & Wilson, Inc. [S&W], 2016), we anticipate road improvements will be required to support construction traffic. Anticipated improvements include road widening, particularly at the sharp curves, and stabilization measures along the outside portion of the road where longitudinal pavement cracks have been observed and potentially unstable, non-engineered fill is suspected.

GEOLOGIC CONDITIONS

Geologists generally agree that the Puget Sound area was subjected to six or more major glacial events. Each glaciation deposited new sediment and partially eroded previous sediments. During the intervening periods when glacial ice was not present, normal stream processes, wave action, weathering, and landsliding eroded and reworked some of the glacially-derived sediment, further complicating the geologic setting.

During the Vashon Stade of the Fraser Glaciation (most recent ice incursion) that covered the central Puget Lowland, approximately 18,000 to 16,000 years before present (Porter and Swanson, 1998), the glacial ice is estimated to have been about 3,000 feet thick in the project area (Thorson, 1989). The weight of the glacial ice resulted in compaction of the glacial and nonglacial soils beneath the ice. The glacial and nonglacial deposits are overlain by younger (Holocene Epoch), relatively loose and soft, post-glacial soils that include peat, beach, colluvial, and fill deposits.

Lund's Gulch incises through glacial and nonglacial soils from uplands of greater than 300 feet elevation to Puget Sound along a west-northwest trend in south Snohomish County (Figure 1, Vicinity Map). Meadowdale Beach Park encompasses the lower part of Lund's Gulch.

Lund's Gulch was carved by glacial meltwater after Vashon ice retreated and the land was uncovered (Applied Geotechnology, Inc., 1986). During the time of ice retreat, the steep slopes along the sides of the meltwater channels (the gulch and Puget Sound) became destabilized. On the creek side of the park, the slopes remain largely set in their position (Applied Geotechnology Inc., 1986). On the Puget Sound side of the park, the shoreline slopes retreated many hundreds of feet following deglaciation owing to upland instability, wave action, and soil erosion by longshore drift.

Lund's Gulch Creek flows through an approximately 6-foot-wide by 9-foot-high by 55-foot-long concrete box culvert through the BNSF embankment. A delta has formed in the intertidal zone between the culvert outlet and Puget Sound shoreline. The stream outlets on the north side of the delta as influenced by northward littoral drift.

Existing Geologic Information

According to geologic maps of the area (Washington State Department of Natural Resources, 2016; Minard, 1982; Smith, 1976), we have interpreted the stratigraphic layers along the park entrance road as follows

- **(Hf) Fill** – Materials placed in locations other than their original native locations. The engineering properties of such deposits vary widely with soil density and composition. Slope stability will be negatively affected where loose fill soils are present, and positively affected where dense fill soils are present. Older fills, such as along the outside edge of the park entrance road, are commonly very loose to loose,

because they were not compacted during original construction. They were likely excavated from the inboard side of the road prism and dumped on the outboard side. Permeability of these soils ranges from highly pervious to relatively impervious, depending on their source and the amount of compaction during construction.

- **(Qls/Hc) Landslide Debris/Colluvium** – Loose or soft landslide debris/colluvium deposits cover nearly of the slopes, except for those that are too steep to maintain a colluvial cover. These deposits generally reflect the soils that are uphill from them. They may be relatively pervious, but within close proximity, the soil may have a low permeability. Landslide debris and colluvium is generally loose to medium dense, with density increasing with depth. Engineering properties of such deposits vary widely with soil density and composition. On steep slopes, such soils are susceptible to failure, particularly at the contact with underlying undisturbed formations.
- **(Qvt) Vashon Till** – Very dense, low permeability diamict that blankets much of upland to the east of the project area, but does not outcrop near the proposed improvements. Till is very dense, has a low permeability, and has high shear strength properties because it is poorly sorted, contains 20 to 50 percent fine-grained particles and has been overridden by glacial ice. As a foundation material, it can support heavy loads. Slopes in this material generally exhibit stable behavior. Surface water commonly ponds on top of this layer.
- **(Qva) Advance Outwash Sand** – Very dense, glaciofluvial, advance outwash consisting of sand and/or gravel with relatively few fine-grained particles. It has a relatively high permeability and can support heavy loads where it is undisturbed. This soil type generally exhibits high shear strength due to its density and granular composition. Where exposed in slopes, it can exhibit both stable and unstable behavior. In locations where it is underlain by lower permeability Transitional Beds, groundwater commonly perches on the finer-grained soil and forms seeps or springs where exposed. This seepage can cause slope instability.
- **(Qtb) Transitional Beds** – Interbedded glacial and nonglacial fine sand, silt, and clay in the exposed cut slopes along the southern end of the entrance road. The fine sand and silt are dense to very dense and clay is commonly very stiff to hard. The silt and clay have a very low to low permeability, except where they have been fractured, and water is able to move in the cracks. The fine sand is commonly wet. Where undisturbed, these soils support moderate loads. These soils typically exhibit moderate to high shear strength values, and in slopes exhibit both stable and unstable behavior. Along the park entrance road, fractured and jointed silt, clay, and fine sand are exposed and have a history of small failures.

DRAFT

- **(Qog) Olympia Gravel** – Very dense, nonglacial, relatively pervious sand and gravel deposit lying at and below the entrance road level. The gravel is very dense, where undisturbed, exhibits high shear strength, and can support heavy loads. It is locally cemented and can stand vertically for years. Where cemented and containing fine-grained particles in the matrix, it has a low permeability.
- **(Qw) Whidbey Formation** – Very dense, nonglacial, fluvial, interbedded fine to medium sand with fine gravel interbedded with silt and clay exposed in the vertical bluff along the BNSF tracks to the west of the entrance road. No seepage was observed. The exposure was blocky, and colluvium at the toe of the slope contained small soil blocks. Due to its compaction by ice and fine-grained particles in its matrix, it exhibits high shear strength and low permeability at this site.

The Natural Resources Conservation Service map (Debose and Klungland, 1983) of soils indicates three soil types within the park boundaries:

- The lawn and parking areas, and other predominantly flat areas of the lower park are underlain by Alderwood gravelly, sandy loam on 2 to 8 percent slopes. The erosion potential for this soil type is classified as slight.
- The southern end of the entrance road is underlain by Alderwood gravelly, sandy loam on 15 to 30 percent slopes. The erosion potential for this soil type is classified as moderate.
- The remainder of the entrance road and park areas that are on steep slopes are underlain by Alderwood-Everett gravelly, sandy loam on 25 to 70 percent slopes. The erosion potential for this soil type is classified as high.

Geologic Hazards

Geologic hazards at the site include faulting, seismic liquefaction, slope instability, and soil erosion.

Seismic Hazards

The Meadowdale Beach Park is located near a seismically active zone; the Southern Whidbey Island Fault Zone. As shown in Figure 3, the park is about 1 mile south of the active fault zone, and is about halfway between two other geophysical lineaments of unknown age. The potential effects of an earthquake and faulting on the site included ground rupture, liquefaction, and seismically induced landslides. Seismic liquefaction is the loss of soil strength caused by ground shaking during an earthquake in areas with loose sand and silt and a high

groundwater table. The liquefaction susceptibility map of Snohomish County (Palmer and others, 2004) indicates the project site has low to very low susceptibility. The alluvial and colluvial soils in the parking area and the picnic area to the west may be liquefiable, but we have no site-specific soil density and consistency data on which to evaluate their susceptibility. Strong shaking could also engender landslides on the steep slopes along the south entrance road, particularly during the wet winter season.

Landslide Hazard – Natural Slopes

Landslides at the site are both deep-seated and shallow. No active or dormant deep-seated landslides were identified on slopes along the entrance road. Three moderately sized bowls are on the slope above the road on the north-facing slope of the road corridor, as shown in Figure 2, but there are no signs of active or recent deep-seated instability. These bowls are relict remains of past instability.

The colluvium-filled slopes above and below the entrance road are susceptible to shallow instability. Figure 2 indicates locations at which scars of landslides and evidence of recent instability were observed.

A very large bowl breaks the otherwise uniform, south-facing slope (north side of Lund's Gulch Creek) to the north of the proposed site improvements. Based on reconnaissance of the lower part of the bowl, there is no seepage and no defined channel that carries water. Therefore, this bowl is also considered to be relict.

A near-vertical cliff of cemented sand and gravel with silt interbeds is about 20 to 30 feet high for a length of about 110 feet along the BNSF. A large block of fallen soil at the toe of the slope is indicative of the type of instability that could be expected from this bluff. However, due to the slope orientation, such an event would not affect park facilities.

Landslide Hazard – Constructed Slopes

The southern 400 feet of the entrance road is located on a steep, west-facing slope and northern 900 feet of the road is north-facing, as indicated in Figure 2. The asphalt-paved road appears to have been constructed by cut-and-fill methods, with a paved drainage ditch on the inboard side. A guard rail protects the outboard edge of the road. Linear cracks were observed on the outside half of the road in several places along the road, and repairs have been made at

Draft

two locations along the road, the result of road prism failures. The cut slopes in the southern 400 feet of the entrance road were excavated to very steep inclinations, the result of which are periodic failures of blocks of soil into the ditch or onto the pavement.

The slopes immediately downslope from the road are very steep (65 to 130 percent), and downhill bowing of the guard rail in two locations indicates slow failure of those slopes along the outboard edge of the road. Mounds of colluvium form a mostly continuous apron at the toe of the north-facing slope.

Two walls have been constructed on the outboard side of the north-facing segment of the entrance road at the locations indicated in Figure 2. The date of construction of the wooden soldier pile wall is unknown. This wall is about 80 feet long and a maximum 12 feet high. No as-built plans are available for this wall. The mechanically stabilized earth wall is about 10 feet (maximum) high and 100 feet long. It was built in 2008 by the Snohomish County Public Works Department to repair the failure of the outside shoulder of the road that crossed a steep, but shallow ravine. Excavation for the repair extended to 23 feet below the inside edge of pavement, and backfill consisted of quarry rock and geogrids. Presently, no distress was observed on the road at this site and the face of the wall appeared to be in good condition.

Draft

Vegetation and Erosion Hazard

Vegetation consists mainly of deciduous trees, namely red alder and big-leaf maple, with moderate to thick undergrowth. Large-diameter conifers, such as Douglas fir, western hemlock, and western red cedar, are scattered throughout the site.

Erosion will occur naturally and in response to construction. The site is well vegetated for the most part; however, some of the cut slopes are bare, exposing soil to rain and entrainment. They provide little sediment, except infrequently when the slope soils fail and fill the drainage ditch. During construction, sediment will be created during excavation and filling, but Best Management Practices will control sediment so it does not reach Lund's Gulch Creek or Puget Sound.

WATER WELLS

We searched the Washington State Department of Ecology well log database and found 68 records on file within the same township, range, section, and quarter-section as the project site. Of the 68 records, 15 were listed as water wells, 15 were listed as resource protection wells, and 36 were listed as well abandonments. The 15 water wells were registered to Alderwood Water District, and each water well log had a corresponding abandonment log. The location stated in the well logs for the 15 water wells is the Alderwood Water and Wastewater District Water Treatment Plant address, 6315 Picnic Point Road, Edmonds, Washington 98026. That address is more than one mile from the project site. Based on available water well records, it appears there are no water wells within the project site.

DRAINAGE

Drainage at the site is surface and subsurface. No surface channels were observed on, below or above the access road. A paved drainage ditch is located on the inboard side of the road. From the high point at the curve about 400 feet north of the entrance gate, the ditch water flows south and east. Most of the subsurface water in the park appears to be intercepted by the deep valley of Lund's Gulch, on the slopes to the north and south of the creek. The result of that seepage is a plethora of small to very large landslides along the gulch sidewalls. On the slope facing westward, above the BNSF tracks, no seeps were observed. Minor seepage was observed in the locations indicated in Figure 2, in the project area. Two small seeps were observed on the uphill side of the road on the north-facing slope: (1) behind an electrical service box at the bottom of the slope where the road bends sharply to the west and (2) from a topographic bowl uphill from the road, as indicated in Figure 2.

SUMMARY

The project area and entrance road are underlain by competent overconsolidated glacial soils, alluvial deposits, and weak colluvial deposits. The latter are the result of past slope instability and erosion on the steep slopes. Only two seeps were observed, both on the north-facing slope of the road.

Draft

Three types of geologic hazard exist along this alignment and adjacent areas: landslides, erosion, and seismic. Potential landslide hazards are both deep-seated and shallow, and may be natural or the result of past disturbance of the natural conditions. The deep-seated landslides identified along the alignment are relict, and very unlikely to reactivate naturally or as the result of the proposed site improvements. There are many instances of shallow landsliding:

1. The cut slope of the road is too steep to maintain a stable condition. This slope has failed many times in the past, and can be expected to fail in discrete small areas (on the order of 5 to 100 cubic yards) in the future. The trees on this slope will also fall of their own volition or along with a soil mass. The trees constitute a particular danger to the walking and driving public. Sudden shallow landslides and tree falls are likely, but not exclusively, to occur during the winter months.
2. The outside edge of the roadway is loose sidecast fill for perhaps as much as 80 percent of the road alignment length. Where there are signs of distress in the pavement or the guard rail, measures need to be taken to remediate the road; however, other sidecast fill areas are still susceptible to failure or settlement in the future. Such failures could endanger drivers if failure of soils beneath the existing roadway occurred and a void developed suddenly, and was undetected.
3. The bluff along the BNSF tracks is exposed and vertical, and fails periodically in blocks defined by joints in the glacially overridden soil. The soil comes to rest in the railroad drainage ditch. Failures of this type will not affect the project area, and the BNSF has posted no trespassing signs, making access off limits.

DRAFT

To comply with SCC 30.62B.340, structures in LHA must be designed to provide protection commensurate to being located outside of the LHA. During final design, appropriate recommendations will be included for structures located within identified landslide runout zones.

Liquefaction is not likely along the access road because groundwater is low or non-existent. However, in the parking lot and in the open field and picnic area to the west of the Ranger's house, the groundwater level is high and the soils may be very loose to medium dense, making them susceptible to liquefaction and damage under seismic shaking. This hazard could potentially heighten the risk for structures in this area, such as the proposed restroom enclosure and pedestrian bridge across Lund's Gulch Creek. Mitigative measures, such as removal of the liquefiable layer, pile support, dynamic compaction, or other ground improvement, will be evaluated and recommended as appropriate in the project geotechnical report. In the parking lot, it may be more economical in the long-term to repair damaged pavement due to liquefaction.

So as to maintain stability and prevent erosion along the entrance road, surface water and groundwater will not be allowed to concentrate and ditches will be regularly cleared. Impervious surfaces will be minimized to the extent possible and native vegetation will be retained. The exception to this is the cutting of leaning trees along the entrance road that could fall with or without slope movement. Evaluation of the trees could be provided by a professional forester.

The south entrance road improvements will not, in our opinion, increase the risk of property damage, injury or death. Nor will the improvements increase similar risks to neighboring properties.

CLOSURE

This report was prepared for the exclusive use of Snohomish County and their representatives for its evaluation of the Geologically Hazardous Areas on and adjacent to the proposed project. Our evaluation was performed solely to address the Geologically Hazardous Areas on and adjacent to the proposed project, and should not be used for design or construction. Explorations will be performed to support engineering recommendations for this project. Our assessment of geologically hazardous areas for this report is based on:

- The limitations of our approved scope, schedule, and budget.
- Our understanding of the project and information provided by Snohomish County.

For any site located on or near a slope, there are slope instability risks that present and future owners have to accept, including, but not limited to:

- Natural factors: soil and groundwater conditions, steep topography, heavy rainfall events, erosion, and vegetation conditions.
- Human-related factors: water leaks, pipe breaks, improper drainage, lack of maintenance of vegetation or drainage facilities, fill or debris placement, excavation, and/or removal of trees/vegetation.

Similar circumstances or other unknown conditions may also affect slope stability. Our evaluation and recommendations described herein are not a guarantee or warranty of future stability.

Draft

We have prepared the document "Important Information About Your Geotechnical/ Environmental Report" to assist you and others in understanding the use and limitations of this report. Please read this document to learn how you can lower your risks for this project.

Sincerely,

SHANNON & WILSON, INC.

Tyler J. Stephens, PE
Associate

State of Washington
Engineering Geologist
111
Licensed Geologist
William Thomas Laprade

William T. Laprade, LEG
Senior Vice President

Draft

TJS:WTL/tjs

Enc: References
Figure 1 – Vicinity Map
Figure 2 – Site Plan
Figure 3 – Fault Map
Important Information About Your Geotechnical/Environmental Report

REFERENCES

Applied Geotechnology, Inc., 1986, Geotechnical engineering study, Meadowdale Beach Park, Snohomish County, Washington: Report prepared by Applied Geotechnology, Inc., Bellevue, Wash., 14,845.004, for Snohomish County Parks and Recreation, August 28.

Debose, Alfonso, and Klungland, M. W. 1983, Soil survey of Snohomish County, Washington: Washington, D.C, U. S. Soil Conservation Service, 197 p., 65 maps.

Minard, J. P., 1982, Geologic map of the Mukilteo quadrangle, Washington: U.S. Geological Survey Miscellaneous Field Studies Map MF-1438, scale 1:24,000.

Palmer, S. P.; Magsino, S. L.; Bilderback, E. L.; and others, 2004, Liquefaction susceptibility map of Snohomish County, Washington, in Liquefaction susceptibility and site class maps for Washington State, by county: Washington State Department of Geology and Earth Resources, Open File Report 2004-20, sheet 61, scale 1:150,000.

Porter, S. C., and Swanson, T. W., 1998, Radiocarbon age constraints on rates of advance and retreat of the Puget Lobe of the Cordilleran ice sheet during the last glaciation: Quaternary Research, v. 50, p. 205-213.

Smith, Mackey, 1976, Preliminary surficial geologic map of the Mukilteo and Everett quadrangles, Snohomish County, Washington: Washington State Division of Geology and Earth Resources Geologic Map GM-20, scale 1:24,000.

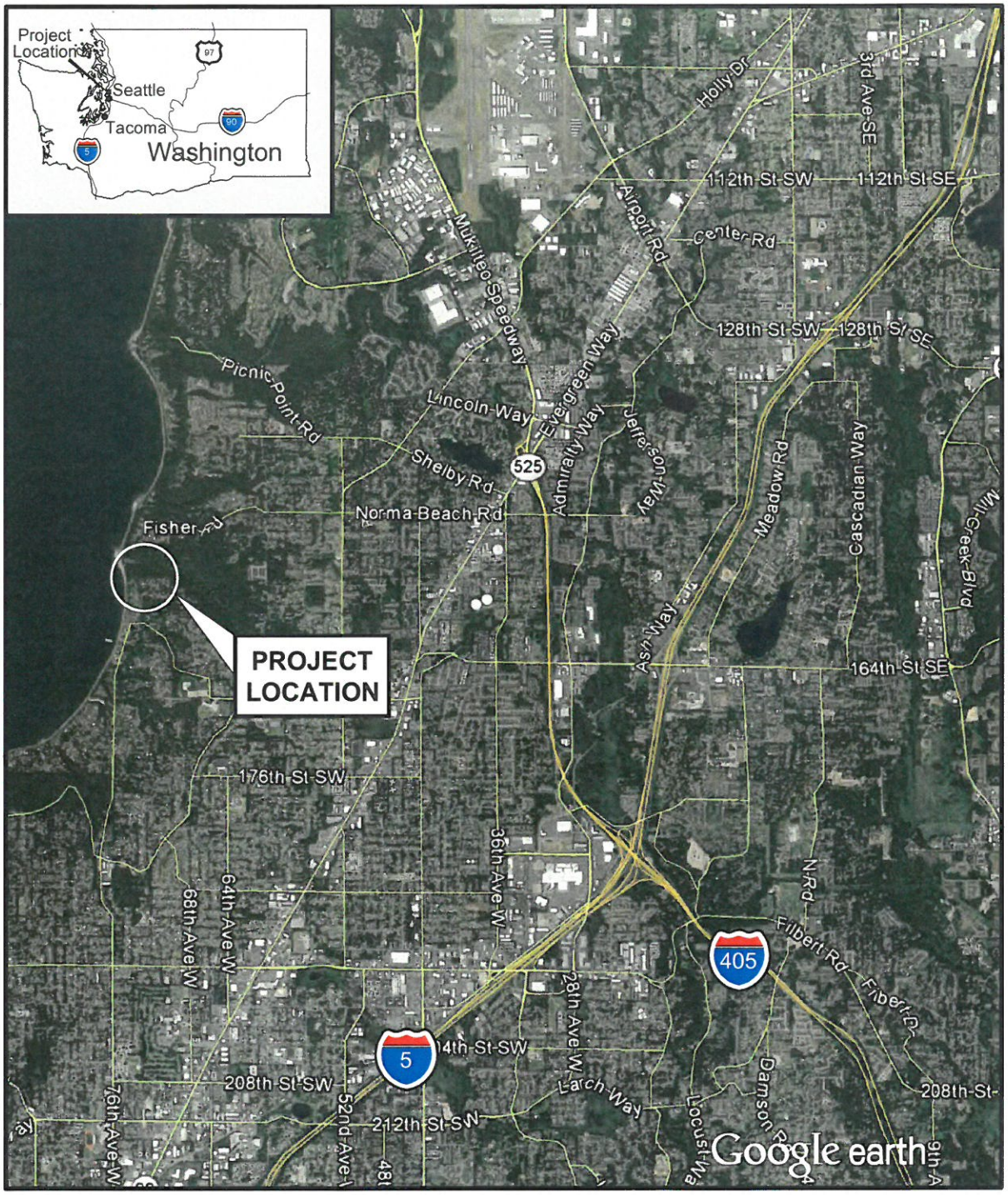
Shannon & Wilson, Inc. (S&W), 2016, Meadowdale Beach Park feasibility study, preliminary geotechnical assessment addendum, south Snohomish County, Washington: Report prepared by Shannon & Wilson, Inc., Seattle, Wash., 21-1-22034-001, for Anchor QEA, LLC, Seattle, Wash., February 3.

Snohomish County, Wash., Planning and Developments Services, 2017, Critical areas regulations update: Available: http://snohomishcountywa.gov/2183/Critical-Areas-Regulations-Update, accessed April, 2017.

Thorson, R. M., 1989, Glacio-isostatic response of the Puget Sound area, Washington: Geological Society of America Bulletin, v. 101, no. 9, p. 1163-1174.

Washington State Division of Geology and Earth Resources, 2016, Washington interactive geologic map: Available: http://www.dnr.wa.gov/geologyportal, accessed December, 2016.

DRAFT



NOTE

Map adapted from aerial imagery provided by Google Earth Pro, reproduced by permission

0 1 2

Approximate Scale in Miles

Meadowdale Beach Park
Estuary Restoration Project
Snohomish County, WA

VICINITY MAP

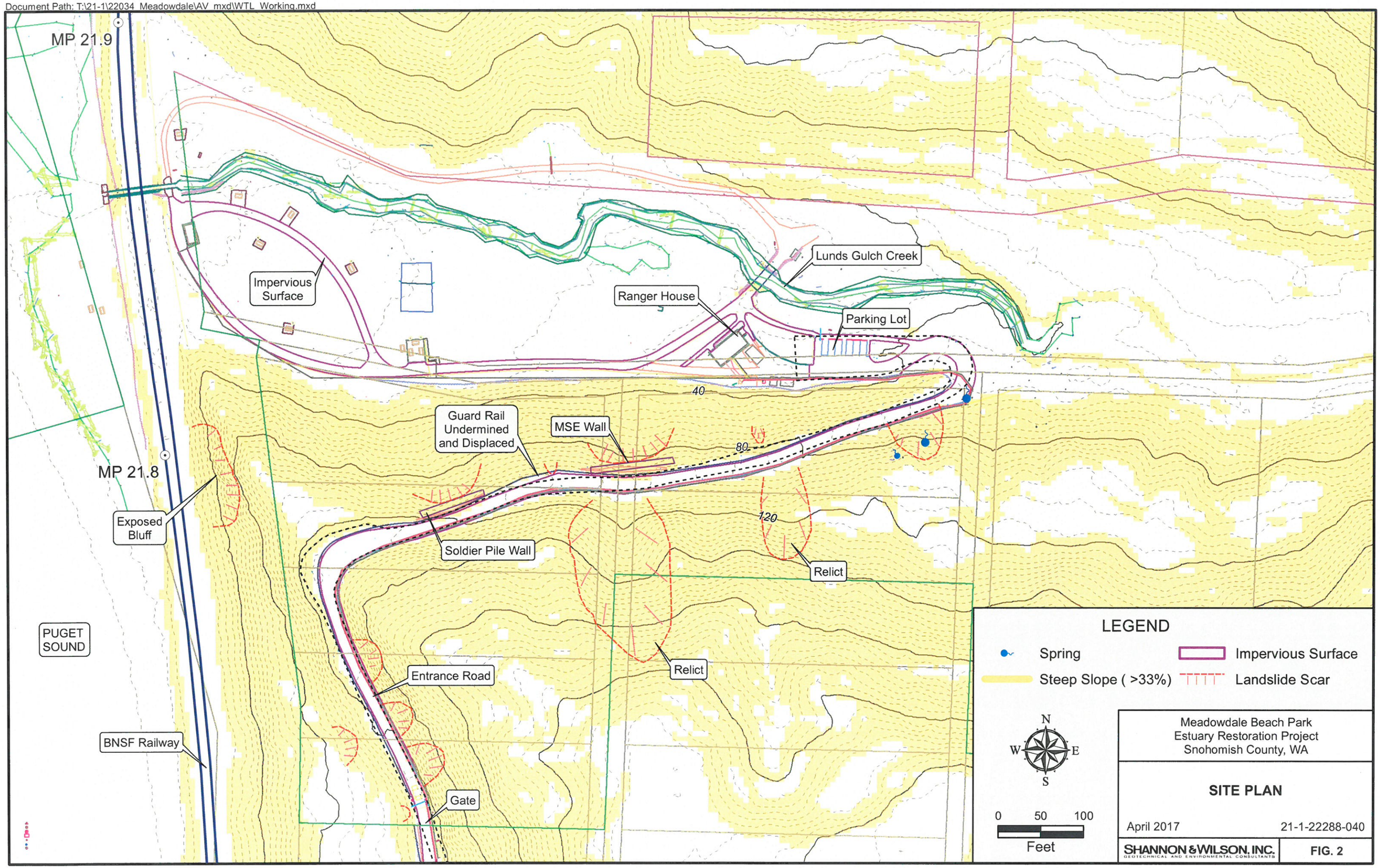
April 2017 21-1-22288-040

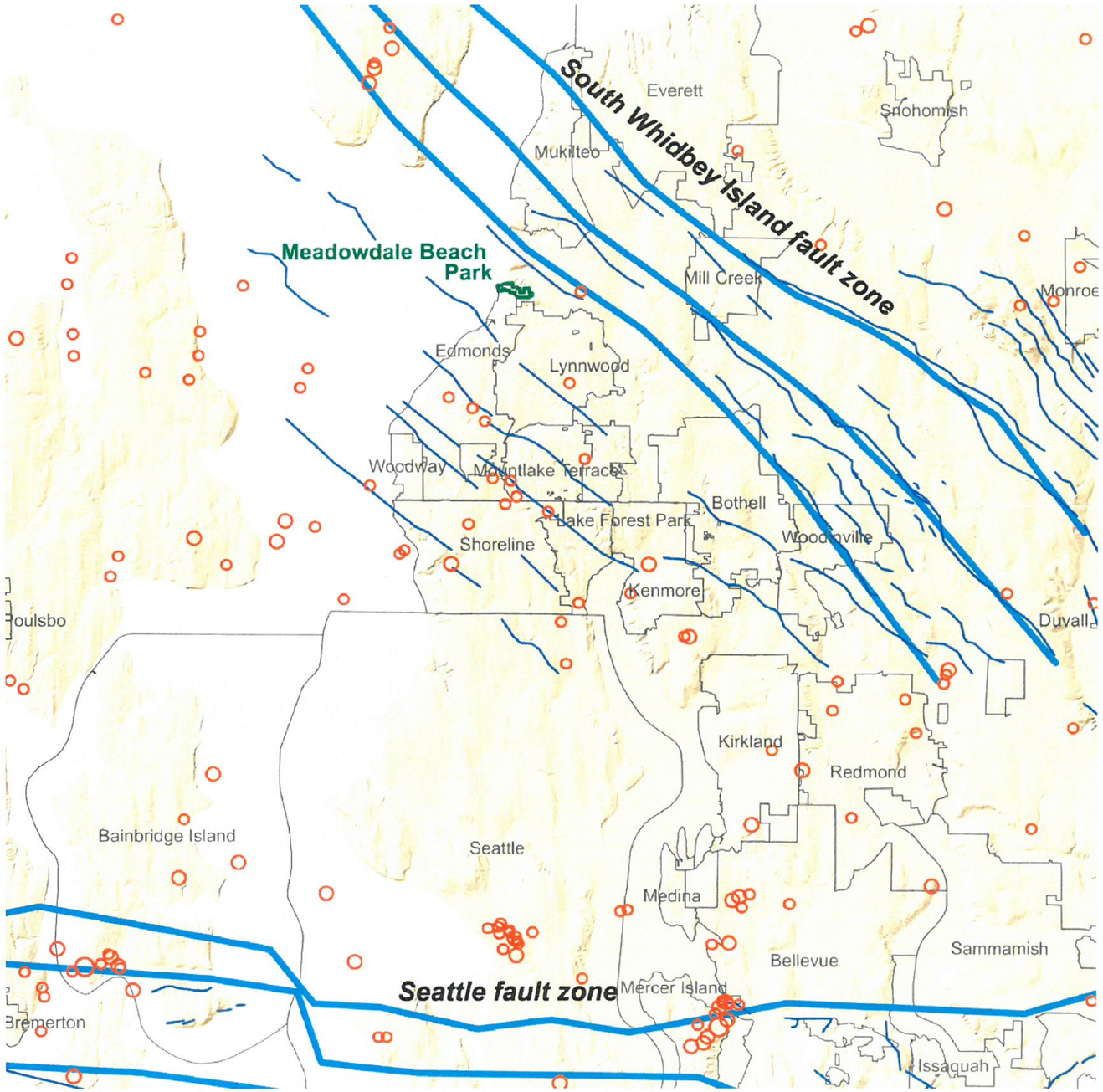
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 1

Filename: J:\211\22288\040\21-1-22288-040 Vic.Map.dwg Date: 04-03-2017 Login: mjm

Document Path: T:\21-1\22034_Meadowdale\AV_mxd\WTL_Working.mxd





N

LEGEND

- Trace of Inferred Active Fault
- Geophysical lineaments of unknown age
- Meadowdale Beach Park
- City Boundaries

EARTHQUAKES

- 2.0 Magnitude
- 3.0 Magnitude
- 4.0 Magnitude

NOTE

1. Earthquake data accessed through the U.S. Geological Survey.
2. Active fault traces from U.S. Geological Survey Nation Hazard Maps, Peterson (2014); Geophysical lineaments compiled by Washington State Dept. of Natural Resources, Bowman and Czajkowki.

0 5 10

Scale in Miles

Meadowdale Beach Park
Estuary Restoration Project
Snohomish County, Washington

FAULT MAP

April 2017 | 21-1-22288-040

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 3

Filename: J:\21\22288\040\21-1-22288-040 Fault Map.dwg Layout: Fault Map Date: 04-03-2017 Login: mjm

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors which were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the
ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland

Appendix F-1
Draft Geotechnical Report (June 6, 2017)

Geotechnical Report
Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

June 6, 2017

SHANNON & WILSON, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Excellence. Innovation. Service. Value.

Since 1954.

DRAFT

Submitted To:
Snohomish County Parks & Recreation
Attn: Ms. Logan Daniels, PE
6705 Puget Park Drive
Snohomish, Washington 98296

By:
Shannon & Wilson, Inc.
400 N 34th Street, Suite 100
Seattle, Washington 98103

21-1-22288-060

TABLE OF CONTENTS

Page

1.0 INTRODUCTION 1

2.0 SITE AND PROJECT DESCRIPTION 1

3.0 PREVIOUS STUDIES 2

4.0 SUBSURFACE EXPLORATION 2
- 4.1 Access Road Borings 3
- 4.2 Bridge Borings 3
- 4.3 Infiltration Potential Hand Borings 3
- 4.4 Horizontal Embankment Boring 3
- 4.5 Test Pits 3

5.0 LABORATORY TESTING 4

6.0 GEOPHYSICAL SURVEYS 4
- 6.1 Ground Penetrating Radar (GPR) 4
  - 6.1.1 Park Lawn Area Ground Penetrating Radar (GPR) Survey 4
  - 6.1.2 BNSF Railway Company (BNSF) Embankment Ground Penetrating Radar (GPR) Survey 5
- 6.2 Electrical Resistivity Tomography (ERT) 5

7.0 GEOLOGY AND SUBSURFACE CONDITIONS 6
- 7.1 Regional Geology 6
- 7.2 Geologic Setting 6
- 7.3 Geologic Units and Generalized Subsurface Conditions 7
- 7.4 Railroad Embankment Fill 8
- 7.5 Demolished Structures and Buried Swimming Pool Fill 9
- 7.6 Groundwater 9

8.0 ENGINEERING CONCLUSIONS AND RECOMMENDATIONS 9
- 8.1 Design Standards 9
- 8.2 Seismic Design 10
  - 8.2.1 Seismic Design Parameters 10
  - 8.2.2 Liquefaction Potential 11
  - 8.2.3 Seismically Induced Slope Instability 11
- 8.3 Railroad Bridge Design 11
  - 8.3.1 Driven Pile Foundations 12
  - 8.3.2 Drilled Pile Foundations 12
  - 8.3.3 Lateral Earth Pressures 12

DRAFT

Page

8.3.4 Temporary Shoring Wall Anticipated Movements 12
8.3.5 Temporary and Permanent Slopes 13
8.4 Pedestrian Bridge 13
8.5 Lateral Pile Analysis 14
8.6 Structure Foundations 14
8.6.1 Bearing Capacity 14
8.6.2 Slab-on-Grade 15
8.7 Access Road Stability Improvements 15

9.0 CONSTRUCTION CONSIDERATIONS 16
9.1 Footings 16
9.2 Compaction, Structural Fill Placement, and Use of On-site Soils 16
9.3 Temporary Excavation Slopes 17
9.4 Driven Piles 18
9.4.1 General 18
9.4.2 Obstructions 18
9.5 Construction Impacts to Railroad Tracks 18
9.6 Embankment Excavation and Shoring Monitoring 19
9.7 Wet Weather Earthwork 19
9.8 Erosion Control 20
9.9 Obstructions 20

10.0 ADDITIONAL SERVICES 20

11.0 LIMITATIONS 21

12.0 REFERENCES 23

TABLES

1 AREMA 2016/ASCE 7-10 Parameters for Seismic Design of Structures
2 Recommended L-Pile Parameters

DRAFT

FIGURES

1 Vicinity Map
2 Site and Exploration Plan
3 Generalized Subsurface Profile A-A'
4 GPR Results –Park Lawn Area
5 Estimated Axial Pile Resistance, HP 14X89 Driven Pile, Boring MB-6
6 Estimated Axial Pile Resistance, HP 14X89 Driven Pile, Boring MB-7
7 RESERVED (Estimated Axial Pile Resistance, __-Inch-Diameter Bored Pile, Boring MB-6)
8 RESERVED (Estimated Axial Pile Resistance, __-Inch-Diameter Bored Pile Boring MB-7)
9 Recommended Lateral Earth Pressures for Temporary Walls
10 Recommended Surcharge Loading for Temporary and Permanent Walls
11 Estimated Axial Pile Resistance, 2-Inch-Diameter Pin Pile, Boring MB-8
12 Estimated Axial Pile Resistance, 4-Inch-Diameter Pin Pile, Boring MB-8
13 Estimated Axial Pile Resistance, 6-Inch-Diameter Pin Pile, Boring MB-8

APPENDICES

A Subsurface Boring Explorations
B Geotechnical Laboratory Testing
C Geophysical Surveys
D Important Information About Your Geotechnical/Environmental Report

DRAFT

GEOTECHNICAL REPORT
MEADOWDALE BEACH
PARK AND ESTUARY RESTORATION
SNOHOMISH COUNTY, WASHINGTON

1.0 INTRODUCTION

This report presents geotechnical engineering conclusions and recommendations for the proposed Meadowdale Beach Park and Estuary Restoration Project near Edmonds, Washington. The project location is shown in the Vicinity Map, Figure 1. This report includes a summary of surveys and explorations, subsurface conditions, and the results of engineering studies and analyses completed to date. Our exploration program has not been fully completed and is ongoing, with a horizontal boring into the BNSF Railway Company (BNSF) embankment and test pits in the park lawn area to be completed in the coming weeks. Our scope of services consisted of site reconnaissance, two geophysical surveys, drilling and sampling ten borings, laboratory testing, geotechnical engineering studies, and preparation of this report. Our services were authorized via contract between Snohomish County and Shannon & Wilson, Inc. (Shannon & Wilson), dated August 25, 2016, and via Task Assignment TA#3 issued through On-Call Contract OCC15/1-9(AN) between Snohomish County and Shannon & Wilson. Our services were provided in general accordance with our proposals dated July 25, 2016, and June 1, 2016.

Per direction received during a May 16, 2017, phone conversation with Ms. Logan Daniels of Snohomish County Parks and Recreation, this report includes scope items identified in both the July 25, 2016, and June 1, 2016, proposals.

Our July 25, 2016, scope of services includes several tasks associated with planning and designing a shoofly to bypass the construction site. During preliminary design review, BNSF stated they would not allow a shoofly. Subsequent exploration and design efforts have excluded shoofly elements, and there are no discussion or recommendations regarding shoofly elements in this report.

2.0 SITE AND PROJECT DESCRIPTION

The project site is at Meadowdale Beach Park, which is located on the north boundary of Edmonds, Washington, as shown in the Vicinity Map, Figure 1. The southwestern portion of the site, approximately defined as the area west of where 69th Avenue West would intersect Lunds Gulch Creek, and south of where 154th Street West would cross through the park, is within the

DRAFT

Edmonds city limits. The park areas north and east of those approximate boundaries are in unincorporated Snohomish County.

Meadowdale Beach Park occupies approximately the lower half of Lund's Gulch, which is an approximately 1.5-mile-long, west-northwest-oriented drainage from uplands to Puget Sound, through which Lund's Gulch Creek flows. Topographic relief is approximately 450 feet between the upland park entrance at the terminus of 162nd Place SW and the Puget Sound shoreline. Slope angles vary throughout Lund's Gulch, with localized areas of near-vertical bluffs and nearly horizontal creek banks. The majority of the slopes along the north and south valley walls are 3 Horizontal to 1 Vertical (3H:1V) or steeper and the valley bottom near the creek is flatter. The park is heavily vegetated with low brush, alder, and scattered conifers.

The site is accessible via a gated road (Figure 2), which extends north from 75th Place West. North of the park entrance gate, the road continues in a northern direction, paralleling the Puget Sound shoreline and a west-facing coastal bluff for about 400 feet before turning sharply to the east and descending the north-facing slope of Lund's Gulch. At the toe of this steep hillside, the road again turns sharply to the west to a parking lot. The park ranger's residence and a playfield with picnic shelters are located west of the parking lot. The western edge of the playfield is separated from Puget Sound beach by an approximately 10-foot-high embankment of the BNSF. Lund's Gulch Creek flows through a concrete box culvert under the BNSF embankment.

3.0 PREVIOUS STUDIES

Shannon & Wilson previously produced the following reports for this project:

- Meadowdale Beach Park Geotechnical Feasibility Study, Geologic Assessment, and Sediment Loading (Shannon & Wilson, 2015).
- Meadowdale Beach Park Feasibility Study, Preliminary Geotechnical Assessment Addendum (Shannon & Wilson, 2016).
- Meadowdale Beach Park Estuary Restoration Project, Geologically Hazardous Areas (Shannon & Wilson, 2017).

4.0 SUBSURFACE EXPLORATION

The field exploration program was comprised of separate mobilizations to support different geotechnical design elements. The exploration program consisted of drilling and sampling eleven borings and excavating and sampling two test pits. Project archaeologists were on site to

DRAFT

observe soils in select explorations on the valley bottom. The soil borings were drilled during the following mobilizations:

- Access road borings included five soil borings along the access road,
- Bridge borings included two soil borings near the proposed railroad bridge abutments and one soil boring near the proposed pedestrian bridge,
- Infiltration design borings included two shallow hand borings, and
- Embankment boring included one horizontal boring into the railroad fill.

The locations of completed explorations are shown in Figure 2. Appendix A describes the field methods and procedures used to advance the borings and excavate the test pits. Logs of the borings and test pits are included in Appendix A.

4.1 Access Road Borings

Cascade Drilling completed five soil borings along the access road, designated MB-1 through MB-5, from November 21 to 23, 2016. These borings ranged in depth from 40 to 60 feet.

4.2 Bridge Borings

Holt Services, Inc. (Holt) completed three soil borings, designated MB-6 through MB-8, between April 11 and 21, 2017. Boring depths at MB-6 and MB-7, near the proposed railroad bridge abutments ranged from 120 to 130 feet. Holt drilled boring MB-8, near the proposed pedestrian bridge, to a depth of 25 feet. Project archeologists observed soils in these borings to the extent of glacial soils.

4.3 Infiltration Potential Hand Borings

Shannon & Wilson staff advanced two hand borings, designated HB-1 and HB-2, on March 16, 2017. Boring depths at HB-1 and HB-2, at the east end of the playfield and parking lot, respectively, ranged from 6 to 10 feet. Shannon & Wilson staff installed open standpipe piezometers in these borings to monitor groundwater levels.

4.4 Horizontal Embankment Boring

TEXT TO BE PROVIDED IN SUBSEQUENT REPORT

4.5 Test Pits

TEXT TO BE PROVIDED IN SUBSEQUENT REPORT

DRAFT

5.0 LABORATORY TESTING

We performed geotechnical laboratory testing on select samples retrieved from the borings to evaluate index and engineering properties of the soil. Testing was performed in the Shannon & Wilson laboratory in Seattle, Washington, and included visual classification, water content, grain size analyses, and Atterberg limits. Soil testing was performed in general accordance with ASTM International (ASTM, 2014) standard test procedures. Detailed descriptions of testing methods and results are presented in Appendix B and shown graphically in the boring logs in Appendix A.

6.0 GEOPHYSICAL SURVEYS

Global Geophysics performed a geophysical survey throughout the lawn area between the Park Ranger's residence and the BNSF embankment, and another geophysical survey along the BNSF embankment. The geophysical survey throughout the lawn area occurred in two phases; the initial survey was completed on November 8, 2016, with results delivered December 7, 2016 (Global Geophysics, 2016). The supplemental survey was completed on January 20, 2017, with results delivered February 7, 2017 (Global Geophysics, 2017a). The geophysical survey along the BNSF embankment was completed on April 11 and 12, 2017, with results delivered May 1, 2017 (Global Geophysics, 2017b). The geophysical survey transect locations are shown in Figure 2. Global Geophysics provided reports for each survey area, which describe the methods employed and present interpreted data plots (Appendix C).

6.1 Ground Penetrating Radar (GPR)

The GPR method uses electromagnetic pulses, emitted by an antenna, to penetrate the subsurface soils. The electromagnetic pulses are reflected by objects or materials whose electrical properties are different from the surrounding soil. The reflected electromagnetic pulses are received by an antenna and recorded. The emitting and receiving antennae are housed within a single unit whose position is tracked as the data is being collected, such that GPR results can be located spatially within the survey area. GPR data is typically collected along linear transects which are closely spaced such that plotted output represents nearly complete coverage of the study area.

6.1.1 Park Lawn Area Ground Penetrating Radar (GPR) Survey

The geophysical survey throughout the park lawn area utilized GPR to evaluate whether concrete rubble and other debris were present within and near the site where a structure and pool

DRAFT

had been demolished. The initial GPR survey utilized onboard global positioning system (GPS) methods to collect transect spatial data. Due to poor satellite visibility at the site, the accuracy of GPS position data was poor and the spatial component of the GPR data was deemed unreliable. A supplemental survey utilized conventional land surveying methods to measure and collect the transect alignments and endpoints as shown in Figure 2. The results of the supplemental GPR survey are shown in Figure 4.

As indicated in Figure 4, the supplemental GPR survey detected numerous anomalous features throughout the grassy park area, with an apparent concentration of anomalous features along the northern leg of the asphalt walk through the grassy area and just north of the picnic area canopy.

6.1.2 BNSF Railway Company (BNSF) Embankment Ground Penetrating Radar (GPR) Survey

We collected GPR data along four transects located along the top of the BNSF embankment and oriented approximately parallel to the rails (Figure 2). The purpose of the embankment GPR survey was to evaluate whether boulder-sized rock or timber piles are present beneath the tracks.

The GPR results are under review and a more detailed interpretation discussion will be included in a subsequent report.

6.2 Electrical Resistivity Tomography (ERT)

The ERT geophysical method uses electrodes, which are driven into the ground to transmit electrical current at specified locations and measure voltage received at other locations: The measured apparent resistivity is representative of the electrical properties of the subsurface materials, which can vary due to soil type, water content, and pore water chemistry.

Global Geophysics performed ERT along two transects located along the top of the BNSF embankment and oriented approximately parallel to the rails. The locations of the geophysical survey transects are included in Figure 2, and report describing the methods employed and interpreted data plots are presented in Appendix C.

A more detailed discussion of the ERT results will be included in a subsequent report.

DRAFT

7.0 GEOLOGY AND SUBSURFACE CONDITIONS

7.1 Regional Geology

The Puget Sound area was subjected to six or more major glacial events over the past 100,000 years, each depositing new sediment and partially eroding previous sediments. During the intervening periods when glacial ice was not present, stream processes, wave action, weathering, and landsliding eroded and reworked some of the glacially derived sediment, further complicating the geologic setting.

During the most recent Vashon Stade of the Fraser Glaciation, the glacial ice is estimated to have been about 3,000 feet thick in the project area (Thorson, 1989). The weight of the glacial ice resulted in compaction and overconsolidation of the glacial and nonglacial sediments beneath the ice. As the Vashon ice retreated around 13,500 years ago, sand and gravel outwash and mixtures of sediments trapped in the ice were deposited. These recessional glacial deposits are overlain by softer and looser alluvial and colluvial deposits. Development and land use continues to modify the landscape in the Puget Sound.

7.2 Geologic Setting

Lund's Gulch Creek flows through Lund's Gulch and Meadowdale Beach Park to the Puget Sound. Lund's Gulch is a deeply incised valley in its upper reaches with a broader valley bottom in the lower approximately ½-mile, but also with steep side slopes. At its western terminus, Lund's Gulch Creek outlets through a concrete box culvert under the BNSF tracks and then through its delta to the Puget Sound. The creek generally flows in a northerly direction through the delta as influenced by northward littoral drift, but periodically avulses and cuts a more direct westward channel through the delta to reach the Puget Sound before migrating northward again.

Lund's Gulch was carved through largely overconsolidated glacial and nonglacial sediments by glacial meltwater. After the Vashon ice retreated, the land was uncovered and the steep slopes along the sides of the meltwater channel became destabilized and slid or slumped into the valley (Applied Geotechnology Inc., 1986). Several of these glacial meltwater channels and slump benches can be seen with terrain or light detection and ranging imaging between Edmonds and Everett (Shannon & Wilson, 2015). These meltwater channels once carried a larger sediment load than they do today and stream processes were operating at a much larger scale than they are today. More recent landsliding has been documented in and around the project site. A landslide initiated from the southern access road in 1967 destroyed the Meadowdale Country Club formerly established in the playfield near the current covered shelter, according to resident Park

DRAFT

Ranger, Doug Dailer (Pers. Comm., 2014). Several stream and culvert clogging events occurred during the winters of 1996/97 and 2007/08 according to Doug Dailer (Pers. Comm., 2014). More recent landslides and slumps were identified along the steep sides of the valley walls in the upper reaches of the ravine, contributing sediment to Lund's Gulch Creek (Shannon & Wilson, 2015).

7.3 Geologic Units and Generalized Subsurface Conditions

Our interpretation of the subsurface conditions is based on geologic mapping by Minard (1983), previous studies by others, and information obtained from our subsurface explorations. The following sections describe the geologic units and generalized subsurface conditions encountered in the explorations and anticipated throughout the site. Refer to the exploration logs in Appendix A for detailed soil descriptions.

- **Fill (Hf):** Fill represents imported soil and other materials or otherwise modified land. Borings MB-3, MB-4, MB-7, HB-1, and HB-2 encountered fill in the upper approximately 5 to 12 feet. Fill at MB-3 and MB-4 consists of loose to medium dense, silty sand with gravel to poorly graded sand with silt. This fill is similar to the native material, but less dense and likely associated with road and shoulder fill. MB-7 consists of loose to medium dense silt; silty sand; and sand with gravel, organics, wood, and glass refuse in the upper 4.5 feet. Borings HB-1 and HB-2 encountered gravel to silty gravel with sand and cobbles in fill to about 6 feet deep. In some areas, fill may be indistinguishable from alluvium and colluvium.
- **Alluvium/Colluvium (Ha/Hc):** Alluvium and Colluvium is comprised of sand and gravel with silt and clay pockets. These units are typically designated together and reflect a complex depositional environment – sediments deposited by landslides of the valley walls (colluvium) were intermixed with alluvium and reworked by streams in the valley bottom. Explorations HB-1 and HB-2 encountered Ha that consists of silty sand with trace gravel and clay clasts to the bottom of the boreholes, 6 and 10 feet deep, respectively. Iron-oxide staining was encountered 1 foot from the bottom of each of these borings, indicating a fluctuating water level.
- Explorations MB-6, MB-7, and MB-8 encountered two layers of Ha/Hc. The upper layer consists of loose silt and sandy silt to loose, silty sand, sometimes interbedded or with pockets of gravel. The lower layer consists of medium dense to very dense sand and gravel layers in MB-6 and MB-7. The lower layer generally coarsened with depth in borings MB-6 and MB-7. In MB-8 the lower layer consists stiff, lean clay with sand, little gravel, and diamict texture. MB-8 encountered a possible slump block from the valley wall at about 15 feet that is similar to the Whidbey Formation found in the valley walls. This layer is designated as colluvium and Whidbey Formation as it is difficult to determine if the layer is a displaced block or

DRAFT

undisturbed. Borings encountered various amounts of wood and organics throughout the Ha/Hc layers. The presence of coarse gravel or cobbles in MB-6 and MB-7 may have caused the blow counts to be artificially high.

- **Whidbey Formation (Qpnf and Qpnl):** The Whidbey Formation represents sediment deposited on the land surface between glacial periods. These sediments were overridden by at least glacial advances and consolidated to a very dense or hard state. The Qpnf component of the Whidbey Formation represents sediments deposited in a fluvial environment and generally consists of very dense, fine silty sand with a few silt interbeds. Qpnf also contains trace gravel, silt and sand seams, and organics and fines are nonplastic to low plasticity. The Qpnl component of the Whidbey Formation represents sediments deposited in a lake environment. Qpnl consists of hard silt to sandy silt, with sand laminations. Fines in Qpnl have low plasticity or are nonplastic.

Borings MB-1 through MB-5 encountered Qpnf and Qpnl. Sediments in the upper 20 feet in borings MB-3 through MB-5 were consistent with grain size and appearance of Qpnf and Qpnl sediments observed elsewhere, but had lower blow counts, registering as medium dense to dense instead of very dense. Ancient movement of or stress relief within the valley walls as the ice retreated or more recently, may account for lower blow counts in the upper 20 feet of these borings. Borings MB-6 and MB-7 encountered very dense Qpnf and Qpnl below 50 and 77 feet, respectively.

Figure 3 presents a generalized subsurface profile A-A' near the proposed bridge abutments, as shown in Figure 2.

7.4 Railroad Embankment Fill

The railroad embankment is composed of approximately 10 feet of fill. The proposed embankment exploration has not been completed and description of the materials encountered during that exploration will be provided in a subsequent report. Additional historical embankment construction research is ongoing and will also be provided in a subsequent report. There is historical evidence that the railroad may have been constructed using timber trestle structures, which were later replaced with embankment fill. Common practice called for burying the trestle structure and timber piles. Consequently, there is potential that timber piles may be present within the embankment fill and underlying soil. The embankment is believed to have been constructed in two phases – the initial main line track (eastern track) and the second track built west of the main line. Riprap and boulder-size rock is present along the western edge of the embankment fill, and is assumed to be present along the former western edge of the embankment prior to constructing the second track.

DRAFT

7.5 Demolished Structures and Buried Swimming Pool Fill

A structure and swimming pool once occupied a portion of the lawn area, and were demolished. The specific location of the former structure and pool are unknown. Current estimated locations are based on oblique photographs which do not provide accurate location information. The design team suspects that the swimming pool may have been filled with debris and capped with soil. The GPR survey in the lawn area identified numerous anomalies.

INSERT DISCUSSION OF CONDITIONS OBSERVED IN TEST PITS.

7.6 Groundwater

Groundwater was encountered at all explorations on the valley floor, including HB-1, HB-2, MB-6, MB-7, MB-8, TP-1, and TP-2. Borings HB-1 and HB-2 encountered shallow groundwater at about 0.5 foot and at the ground surface, respectively, while advancing these borings. Well readings taken three days after completing HB-1 and HB-2 indicated slightly lower water levels at 5.5 feet and 3 feet, elevations 33.5 and 27 feet, respectively. Iron oxide staining in these borings indicates that groundwater levels fluctuate and may vary seasonally with precipitation.

Borings MB-6 and MB-7 encountered groundwater at 6 and 2 feet, at elevations 7 and 13 feet, respectively. Shannon & Wilson staff observed seepage onto the trail near MB-7, indicating shallow groundwater depths at this location. Groundwater levels at MB-6 and MB-7 may be influenced by tidal water levels. Boring MB-8 encountered groundwater at 5 feet, at elevation 19 feet, and is likely influenced by stream water levels.

8.0 ENGINEERING CONCLUSIONS AND RECOMMENDATIONS

8.1 Design Standards

For design of the proposed railroad bridge, including temporary and permanent features, we have adhered to the 2016 America Railway Engineering and Maintenance of Way Association (AREMA) manual guidelines (AREMA, 2016). The AREMA manual is a design guideline and not a rigid design standard, and refers to other standards as appropriate for specific design elements. For seismic site characterization and site response, AREMA refers to the American Society of Civil Engineers (ASCE) Minimum Design Loads for Buildings and Other Structures, ASCE Standard ASCE/SEI 7-10 (ASCE, 2013).

DRAFT

For design of the proposed restroom enclosure structure, we have adhered to the Snohomish County Department of Planning and Development Services Building Construction Codes, which reference 2015 International Building Code design standards (International Code Council, 2014). For design of the proposed pedestrian bridge, we have referenced the SCDPDS Rule 5660 concerning design requirements for small-diameter (defined as less than 8 inches in diameter) pipe piles, referred to as pin piles (SCDPDS, 2006).

8.2 Seismic Design

8.2.1 Seismic Design Parameters

The 2016 AREMA Manual for Railway Engineering (Chapter 9) utilizes a three-level ground motion and performance-criteria limit state for the seismic design of railway bridges. Return periods for each limit state can be calculated based on risk factors that consider immediate safety, immediate value, and replacement value. The return period for each limit state can then be used to calculate a corresponding base acceleration coefficient.

If the parameters used to determine risk factors are unknown, average return periods may be used in conjunction with maps developed by the USGS to determine base acceleration coefficients for each limit state. Preliminary USGS 2008 maps corresponding to average return periods of 100, 475, and 2,475 years for the serviceability, ultimate, and survivability limit states, respectively, are presented in the AREMA Manual as Figures 9-1-1 through 9-1-3. However, AREMA Chapter 9, Section 1.3.2.3, states that the provided ground motion parameters maps are for illustration purposes and more accurate ground motions parameters may be determined based on web-based interactive USGS tools. This section also states that other sources or site-specific procedures may be used to define the ground motion parameters as long as they are based on accepted methods. We recommend the use of more current ground motion parameter maps published by the U.S. Geological Survey (USGS) U.S. Seismic Design Maps (USGS, 2017).

The Seismic Site Class was developed based on the recommended procedure provided in AREMA Table 9-1-6 and average shear wave velocities correlated from Standard Penetration Test (SPT) N-values for the upper 100 feet of the soil column. AREMA Section C-1.4.4.1.1 references methods provided in ASCE 7-10 to calculate the average shear wave velocity used to determine the Site Class. Our evaluation, based on the measured SPT values from borings MB-6 and MB-7, indicates that the project site is classified as Site Class D. Site Class D corresponds to a stiff soil profile with an average shear wave velocity of 600 to 1,200 feet per second or an

DRAFT

average SPT N-value of 15 to 50 blows per foot in the upper 100 feet of soil. We recommend applying the seismic design ground motion parameters presented in Table 1.

8.2.2 Liquefaction Potential

We evaluated liquefaction potential for borings MB-6 and MB-7 for the three earthquake events specified in AREMA. Based on the SPT data and soil description for those borings, it appears both locations are susceptible to liquefaction under all seismic cases. Boring MB-6 is susceptible to liquefaction to a depth of about 15 feet for the 100-year return period event, and a specific sand layer between 75 and 80 feet deep is susceptible to liquefaction during the 475- and 2,475-year return period events. Boring MB-7 is susceptible to liquefaction to a depth of about 15 feet for the 100-year return period event, and a specific sample between 35 and 40 feet is susceptible to liquefaction during the 475- and 2,475-year return period events. Maximum anticipated settlement within the liquefiable depth ranges are 6 and 8 inches for borings MB-6 and MB-7, respectively.

Note that these results are preliminary and laboratory test results had not been finalized and incorporated into the boring logs at the time this report was issued. We will provide revised results in our subsequent report.

8.2.3 Seismically Induced Slope Instability

TO BE PROVIDED IN SUBSEQUENT REPORT

8.3 Railroad Bridge Design

Preliminary design drawings indicate the proposed railroad bridge spans will be supported on precast concrete and steel pile caps and abutments, which will bear on driven pile foundations. We understand the construction sequence calls for installing piles through the existing embankment, then excavating to place pile caps and abutment blocks, deck spans, and track elements before excavating the embankment beneath the deck and installing steel cross members at each bent. Construction stages will be coordinated within single track closure windows, after which both tracks will be put back into service such that the tracks will have to be service-ready after each construction stage. We understand the bridge will be constructed one track at a time, with the first bridge being completed and put into service before the second bridge is constructed. As such, it will be necessary to install shoring between the two tracks to support embankment soil and track surcharge loads during excavation beneath the deck to connect steel cross members, and throughout much of construction of the second bridge.

DRAFT

8.3.1 Driven Pile Foundations

We have estimated axial capacity for driven steel, HP 14X89 piles, based on the subsurface conditions observed in borings MB-6 and MB-7, as presented in Figures 5 and 6, respectively. Note that the axial capacities are presented relative to the approximate channel bottom ground surface depicted at elevation 8.5 feet in the preferred alternative drawings provided by Anchor QEA.

PILE DRIVEABILITY (GRLWEAP) ANALYSES TO BE PRESENTED IN SUBSEQUENT REPORT.

8.3.2 Drilled Pile Foundations

TO BE PROVIDED IN SUBSEQUENT REPORT

8.3.3 Lateral Earth Pressures

Preliminary drawings indicate steel sheet pile temporary shoring will be installed between the tracks to support the embankment soils and track during excavation to install bridge spans and pile bent reinforcements.

Recommended lateral earth pressures for a cantilevered sheet pile wall under drained conditions are presented in Figure 9. Lateral pressures due to surcharges, including Cooper E80 train loading should be added to the recommended lateral earth pressures when appropriate. Various recommended surcharge loads are presented in Figure 10.

Note that we did not provide recommended lateral earth pressures for single or multiple tieback wall configurations because the narrow embankment does not provide the width necessary for tieback bond development outside of the no-load zone behind the wall. If the design and surcharge loads cannot be feasibly supported by a cantilevered wall, we will provide additional recommendations in subsequent reports.

8.3.4 Temporary Shoring Wall Anticipated Movements

The lateral earth pressures in Figure 9 assume active soil conditions. For active conditions, lateral wall movements could range from 0.10 to 0.15 percent of the excavation depth. In general, settlements of the same order-of-magnitude could occur behind the wall, extending a distance equal to approximately half the height of the excavation, then decreasing linearly to zero at a distance of approximately 1.5 to 2 times the excavation height.

DRAFT

Lateral earth pressures acting on retaining walls depend on many factors, including groundwater conditions, backslope, surcharges, the type of backfill soil and/or adjacent native soils, drainage provisions, and wall flexibility. For walls that are not allowed to move 0.001 times the wall height (rigid condition), at-rest lateral earth pressures should be used.

The above-mentioned deflections and settlements are estimates only and are, in part, affected by the method and care used during installation. The actual performance of the wall should be monitored during construction as discussed later in this report.

8.3.5 Temporary and Permanent Slopes

TEXT TO BE PROVIDED IN SUBSEQUENT REPORT

8.4 Pedestrian Bridge

The proposed pedestrian bridge shown in the preferred alternative drawings provided by Anchor QEA is located approximately midway between the existing pedestrian bridge near the Ranger's residence and the BNSF embankment. Design details are not available at this time. Based on conversation with Anchor QEA, we understand the proposed bridge will be approximately the same size and span length of the existing pedestrian bridge, which is about 32 feet long and 10 feet wide.

We anticipate the proposed bridge will bear on concrete abutments. Considering the potential for channel scour and migration, we recommend small diameter (less than 8 inches) pipe piles be considered to support the concrete abutments, as they will provide a greater degree of support in the event that the abutment becomes undermined.

We have estimated the axial capacity for 2-, 4- and 6-inch-diameter, driven steel pipe piles based on the subsurface conditions observed in boring MB-8, as presented in Figures 11, 12, and 13, respectively. Note that the axial capacities are presented relative to the existing ground surface.

Based on SCDPDS Rule 5660, 2-inch-diameter pin piles shall be no more than 30 feet long and shall be of extra strong steel as defined in the American Institute of Steel Construction (AISC) Steel Construction Manual (AISC, 2011). Extra strong is a class of steel pipe which has nominal inside and outside diameters of 1.94 and 2.38 inches, respectively, with steel materials in accordance with ASTM Designation A53 Gr. B. For the 4- and 6-inch-diameter piles, SCDPDS Rule 5660 specifies at least 3 percent and up to five piles maximum be subjected to static axial

DRAFT

compressive load testing in general accordance with ASTM D1143-81, Quick Load Test Method.

8.5 Lateral Pile Analysis

Lateral loads may be resisted by the passive pressure against deep foundations. The computer program LPILE (Reese and others, 2016) and other similar methods may be used to generate load deflection (p-y) curves for lateral resistance analysis of drilled shafts to calculate the magnitude of deflection, shear, and moment along the shaft. Table 2 presents our recommended soil parameters for lateral resistance analysis using LPILE for static and seismic loading conditions.

Group interaction should be considered when evaluating horizontal movement of shafts with center-to-center spacing less than 5D. When the p-y method is used, the lateral resistance "p" should be multiplied by a p-multiplier to account for group interaction.

8.6 Structure Foundations

We anticipate the proposed restroom enclosure structure will be supported on conventional spread footings. Spread and continuous footings may be considered for the project but improvement of the ground may be needed to develop the required allowable bearing resistance. We recommend the following shallow foundation options:

8.6.1 Bearing Capacity

- Spread footing foundations may designed to bear in the existing fill using an allowable bearing pressure of 2 kips per square foot (ksf). Due to the anticipated loose nature of the fill, up to 1 inch of total settlement is anticipated.
- Spread footing foundations may be deigned to bear in improved fill deposits for an allowable bearing pressure of 3 ksf. For this option, the existing fill material would be excavated to a depth of at least twice the design footing width below the base of the footing, and a width twice that of the footing. The base of the excavation would be compacted to a dense and unyielding condition, then excavated soil that is suitable for reuse would be placed back into the excavation in lifts and compacted to achieve a dense condition. In this case, anticipated total settlements range up to 0.5 inch.

The above allowable bearing capacities include a factor of safety (FS) of 2.0. Bearing pressures may be increased by up to one-third for seismic and wind loads. The estimated settlements are expected to occur as structural loads are applied. Differential settlements

DRAFT

between adjacent column footings are estimated to be approximately one-half of the total settlement.

The bearing pressure recommendations assume the fill or subgrade is prepared as described in Sections 9.1 and 9.2. Minimum footing widths should be 24 inches for individual column footings and 18 inches for continuous spread footings. The base of all footings should be located at least 24 inches below the lowest adjacent grade.

For portions of the structure supported on shallow foundations, lateral loads may be resisted by passive earth pressure acting against the footing and friction against the bottom of the footing. In our opinion, passive earth pressures developed from compacted granular fill could be estimated using an equivalent fluid unit weight of 300 pounds per cubic foot. The equivalent fluid pressure includes a FS of 1.5 and assumes that the footings extend at least 24 inches below the lowest adjacent grade, are properly drained, and that the backfill around the structure is compacted in accordance with the recommendations for structural fill outlined herein. We recommend that a coefficient of friction of 0.35 be used between cast-in-place concrete and medium dense fill. This value includes a FS of 1.5.

8.6.2 Slab-on-Grade

Floor slabs for the proposed structure may be slab-on-grade bearing on densely compacted structural fill. We recommend the area be prepared by removing all existing fill; loose, soft, or disturbed soils; organics; and debris (if present) to expose the underlying native soils. The exposed native soils should be evaluated by a geotechnical engineer or the engineer's representative prior to backfill or concrete placement. All new fills under slab-on-grade floors should consist of structural fill and be compacted to a dense, unyielding condition according to the recommendations presented herein. For floor slabs prepared in accordance with these recommendations, we recommend using a modulus of subgrade reaction, k, of 200 pounds per cubic inch for design of the slab.

8.7 Access Road Stability Improvements

TO BE PROVIDED IN SUBSEQUENT REPORT

DRAFT

DRAFT

9.0 CONSTRUCTION CONSIDERATIONS

9.1 Footings

The recommended allowable bearing capacities presented previously in this report are contingent upon the following construction considerations:

- Footing subgrade excavations should be cleaned of all fill, debris, and loose, soft, wet, or disturbed soil prior to placing the reinforced concrete.
- Exposed footing subgrade should be compacted to a dense and unyielding condition using excavator mounted compaction equipment. Compaction should observed by a geotechnical engineer to confirm a dense and unyielding condition.
- If unanticipated loose, soft, or unsuitable soil is encountered below the footing level, the subgrade should be overexcavated to a suitable bearing soil. The overexcavated portion may be backfilled with a compacted granular structural fill, controlled density fill (CDF), or lean concrete as appropriate to attain the design bearing capacity. The structural fill should be compacted as recommended in previous sections of this report. CDF and lean concrete mixes must have sufficient design strength to support foundation loads.
- If construction takes place in wet weather, we recommend placing 2 to 3 inches of lean concrete or at least 6 inches of compacted, well-graded, clean sand and gravel immediately after excavation to serve as a working surface. The clean sand and gravel should have less than 5 percent by dry weight passing the No. 200 sieve based on the ¾-inch minus fraction. If groundwater is encountered, it should be lowered to at least 2 feet below the bottom of footing excavations. Footing excavations should be kept free of water at all times.
- As needed, temporary dewatering of accumulated stormwater should be performed during construction to maintain dry working conditions. We anticipate that sump pumps will be suitable for removing accumulated stormwater from the excavations.
- All excavations for spread footing foundations should be observed by a geotechnical engineer to evaluate the adequacy of the bearing stratum and to confirm that subsurface conditions at and below the bearing elevation are suitable for the design bearing values provided.

9.2 Compaction, Structural Fill Placement, and Use of On-site Soils

In areas to be filled, such as beneath foundations, floor slabs, and pavements, the exposed soil surface, after clearing and stripping and prior to any fill placement or foundation or pavement construction, should be compacted using a heavy vibratory roller or backhoe-mounted hydraulic plate compactor, or evaluated by an experienced geotechnical engineer probing with a steel

DRAFT

DRAFT

T-bar. Where unsuitable soil that is loose, soft, wet, or contains organic material is encountered during the compaction process, it should be removed and replaced with densely compacted structural fill.

Native granular soil in dry conditions and granular on-site fill material without debris, wood, and free of topsoil (abundant organic material) would be suitable for use as structural fill provided the soil is within +/- 2 percent of its optimum moisture content for compaction. On-site fill soil could be re-used as structural fill provided it is evaluated by a geotechnical engineer and used following the recommendations in this section. The fines content of on-site soil may make them difficult to compact during wet weather or in wet conditions. On-site soil could be used as fill in dry weather and dry conditions, but may require thinner lifts and/or more effort to achieve compaction requirements.

Imported structural fill soil should consist of a well-graded mixture of sand and gravel; free of organics, debris, and rubbish; and should contain no more than 15 percent fines (material passing the No. 200 mesh sieve, based on the minus ¾-inch fraction). The fines should be nonplastic, and the moisture content of the soil should also be within +/- 2 percent of its optimum. All structural fill should have a maximum particle size of 3 inches.

Structural fill should be placed in uniform lifts and compacted to a dense and unyielding condition, to at least 95 percent of the Modified Proctor maximum dry density (ASTM D1557-70). The thickness of soil layers before compaction should not exceed 8 inches for heavy equipment compactors or 4 inches for hand-operated mechanical compactors. In landscaped areas where larger settlements are acceptable, the backfill should be compacted to at least 90 percent of the Modified Proctor maximum dry density.

During wet weather or in wet conditions where control of soil moisture is difficult, structural fill material should consist of clean, granular soil, of which not more than 5 percent by dry weight passes the No. 200 mesh sieve, based on wet-sieving the fraction passing the ¾-inch sieve. The fines should be nonplastic.

9.3 Temporary Excavation Slopes

Temporary excavation slopes should be made the responsibility of the Contractor, who is continually at the site and able to observe the nature and conditions of the subsurface materials and groundwater and has responsibility for the methods, sequence, and schedule of construction.

DRAFT

For planning purposes, we recommend that temporary, unsupported, open-cut slopes in existing fill be no steeper than 1.5H:1V. This recommendation is applicable to slopes in areas where groundwater and/or groundwater seepage is not present. Flatter slopes may be required based on the actual conditions encountered, particularly where groundwater or seepage is encountered. We recommend that all exposed slopes be protected with waterproof covering during periods of wet weather to reduce sloughing and erosion.

9.4 Driven Piles

9.4.1 General

The proposed construction sequence requires driven piles, both HP 14X89 foundation piles and steel sheet piles, to be advanced through the existing embankment and into the underlying soil. Once the bridges are completed, the embankment soil and approximately 3 to 6 feet of soil underlying the embankment and throughout the estuary restoration area will be removed. Consequently, axial pile capacity and lateral pile analyses must be evaluated relative to the proposed finished ground surface elevation.

9.4.2 Obstructions

We anticipate boulder-size rock and/or timber piles may be present within the existing embankment and underlying alluvium. Such obstructions will likely deflect piles and cause alignment problems, and may stop pile advancement short of the design tip elevation. If obstructions are encountered, and if pile alignment and/or penetration are negatively affected, it may be necessary to pre-drill through and beyond the obstructions to facilitate driven pile installation in accordance with the design. Alternatively, it may be necessary to use drilled foundations such as micropiles to support the bridge.

9.5 Construction Impacts to Railroad Tracks

The railroad tracks and ties will potentially be affected by pile driving or drilling, by excavation to install abutment and interior bent pile caps, and by shoring deflection during excavation to complete the adjacent bridge. We anticipate these impacts can be addressed through tamping and other routine maintenance practices.

DRAFT

9.6 Embankment Excavation and Shoring Monitoring

We recommend that embankment excavation and shoring be observed by an experienced geotechnical engineer. The purpose for this observation is to monitor conditions for indications of excessive shoring deflection or other signs of adverse ground response during construction.

We recommend measuring shoring deflection during excavation to monitor the magnitude of movement in response to excavation depth, and to detect continued movement without additional excavation or other responses that would be cause for concern. We recommend monitoring deflection using inclinometers and/or optical survey methods. These methods have been proven accurate and reliable, and would allow the stakeholders to establish deflection threshold values which would trigger prescribed responses intended to prevent excessive deflection or shoring failure.

9.7 Wet Weather Earthwork

Wet weather generally begins about mid-October and continues through about May, although rainy periods may occur at any time of year. The soil at the site contains sufficient silts and fines to produce an unstable mixture when wet. Such soils are susceptible to changes in water content, and they tend to become unstable and difficult, or impossible, to compact if their moisture content significantly exceeds the optimum. If earthwork at the site continues into the wet season, or if wet conditions are encountered, we recommend the following:

- The ground surface in and surrounding the construction area should be sloped as much as possible to promote runoff of precipitation away from work areas and to prevent ponding of water.
- Earthwork should be accomplished in small sections to minimize exposure to wet conditions. That is, each section should be small enough so that the removal of unsuitable soils and placement and compaction of clean structural fill can be accomplished on the same day. The size of construction equipment may have to be limited to prevent soil disturbance. It may be necessary to excavate soils with a backhoe, or equivalent, located so that equipment does not traffic over the excavated area. Thus, subgrade disturbance caused by equipment traffic will be minimized.
- Fill material should consist of clean, well-graded, pit-run sand and gravel soils of which not more than 5 percent fines by dry weight passes the No. 200 mesh sieve, based on wet-sieving the fraction passing the ¾-inch mesh sieve. The gravel content should range between 20 and 60 percent retained on a No. 4 mesh sieve. The fines should be nonplastic.

DRAFT

- No soil should be left uncompacted and exposed to moisture. A smooth-drum vibratory roller, or equivalent, should roll the surface to seal out as much water as possible.
- In-place soils or fill soils that become wet and unstable and/or too wet to suitably compact should be removed and replaced with clean, granular soil (see third bullet).
- Excavation and placement of structural fill material should be observed on a full-time basis by a geotechnical engineer (or representative) experienced in earthwork to determine that all work is being accomplished in accordance with the project specifications and our recommendations.
- Grading and earthwork should not be accomplished during periods of heavy, continuous rainfall.
- We suggest that these recommendations for wet weather earthwork be included in the contract specifications.

9.8 Erosion Control

The Contractor should employ proper erosion control measures during construction, especially if construction takes place during wet weather. Covering work areas, soil stockpiles, or slopes with plastic and using sandbags, sumps, and other measures should be employed as necessary to permit proper completion of the work. Bales of straw, geotextile silt fences, rock-stabilized entrance, wheel wash (as appropriate), street sweeper, and drain inlet sediment screens/collection systems should be appropriately located to control soil movement and erosion.

9.9 Obstructions

Buildings previously and currently on site, such as floor slabs and basement walls, could be partially or completely buried. The existing foundations, walls, and slabs should be anticipated and could require special consideration during shoring installation and site excavation.

Although boulders were not encountered in the explorations, it has been our experience that cobbles and boulders are commonly encountered in glacial soils. We recommend that contract documents contain an advisory statement that cobbles, boulders, and other obstructions could be encountered during excavation and pile installation.

10.0 ADDITIONAL SERVICES

We recommend that Shannon & Wilson be retained to review the geotechnical aspects of plans and specifications to determine that they are consistent with our recommendations. In addition, we should be retained to observe the geotechnical aspects of construction, particularly

DRAFT

foundation installation, shoring design, drainage and backfill. Observation will allow us to evaluate the subsurface conditions as they are exposed during construction and to determine that the work is accomplished in accordance with our recommendations and the project specifications.

11.0 LIMITATIONS

This report was prepared before the subsurface exploration program had been fully completed. The descriptions, analyses, conclusions and recommendations herein are based on our understanding of subsurface conditions from the partially completed exploration program. We anticipate our understanding will improve after completing the exploration program, and portions of this report will be superseded by subsequent reports. Substantial changes to our recommendations may occur after completing the remaining explorations.

The analyses, conclusions, and recommendations contained in this report are based on site conditions as they presently exist, and further assume that the explorations are representative of the subsurface conditions throughout the site; that is, the subsurface conditions everywhere are not significantly different from those disclosed by the explorations. If subsurface conditions different from those encountered in the explorations are encountered or appear to be present during construction, we should be advised at once so that we can review these conditions and reconsider our recommendations, where necessary. If there is a substantial lapse of time between the submission of this report and the start of construction at the site, or if conditions have changed because of natural forces or construction operations at or adjacent to the site, we recommend that we review our report to determine the applicability of the conclusions and recommendations.

Within the limitations of scope, schedule, and budget, the analyses, conclusions, and recommendations presented in this report were prepared in accordance with generally accepted professional geotechnical engineering principles and practice in this area at the time this report was prepared. We make no other warranty, either express or implied. These conclusions and recommendations were based on our understanding of the project as described in this report and the site conditions as observed at the time of our explorations.

Unanticipated soil conditions are commonly encountered and cannot be fully determined by merely taking soil samples from test borings. Such unexpected conditions frequently require that additional expenditures be made to attain a properly constructed project. Therefore, some contingency fund is recommended to accommodate such potential extra costs.

DRAFT

This report was prepared for the exclusive use of Snohomish County Parks and their design team in the design of the Meadowdale Beach Park Estuary Restoration Project. The data and report should be provided to the contractors for their information, but our report, conclusions, and interpretations should not be construed as a warranty of subsurface conditions included in this report.

The scope of our present work did not include environmental assessments or evaluations regarding the presence or absence of wetlands, or hazardous or toxic substances in the soil, surface water, groundwater, or air on or below or around this site, or for the evaluation or disposal of contaminated soils or groundwater should any be encountered.

Shannon & Wilson has prepared and included Appendix D, "Important Information About Your Geotechnical/Environmental Report," to assist you and others in understanding the use and limitations of our reports.

SHANNON & WILSON, INC.

Tyler Stephens., PE
Associate

SAW:TJS:NDM/saw

DRAFT

DRAFT

12.0 REFERENCES

American Institute of Steel Construction (AISC), 2011, Steel construction manual (14th ed.): Chicago, Ill., American Institute of Steel Construction, 1 v.

American Railway Engineering and Maintenance-of-Way Association (AREMA), 2016, Manual for railway engineering: Landover, Md., AREMA, 7 v.

American Society of Civil Engineers (ASCE), 2013, Minimum design loads for buildings and other structures (3rd printing): Reston, Va., American Society of Civil Engineers, ASCE Standard ASCE/SEI 7-10.

Applied Geotechnology Inc., 1986: Available: https://fortress.wa.gov/dnr/geology/?Theme=subsurf, Borehole ID 60442, Document ID10996, accessed 11/2014.

ASTM International (ASTM), 2014, Annual book of standards, Construction v. 04.08, Soil and rock (I): D420 – D5876: West Conshohocken, Penn., ASTM International, 1 v.

Dailer, Doug, 2014, Meadowdale Beach Park history: Personal communication (in-person conversation) between Doug Dailer, Meadowdale Beach Park resident ranger for Snohomish County, Washington and Stephanie Williams and Bill Laprade of Shannon and Wilson, Seattle, Washington, December 4.

Global Geophysics, 2016, Report for the ground penetration radar survey at Meadowdale Beach Park, Edmonds, WA: Report prepared by Global Geophysics, Redmond, Wash., 105-0419.001, for Shannon & Wilson, Inc., Seattle, Wash., December 7.

Global Geophysics, 2017a, GPR survey line location map (fig. 1-A) and interpreted GPR anomalies (fig. 1-B) [rev.], in, Report for the ground penetration radar survey at Meadowdale Beach Park, Edmonds, WA: Report prepared by Global Geophysics, Redmond, Wash., 105-0419.001, for Shannon & Wilson, Inc., Seattle, Wash., February 7.

Global Geophysics, 2017b, Report for the ground penetration radar and electrical resistivity tomography surveys at Meadowdale Beach Park, Edmonds, WA: Report prepared by Global Geophysics, Redmond, Wash., 105-0419.002, for Shannon & Wilson, Inc., Seattle, Wash., May 1.

International Code Council, Inc., 2014, International building code 2015: Country Club Hills, Ill., International Code Council, Inc., 700 p.

Minard, J.P., 1983, Geologic map of the Edmonds East and Part of the Edmonds West quadrangles, Washington: U.S. Geological Survey Miscellaneous Field Studies Map MF-1541, scale 1:24,000.

DRAFT

Reese, L. C.; Wang, S. T.; Isenhower, W. M.; and Arrellaga, J. A., 2016, LPILE v. 2016.9.10: Austin, Texas, Ensoft, Inc.

Shannon & Wilson, Inc. (Shannon & Wilson), 2015, Meadowdale Beach Park Geotechnical Feasibility Study, Geologic Assessment, and Sediment Loading, South Snohomish County, Washington: report prepared for Anchor QEA, LLC, project no. 21-1-22034-001.

Shannon & Wilson, Inc. (Shannon & Wilson), 2016, Meadowdale Beach Park feasibility study, preliminary geotechnical assessment addendum, south Snohomish County, Washington: Report prepared by Shannon & Wilson, Inc., Seattle, Wash., 21-1-22034-001, for Anchor QEA, LLC, Seattle, Wash., February.

Shannon & Wilson, Inc. (Shannon & Wilson), 2017, Geologically hazardous areas, Meadowdale Beach Park estuary restoration project, Snohomish County, Washington, draft: Report prepared by Shannon & Wilson, Inc., Seattle, Wash., 21-1-22288-040, for Snohomish County Parks& Recreation, Snohomish, Wash., April.

Snohomish County, Wash., Department of Planning & Development Services (SCDPDS), 2006, Standards for construction of pin piles for foundation construction: Rule 5660, 2 p., August 15, available: https://snohomishcountywa.gov/documentcenter/view/9876.

Thorson, R.M., 1989, Glacio-isostatic response of the Puget Sound area, Washington: Geological Society of American Bulletin, v. 101, no. 9, p. 1163-1174.

U.S. Geological Survey (USGS), 2017, U.S. seismic design maps: Available: http://earthquake.usgs.gov/designmaps/us/application.php, accessed June, 2017.

DRAFT

TABLE 1
AREMA 2016/ASCE 7-10
PARAMETERS FOR SEISMIC DESIGN OF STRUCTURES

Return Period (AREMA Level)	Magnitude	$S_{a(T=0)}$	S_{DS}	S_{D1}
100-year (I)	6.6	0.12	0.29	0.13
475-year (II)	6.8	0.22	0.55	0.28
2,475-year (III)	7.0	0.34	0.85	0.46

Notes:
ASCE = American Society of Civil Engineers
AREMA = American Railway Engineering and Maintenance of-Way Association

DRAFT

TABLE 2
RECCOMMENDED L-PILE PARAMETERS

Location (Boring)	Approximate Top Elevation (feet)	Approximate Bottom Elevation (feet)	USCS Classification	Geologic Unit	Soil Model	Total Unit Weight, γ (pcf)	Effective Unit Weight, γ' (pcf)	Friction Angle, Φ (degrees)		Modulus of Subgrade Reaction, k (pci)		Undrained Shear Strength, S_u (psf)	Strain at 50% Maximum Stress, ε_{50} Static/Cyclic
								Static	Seismic	Static	Liquified	Static/Cyclic	
MB-6	13	3.5	ML to SM	Ha, Hc, Hf	Sand (Reese/API)	105	43	26	5	10	2	--	--
	3.5	-37	SM to SP-SM to GP-GM	Ha, Hc	Sand (Reese/API)	115	53	33	33	75	75	--	--
	-37	-117.8	SP to ML	Qpnl	Stiff Clay without Free Water	125	63	--	--	125	125	6000	0.010
MB-7	14	-1	ML to SM	Ha, Hc, Hf	Sand (Reese/API)	105	43	24	5	10	2	--	--
	-1	-34	ML to SP-SM to GP-GM	Ha, Hc	Sand (Reese/API)	125	63	32	32	65	65	--	--
	-34	-106	GP-GM to SM	Qpnl	Stiff Clay without Free Water	125	63	--	--	125	125	6000	0.010
MB-8	23.5	6.5	SM	Ha, Hc, Hf	Sand (Reese/API)	105	43	26	6	15	3	--	--
	6.5	-3	ML to SM	Hc, Qob, Qvro	Sand (Reese/API)	115	53	36	36	80	80	--	--

Notes:
The ground surface elevations were estimated from file titled: 16-2604Topo_4-21-17.dwg
Assume groundwater table at ground surface.
These parameters were developed using the subsurface conditions encountered in the project borings, published correlations, and our judgment.
pcf = pounds per cubic foot
pci = pounds per cubic foot
psf = pounds per square foot
USCS = Unified Soil Classification System

DRAFT

NOTE

Map adapted from aerial imagery provided by Google Earth Pro, reproduced by permission granted by Google Earth ™ Mapping Service.

0 1 2

Approximate Scale in Miles

Meadowdale Beach
Park and Estuary Restoration Project
Snohomish County, WA

VICINITY MAP

June 2017 21-1-22288-060

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG.

Filename: 211\22288\060\21-1-22288-060 Fig 1.dwg Date: 05-26-2017 Login: rs

DRAFT

NOTES

1. Map adapted from aerial imagery provided by Google Earth Pro, reproduced by permission granted by Google Earth ™ Mapping Service.
2. Base survey drawing provided by Duane Hartman & Associates

LEGEND

MB Boring Designation and Approximate Location

HB Hand Boring Designation and Approximate Location

A Generalized Subsurface Profile

Ground Penetrating Radar Transect

Electrical Resistivity Tomography Transect

0 80 160

Scale in Feet

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

SITE AND EXPLORATION PLAN

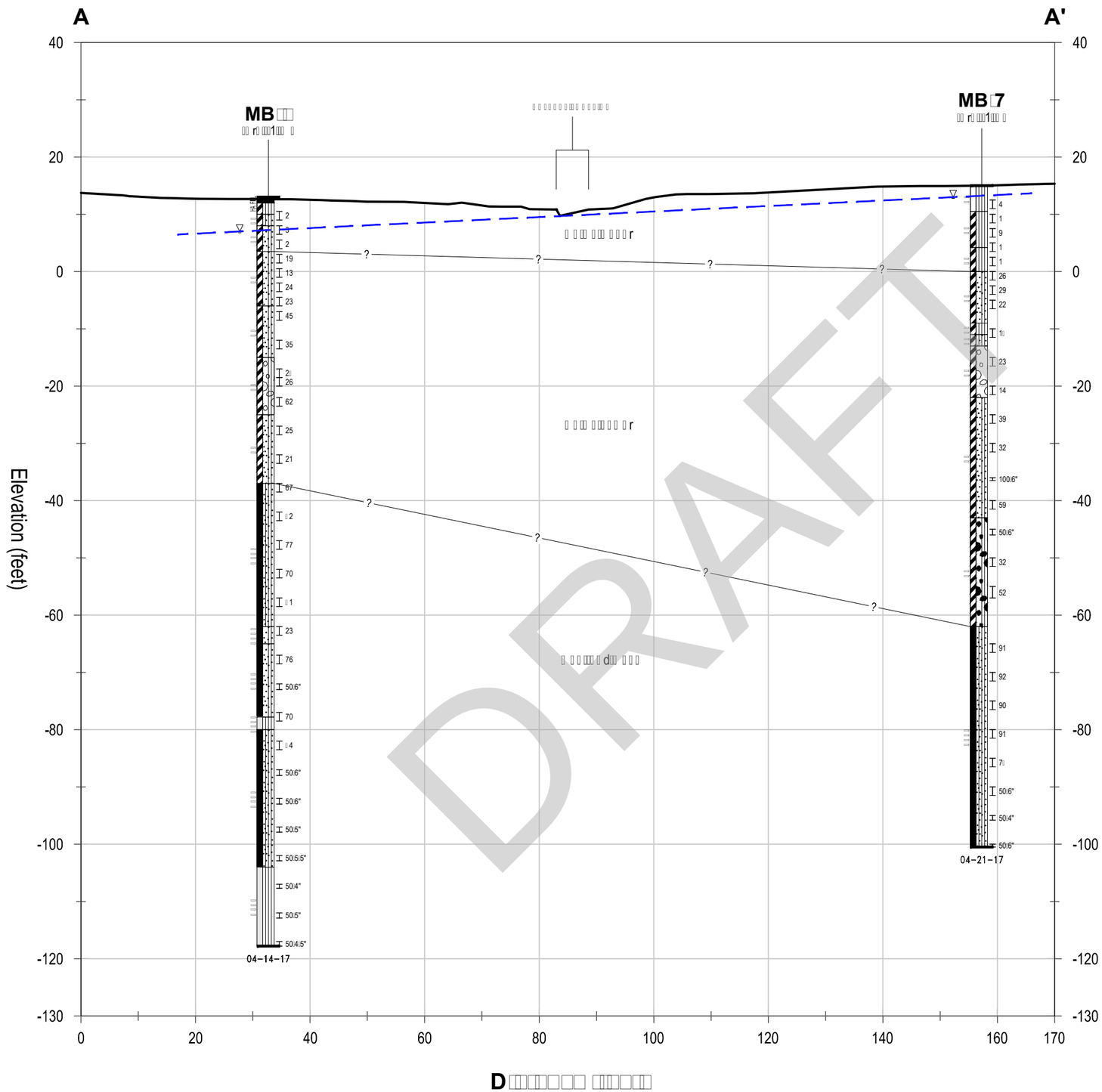
June 2017 21-1-22288-060

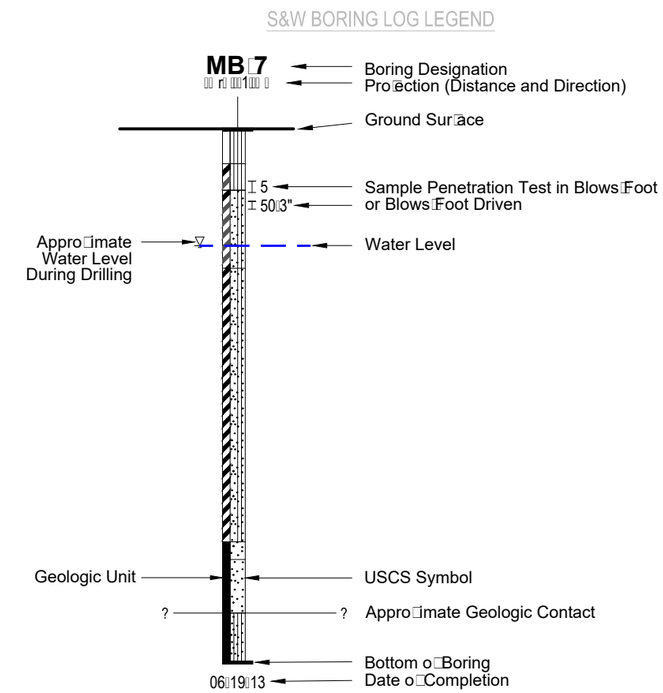
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

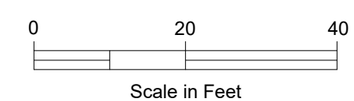
FIG. 2

Filename: 21-1-22288-060 Fig 2.dwg Layout: Exploration Date: 05-26-2017 Login: rs

DRAFT







Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

GENERALI ED SUBSURFACE PROFILE A A'

June 2017 | 21-1-22288-060

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG.

Filename: J:\211\22288\060\21-1-22288-060 Fig 3.dwg Layout: Profile A Date: 06-01-2017 Login: jrs

DRAFT

LEGEND

GPR Transect Lines

Shallow GPR Anomalies (mostly less than 4)

Deep GPR Anomalies (mostly greater than 5)

0 30 60

Scale in Feet

NOTE

Figure adapted from F r B GPR d, provided by Duane Hartman and Associates, dated 02 10 2017.

Meadowdale Beach
Par and Estuary Restoration
Snohomish County, WA

GPR RESULTS
PARK LAWN AREA

une 2017 21-1-22288-060

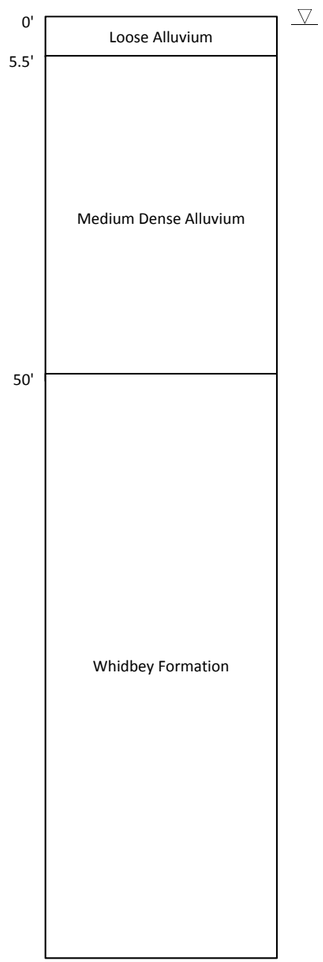
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG.

Filename: 211 22288 060 21-1-22288-060 Fig 4.dwg Layout: GPR Results Date: 05-26-2017 Login: ts

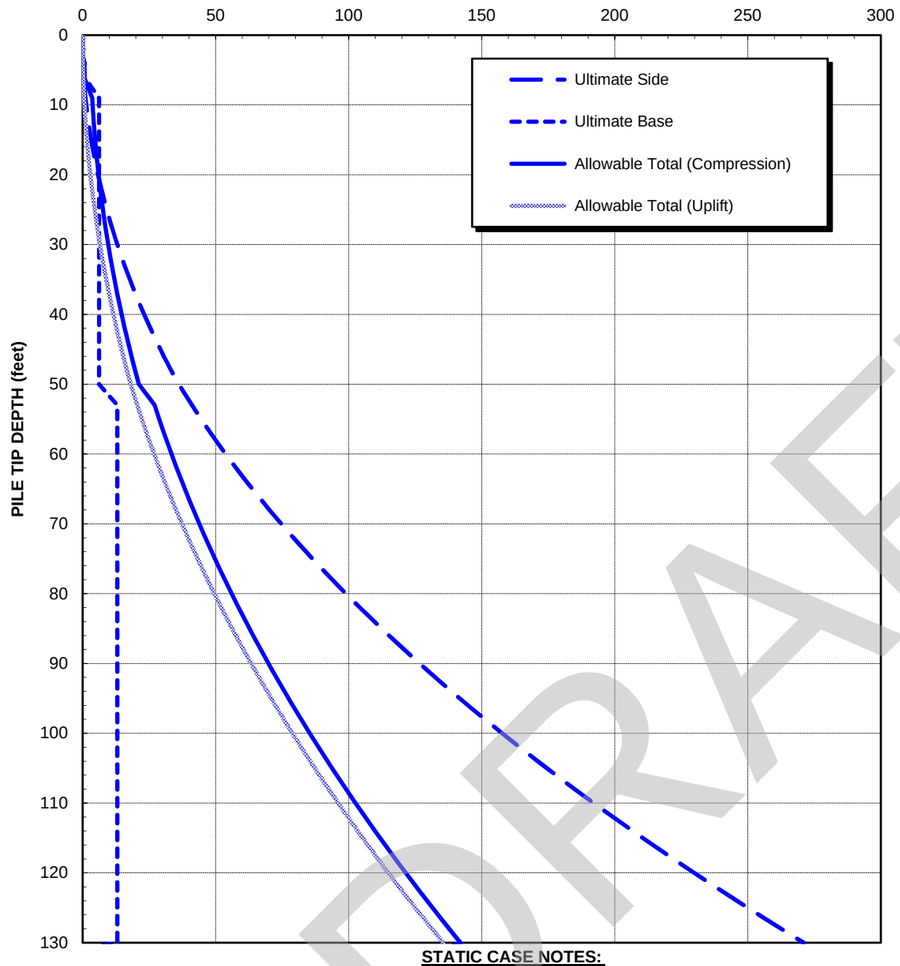
DRAFT

ASSUMED SUBSURFACE PROFILE



STATIC CASE

AXIAL CAPACITY (tons)

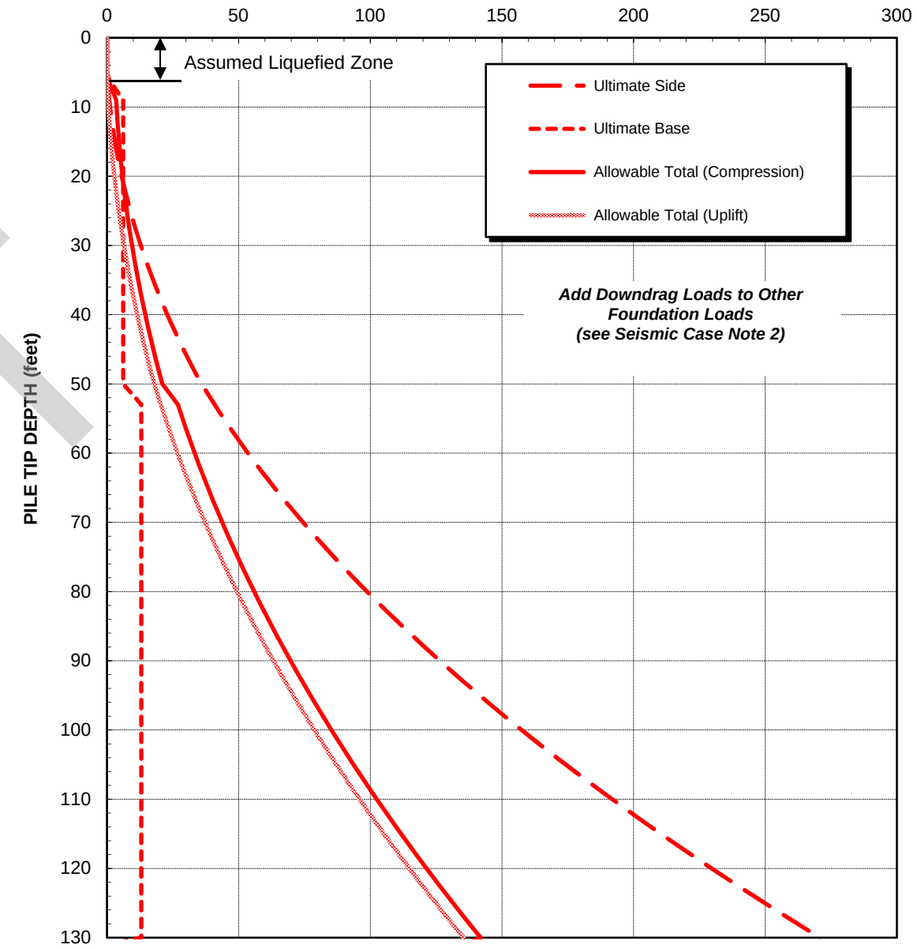


STATIC CASE NOTES:

1. Factor of Safety of 2.0 pplied for Allowable Total (Compression)

SEISMIC CASE

AXIAL CAPACITY (tons)



SEISMIC CASE NOTES:

1. Factor of Safety of 2.0 applied for Allowable Total (Compression).
2. Ultimate downdrag force is estimated to be 0 tons. Downdrag force is recommended to be applied with post-earthquake loading.

DRAFT

GENERAL NOTES

1. The analyses were performed based on guidelines included in AREMA and local experience. The analyses are based on a single pile and do not consider group action of closely spaced piles (closer than 2.5 diameters, center to center).
2. Allowable total pile capacity shown on plots is determined by adding its ultimate side and base resistances dividing by the appropriate factors of safety as noted above.

Meadowdale Beack
Park and Estuarty Restoration Project
Snohomish County, WA

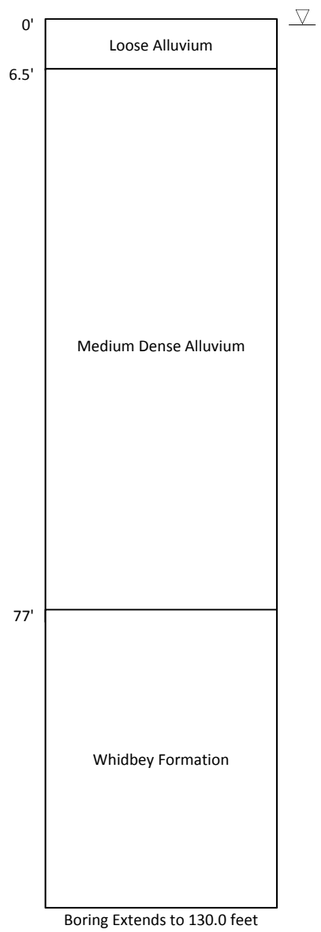
ESTIMATED AXIAL PILE CAPACITY
HP 14x89 DRIVEN PILE
MB-6

June, 2017 21-1-22288-060

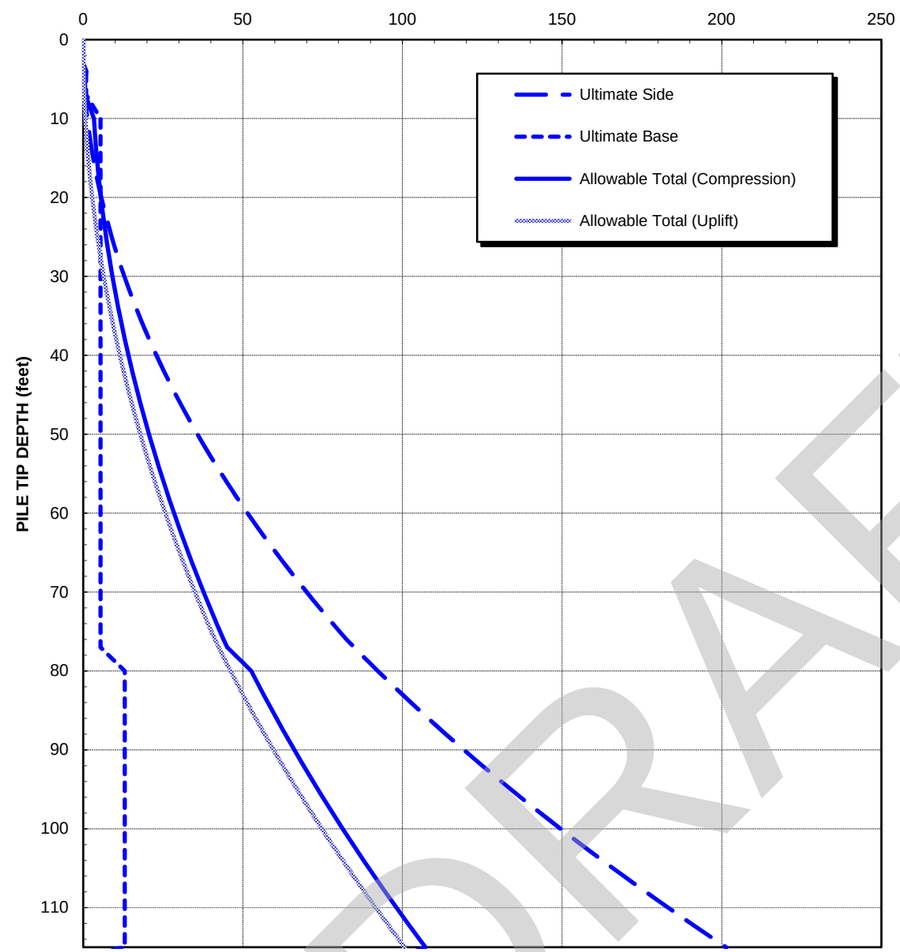
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 5

ASSUMED SUBSURFACE PROFILE



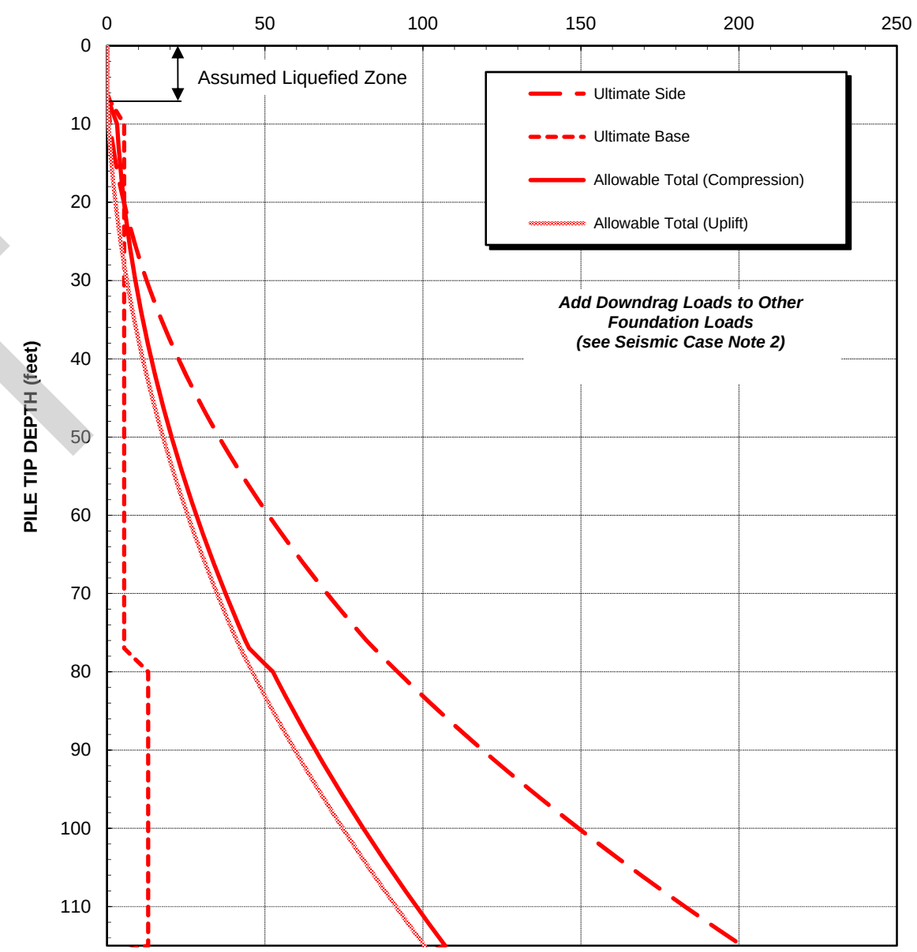
STATIC CASE



STATIC CASE NOTES:

1. Factor of Safety of 2.0 applied for Allowable Total (Compression)

SEISMIC CASE



SEISMIC CASE NOTES:

1. Factor of Safety of 2.0 applied for Allowable Total (Compression)
2. Ultimate downdrag force is estimated to be 0 tons. Downdrag force is recommended to be applied with post-earthquake loading.

DRAFT

GENERAL NOTES

1. The analyses were performed based on guidelines included in AREMA and local experience. The analyses are based on a single pile and do not consider group action of closely spaced piles (closer than 2.5 diameters, center to center).
2. Allowable total pile capacity shown on plots is determined by adding its ultimate side and base resistances divided by the appropriate factors of safety as noted above.

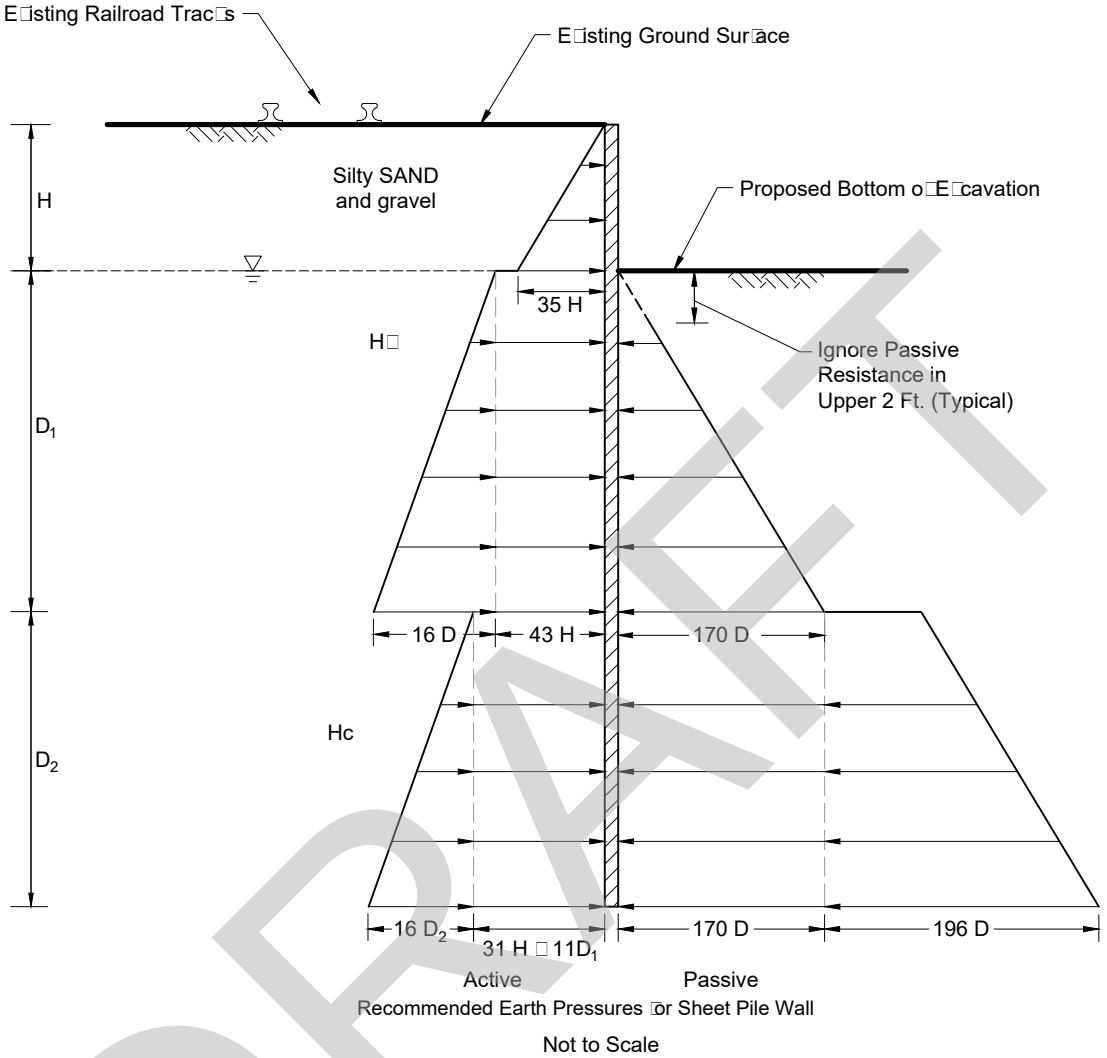
Meadowdale Beach
Park and Estuarty Restoration Project
Snohomish County, WA

ESTIMATED AXIAL PILE CAPACITY
HP 14x89 DRIVEN PILE
MB-7

June, 2017 21-1-22288-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 6



DRAFT

NOTES

1. All earth pressures are in units of pounds per square foot.
2. Wall embedment (D) should consider lateral resistance. Embedment should be determined by satisfying horizontal static equilibrium about the bottom of the pile. Minimum recommended embedment is 10 feet below bottom of excavation.
3. The recommended pressure diagrams are based on a continuous wall system.
4. Pressures assume that there is no difference in water levels on either side of the wall.
5. Passive pressures shown above include a factor-of-safety of 1.5.
6. Cooper E 80 surcharge = 1880 psf. See Figure 9.
7. Diagrams on this figure are applicable to a cantilever sheet pile wall only.

LEGEND

H = Exposed Wall Height (Ft.)

D_1 = Thickness of H/15 (Ft.)

D_2 = Thickness of Hc 25 (Ft.)

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

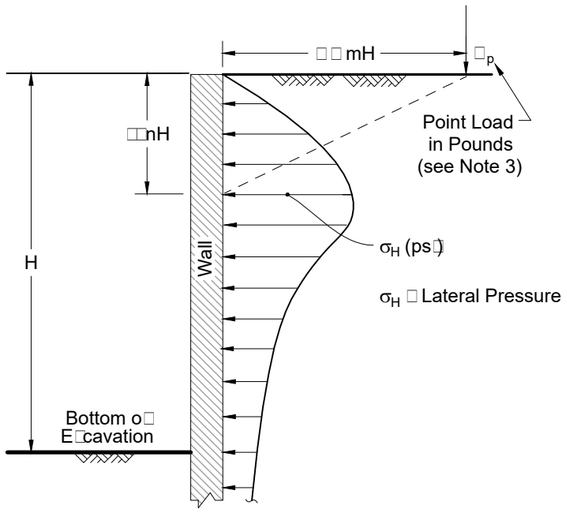
RECOMMENDED LATERAL EARTH PRESSURE FOR TEMPORARY WALLS

June 2017 21-1-22288-060

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 9

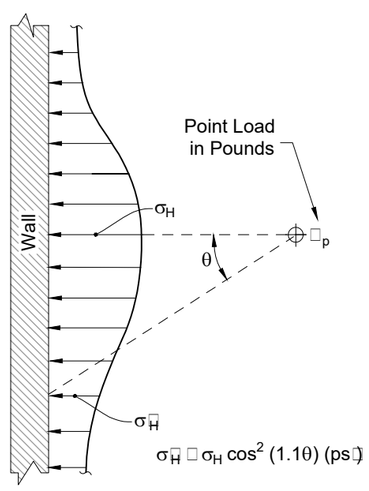
File: 211\22288\060\21-1-22288-060 Fig 8.dwg Date: 05-26-2017 Author: rs



ELEVATION VIEW

For m ≤ 0.4: $\sigma_H = 0.28 \frac{P_p}{H^2} \frac{n^2}{(0.16 + n^2)^3}$ (psf) (see Note 3)

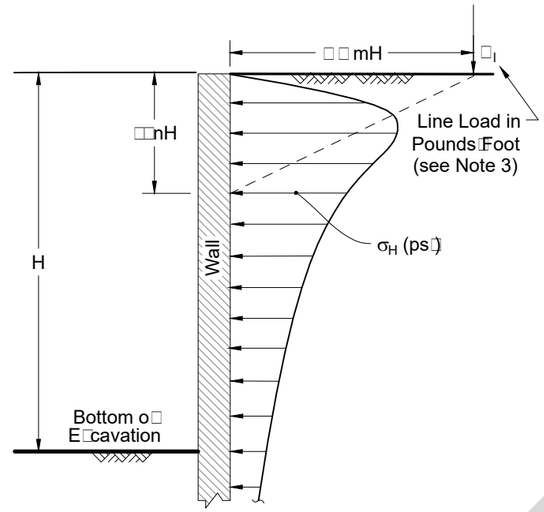
For m > 0.4: $\sigma_H = 1.77 \frac{P_p}{H^2} \frac{m^2 n^2}{(m^2 + n^2)^3}$ (psf)



PLAN VIEW

**A. LATERAL PRESSURE DUE TO POINT LOAD
SMALL ISOLATED FOOTING OR WHEEL LOAD**

(NAVFAC DM 7.2, 1986)



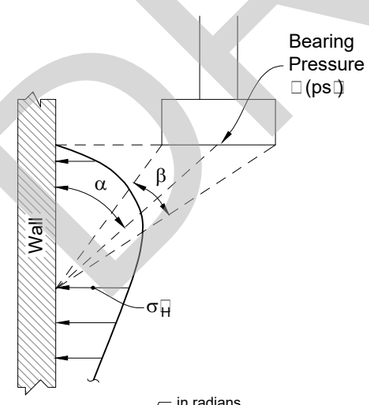
ELEVATION VIEW

For m ≤ 0.4: $\sigma_H = 0.20 \frac{P_l}{H} \frac{n}{(0.16 + n^2)^2}$ (psf) (see Note 3)

For m > 0.4: $\sigma_H = 1.28 \frac{P_l}{H} \frac{m^2 n}{(m^2 + n^2)^2}$ (psf)

**B. LATERAL PRESSURE DUE TO LINE LOAD
OR NARROW CONTINUOUS FOOTING
PARALLEL TO WALL**

(NAVFAC DM 7.02, 1986)

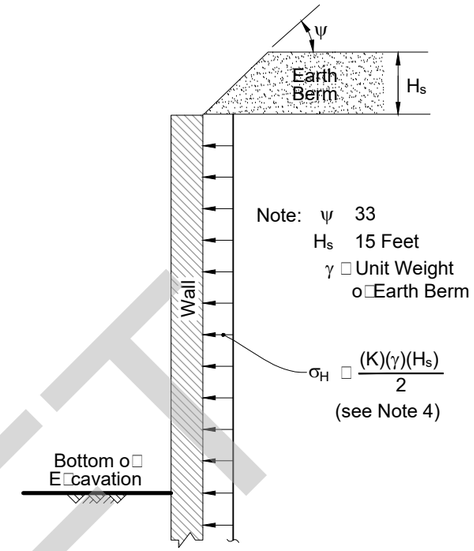


in radians

$\sigma_H = \frac{2P}{\pi} (\beta - \sin\beta \cos 2\alpha)$ (psf)

C. LATERAL PRESSURE DUE TO STRIP LOAD

(derived from Fang, *Foundation Engineering*, 1991)

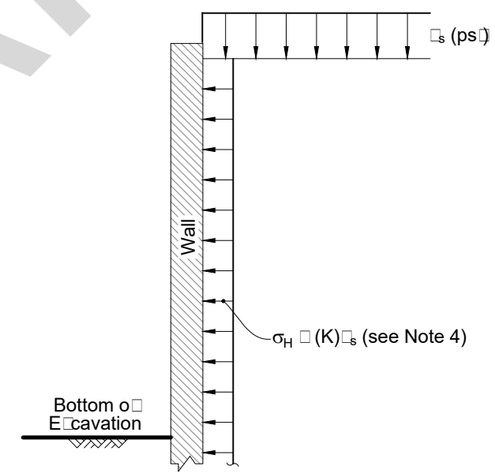


Note: ψ = 33
H_s = 15 Feet
γ = Unit Weight of Earth Berm

$\sigma_H = \frac{(K)(\gamma)(H_s)}{2}$

(see Note 4)

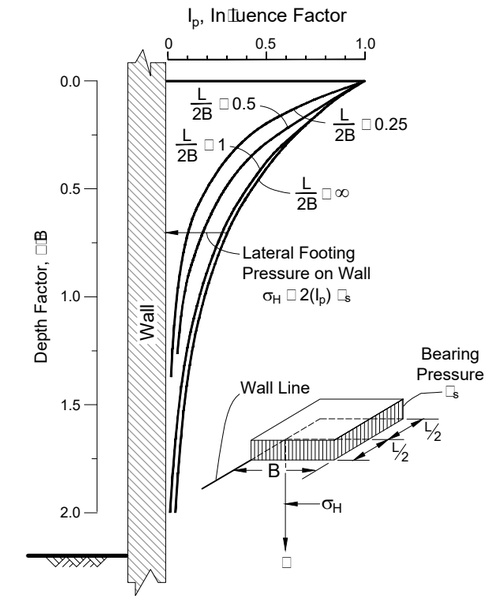
EARTH BERM



UNIFORM SURCHARGE

**D. LATERAL PRESSURE DUE TO EARTH BERM
OR UNIFORM SURCHARGE**

(derived from Poulos and Davis, *Elastic Solutions for Soil and Rock Mechanics*, 1974 and Terzaghi and Peck, *Soil Mechanics in Engineering Practice*, 1967)



**E. LATERAL PRESSURE DUE
TO ADJACENT FOOTING**
(see Notes 5 and 6)

(derived from NAVFAC DM 7.02, 1986 and Sandhu, *Earth Pressures Due to Surface Loads*, 1974)

NOTES

1. Figures are not drawn to scale.
2. Applicable surcharge pressures should be added to appropriate permanent wall lateral earth and water pressure.
3. If point or line loads are close to the back of the wall such that m ≤ 0.4, it may be more appropriate to model the actual load distribution (i.e., Detail E) or use more rigorous analysis methods.
4. See text for recommended K values.
5. The stress is estimated on the back of the wall at the center of the length, L, of loading.
6. The estimated stress is based on a Poisson's ratio of 0.5.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

RECOMMENDED SURCHARGE LOADING FOR TEMPORARY AND PERMANENT WALLS

June 2017 | 21-1-22288-060

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 10

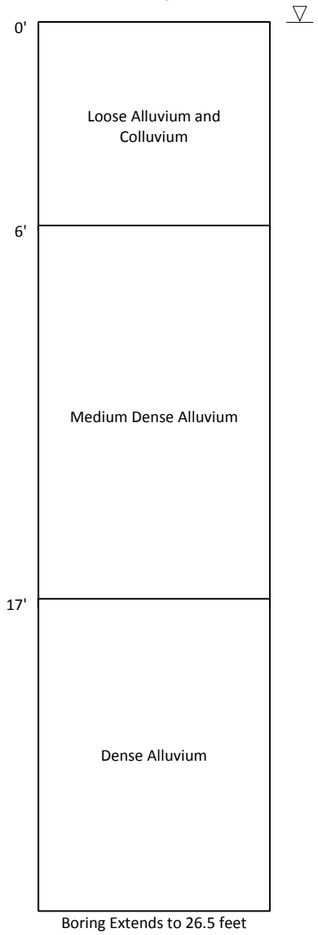
DRAFT

File: 21 22288 060 21-1-22288-060 Fig 9.dwg Date: 05-26-2017 Author: rs

DRAFT

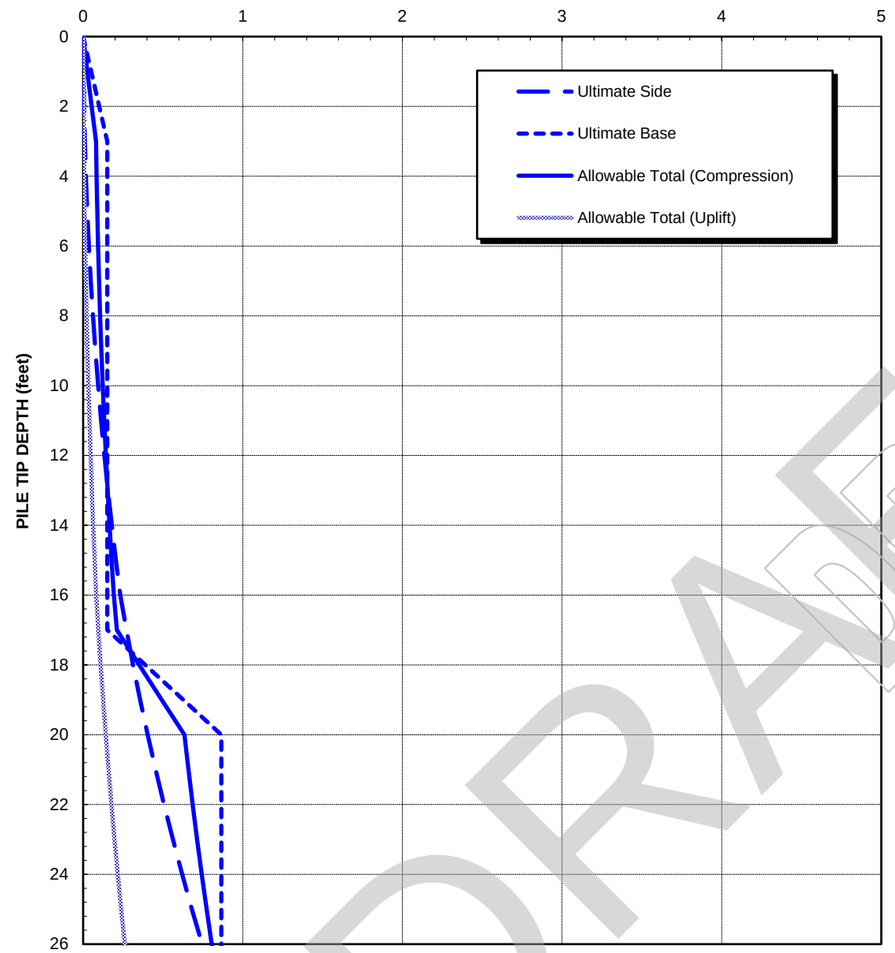
ASSUMED SUBSURFACE PROFILE

Based on Nearby Explorations:
MB-8



STATIC CASE

AXIAL CAPACITY (tons)

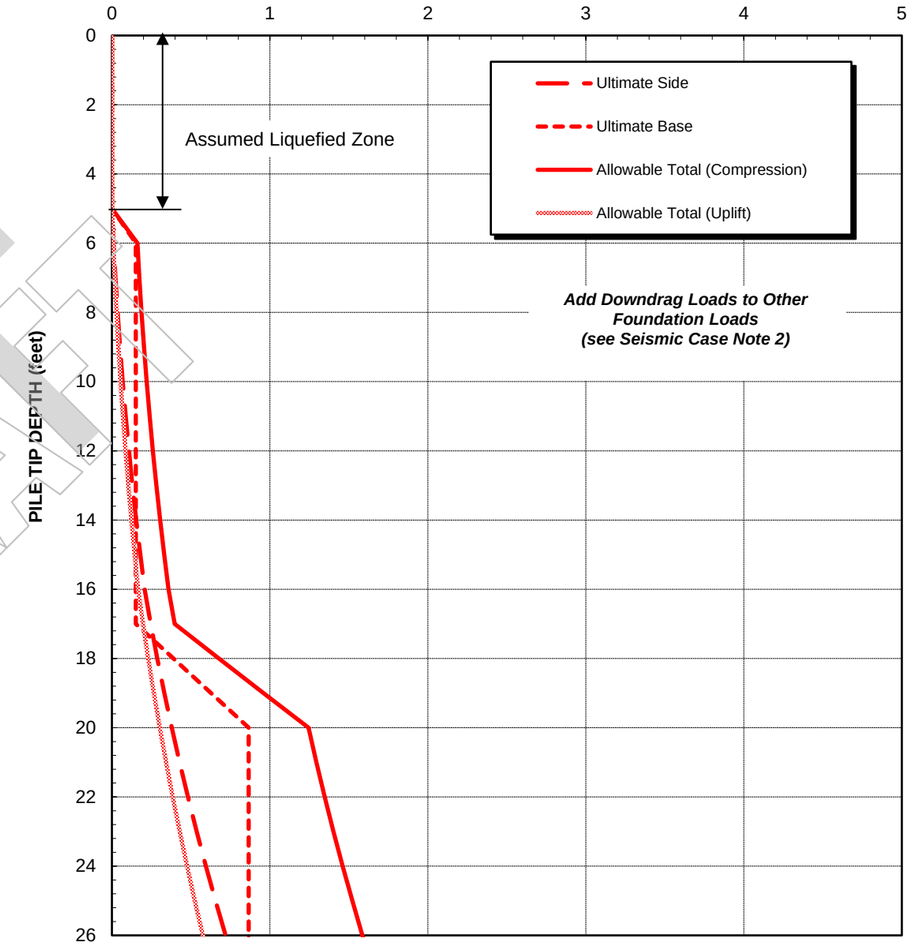


STATIC CASE NOTES:

1. Factor of safety of 2.0 applied for Allowable Total (Compression).

SEISMIC CASE

AXIAL CAPACITY (tons)



SEISMIC CASE NOTES:

1. Factor of safety of 2.0 applied for Allowable Total (Compression).
2. Ultimate downdrag force is estimated to be 0 tons. Downdrag force is recommended to be applied with post-earthquake loading.

DRAFT

GENERAL NOTES

1. The analyses were performed based on guidelines included in the WSDOT Geotechnical Design Manual (GDM) and local experience. The analyses are based on a single pile and do not consider group action of closely spaced piles (closer than 2.5 diameters, center to center).
2. Allowable total pile capacity shown on plots is determined by adding its unfactored side and base resistances divided by the appropriate factor of safety as noted above.

Meadowdale Beach
Park and Estuary Restoration Project
Snohomish County, WA

ESTIMATED AXIAL PILE CAPACITY
2-INCH DIAMATER PIN PILE
BORING MB-8

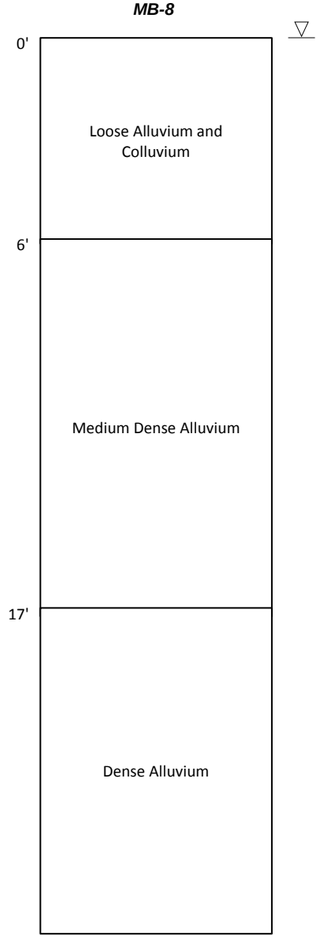
June 2017 21-1-22288-051

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 11

ASSUMED SUBSURFACE PROFILE

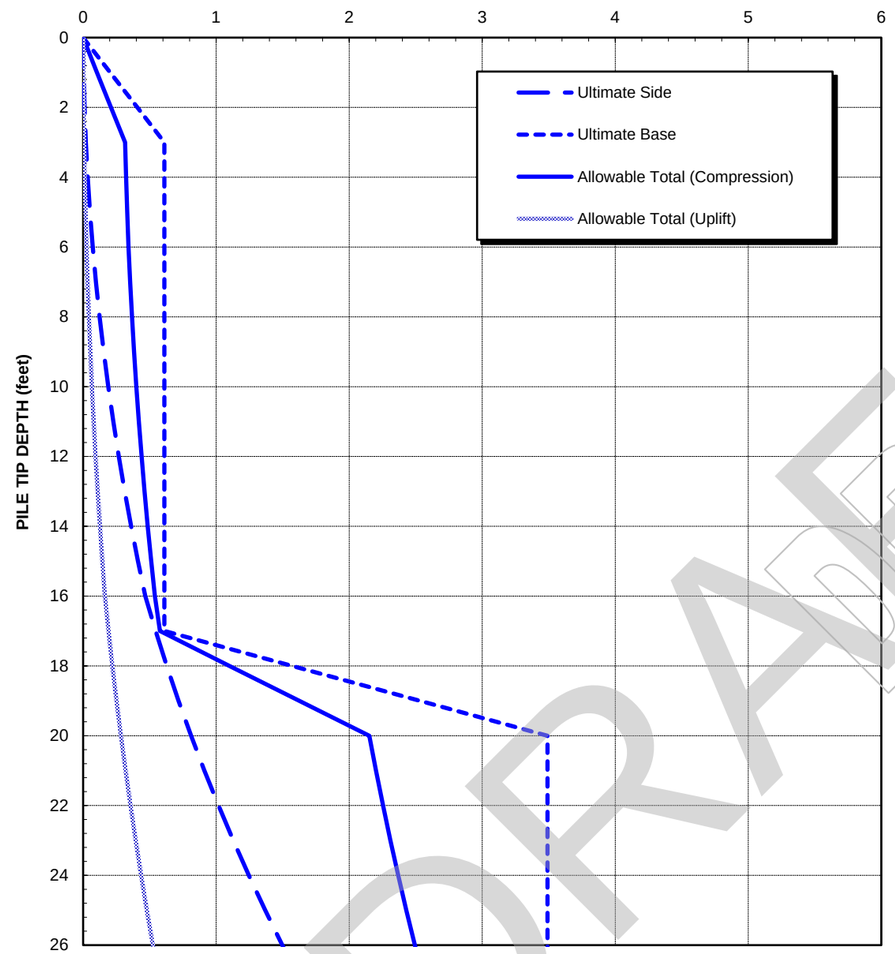
Based on Nearby Explorations:
MB-8



Boring Extends to 26.5 feet

STATIC CASE

AXIAL CAPACITY (tons)

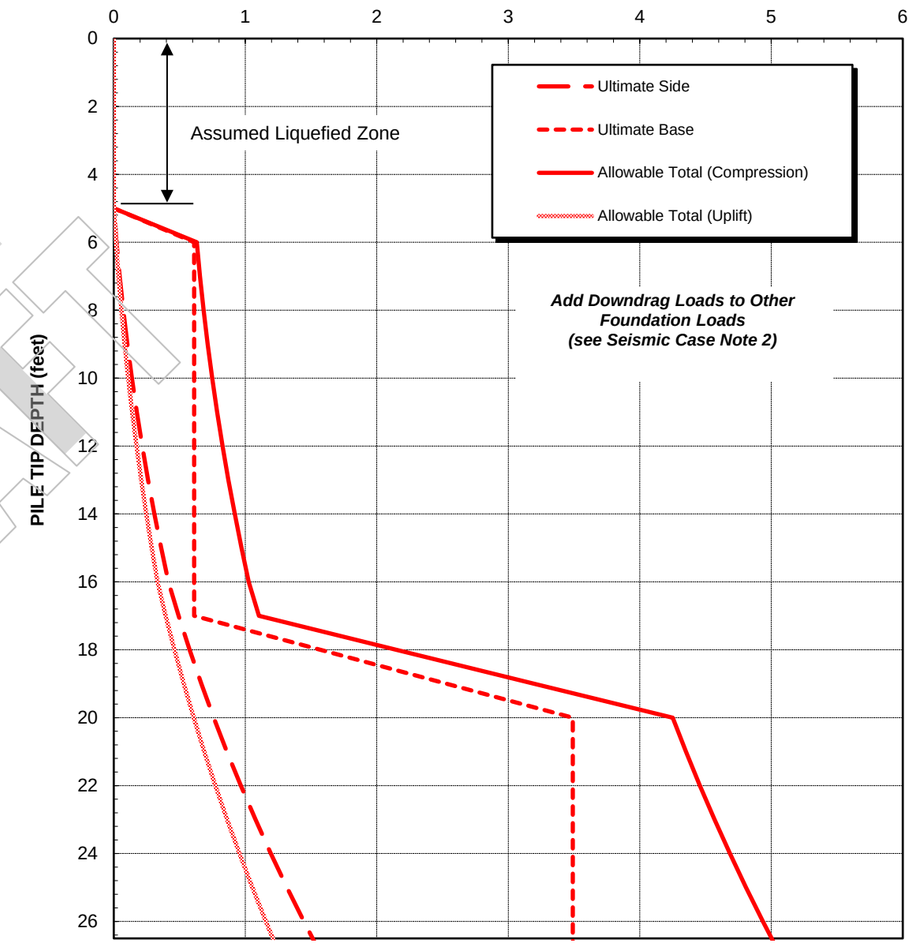


STATIC CASE NOTES:

1. Factor of safety of 2.0 applied for Allowable Total (Compression).

SEISMIC CASE

AXIAL CAPACITY (tons)



SEISMIC CASE NOTES:

1. Factor of safety of 2.0 applied for Allowable Total (Compression).
2. Ultimate downdrag force is estimated to be 0 tons. Downdrag forice is recommended to be applied with post-earthquake loading.

DRAFT

GENERAL NOTES

1. The analyses were performed based on guidelines included in the WSDOT Geotechnical Design Manual (GDM) and local experience. The analyses are based on a single pile and do not consider group action of closely spaced piles (closer than 2.5 diameters, center to center).
2. Allowable total pile capacity shown on plots is determined by adding its unfactored side and base resistances divided by the appropriate factor of safety as noted above.

Meadowdale Beach
Park and Estuary Restoration Project
Snohomish County, WA

ESTIMATED AXIAL PILE CAPACITY
4-INCH DIAMATER PIN PILE
BORING MB-8

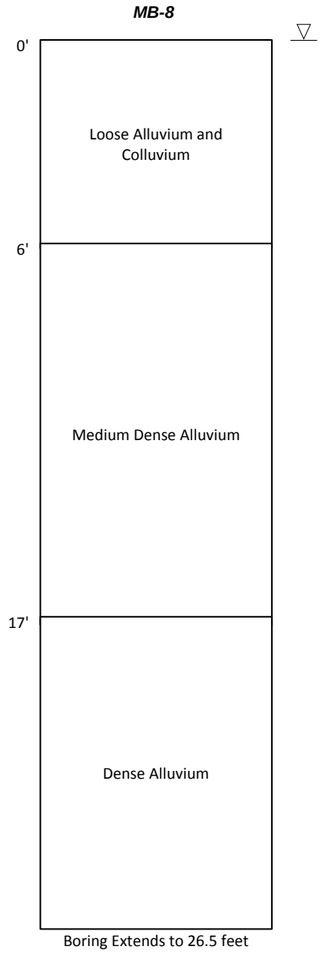
June 2017 21-1-22288-051

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 12

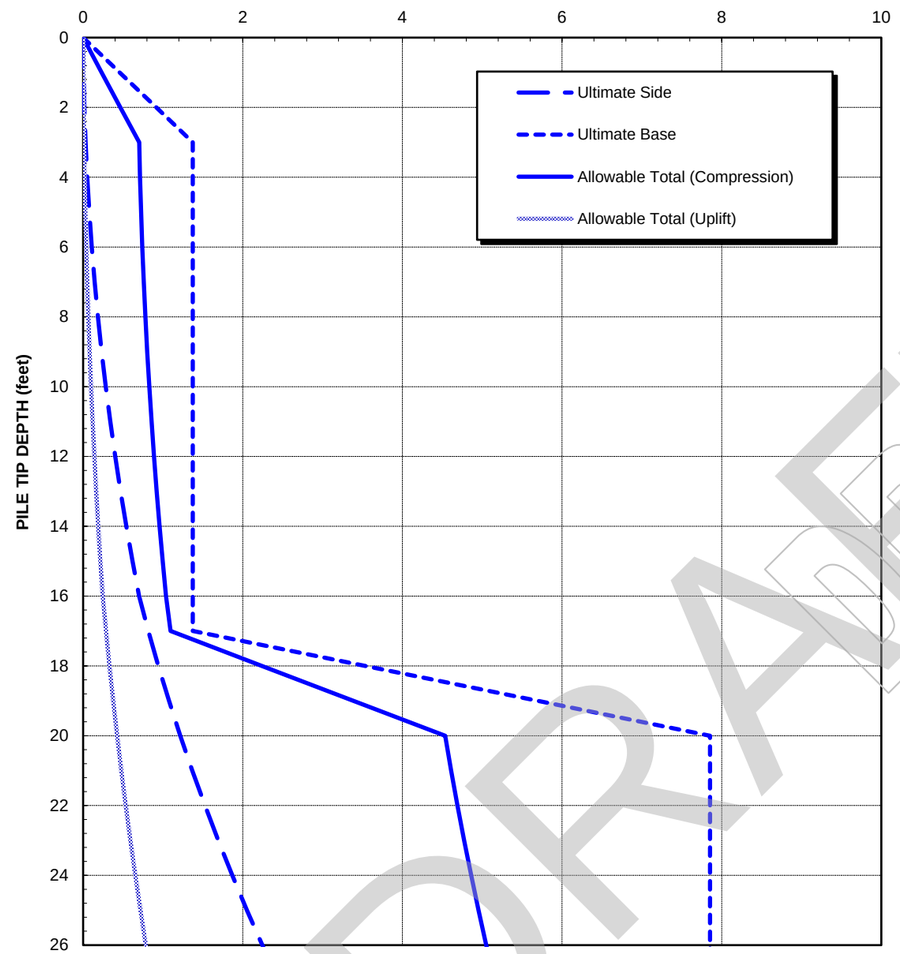
ASSUMED SUBSURFACE PROFILE

Based on Nearby Explorations:
MB-8



STATIC CASE

AXIAL CAPACITY (tons)

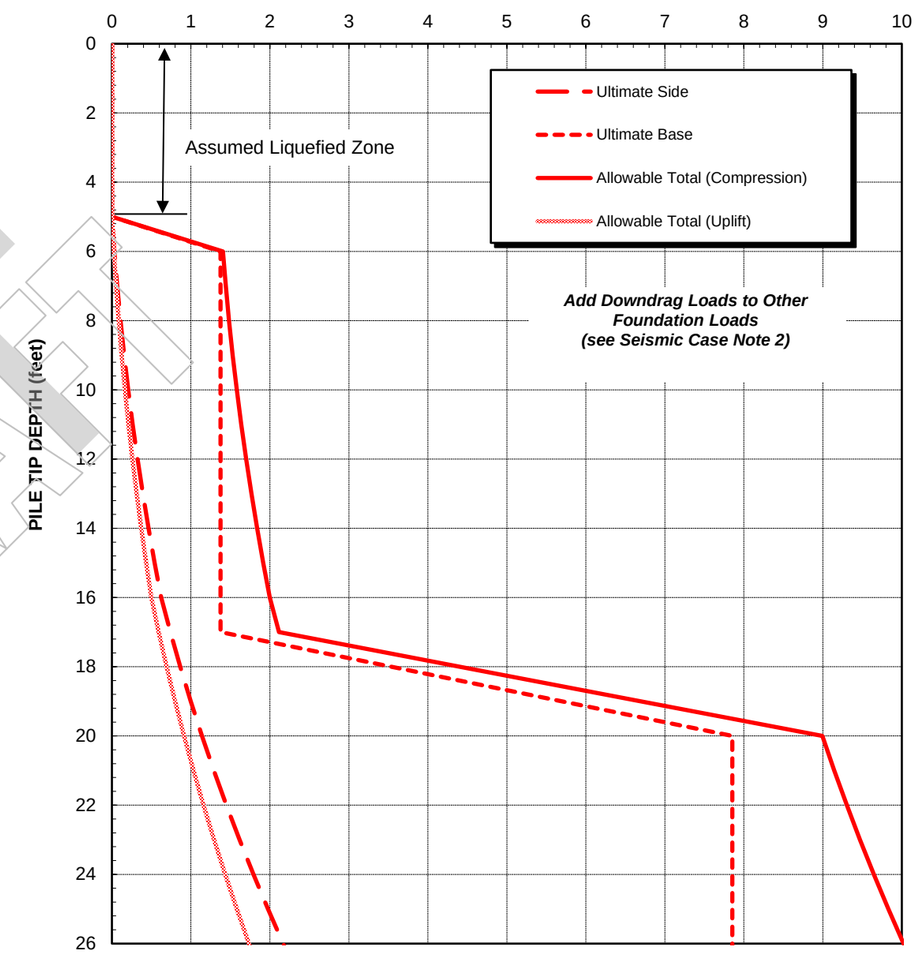


STATIC CASE NOTES:

1. Factor of safety of 2.0 applied for Allowable Total (Compression).

SEISMIC CASE

AXIAL CAPACITY (tons)



SEISMIC CASE NOTES:

1. Factor of safety of 2.0 applied for Allowable Total (Compression).
2. Ultimate downdrag force is estimated to be 0 tons. Downdrag forice is recommended to be applied with post-earthquake loading.

DRAFT

GENERAL NOTES

1. The analyses were performed based on guidelines included in the WSDOT Geotechnical Design Manual (GDM) and local experience. The analyses are based on a single pile and do not consider group action of closely spaced piles (closer than 2.5 diameters, center to center).
2. Allowable total pile capacity shown on plots is determined by adding its unfactored side and base resistances divided by the appropriate factor of safety as noted above.

Meadowdale Beach
Park and Estuary Restoration Project
Snohomish County, WA

ESTIMATED AXIAL PILE CAPACITY
6-INCH DIAMATER PIN PILE
BORING MB-8

June 2017 21-1-22288-051

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 13

APPENDIX A

SUBSURFACE BORING EXPLORATIONS

DRAFT

APPENDIX A

SUBSURFACE BORING EXPLORATIONS

TABLE OF CONTENTS

		Page
A.1	GENERAL	A-1
A.2	SOIL SAMPLING AND CLASSIFICATION	A-1
A.3	DRILLING MOBILIZATIONS	A-2
A.3.1	Access Road Borings	A-2
A.3.1	Bridge Borings	A-2
A.3.1	Infiltration Design Borings	A-3
A.3.2	Embankment Boring	A-3
A.4	DRILLING PROCEEDURES	A-3
A.4.1	Hollow-Stem Auger (HSA)	A-3
A.4.2	Mud Rotary	A-3
A.4.3	Hand Boring	A-4
A.4.4	Horizontal Drilling	A-4
A.5	TEST PIT EXCAVATION	A-4
A.6	REFERENCE	A-4

FIGURES

A-1 Soil Description and Log Key (3 sheets)
A-2 Log of Boring MB-1 (2 sheets)
A-3 Log of Boring MB-2 (2 sheets)
A-4 Log of Boring MB-3 (3 sheets)
A-5 Log of Boring MB-4 (3 sheets)
A-6 Log of Boring MB-5 (2 sheets)
A-7 Log of Boring MB-6 (5 sheets)
A-8 Log of Boring MB-7 (4 sheets)
A-9 Log of Boring MB-8 (2 sheets)
A-10 Log of Boring HB-1
A-11 Log of Boring HB-2

DRAFT

APPENDIX A

SUBSURFACE EXPLORATIONS

A.1 GENERAL

The subsurface exploration program consisted of drilling and sampling ten borings between November 21 and June 25, 2017. The soil borings were completed in separate mobilization efforts and will be discussed as such in the following sections:

- Access road borings included five soil borings along the access road. These borings, designated MB-1 through MB-5, extended to depths of 40 to 60 feet.
- Bridge borings included two soil borings near the proposed railroad bridge abutments and one soil boring near the proposed pedestrian bridge. These borings, designated as MB-6 through MB-8.
- Infiltration design borings included two shallow hand borings, designated HB-1 and HB-2.

Locations of completed explorations are shown in Figure 2.

Figure A-1 presents a key to our classification of the soils encountered in the explorations. The soil boring logs are presented as Figures A-2 through A-7.

A.2 SOIL SAMPLING AND CLASSIFICATION

We collected disturbed soil samples with a split-spoon sampler and performed Standard Penetration Testing (SPT) in accordance with ASTM International (ASTM) Designation: D1586, Standard Test Method for Standard Penetration Test and Split-barrel Sampling of Soils (ASTM, 2014). The SPT consists of a 2-inch outside diameter, 1.375-inch inside diameter, split-spoon sampler driven 18 in into the bottom of the borehole with a 140-pound hammer free-falling 30 inches. The number of blows required to penetrate the final 12 inches is termed the Standard Penetration Resistance (N-value). The field N-values are plotted in the boring logs. These values provide an empirical means for evaluating the relative density of granular soil and the relative consistency (stiffness) of cohesive soil. Figure A-1 shows the relative density or consistency as it relates to the SPT N-value.

We performed SPTs at 2.5-foot intervals to a depth of 20 feet and then at 5-foot intervals thereafter. The Shannon & Wilson, Inc. (Shannon & Wilson) field representative described each

DRAFT

sample in the field and sealed the samples in plastic jars to preserve moisture. We stored the sample jars in boxes and returned them to our laboratory for further analyses and testing. Sample depth intervals are shown in the boring logs.

We collected grab samples at select depths in borings HB-1 and H-2 and at test pits TP-1 and TP-2. Grab samples were collected directly from the auger head or the excavator bucket. We visually classified soils in the field and stored grab samples in plastic jars or plastic bags to preserve moisture for laboratory analyses and testing. Sample depths are shown in boring and test pits logs.

A Shannon & Wilson representative logged each field exploration, observed the drilling and sampling operations, retrieved representative soil samples for laboratory testing, and prepared descriptive field logs of the borings and text pits. Representative soil samples collected were taken to our laboratory in Seattle, Washington, for analysis. Soil samples were classified using the method described in ASTM Designations D2487, Standard Test Method for Classification of Soil for Engineering Purposes, and D2488, Standard Recommended Practice for Description of Soils (Visual-Manual Procedure). These standards use the Unified Soil Classification System. This classification system is summarized in graphical form in Figure A-1 (sheet 2).

A.3 DRILLING MOBILIZATIONS

A.3.1 Access Road Borings

Cascade Drilling completed five soil borings using hollow-stem auger (HSA) and mud rotary drilling techniques. HSA drilling consists of advancing an auger at 2.5- and 5-foot intervals. For borings B-3 and B-4, TSS used 4-inch-diameter flight auger. For borings B-1 and B-5 through B-7), TSS used 6-inch-diameter HSA. Cascade Drilling collected cuttings in 55-gallon drums and transported to their yard for storage. Borings were backfilled with bentonite chips.

A.3.1 Bridge Borings

Holt Services, Inc. (Holt) completed three soil borings using mud rotary and HSA drilling techniques at borings MB-6 through MB-8. Due to the location near the railroad, BNSF Railway Company requested that drillers within not extend rods more than 30 feet above the ground

during drilling. For boring MB-6, Holt used mud rotary drilling techniques with a 4⅞-inch-diameter drill bit to 55 feet, then switched over to a 3⅞-inch-diameter drill bit once finer-grained,

DRAFT

glacially overridden soils were encountered for the remainder of the boring. For boring MB-7, Holt started with 6-inch-diameter HSA to 40 feet, then switched over to mud rotary drilling techniques with a 5⅞-inch-diameter drill bit for the remainder of the boring. Drilling in gravelly soils in the upper 50 feet at MB-6 and 75 feet at MB-7, as well as caving or collapsing of the borehole was problematic at these locations. Boring MB-6 was backfilled with bentonite chips from 37 feet, the depth of borehole collapse. Boring MB-7 was backfilled with bentonite chips from 110 feet, the depth of borehole collapse. Holt drilled MB-8 to 25 feet and backfilled with bentonite chips. Holt collected cuttings in 55-gallon drums and transported them to their yard for storage.

A.3.1 Infiltration Design Borings

Infiltration design borings were hand-augered by Shannon & Wilson staff at borings HB-1 and HB-2. Shannon & Wilson staff augered to 6.5 and 10 feet using a 4-inch-diameter auger head. Wells were installed in these borings to assess water levels at these locations and whether infiltration designs were feasible. The upper 1 to 1.5 feet of the well was cased with bentonite and the bottom foot of the well was screened. Measured water levels following completion of the borings is representative of the layer of the water levels of the site at these locations. A 6-inch-diameter irrigation box seals the well cover at or near grade and the well remains in place for future readings. Cuttings from the hand borings were spread out onsite.

A.3.2 Embankment Boring

TEXT TO BE PROVIDED IN SUBSEQUENT REPORT

A.4 DRILLING PROCEEDURES

A.4.1 Hollow-Stem Auger (HSA)

The HSA drilling method consists of advancing a continuous-flight auger to remove soil from the borehole. Soil samples are obtained by removing a center bit and lowering a sampler attached to a sample rod through the hollow stem and out the end of the auger. The augers are left in place in the borehole to serve as a casing during boring advancement.

A.4.2 Mud Rotary

Mud rotary drilling borings are advanced by circulating drilling fluid from the drill rig down through hollow rods to a tri-cone bit at the bottom of the borehole. Water mixed with

DRAFT

bentonite powder creates the drilling fluid. The density of the drilling fluid keeps the borehole open while the drill advances. Cuttings were transported from the bottom of the borehole to the surface by drilling fluid flowing between the drilling rods and the sides of the borehole. The cuttings were deposited in a settling tank at the ground surface and the fluid re-circulated.

A.4.3 Hand Boring

Hand boring equipment consists of a 4-inch-diameter auger head attached to rods and a handle. Turning the handle advances the auger to specified depths. Hand borings are often utilized for shallow explorations, exploration in sensitive areas, or sites where heavy equipment cannot access.

A.4.4 Horizontal Drilling

TEXT TO BE PROVIDED IN SUBSEQUENT REPORT

A.5 TEST PIT EXCAVATION

TEXT TO BE PROVIDED IN SUBSEQUENT REPORT

A.6 REFERENCE

ASTM International (ASTM), 2014, Annual book of standards, Construction v. 04.08, Soil and rock (I): D420 – D5876: West Conshohocken, Penn., ASTM International, 1 v., available: www.astm.org.

DRAFT

Shannon & Wilson, Inc. (S&W), uses a soil identification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this and the following pages. Soil descriptions are based on visual-manual procedures (ASTM D2488) and laboratory testing procedures (ASTM D2487), if performed.

S&W INORGANIC SOIL CONSTITUENT DEFINITIONS

CONSTITUENT[2]	FINE-GRAINED SOILS (50% or more fines)[1]	COARSE-GRAINED SOILS (less than 50% fines)[1]
Major	***Silt, Lean Clay, Elastic Silt,*** or ***Fat Clay***[3]	***Sand*** or ***Gravel***[4]
Modifying (Secondary) Precedes major constituent	30% or more coarse-grained: ***Sandy*** or ***Gravelly***[4]	More than 12% fine-grained: ***Silty*** or ***Clayey***[3]
Minor Follows major constituent	15% to 30% coarse-grained: ***with Sand*** or ***with Gravel***[4]	5% to 12% fine-grained: ***with Silt*** or ***with Clay***[3]
	30% or more total coarse-grained *and* lesser coarse-grained constituent is 15% or more: ***with Sand*** or ***with Gravel***[5]	15% or more of a second coarse-grained constituent: ***with Sand*** or ***with Gravel***[5]

[1]All percentages are by weight of total specimen passing a 3-inch sieve.
[2]The order of terms is: *Modifying Major with Minor*.
[3]Determined based on behavior.
[4]Determined based on which constituent comprises a larger percentage.
[5]Whichever is the lesser constituent.

MOISTURE CONTENT TERMS

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

STANDARD PENETRATION TEST (SPT) SPECIFICATIONS

Hammer: 140 pounds with a 30-inch free fall. Rope on 6- to 10-inch-diam. cathead 2-1/4 rope turns, > 100 rpm

NOTE: If automatic hammers are used, blow counts shown on boring logs should be adjusted to account for efficiency of hammer.

Sampler: 10 to 30 inches long
Shoe I.D. = 1.375 inches
Barrel I.D. = 1.5 inches
Barrel O.D. = 2 inches

N-Value: Sum blow counts for second and third 6-inch increments.
Refusal: 50 blows for 6 inches or less; 10 blows for 0 inches.

NOTE: Penetration resistances (N-values) shown on boring logs are as recorded in the field and have not been corrected for hammer efficiency, overburden, or other factors.

PARTICLE SIZE DEFINITIONS

DESCRIPTION	SIEVE NUMBER AND/OR APPROXIMATE SIZE
FINES	< #200 (0.075 mm = 0.003 in.)
SAND	
Fine	#200 to #40 (0.075 to 0.4 mm; 0.003 to 0.02 in.)
Medium	#40 to #10 (0.4 to 2 mm; 0.02 to 0.08 in.)
Coarse	#10 to #4 (2 to 4.75 mm; 0.08 to 0.187 in.)
GRAVEL	
Fine	#4 to 3/4 in. (4.75 to 19 mm; 0.187 to 0.75 in.)
Coarse	3/4 to 3 in. (19 to 76 mm)
COBBLES	3 to 12 in. (76 to 305 mm)
BOULDERS	> 12 in. (305 mm)

RELATIVE DENSITY / CONSISTENCY

COHESIONLESS SOILS		COHESIVE SOILS	
N, SPT, BLOWS/FT.	RELATIVE DENSITY	N, SPT, BLOWS/FT.	RELATIVE CONSISTENCY
< 4	Very loose	< 2	Very soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very dense	15 - 30	Very stiff
		> 30	Hard

WELL AND BACKFILL SYMBOLS

Bentonite Cement Grout	Surface Cement Seal
Bentonite Grout	Asphalt or Cap
Bentonite Chips	Slough
Silica Sand	Inclinometer or Non-perforated Casing
Perforated or Screened Casing	Vibrating Wire Piezometer

PERCENTAGES TERMS [1, 2]

Trace	< 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

[1]Gravel, sand, and fines estimated by mass. Other constituents, such as organics, cobbles, and boulders, estimated by volume.

[2]Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

SOIL DESCRIPTION AND LOG KEY

May 2017 | 21-1-22288-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-1
Sheet 1 of 3

DRAFT

DRAFT

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)
(Modified From USACE Tech Memo 3-357, ASTM D2487, and ASTM D2488)

MAJOR DIVISIONS			GROUP/GRAPHIC SYMBOL		TYPICAL IDENTIFICATIONS
COARSE-GRAINED SOILS *(more than 50% retained on No. 200 sieve)*	Gravels *(more than 50% of coarse fraction retained on No. 4 sieve)*	Gravel *(less than 5% fines)*	GW		Well-Graded Gravel; Well-Graded Gravel with Sand
			GP		Poorly Graded Gravel; Poorly Graded Gravel with Sand
		Silty or Clayey Gravel *(more than 12% fines)*	GM		Silty Gravel; Silty Gravel with Sand
			GC		Clayey Gravel; Clayey Gravel with Sand
	Sands *(50% or more of coarse fraction passes the No. 4 sieve)*	Sand *(less than 5% fines)*	SW		Well-Graded Sand; Well-Graded Sand with Gravel
			SP		Poorly Graded Sand; Poorly Graded Sand with Gravel
		Silty or Clayey Sand *(more than 12% fines)*	SM		Silty Sand; Silty Sand with Gravel
			SC		Clayey Sand; Clayey Sand with Gravel
FINE-GRAINED SOILS *(50% or more passes the No. 200 sieve)*	Silts and Clays *(liquid limit less than 50)*	Inorganic	ML		Silt; Silt with Sand or Gravel; Sandy or Gravelly Silt
			CL		Lean Clay; Lean Clay with Sand or Gravel; Sandy or Gravelly Lean Clay
		Organic	OL		Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
	Silts and Clays *(liquid limit 50 or more)*	Inorganic	MH		Elastic Silt; Elastic Silt with Sand or Gravel; Sandy or Gravelly Elastic Silt
			CH		Fat Clay; Fat Clay with Sand or Gravel; Sandy or Gravelly Fat Clay
		Organic	OH		Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
HIGHLY-ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT		Peat or other highly organic soils (see ASTM D4427)

NOTE: No. 4 size = 4.75 mm = 0.187 in.; No. 200 size = 0.075 mm = 0.003 in.

DRAFT

NOTES

1. Dual symbols *(symbols separated by a hyphen, i.e., SP-SM, Sand with Silt)* are used for soils with between 5% and 12% fines or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart. Graphics shown on the logs for these soil types are a combination of the two graphic symbols (e.g., SP and SM).

2. Borderline symbols *(symbols separated by a slash, i.e., CL/ML, Lean Clay to Silt; SP-SM/SM, Sand with Silt to Silty Sand)* indicate that the soil properties are close to the defining boundary between two groups.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

SOIL DESCRIPTION AND LOG KEY

May 2017 | 21-1-22288-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-1
Sheet 2 of 3

SOIL_CLASS_KEY_PG2 21-22288-040.GPJ SHAN_WIL.GDT 5/19/17

DRAFT

GRADATION TERMS

Poorly Graded	Narrow range of grain sizes present or, within the range of grain sizes present, one or more sizes are missing (Gap Graded). Meets criteria in ASTM D2487, if tested.
Well-Graded	Full range and even distribution of grain sizes present. Meets criteria in ASTM D2487, if tested.

CEMENTATION TERMS[1]

Weak	Crumbles or breaks with handling or slight finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

PLASTICITY[2]

DESCRIPTION	VISUAL-MANUAL CRITERIA	APPROX. PLASITICITY INDEX RANGE
Nonplastic	A 1/8-in. thread cannot be rolled at any water content.	< 4
Low	A thread can barely be rolled and a lump cannot be formed when drier than the plastic limit.	4 to 10
Medium	A thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. A lump crumbles when drier than the plastic limit.	10 to 20
High	It takes considerable time rolling and kneading to reach the plastic limit. A thread can be rerolled several times after reaching the plastic limit. A lump can be formed without crumbling when drier than the plastic limit.	> 20

ADDITIONAL TERMS

Mottled	Irregular patches of different colors.
Bioturbated	Soil disturbance or mixing by plants or animals.
Diamict	Nonsorted sediment; sand and gravel in silt and/or clay matrix.
Cuttings	Material brought to surface by drilling.
Slough	Material that caved from sides of borehole.
Sheared	Disturbed texture, mix of strengths.

PARTICLE ANGULARITY AND SHAPE TERMS[1]

Angular	Sharp edges and unpolished planar surfaces.
Subangular	Similar to angular, but with rounded edges.
Subrounded	Nearly planar sides with well-rounded edges.
Rounded	Smoothly curved sides with no edges.
Flat	Width/thickness ratio > 3.
Elongated	Length/width ratio > 3.

[1]Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

[2]Adapted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

ACRONYMS AND ABBREVIATIONS

ATD	At Time of Drilling
Diam.	Diameter
Elev.	Elevation
ft.	Feet
FeO	Iron Oxide
gal.	Gallons
Horiz.	Horizontal
HSA	Hollow Stem Auger
I.D.	Inside Diameter
in.	Inches
lbs.	Pounds
MgO	Magnesium Oxide
mm	Millimeter
MnO	Manganese Oxide
NA	Not Applicable or Not Available
NP	Nonplastic
O.D.	Outside Diameter
OW	Observation Well
pcf	Pounds per Cubic Foot
PID	Photo-Ionization Detector
PMT	Pressuremeter Test
ppm	Parts per Million
psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
rpm	Rotations per Minute
SPT	Standard Penetration Test
USCS	Unified Soil Classification System
q_u	Unconfined Compressive Strength
VWP	Vibrating Wire Piezometer
Vert.	Vertical
WOH	Weight of Hammer
WOR	Weight of Rods
Wt.	Weight

STRUCTURE TERMS[1]

Interbedded	Alternating layers of varying material or color with layers at least 1/4-inch thick; singular: bed.
Laminated	Alternating layers of varying material or color with layers less than 1/4-inch thick; singular: lamination.
Fissured	Breaks along definite planes or fractures with little resistance.
Slickensided	Fracture planes appear polished or glossy; sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps that resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay.
Homogeneous	Same color and appearance throughout.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

SOIL DESCRIPTION AND LOG KEY

May 2017 | 21-1-22288-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-1
Sheet 3 of 3

DRAFT

DRAFT

Total Depth:	41.5 ft.	Northing:	~ 316,667 ft.	Drilling Method:	Hollow Stem Auger	Hole Diam.:	12 in.
Top Elevation:	~ 122 ft.	Easting:	~ 1,272,159 ft.	Drilling Company:	Cascade Drilling	Rod Diam.:	8.75-in.
Vert. Datum:		Station:	~	Drill Rig Equipment:	CME 75	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

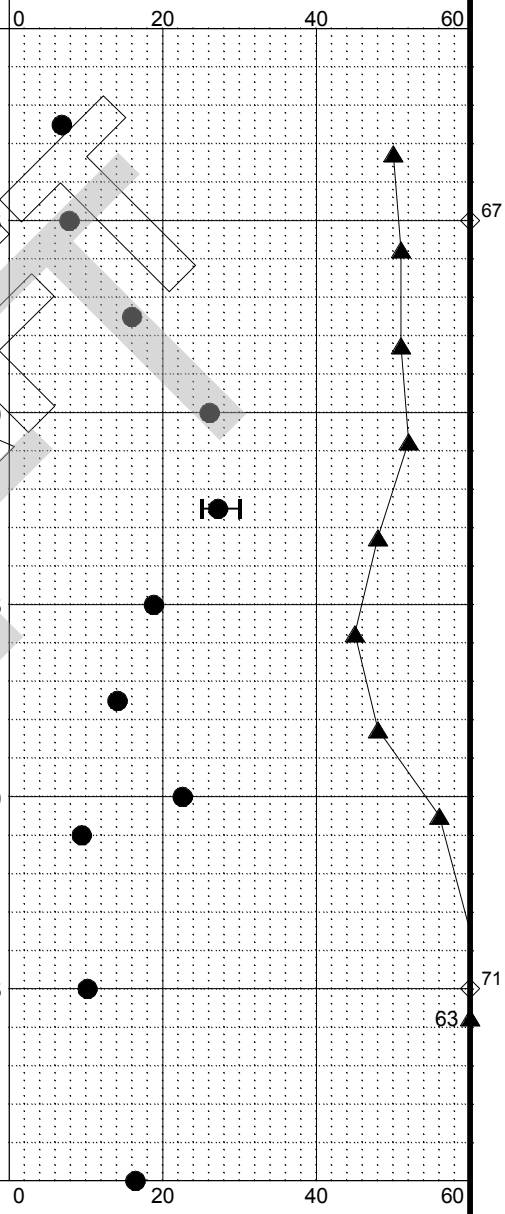
Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Description	Depth, ft.
3 inches of Asphalt.	0.3
2 inches of Road Base.	0.4
Dense, light gray-brown, *Poorly Graded Sand with Silt (SP-SM)*; moist; fine sand; nonplastic fines. Whidbey Formation (Qpnf)	5.0
Dense, gray-brown, *Silty Sand (SM)* to *Sandy Silt (ML)*; moist; fine sand; nonplastic fines. Whidbey Formation (Qpnf)	9.5
Dense, gray-brown, *Silt (ML)*; moist; iron-oxide staining; blocky texture; scattered fine sand laminations. Whidbey Formation (Qpnl)	17.0
Dense, gray-brown, *Silty Sand (SM)*; moist; fine sand; iron-oxide staining; interbeds of sandy silt. Whidbey Formation (Qpnf)	19.5
Dense, gray-brown, *Silt (ML)*; moist; trace of fine sand; nonplastic fines; fine sand laminations. Whidbey Formation (Qpnl)	21.0
Dense to very dense, gray-brown, *Silty Sand (SM)*; interbedded with *Silt (ML)*; moist; fine sand; nonplastic fines; trace organics and pumice near base of unit. Whidbey Formation (Qpnf)	

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*



CONTINUED NEXT SHEET

LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-1

June 2017 | 21-1-22288-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-2
Sheet 1 of 2

REV 3 - Approved for Submittal

DRAFT

MASTER_LOG_E 21-22288-040.GPJ SHAN_WIL.GDT 5/29/17 Log: AXT Rev: WTL Typ: LK

DRAFT

Total Depth:	41.5 ft.	Northing:	~ 316,667 ft.	Drilling Method:	Hollow Stem Auger	Hole Diam.:	12 in.
Top Elevation:	~ 122 ft.	Easting:	~ 1,272,159 ft.	Drilling Company:	Cascade Drilling	Rod Diam.:	8.75-in.
Vert. Datum:		Station:	~	Drill Rig Equipment:	CME 75	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

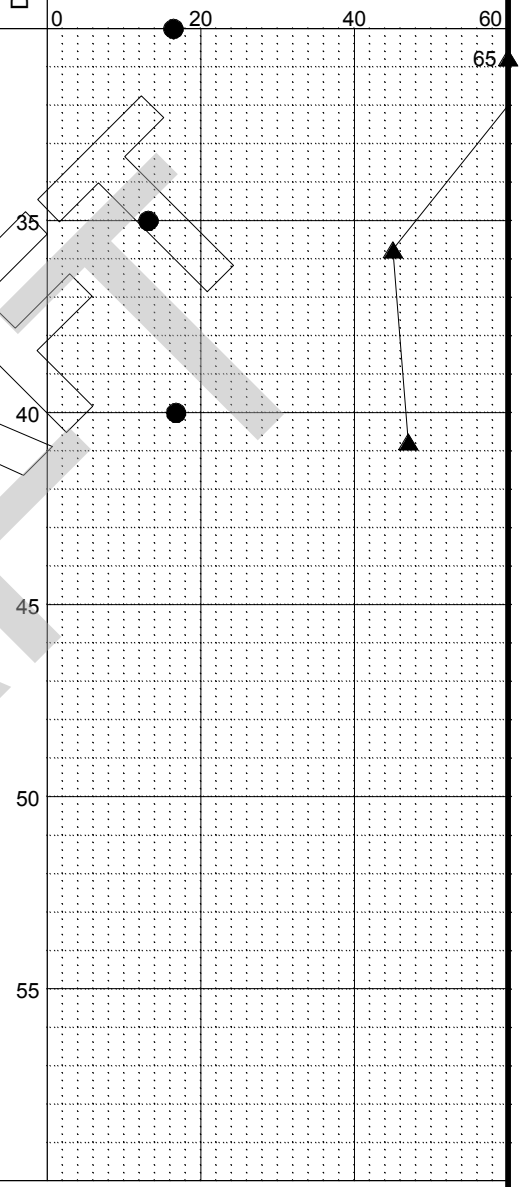
Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.
Dense, gray-brown, *Silt (ML)*; moist; trace fine sand; nonplastic fines; interbeds of fine sand. Whidbey Formation (Qpnl)	38.0
BOTTOM OF BORING COMPLETED 11/21/2016	41.5

Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*



LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-1

June 2017 | 21-1-22288-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-2
Sheet 2 of 2

REV 3 - Approved for Submittal

DRAFT

MASTER_LOG_E 21-22288-040.GPJ SHAN_WIL.GDT 5/29/17 Log: AXT Rev: WTL Typ: LK

DRAFT

Total Depth:	41.5 ft.	Northing:	~ 316,818 ft.	Drilling Method:	Hollow Stem Auger	Hole Diam.:	12 in.
Top Elevation:	~ 129 ft.	Easting:	~ 1,272,096 ft.	Drilling Company:	Cascade Drilling	Rod Diam.:	8.75-in.
Vert. Datum:		Station:	~	Drill Rig Equipment:	CME 75	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

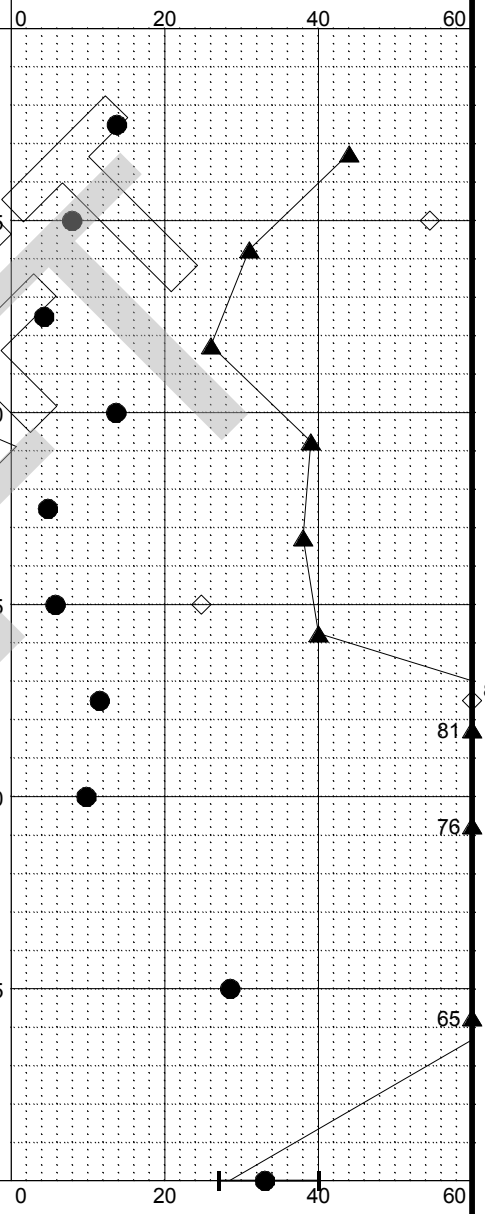
Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Description	Depth, ft.
3 inches of Asphalt.	0.3
2 inches of Road Base.	0.4
Medium dense to dense, light gray-brown, *Silty Sand (SM)* to *Sandy Silt (ML)*; moist; fine sand; nonplastic fines; fines content decreases with depth; iron-oxide staining. Whidbey Formation (Qpnl)	9.5
Dense, gray-brown, *Silt (ML)* interbedded with *Silty Sand (SM)*; moist; fine sand; nonplastic fines. Whidbey Formation (Qpnl)	12.0
Dense, gray-brown, *Silty Sand (SM)*; moist; fine sand; nonplastic fines; iron-oxide staining. Whidbey Formation (Qpnf)	17.0
Very dense, gray-brown, *Silt (ML)*; moist; trace of fine sand; nonplastic fines. Whidbey Formation (Qpnl) - Laminated silt and silty sand between 19.5 and 23 feet.	23.0
Very stiff to hard, gray-brown, *Silt (ML)*; moist; trace of fine sand; low to medium plasticity fines; iron-oxide staining; blocky texture. Whidbey Formation (Qpnl)	

Samples: 1, 2, 3, 4, 5, 6, 7, 8, 9

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*



CONTINUED NEXT SHEET

LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-2

June 2017 | 21-1-22288-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-3
Sheet 1 of 2

REV 3 - Approved for Submittal

DRAFT

MASTER_LOG_E 21-22288-040.GPJ SHAN_WIL.GDT 5/29/17 Log: AXT Rev: WTL Typ: LK

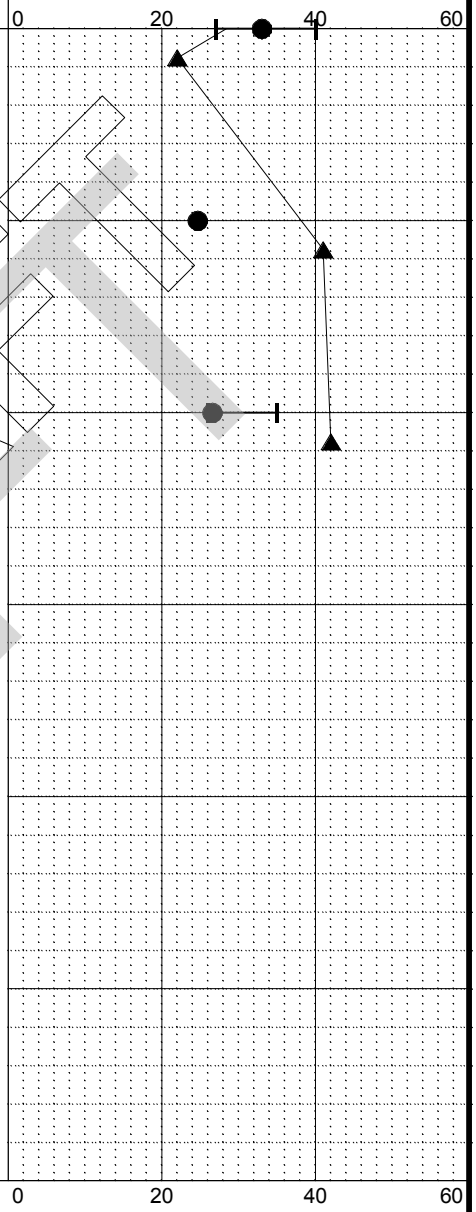
DRAFT

Total Depth:	41.5 ft.	Northing:	~ 316,818 ft.	Drilling Method:	Hollow Stem Auger	Hole Diam.:	12 in.
Top Elevation:	~ 129 ft.	Easting:	~ 1,272,096 ft.	Drilling Company:	Cascade Drilling	Rod Diam.:	8.75-in.
Vert. Datum:		Station:	~	Drill Rig Equipment:	CME 75	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION	Depth, ft.	Symbol	Samples	Ground Water	Depth, ft.
Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.					
Hard, gray, *Silt (ML)*; moist; trace of fine sand; low plasticity fines; abundant iron-oxide staining. Whidbey Formation (Qpnl)	33.0		10, 11, 12		35, 40, 45, 50, 55
BOTTOM OF BORING COMPLETED 11/21/2016	41.5				

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*



LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-2

June 2017 | 21-1-22288-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-3
Sheet 2 of 2

REV 3 - Approved for Submittal

DRAFT

MASTER_LOG_E 21-22288-040.GPJ SHAN_WIL.GDT 5/29/17 Log: AXT Rev: WTL Typ: LK

DRAFT

Total Depth:	61.5 ft.	Northing:	~ 316,865 ft.	Drilling Method:	Hollow Stem Auger	Hole Diam.:	12 in.
Top Elevation:	~ 129 ft.	Easting:	~ 1,272,090 ft.	Drilling Company:	Cascade Drilling	Rod Diam.:	8.75-in.
Vert. Datum:		Station:	~	Drill Rig Equipment:	CME 75	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

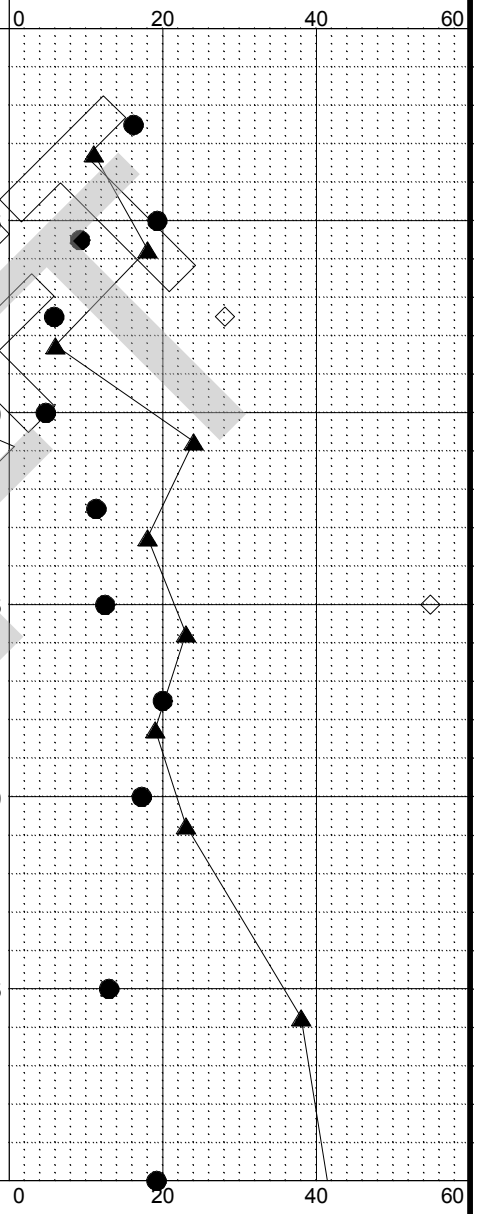
Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Description	Depth, ft.
3 inches of Asphalt.	0.3
2 inches of Road Base.	0.4
Medium dense, brown, *Silty Sand (SM)*; moist; trace fine gravel; primarily fine sand; trace medium to coarse sand; nonplastic fines; pocket of silt; trace burnt organics. Fill (Hf)	7.0
Loose to medium dense, reddish-brown, *Silty Sand with Gravel (SM)*; moist; fine to coarse gravel; primarily fine sand; trace medium to coarse sand; nonplastic fines; scattered roots. Fill (Hf)	12.0
Medium dense, reddish-brown, *Sandy Silt (ML)*; moist; fine sand; nonplastic fines; thin layers of sandy silt; iron-oxide staining. Whidbey Formation (Qpnl)	17.0
Medium dense, gray-brown, *Silt (ML)*; trace fine sand; nonplastic fines; iron-oxide staining; blocky texture; silty, fine sand interbeds. Whidbey Formation (Qpnl)	19.5
Medium dense, gray-brown, *Silty Sand (SM)*; moist; fine sand; nonplastic fines. Whidbey Formation (Qpnl)	23.0
Dense to hard, gray-brown, *Silt (ML)*; moist; trace to few fine sand; nonplastic to low plasticity; blocky texture. Whidbey Formation (Qpnl)	

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*



CONTINUED NEXT SHEET

LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-3

June 2017 | 21-1-22288-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-4
Sheet 1 of 3

REV 3 - Approved for Submittal

DRAFT

MASTER_LOG_E 21-22288-040.GPJ SHAN_WIL.GDT 5/30/17 Log: AXT Rev: WTL Typ: LK

DRAFT

Total Depth:	61.5 ft.	Northing:	~ 316,865 ft.	Drilling Method:	Hollow Stem Auger	Hole Diam.:	12 in.
Top Elevation:	~ 129 ft.	Easting:	~ 1,272,090 ft.	Drilling Company:	Cascade Drilling	Rod Diam.:	8.75-in.
Vert. Datum:		Station:	~	Drill Rig Equipment:	CME 75	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

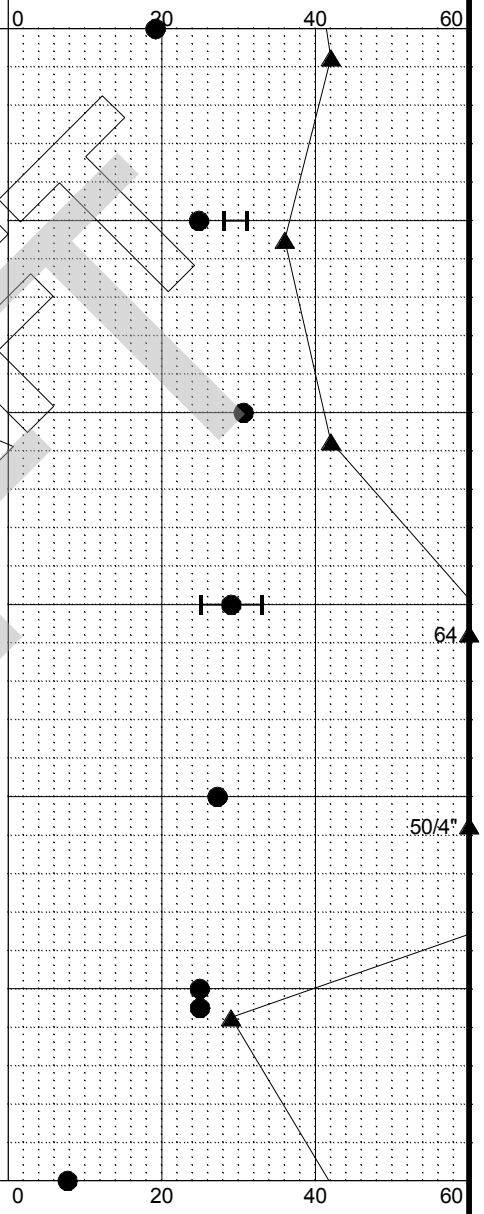
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



- Grades to dark gray at 56 feet.

57.0

Dense, gray-brown, *Silty Sand (SM)*; moist; fine sand; iron-oxide staining.
Whidbey Formation (Qpnf)

CONTINUED NEXT SHEET

LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-3

June 2017 | 21-1-22288-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-4
Sheet 2 of 3

DRAFT

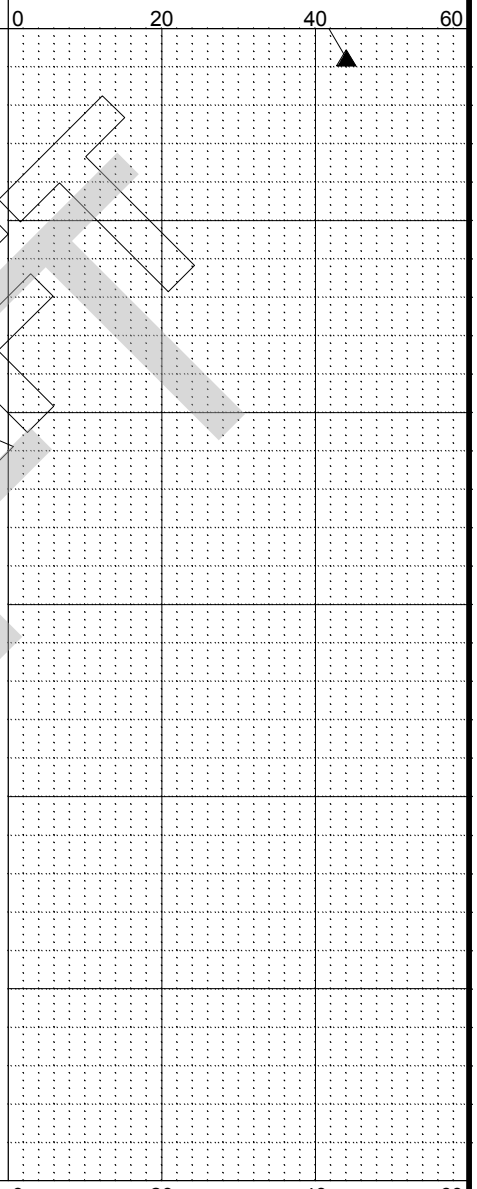
DRAFT

Total Depth:	61.5 ft.	Northing:	~ 316,865 ft.	Drilling Method:	Hollow Stem Auger	Hole Diam.:	12 in.
Top Elevation:	~ 129 ft.	Easting:	~ 1,272,090 ft.	Drilling Company:	Cascade Drilling	Rod Diam.:	8.75-in.
Vert. Datum:		Station:	~	Drill Rig Equipment:	CME 75	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION	Depth, ft.	Symbol	Samples	Ground Water	Depth, ft.
Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.					
			16		
BOTTOM OF BORING COMPLETED 11/22/2016	61.5				

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*



LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-3

June 2017 | 21-1-22288-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-4
Sheet 3 of 3

DRAFT

Total Depth:	61.5 ft.	Northing:	~ 316,902 ft.	Drilling Method:	Hollow Stem Auger	Hole Diam.:	12 in.
Top Elevation:	~ 119 ft.	Easting:	~ 1,272,234 ft.	Drilling Company:	Cascade Drilling	Rod Diam.:	8.75-in.
Vert. Datum:		Station:	~	Drill Rig Equipment:	CME 75	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

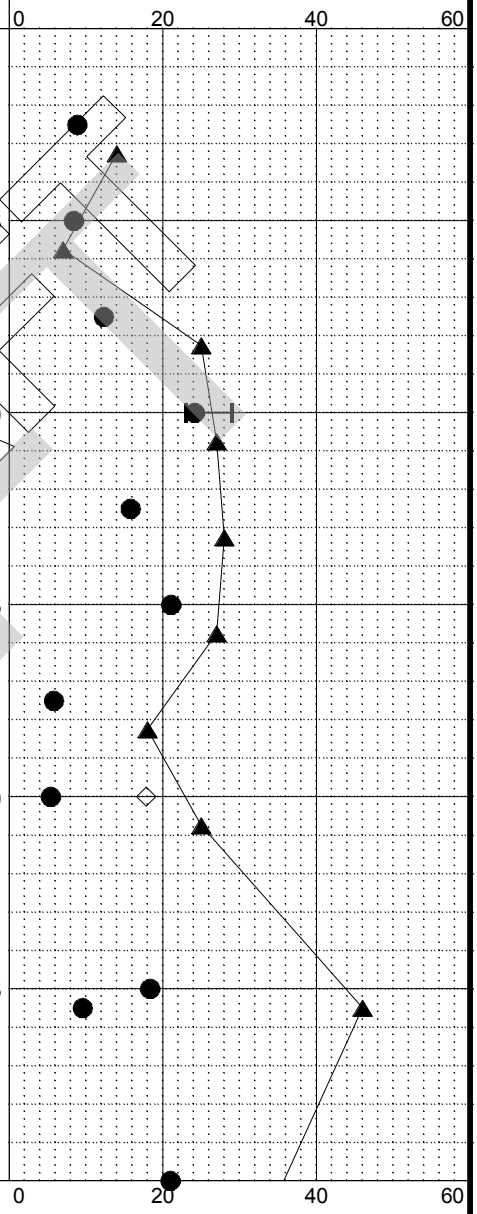
Description	Depth, ft.
3 inches of Asphalt.	0.3
2 inches of Road Base.	0.4
Loose, reddish-brown, *Poorly Graded Sand with Silt (SP-SM)* to *Silty Sand (SM)*; moist; trace gravel; primarily fine sand; trace organics and wood. Fill (Hf)	7.0
Medium dense, brown, *Silty Sand (SM)*; moist; fine sand; silt layers/pockets. Whidbey Formation (Qpnf)	9.5
Very stiff, gray-brown, *Silt (ML)*; moist; trace fine sand; low plasticity fines; iron-oxide staining. Whidbey Formation (Qpnl)	12.0
Medium dense, gray-brown, *Silty Sand (SM)* to *Poorly Graded Sand with Silt (SP-SM)*; moist; fine sand; nonplastic fines; interbedded with silt between 14.5 and 17 feet. Whidbey Formation (Qpnf)	19.5
Medium dense, gray-brown, *Silty Sand (SM)*; fine sand; iron-oxide staining. Whidbey Formation (Qpnf)	25.0
Dense, reddish-brown, *Silt (ML)*; moist; trace fine sand; nonplastic fines; iron-oxide staining. Whidbey Formation (Qpnl)	25.5
Dense, gray-brown, *Silty Sand (SM)*; moist; fine sand. Whidbey Formation (Qpnf)	28.0

Samples: 1, 2, 3, 4, 5, 6, 7, 8, 9

Ground Water Depth, ft.

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*



CONTINUED NEXT SHEET

LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-4

June 2017 21-1-22288-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-5
Sheet 1 of 3

REV 3 - Approved for Submittal

DRAFT

MASTER_LOG_E 21-22288-040.GPJ SHAN_WIL.GDT 5/30/17 Log: AXT Rev: WTL Typ: LK

DRAFT

Total Depth:	61.5 ft.	Northing:	~ 316,902 ft.	Drilling Method:	Hollow Stem Auger	Hole Diam.:	12 in.
Top Elevation:	~ 119 ft.	Easting:	~ 1,272,234 ft.	Drilling Company:	Cascade Drilling	Rod Diam.:	8.75-in.
Vert. Datum:		Station:	~	Drill Rig Equipment:	CME 75	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Dense to hard, gray-brown, *Silt with Sand (ML)*; moist; fine sand; nonplastic to low plasticity fines; iron-oxide staining.
Whidbey Formation (Qpnl)

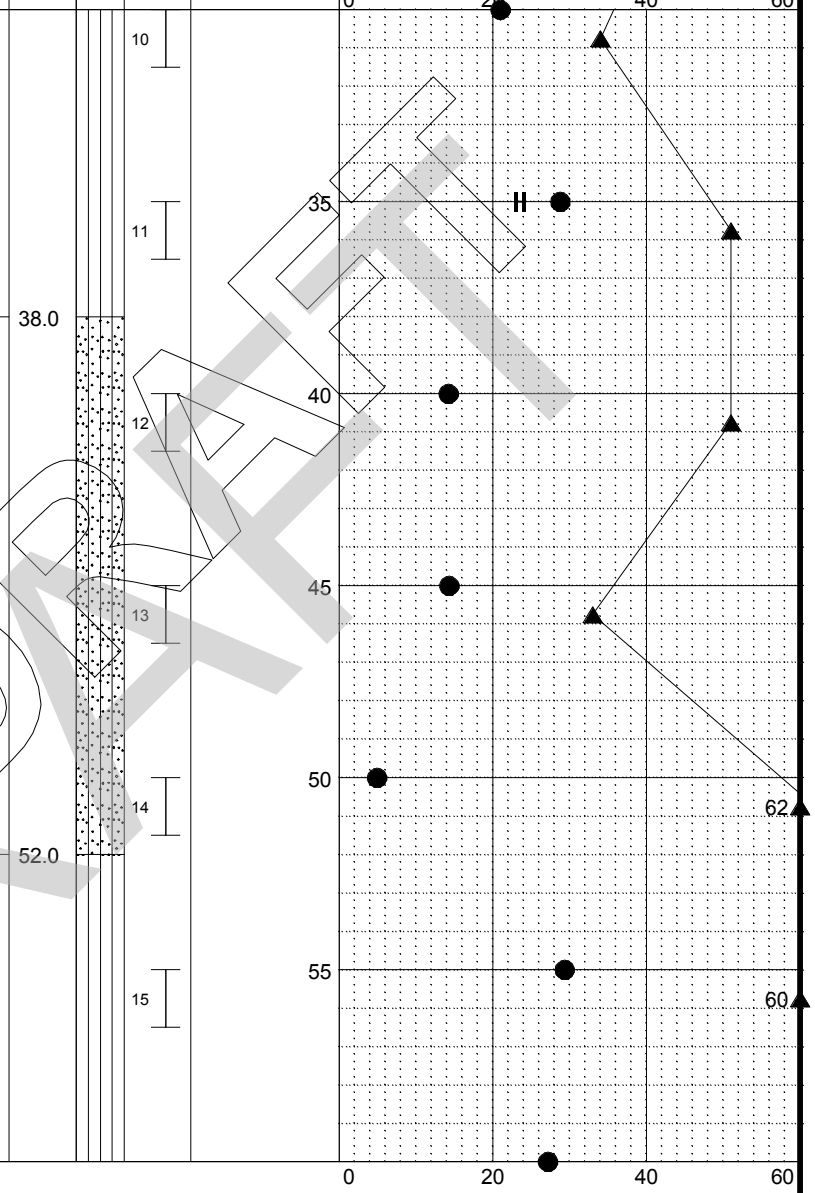
38.0

Dense to very dense, gray, *Silty Sand (SM)* to *Poorly Graded Sand with Silt (SP-SM)*; moist; fine sand; nonplastic fines.
Whidbey Formation (Qpnf)

52.0

Very dense, brown, *Silt (ML)*; moist; trace fine sand; nonplastic fines; iron-oxide staining.
Whidbey Formation (Qpnl)

CONTINUED NEXT SHEET



LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-4

June 2017 | 21-1-22288-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-5
Sheet 2 of 3

REV 3 - Approved for Submittal

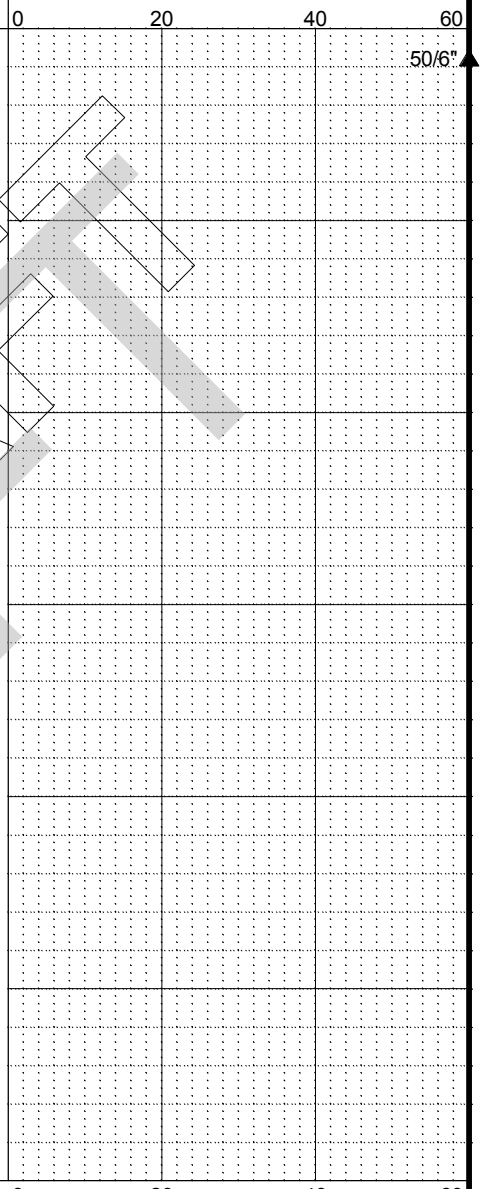
DRAFT

MASTER_LOG_E 21-22288-040.GPJ SHAN_WIL.GDT 5/30/17 Log: AXT Rev: WTL Typ: LK

DRAFT

Total Depth:	61.5 ft.	Northing:	~ 316,902 ft.	Drilling Method:	Hollow Stem Auger	Hole Diam.:	12 in.
Top Elevation:	~ 119 ft.	Easting:	~ 1,272,234 ft.	Drilling Company:	Cascade Drilling	Rod Diam.:	8.75-in.
Vert. Datum:		Station:	~	Drill Rig Equipment:	CME 75	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION	Depth, ft.	Symbol	Samples	Ground Water	Depth, ft.	PENETRATION RESISTANCE (blows/foot)
Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.						▲ Hammer Wt. & Drop: 140 lbs / 30 inches
			16			50/6" ▲
BOTTOM OF BORING COMPLETED 11/22/2016	61.5					



LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-4

June 2017 | 21-1-22288-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-5
Sheet 3 of 3

REV 3 - Approved for Submittal

DRAFT

MASTER_LOG_E 21-22288-040.GPJ SHAN_WIL.GDT 5/30/17 Log: AXT Rev: WTL Typ: LK

DRAFT

Total Depth:	41.5 ft.	Northing:	~ 316,963 ft.	Drilling Method:	Hollow Stem Auger	Hole Diam.:	12 in.
Top Elevation:	~ 94 ft.	Easting:	~ 1,272,526 ft.	Drilling Company:	Cascade Drilling	Rod Diam.:	8.75-in.
Vert. Datum:		Station:	~	Drill Rig Equipment:	CME 75	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

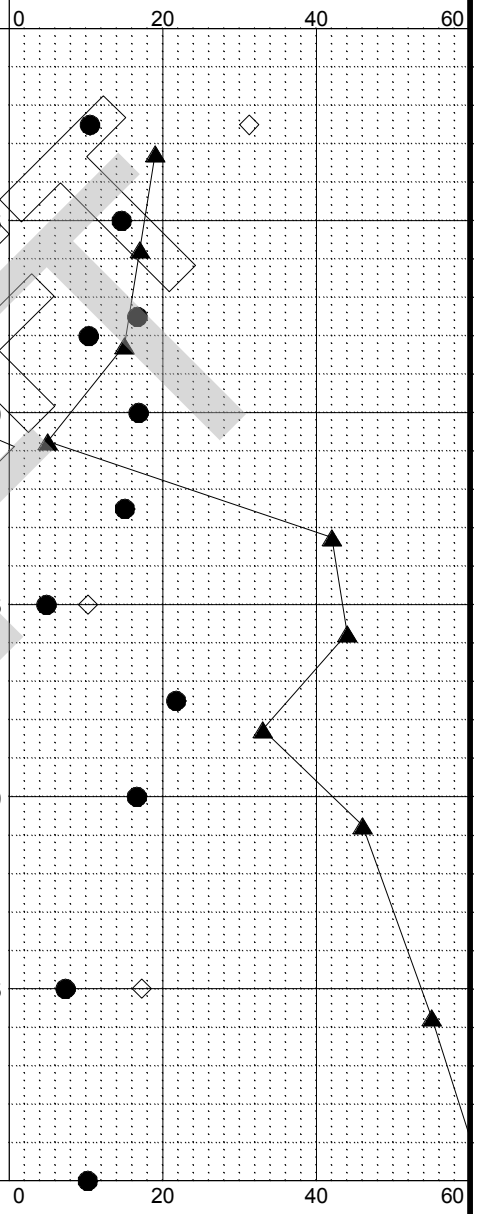
Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Description	Depth, ft.
3-inch Asphalt.	0.3
2-inch Road Base.	0.4
Medium dense, brown, *Silty Sand (SM)*; moist; fine sand; iron-oxide staining. Whidbey Formation (Qpnf)	7.0
Medium dense, brown, *Silty Sand (SM)* interbedded with *Silt (ML)*; moist; fine sand; nonplastic fines. Whidbey Formation (Qpnf)	8.5
Medium dense, gray-brown, *Poorly Graded Sand with Silt (SP-SM)*; moist; fine sand; silt pockets. Whidbey Formation (Qpnf)	9.5
Loose to dense, gray-brown, *Silty Sand (SM)*; moist; fine sand; nonplastic fines interbedded with layers of fine sandy silt. Whidbey Formation (Qpnf)	15.0
Dense, gray-brown, *Poorly Graded Sand with Silt (SP-SM)*; moist; fine sand. Whidbey Formation (Qpnf)	17.0
Medium dense, gray-brown, *Silty Sand (SM)* interbedded with *Silt (ML)*; moist; fine sand; nonplastic fines. Whidbey Formation (Qpnf)	19.5
Dense to very dense, gray-brown, *Silty Sand (SM)*; moist; fine sand; iron-oxide staining. Whidbey Formation (Qpnf)	

Symbol | Samples | Ground Water

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*



CONTINUED NEXT SHEET

LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

◇ % Fines (<0.075mm)

● % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-5

June 2017 | 21-1-22288-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-6
Sheet 1 of 2

REV 3 - Approved for Submittal

DRAFT

MASTER LOG_E 21-22288-040.GPJ SHAN WIL.GDT 5/30/17 Log: AXT Rev: WTL Typ: LK

DRAFT

Total Depth:	41.5 ft.	Northing:	~ 316,963 ft.	Drilling Method:	Hollow Stem Auger	Hole Diam.:	12 in.
Top Elevation:	~ 94 ft.	Easting:	~ 1,272,526 ft.	Drilling Company:	Cascade Drilling	Rod Diam.:	8.75-in.
Vert. Datum:		Station:	~	Drill Rig Equipment:	CME 75	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

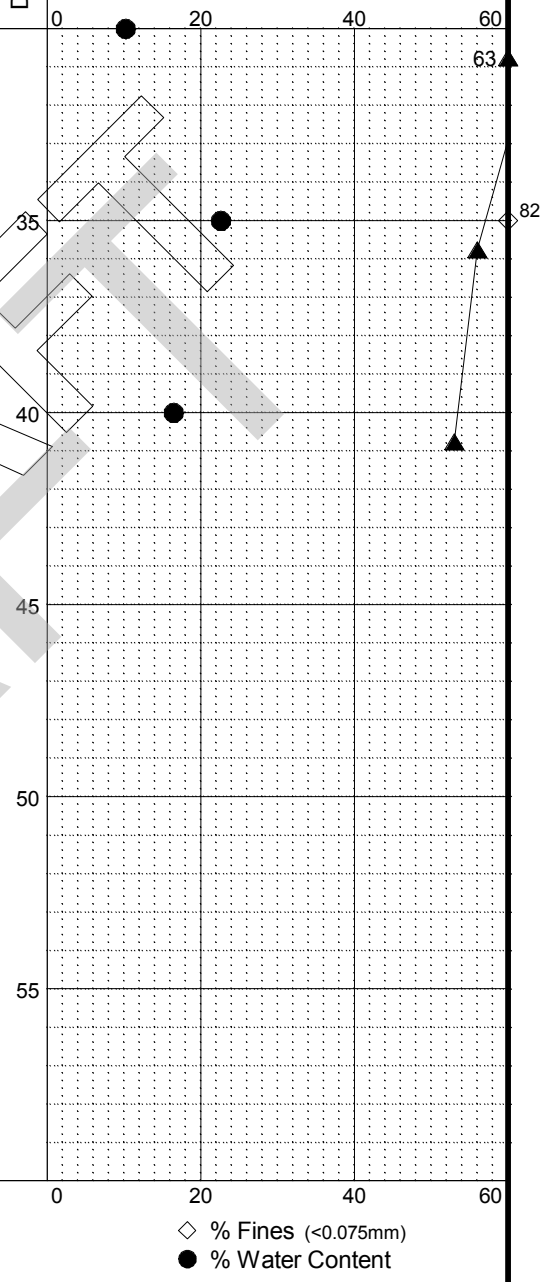
Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soil Description	Depth, ft.
Very dense, gray-brown, *Silt (ML)*; moist; trace fine sand; nonplastic fines; iron-oxide staining. Whidbey Formation (Qpnl)	33.0
Very dense, brown, *Silty Sand (SM)*; moist; fine sand; interbeds of fine sandy silt; nonplastic fines. Whidbey Formation (Qpnf)	37.0
BOTTOM OF BORING COMPLETED 11/23/2016	41.5

Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*



LEGEND

* Sample Not Recovered

⌶ 2.0" O.D. Split Spoon Sample

◇ % Fines (<0.075mm)

● % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-5

June 2017 | 21-1-22288-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-6
Sheet 2 of 2

REV 3 - Approved for Submittal

DRAFT

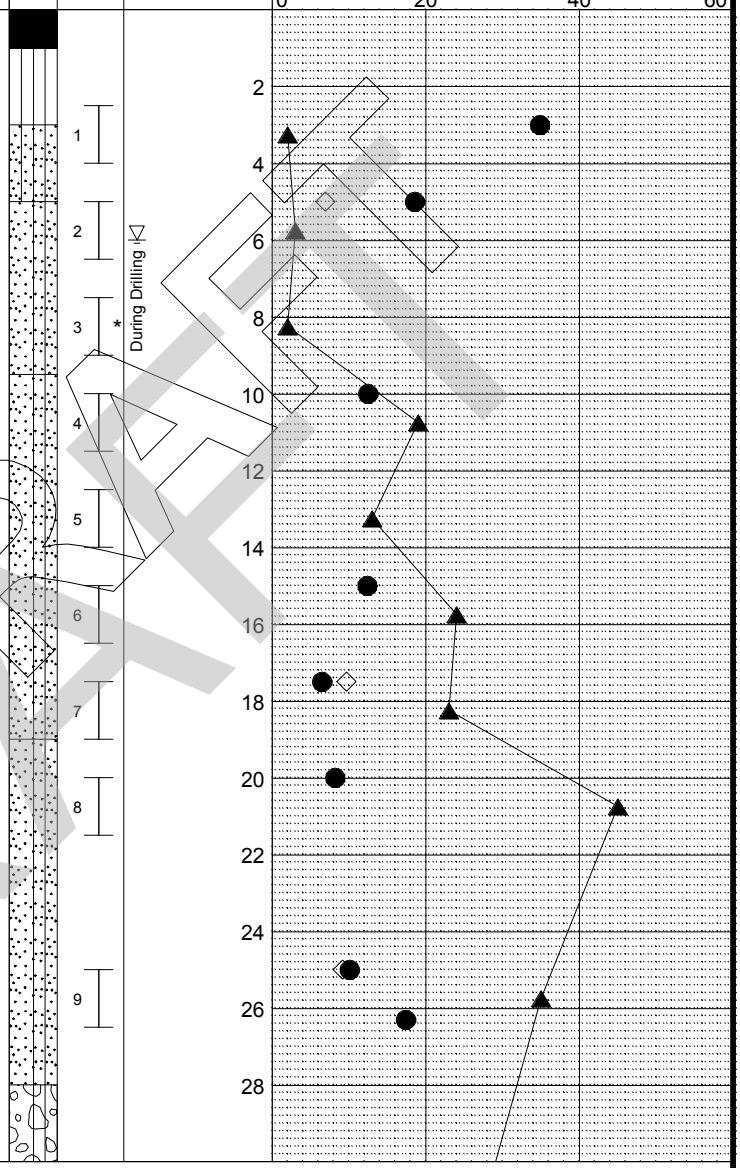
DRAFT

Total Depth:	130.8 ft.	Northing:	~ 317,238 ft.	Drilling Method:	Mud Rotary	Hole Diam.:	5 in.
Top Elevation:	~ 13 ft.	Easting:	~ 1,271,914 ft.	Drilling Company:	Holt Services, Inc.	Rod Diam.:	NWJ 2-5/8"
Vert. Datum:		Station:	~	Drill Rig Equipment:	Mobile Drill B57	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Description	Depth, ft.
Asphalt and subgrade gravel. (Fill)	1.0
Soft, dark brown, *Silt (ML)* and *Organic Silt (OL)*; moist to wet; few fine sand; little organics. Alluvium (Ha)/Colluvium (Hc)	3.0
Very loose, gray, *Silty Sand (SM)*; moist; mostly fine sand; little wood and organics. Alluvium (Ha)/Colluvium (Hc)	5.0
Very loose, dark gray-brown, *Poorly Graded Sand with Silt and Gravel (SP-SM)*; moist to wet; subrounded gravel; fine to coarse sand, mostly fine sand; few wood and organics. Alluvium (Ha)/Colluvium (Hc) - Wood fragments in cuttings from about 7 to 7.5 feet.	9.5
Medium dense, gray, *Poorly Graded Sand with Silt and Gravel (SP-SM)*; wet; fine to coarse, subrounded gravel; fine to course sand; trace to few wood and organics. Alluvium (Ha)/Colluvium (Hc)	19.0
Medium dense to dense, gray, *Poorly Graded Sand with Silt and Gravel (SP-SM)*; wet; fine to coarse gravel and sand; low plasticity fines; few interbeds of fine, silty sand; slight diamict texture around 21 and 26 feet; few organics and wood. Alluvium (Ha)/Colluvium (Hc) - Blow counts in this layer may be artificially high due to presence of gravel.	28.0



CONTINUED NEXT SHEET

LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

Ground Water Level ATD

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-6

June 2017 | 21-1-22888-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-7
Sheet 1 of 5

REV 3 - Approved for Submittal

DRAFT

MASTER_LOG_E 21-22167.GPJ SHAN_WIL.GDT 5/29/17 Log: SAW Rev: SAW Typ: LKN

Total Depth:	130.8 ft.	Northing:	~ 317,238 ft.	Drilling Method:	Mud Rotary	Hole Diam.:	5 in.
Top Elevation:	~ 13 ft.	Easting:	~ 1,271,914 ft.	Drilling Company:	Holt Services, Inc.	Rod Diam.:	NWJ 2-5/8"
Vert. Datum:		Station:	~	Drill Rig Equipment:	Mobile Drill B57	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Medium dense to very dense, gray, *Poorly Graded Gravel with Silt and Sand (GP-GM)*; wet; fine to coarse gravel and sand; low plasticity fines; few brown organics; few cobbles below 34 feet based on drill action.
Alluvium (Ha)/Colluvium (Hc)

- Few organics at about 35.5 feet.

- Blow counts in this layer may be artificially high due to presence of gravel.

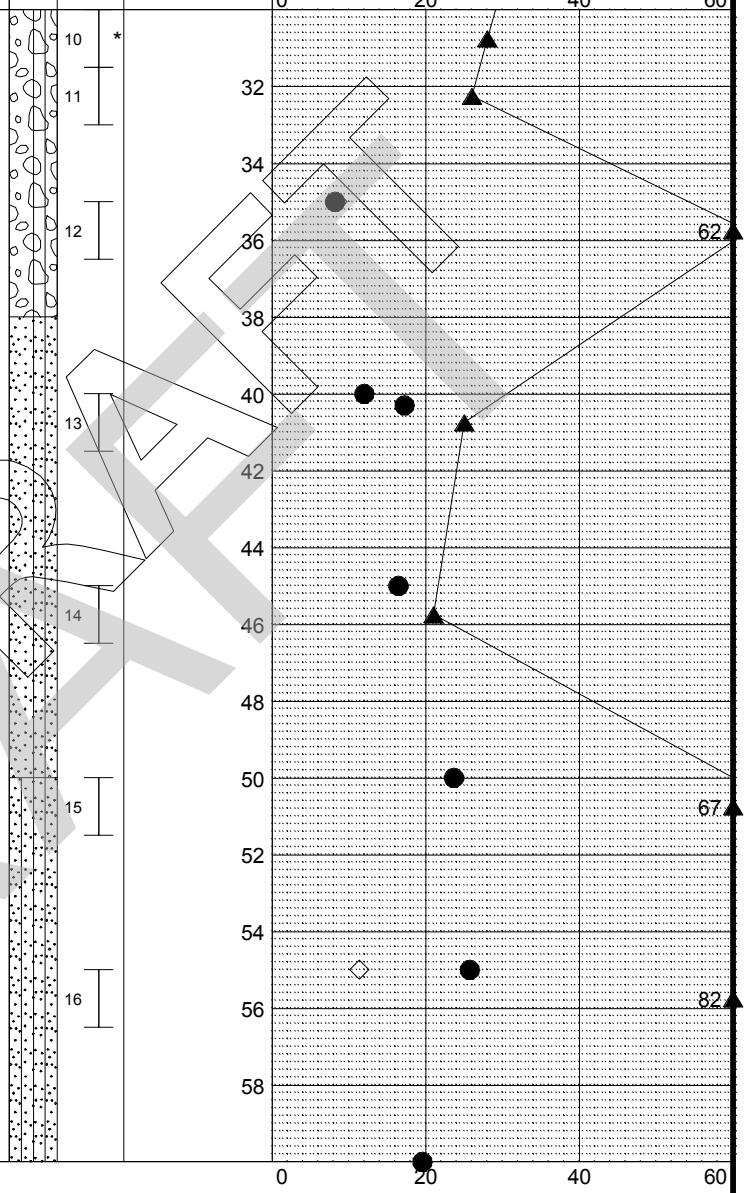
38.0

Medium dense, gray, *Poorly Graded Sand with Silt and Gravel (SP-SM)*; moist to wet; few fine gravel; fine to coarse sand; low plasticity fines; few organics; few 3-inch interbedded blue-gray, gravelly silt and silty sand with low to medium plasticity fines.
Alluvium (Ha)/Colluvium (Hc)

50.0

Very dense, gray, *Silty Sand (SM)*; wet; fine to medium sand; nonplastic to low plasticity fines; few fine organics and silt partings to 56.5 feet.
Whidbey Formation (Qpnf)

CONTINUED NEXT SHEET



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-6

June 2017 | 21-1-22888-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-7
Sheet 2 of 5

REV 3 - Approved for Submittal

DRAFT

MASTER_LOG_E 21-22167.GPJ SHAN_WIL.GDT 5/29/17 Log: SAW Rev: SAW Typ: LKN

DRAFT

Total Depth:	130.8 ft.	Northing:	~ 317,238 ft.	Drilling Method:	Mud Rotary	Hole Diam.:	5 in.
Top Elevation:	~ 13 ft.	Easting:	~ 1,271,914 ft.	Drilling Company:	Holt Services, Inc.	Rod Diam.:	NWJ 2-5/8"
Vert. Datum:		Station:	~	Drill Rig Equipment:	Mobile Drill B57	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

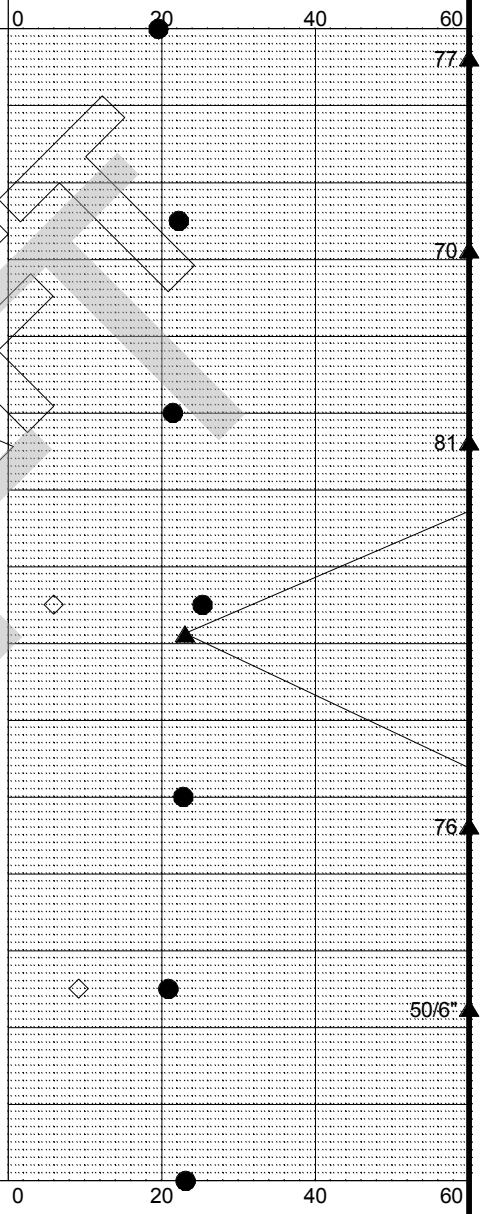
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



Medium dense, gray, *Poorly Graded Sand with Silt (SP-SM)*; wet; few fine gravel; fine to coarse sand; trace fines.
Whidbey Formation (Qpnf)

75.0

Very dense, gray, *Poorly Graded Sand with Silt (SP-SM)*; wet; fine to medium sand, mostly fine sand; low plasticity to nonplastic fines.
Whidbey Formation (Qpnf)

78.0

CONTINUED NEXT SHEET

LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-6

June 2017 | 21-1-22888-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-7
Sheet 3 of 5

REV 3 - Approved for Submittal

DRAFT

MASTER_LOG_E 21-22167.GPJ SHAN_WIL.GDT 5/29/17 Log: SAW Rev: SAW Typ: LKN

DRAFT

Total Depth:	130.8 ft.	Northing:	~ 317,238 ft.	Drilling Method:	Mud Rotary	Hole Diam.:	5 in.
Top Elevation:	~ 13 ft.	Easting:	~ 1,271,914 ft.	Drilling Company:	Holt Services, Inc.	Rod Diam.:	NWJ 2-5/8"
Vert. Datum:		Station:	~	Drill Rig Equipment:	Mobile Drill B57	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*

Very dense, gray, *Sandy Silt (ML)*; moist; fine sand; nonplastic fines; few silt partings; 1/8- to 1/4-inch fine sand interbeds.
Whidbey Formation (Qpnl)

90.8

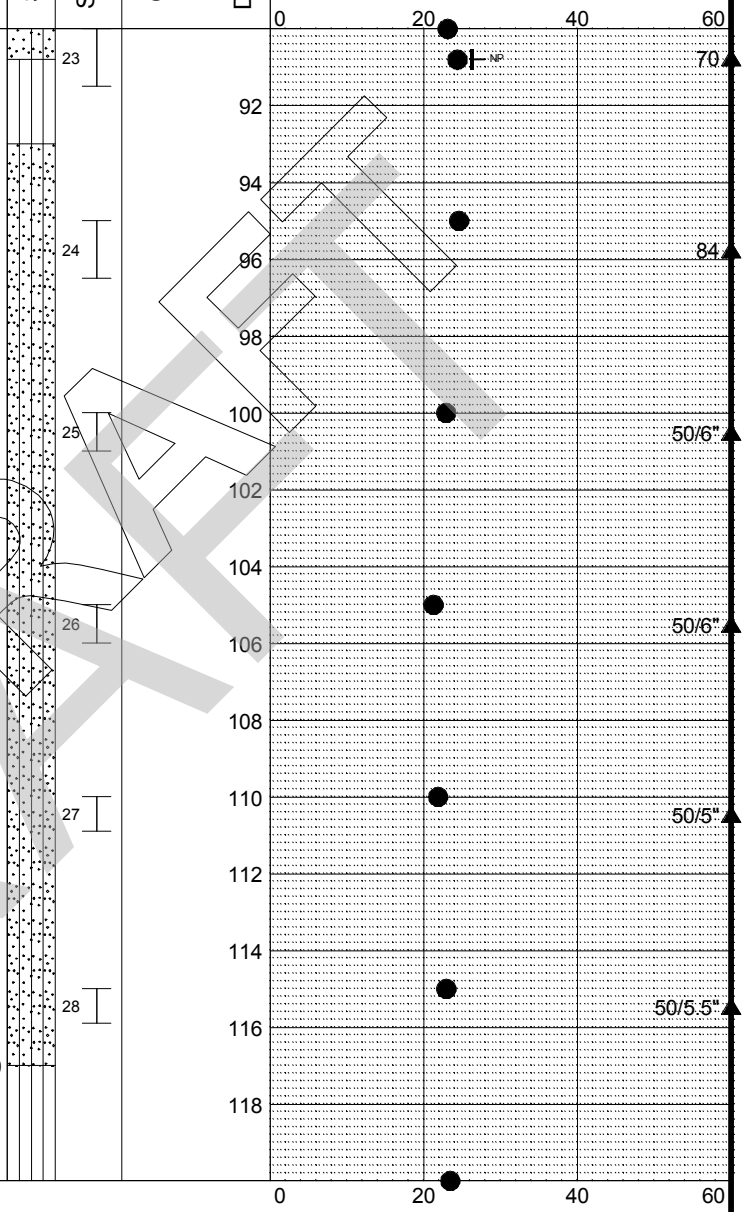
Very dense, gray, *Silty Sand (SM)*; moist to wet; fine sand; nonplastic fines.
Whidbey Formation (Qpnf)

93.0

- Silt partings, trace organics, and slight iron-oxide staining below 110.5 feet.

Very dense, gray, *Silt with Sand (ML)*; moist; fine sand; nonplastic to low plasticity fines; fine sand laminations.

117.0



CONTINUED NEXT SHEET

LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

Ground Water Level ATD

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-6

June 2017 | 21-1-22888-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-7
Sheet 4 of 5

REV 3 - Approved for Submittal

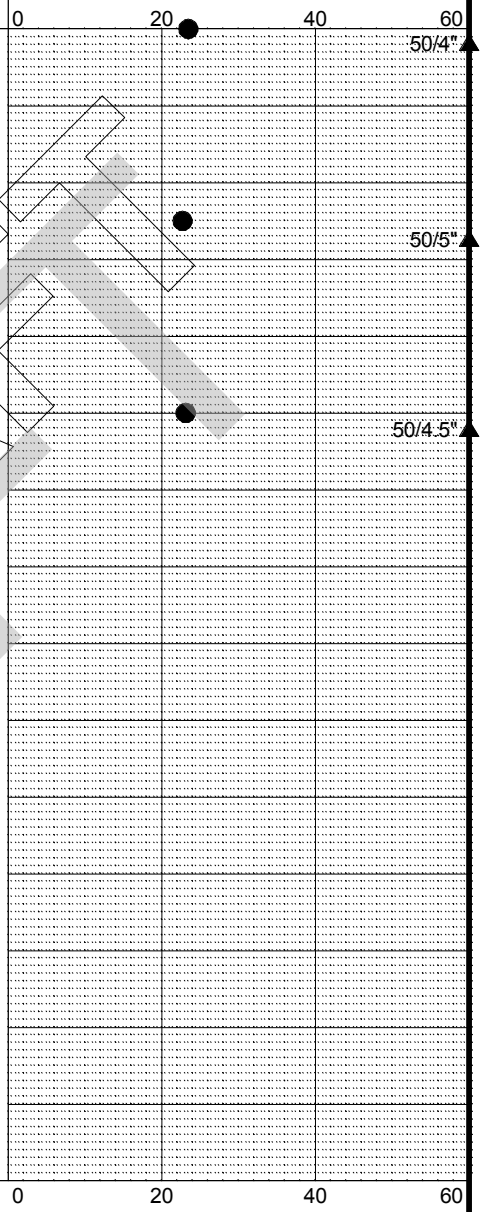
DRAFT

MASTER_LOG_E 21-22167.GPJ SHAN_WIL.GDT 5/29/17 Log: SAW Rev: SAW Typ: LKN

DRAFT

Total Depth:	130.8 ft.	Northing:	~ 317,238 ft.	Drilling Method:	Mud Rotary	Hole Diam.:	5 in.
Top Elevation:	~ 13 ft.	Easting:	~ 1,271,914 ft.	Drilling Company:	Holt Services, Inc.	Rod Diam.:	NWJ 2-5/8"
Vert. Datum:		Station:	~	Drill Rig Equipment:	Mobile Drill B57	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION	Depth, ft.	Samples	Ground Water	Depth, ft.	PENETRATION RESISTANCE (blows/foot)
Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.					▲ Hammer Wt. & Drop: 140 lbs / 30 inches
Whidbey Formation (Qpnl)		29		122	50/4"
		30		124, 126	50/5"
		31		128, 130	50/4.5"
BOTTOM OF BORING COMPLETED 4/14/2017	130.8			132, 134, 136, 138, 140, 142, 144, 146, 148	



LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

Ground Water Level ATD

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-6

June 2017 21-1-22888-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-7
Sheet 5 of 5

REV 3 - Approved for Submittal

DRAFT

MASTER_LOG_E 21-22167.GPJ SHAN WIL.GDT 5/29/17 Log: SAW Rev: SAW Typ: LKN

DRAFT

Total Depth:	120 ft.	Northing:	~ 317,363 ft.	Drilling Method:	HSA and Mud Rotary	Hole Diam.:	6 in.
Top Elevation:	~ 15 ft.	Easting:	~ 1,271,912 ft.	Drilling Company:	Holt Services, Inc.	Rod Diam.:	NWJ 2-5/8"
Vert. Datum:		Station:	~	Drill Rig Equipment:	Mobile Drill B57	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Soft to loose, brown and gray, mixed *Sandy Silt (ML)* and *Poorly Graded Sand with Silt (SP-SM)*; wet below 2 feet; few pockets and layers of fine to coarse gravel and sand; low to medium plasticity fines; trace roots, organics, and charcoal; trace metal and glass debris.
Fill (Hf)

4.5

Very loose to very soft, gray to gray-brown, interbedded, *Silt (ML)* and *Silty Sand (SM)*; wet; 2- to 6-inch-thick sand interbeds with trace fine gravel; fine to coarse sand; nonplastic to low plasticity fines with trace to few brown organics.
Alluvium (Ha)/Colluvium (Hc)

- Loose, silty sand interbedded from about 8 to 9 feet.

10.8

Very soft, gray to gray-brown, *Silt (ML)* ; wet; fine sand; low plasticity fines; trace organics.
Alluvium (Ha)/Colluvium (Hc)

15.0

Medium dense, gray, *Poorly Graded Sand with Silt and Gravel (SP-SM)*; wet; fine to coarse gravel and sand; low plasticity fines.
Alluvium (Ha)/Colluvium (Hc)

- Intermittent gravel layers below 18.5 feet.

24.0

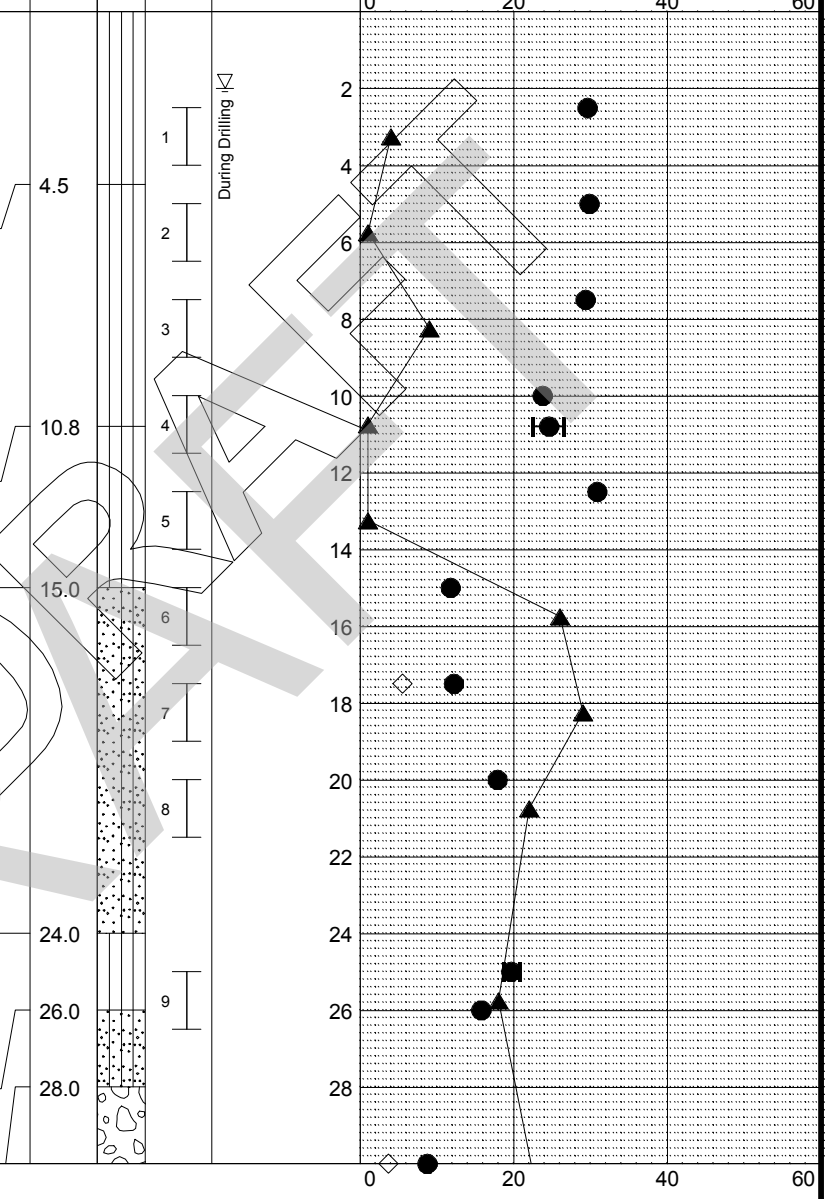
Very stiff, gray and green-gray, *Silt with Sand (ML)*; wet; few fine to coarse gravel and sand; low plasticity fines; slight diamict texture; few 1/4-inch-thick sand interbeds; trace organics.
Alluvium (Ha)/Colluvium (Hc)

26.0

Medium dense, gray, *Silty Sand (SM)*; wet; fine sand; low plasticity fines.

28.0

CONTINUED NEXT SHEET



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-7

June 2017 | 21-1-22888-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-8
Sheet 1 of 4

REV 3 - Approved for Submittal

DRAFT

MASTER_LOG_E 21-22167.GPJ SHAN_WIL.GDT 5/29/17 Log: SAW Rev: SAW Typ: LKN

DRAFT

Total Depth:	120 ft.	Northing:	~ 317,363 ft.	Drilling Method:	HSA and Mud Rotary	Hole Diam.:	6 in.
Top Elevation:	~ 15 ft.	Easting:	~ 1,271,912 ft.	Drilling Company:	Holt Services, Inc.	Rod Diam.:	NWJ 2-5/8"
Vert. Datum:		Station:	~	Drill Rig Equipment:	Mobile Drill B57	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Alluvium (Ha)/Colluvium (Hc)

Medium dense, gray, *Poorly Graded Gravel with Sand (GP)*; wet; fine to coarse gravel and sand; low plasticity fines; trace organics.
Alluvium (Ha)/Colluvium (Hc)

- 1-inch-long, brown, organic seam at about 36 feet.

37.0

Medium dense to very dense, gray, *Poorly Graded Sand with Silt and Gravel (SP-SM)* to *Poorly Graded Gravel with Silt and Sand (GP-GM)*; wet; fine to coarse gravel and sand; few pockets of low plasticity fines; sand with intermittent layers of gravel.
Alluvium (Ha)/Colluvium (Hc)

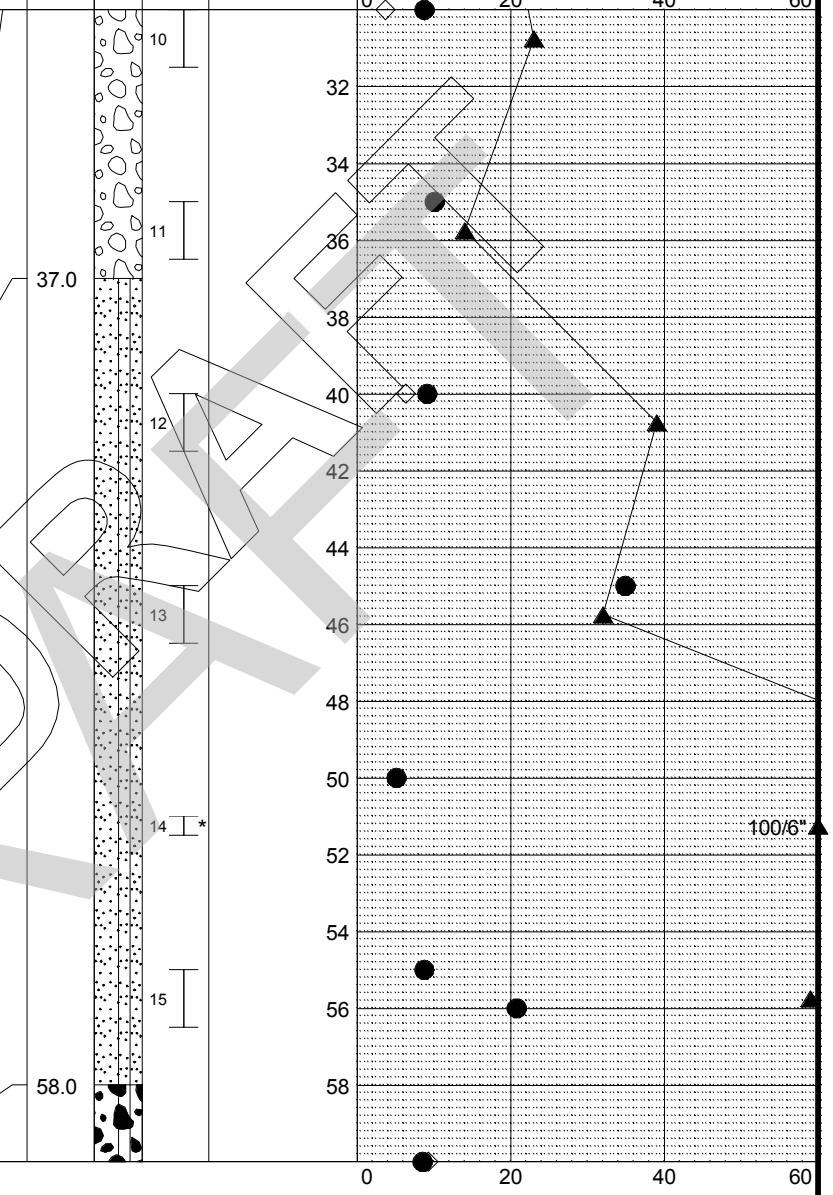
- 6-inch-thick sand interbed at about 45 feet.

- Fine, silty sand interbedded with trace organics at about 56 feet.
- Blow counts in this layer may be artificially high due to presence of gravel.

58.0

Medium dense to very dense, gray, *Well-Graded Gravel with Silt and Sand (GW-GM)*; wet; fine to

CONTINUED NEXT SHEET



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
Ground Water Level ATD
◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-7

June 2017 | 21-1-22888-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-8
Sheet 2 of 4

REV 3 - Approved for Submittal

DRAFT

MASTER_LOG_E 21-22167.GPJ SHAN_WIL.GDT 5/29/17 Log: SAW Rev: SAW Typ: LKN

DRAFT

Total Depth:	120 ft.	Northing:	~ 317,363 ft.	Drilling Method:	HSA and Mud Rotary	Hole Diam.:	6 in.
Top Elevation:	~ 15 ft.	Easting:	~ 1,271,912 ft.	Drilling Company:	Holt Services, Inc.	Rod Diam.:	NWJ 2-5/8"
Vert. Datum:		Station:	~	Drill Rig Equipment:	Mobile Drill B57	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

coarse gravel and sand; low plasticity fines; diamict texture.
Alluvium (Ha)/Colluvium (Hc)

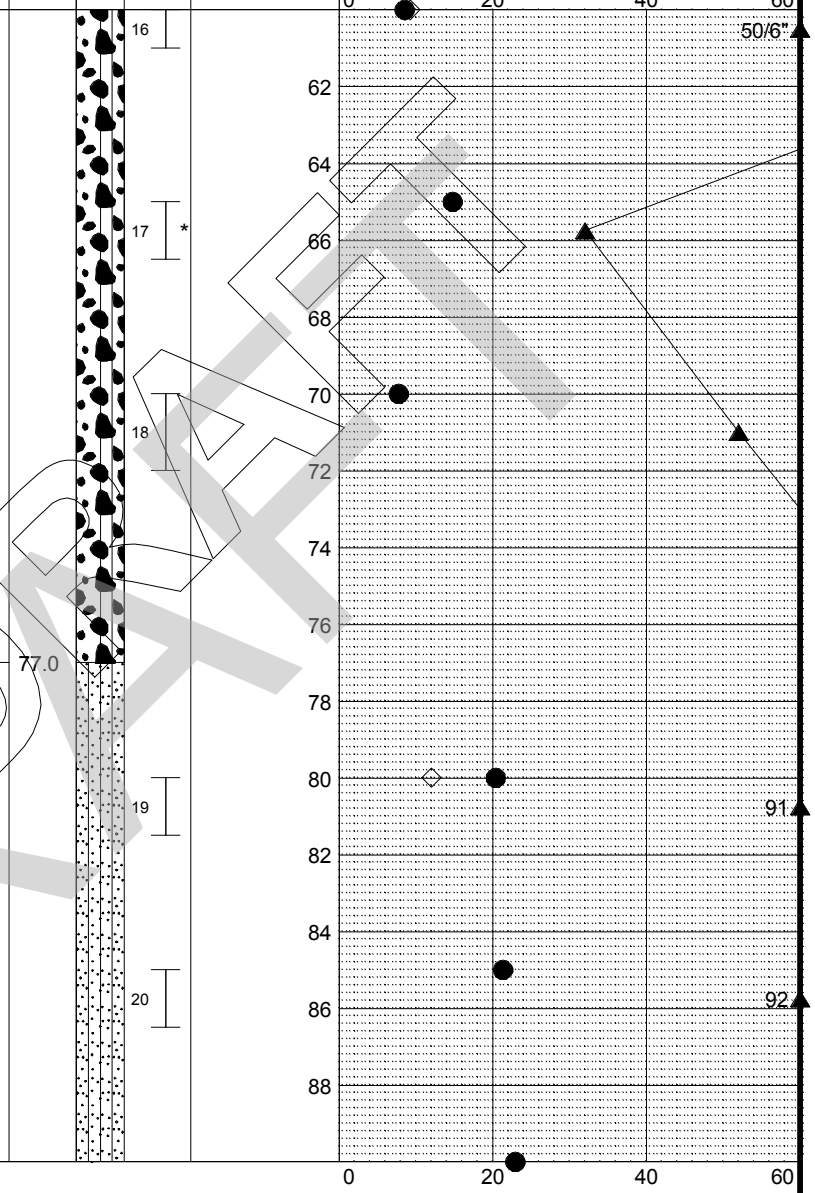
- 6-inch-thick fine, silty sand interbedded at about 66 feet.

- Boulder drilled through from about 72 to 77 feet.

- Blow counts in this layer may be artificially high due to presence of gravel.

77.0

Very dense, gray, *Silty Sand (SM)*; wet; fine to medium sand; low plasticity fines; silt partings; trace fine organics below 110 feet.
Whidbey Formation (Qpnf)



CONTINUED NEXT SHEET

LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-7

June 2017 | 21-1-22888-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-8
Sheet 3 of 4

REV 3 - Approved for Submittal

DRAFT

MASTER_LOG_E 21-22167.GPJ SHAN_WIL.GDT 5/29/17 Log: SAW Rev: SAW Typ: LKN

DRAFT

Total Depth:	120 ft.	Northing:	~ 317,363 ft.	Drilling Method:	HSA and Mud Rotary	Hole Diam.:	6 in.
Top Elevation:	~ 15 ft.	Easting:	~ 1,271,912 ft.	Drilling Company:	Holt Services, Inc.	Rod Diam.:	NWJ 2-5/8"
Vert. Datum:		Station:	~	Drill Rig Equipment:	Mobile Drill B57	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

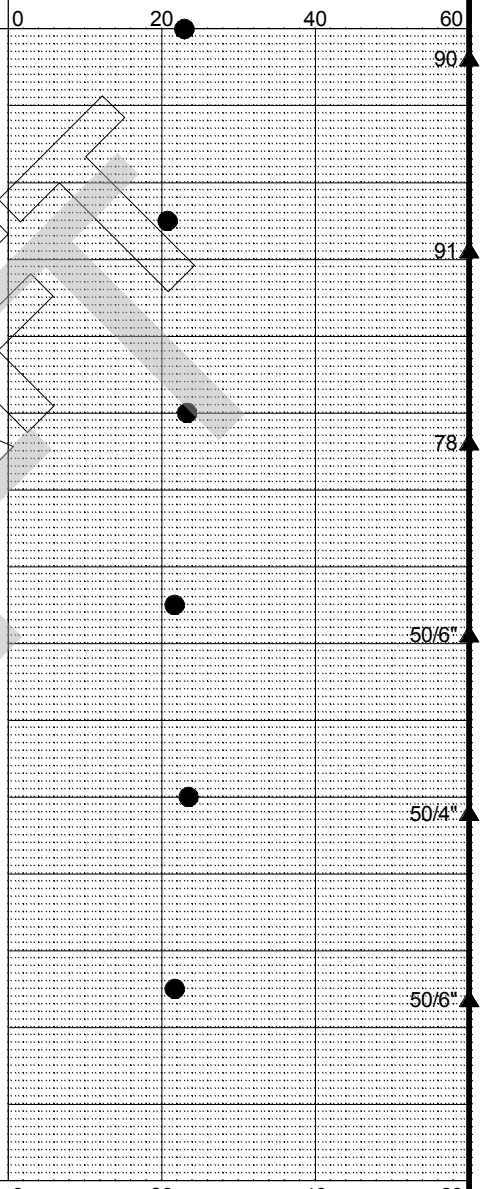
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches



- Boring drilled to 120 feet, but sampled to 115 feet.

115.5

BOTTOM OF BORING
COMPLETED 4/21/2017

DRAFT

LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

Ground Water Level ATD

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-7

June 2017 | 21-1-22888-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-8
Sheet 4 of 4

REV 3 - Approved for Submittal

MASTER_LOG_E 21-22167.GPJ SHAN_WIL.GDT 5/29/17 Log: SAW Rev: SAW Typ: LKN

DRAFT

Total Depth:	26.5 ft.	Northing:	~ 317,298 ft.	Drilling Method:	Hollow Stem Auger	Hole Diam.:	4 in.
Top Elevation:	~ 24 ft.	Easting:	~ 1,272,253 ft.	Drilling Company:	Holt Services, Inc.	Rod Diam.:	NWJ 2-5/8"
Vert. Datum:		Station:	~	Drill Rig Equipment:	Mobile Drill B57	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches

Gray, angular trail *Gravel (GP)*.
Fill (Hf)

1.0

Very loose, brown, *Silty Sand (SM)*; moist; wet below 5 feet; few fine gravel; fine to medium sand; low plasticity fines; few organics and wood; iron-oxide staining.
Alluvium (Ha)

- 2-inch thick, gray, poorly graded sand layer at about 6 feet.

7.0

Soft to stiff, gray to green-gray, *Lean Clay with Sand (CL)*; moist to wet; little fine gravel; fine to coarse sand; low plasticity fines; interbedded sand; trace pockets of medium plasticity fines; few organics and wood; iron-oxide staining; diamict texture.
Alluvium (Ha)/Colluvium (Hc)

15.3

Medium dense, gray, *Silty Sand (SM)*; wet; few fine gravel; fine to medium sand; low plasticity fines; few brown organics; slight diamict texture; iron-oxide staining below 16 feet.
Alluvium (Ha)/Colluvium (Hc)

16.5

Medium dense to dense, brown, *Sandy Silt (ML)*; moist; fine sand; nonplastic to low plasticity fines; interbedded sand; iron-oxide staining.
Colluvium (Hc)/Whidbey Formation (Qpnf)

20.0

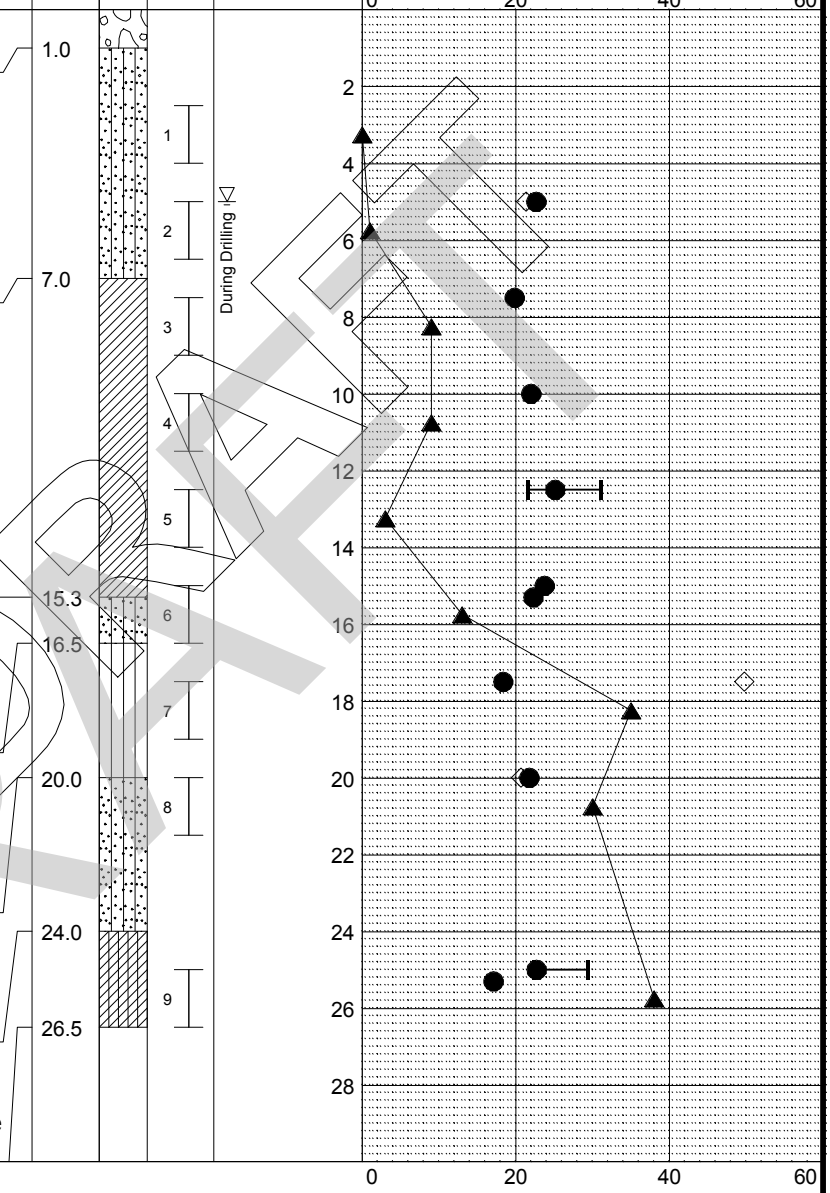
Medium dense to dense, gray-brown, *Silty Sand (SM)*; wet; fine to medium sand; nonplastic fines.
Colluvium (Hc)/Whidbey Formation (Qpnf)

24.0

26.5

Dense to hard, gray and gray-green, interbedded, *Silty Clay (CL-ML)* and *Silty Sand (SM)*; moist to wet; few fine gravel; fine to coarse

CONTINUED NEXT SHEET



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-8

June 2017 | 21-1-22888-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-9
Sheet 1 of 2

REV 3 - Approved for Submittal

DRAFT

MASTER_LOG_E 21-22167.GPJ SHAN_WIL.GDT 5/29/17 Log: SAW Rev: SAW Typ: LKN

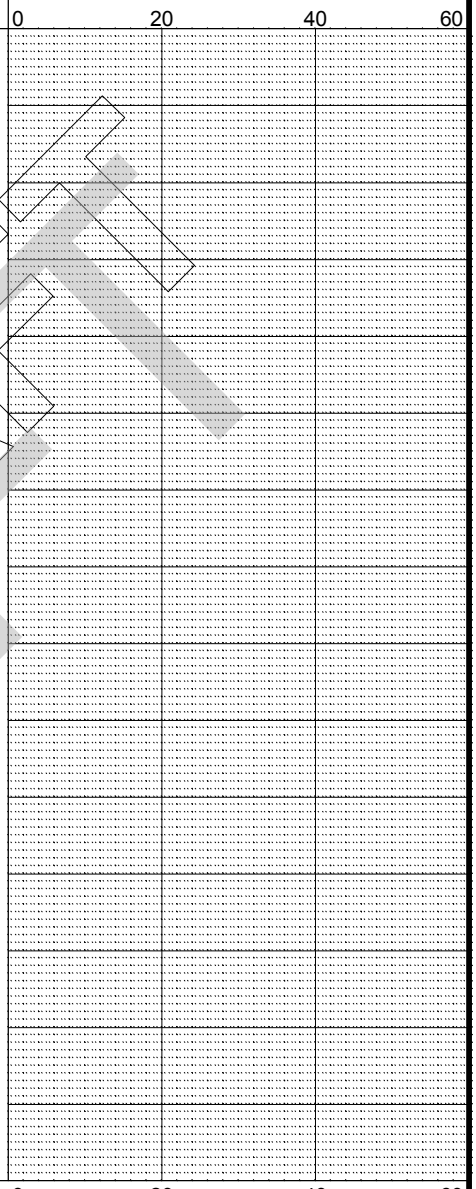
DRAFT

Total Depth:	26.5 ft.	Northing:	~ 317,298 ft.	Drilling Method:	Hollow Stem Auger	Hole Diam.:	4 in.
Top Elevation:	~ 24 ft.	Easting:	~ 1,272,253 ft.	Drilling Company:	Holt Services, Inc.	Rod Diam.:	NWJ 2-5/8"
Vert. Datum:		Station:	~	Drill Rig Equipment:	Mobile Drill B57	Hammer Type:	Automatic
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION	Depth, ft.	Symbol	Samples	Ground Water	Depth, ft.
Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.					
sand; low plasticity fines; slight diamict texture; 3-inch thick sand layer at about 25.3 feet. Alluvium (Ha)/Colluvium (Hc)					
BOTTOM OF BORING COMPLETED 4/21/2017					

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*



DRAFT

LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

Ground Water Level ATD

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING MB-8

June 2017 | 21-1-22888-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-9
Sheet 2 of 2

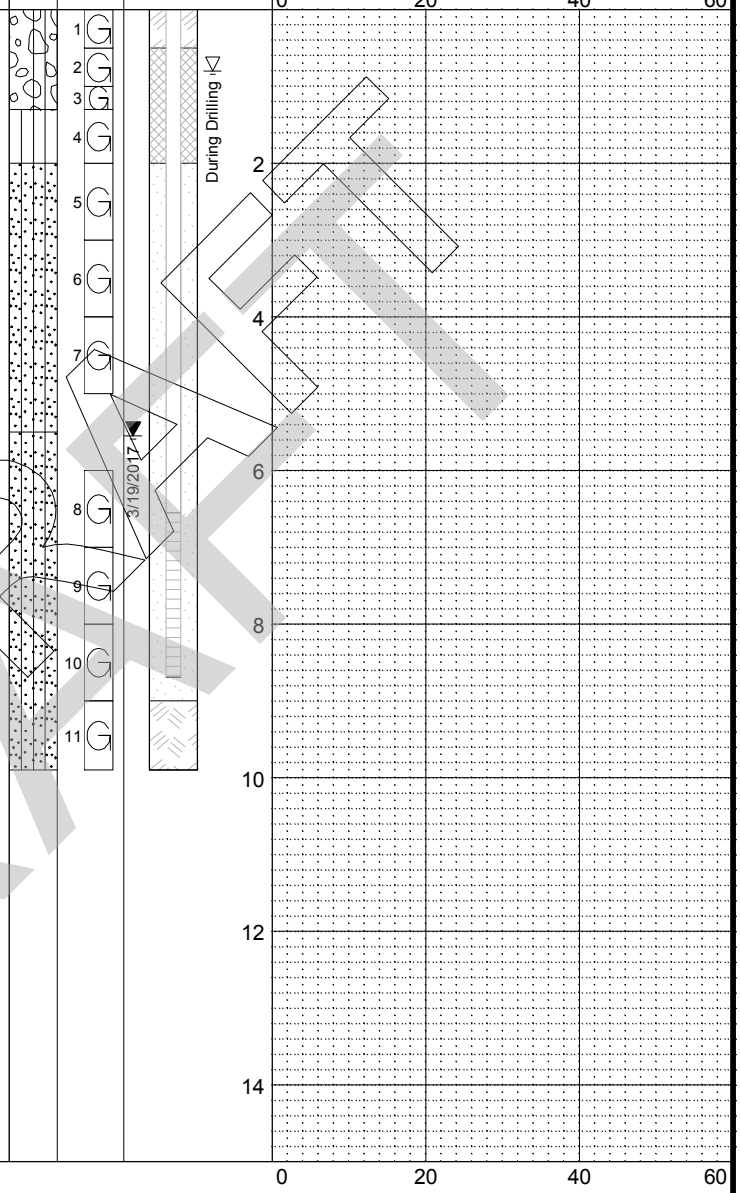
REV 3 - Approved for Submittal

MASTER_LOG_E 21-22167.GPJ SHAN_WIL.GDT 5/29/17 Log: SAW Rev: SAW Typ: LKN

DRAFT

Total Depth:	9.9 ft.	Northing:	~ 317,086 ft.	Drilling Method:	Hand Auger	Hole Diam.:	4 in.
Top Elevation:	~ 39 ft.	Easting:	~ 1,272,729 ft.	Drilling Company:	Shannon & Wilson	Rod Diam.:	
Vert. Datum:		Station:	~	Drill Rig Equipment:		Hammer Type:	
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION *Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.*	Depth, ft.
Dark brown, *Poorly Graded Gravel with Silt and Sand (GP-GM)*; moist; some fine to coarse sand; few nonplastic to low plasticity fines; few organics; rounded to subangular. Fill (Hf)	1.3
- Wet below 0.8 foot.	2.0
Gray and brown, *Sandy Silt/Silty Sand (ML/SM)*; moist to wet; low plasticity fines; few rounded to subangular gravels; fine to medium sand. Fill (Hf)	
Brown, *Silty Sand (SM)*; moist; trace rounded to subrounded, fine gravel; fine to medium sand; little nonplastic fines; trace organics. Fill/Alluvium (Hf/Ha)	5.5
Gray-brown and gray, iron oxide-stained, *Silty Sand (SM)*; wet; trace rounded to subangular, fine gravel; little to some nonplastic to low plasticity fines; few clasts of gray, sandy silt; trace clasts of tan, blocky clay. Alluvium/Colluvium (Ha/Hc)	
- Interlayered with gray, iron oxide-stained, sandy silt below 9 feet.	
BOTTOM OF BORING COMPLETED 3/16/2017	9.9



DRAFT

LEGEND

- * Sample Not Recovered
- Grab Sample
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD
- Ground Water Level in Well

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING HB-1

June 2017 | 21-1-22288-060

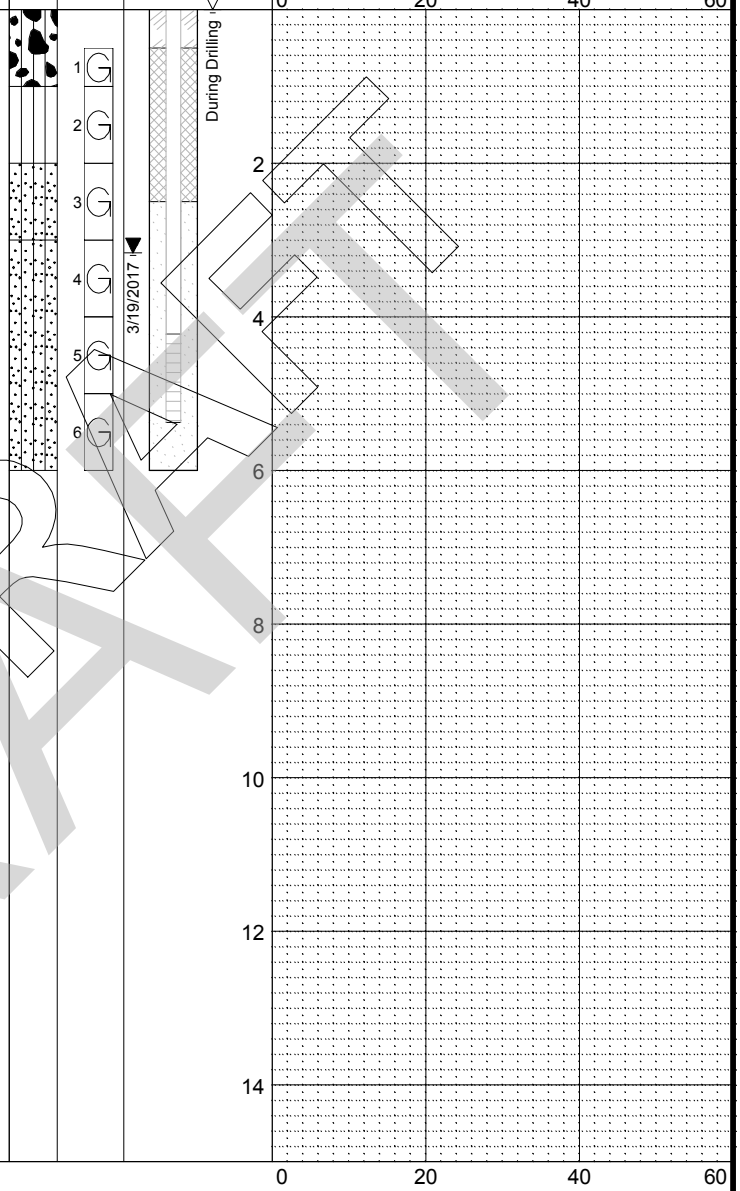
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-10

REV 3 - Approved for Submittal

Total Depth:	6 ft.	Northing:	~ 317,102 ft.	Drilling Method:	Hand Auger	Hole Diam.:	4 in.
Top Elevation:	~ 30 ft.	Easting:	~ 1,272,470 ft.	Drilling Company:	Shannon & Wilson	Rod Diam.:	
Vert. Datum:		Station:	~	Drill Rig Equipment:		Hammer Type:	
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION *Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.*	Depth, ft.
Grass at surface. Brown, *Silty Gravel with Sand and Cobbles (GM)*; wet; some angular quarry spall cobbles; nonplastic fines. Fill (Hf)	1.0
Gray-brown and gray, *Sandy Silt with Gravel (ML)*; most; trace organics; low plasticity fines; trace mica. Fill (Hf)	2.0
Gray-brown, *Silty Sand with Gravel and Cobbles (SM)*; moist; some rounded cobbles; low plasticity fines; trace mica; fine to medium sand. Fill (Hf)	3.0
Brown, interlayered *Silty Sand and Poorly Graded Sand with Silt (SM/SP-SM)*; wet; trace to few rounded to angular gravel; trace organics; low plasticity fines; fine to medium sand. Fill/Alluvium (Hf/Ha) - Iron-oxide-stained and with interlayered sandy silt below 5 feet.	6.0
BOTTOM OF BORING COMPLETED 3/16/2017	



DRAFT

LEGEND

- * Sample Not Recovered
- Grab Sample
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD
- Ground Water Level in Well

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.
4. The hole location was measured from existing site features and should be considered approximate.

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

LOG OF BORING HB-2

June 2017 | 21-1-22288-060

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-11

REV 3 - Approved for Submittal

MASTER_LOG_E 21-22288-040.GPJ SHAN_WIL.GDT 5/29/17 Log: JJM Rev: PVH Typ: LK

DRAFT

APPENDIX B

GEOTECHNICAL LABORATORY TESTING

DRAFT

APPENDIX B

GEOTECHNICAL LABORATORY TESTING

TABLE OF CONTENTS

Page

B.1 VISUAL CLASSIFICATION 1

B.2 WATER CONTENT DETERMINATION 1

B.3 GRAIN SIZE DISTRIBUTION ANALYSIS 1
B.3.1 Sieve Analysis 2
B.3.2 Fines Content Determination 2

B.4 ATTERBERG LIMITS DETERMINATION 2

B.5 CONSIDERATIONS 2

TABLES

Laboratory Terms
Sample Types
Laboratory Test Summary

TESTS

Grain Size Distribution Plot, Boring MB-1
Grain Size Distribution Plot, Boring MB-2
Grain Size Distribution Plot, Boring MB-3
Grain Size Distribution Plot, Boring MB-4
Grain Size Distribution Plot, Boring MB-5
Grain Size Distribution Plot, Boring MB-6
Grain Size Distribution Plot, Boring MB-7
Grain Size Distribution Plot, Boring MB-8
Plasticity Chart, Boring MB-1
Plasticity Chart, Boring MB-2
Plasticity Chart, Boring MB-3
Plasticity Chart, Boring MB-4
Plasticity Chart, Boring MB-6
Plasticity Chart, Boring MB-7
Plasticity Chart, Boring MB-8

DRAFT

APPENDIX B

GEOTECHNICAL LABORATORY TESTING

We performed geotechnical laboratory testing on selected soil samples retrieved from borings completed for the Meadowdale Beach Park and Estuary Restoration Project. The laboratory testing program included tests to classify the soil and provide data for engineering studies. We performed visual classification on all retrieved samples. Our laboratory testing program included water content determinations, grain size distribution analyses, and Atterberg limits determinations.

The following sections describe the laboratory test procedures.

B.1 VISUAL CLASSIFICATION

We visually classified soil samples retrieved from the borings using a system based on ASTM International (ASTM) D2487-11, Standard Test Method for Classification of Soil for Engineering Purposes, and ASTM D2488-09a, Standard Recommended Practice for Description of Soils (Visual-Manual Procedure). We summarize our classification system in Appendix A. We assigned a Unified Soil Classification System (USCS) group name and symbol, based on our visual classification of particles finer than 76.2 millimeters (3 inches). We revised visual classifications using results of the index tests discussed below.

B.2 WATER CONTENT DETERMINATION

We tested the water content of selected samples in accordance with ASTM D2216-10, Standard Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures. Comparison of the water content of a soil with its index properties can be useful in characterizing soil unit weight, consistency, compressibility, and strength. We present water content test results in the Laboratory Test Summary table in this appendix, and graphically on Appendix A exploration logs.

B.3 GRAIN SIZE DISTRIBUTION ANALYSIS

Grain size distribution analyses separate soil particles through mechanical or sedimentation processes. Grain size distributions are used to classify the granular component of soils and can correlate with soil properties, including frost susceptibility, permeability, shear strength, liquefaction potential, capillary action, and sensitivity to moisture. We plot grain size distribution analysis results in this appendix. Grain size distribution plots provide tabular

DRAFT

information about each specimen, including: USCS group symbol and group name; water content; constituent (i.e., cobble, gravel, sand, and fines) percentages; coefficients of uniformity and curvature, if applicable; personnel initials; ASTM standard designation; and testing remarks. Constituent percentages are presented in the Lab Summary Table in this appendix and fines contents are plotted as data points on Appendix A exploration logs.

B.3.1 Sieve Analysis

We performed mechanical sieve analyses on selected soil specimens to determine the grain size distribution of coarse-grained soil particles, in accordance with ASTM C136/C136M-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

B.3.2 Fines Content Determination

We determined the percent of fine-grained soil particles (fines content) of selected soil specimens, in accordance with ASTM D1140-14, Standard Test Methods for Determining the Amount of Material Finer Than 0.075 mm (No. 200) Sieve in Soils by Washing.

B.4 ATTERBERG LIMITS DETERMINATION

We determined soil plasticity by performing Atterberg Limits tests on selected samples in accordance with ASTM D4318-10e1, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils, Method A (Multi-Point Liquid Limit). The Atterberg Limits include liquid limit (LL), plastic limit (PL), and plasticity index (PI=LL-PL). These limits can assist soil classification, indicate soil consistency (when compared to natural water content), provide correlation to soil properties, evaluate clogging potential, and estimate liquefaction potential.

We present soil plasticity test results in the Lab Summary Table and on plasticity charts in this appendix. Plasticity charts provide the liquid limit, plastic limit, plasticity index, USCS group symbol, the sample description, water content, and percent passing the No. 200 sieve (if a grain size distribution analysis was performed). Soil plasticity test results are also shown graphically on Appendix A exploration logs.

B.5 CONSIDERATIONS

Drilling and sampling methodologies may affect the outcome of prescribed geotechnical laboratory tests. Refer to the field exploration discussion in this report for a discussion of these potential effects. Instances of limited recovery may have resulted in test samples not meeting

DRAFT

specified minimum mass requirements, per ASTM standards. Test plots show which samples do not meet ASTM specified minimum mass requirements.

DRAFT

DRAFT

LABORATORY TERMS

Abbreviations, Symbols, and Terms	Descriptions
%	Percent
*	Sample specimen weight did not meet required minimum mass for the test method
"	Inch
#	Test not performed by Shannon & Wilson, Inc. laboratory
ASTM Std.	ASTM International Standard
C_c	Coefficient of curvature
Clay-size	Soil particles finer than 0.002 mm
cm	Centimeter
cm^2	Square centimeter
Coarse-grained	Soil particles coarser than 0.075 mm (cobble-, gravel- and sand-sized particles)
Cobbles	Soil particles finer than 305 mm and coarser than 76.2 mm
C_u	Coefficient of uniformity
CU	Consolidated-Undrained
ε	Axial strain
Fine-grained	Soil particles finer than 0.075 mm (silt- and clay-sized particles)
ft	Feet
γm	Wet unit weight
Gravel	Soil particles finer than 76.2 mm and coarser than 4.75 mm
G_s	Specific gravity of soil solids
H_o	Initial height
ΔH	Change in height
ΔH_{load}	End of load increment deformation
in	Inch
in^3	Cubic inch
LL	Liquid Limit
min	Minute
mm	Millimeter
μ_m	Micrometer
MC	Moisture content
MPa	Mega-Pascal
NP	Non-plastic
OC	Organic content
p	Total stress
p'	Effective stress
Pa	Pascal
pcf	Pounds per cubic foot
PI	Plasticity Index
PL	Plastic Limit
psf	Pounds per square foot
psi	Pounds per square inch
q	Deviatoric stress
Sand	Soil particles finer than 4.75 mm and coarser than 0.075 mm
sec	Second
Silt	Soil particles finer than 0.075 mm and coarser than 0.002 mm
t_n	Time to n% primary consolidation
t_{load}	Duration of load increment
tsf	Short tons per square foot
USCS	Unified Soil Classification System
UU	Unconsolidated-Undrained
WC	Water content

DRAFT

SAMPLE TYPES

Abbreviations, Symbols, and Terms	Descriptions
2SS	2.5-inch Outside Diameter Split-Spoon Sample
2ST	2-inch Outside Diameter Thin-Walled Tube
3HSA	3-inch CME Hollow-stem Auger Sampler
3SS	3-inch Outside Diameter Split-Spoon Sample
4SS	4-inch Inside Diameter Split-Spoon Sample
6SS	6-inch Inside Diameter Split-Spoon Sample
CA_MC	Modified California Sampler
CA_SPT	Standard Penetration Test (SPT)
CORE	Rock Core
DM	+3.25 inch Outside Diameter Split-Spoon Sample
DMR	3.25-inch Sampler with Internal Rings
GRAB	Grab Sample
GUS	3-inch Outside Diameter Gregory Undisturbed Sampler (GUS) Sample
OSTER	3-inch Outside Diameter Osterberg Sample
PITCHER	3-inch Outside Diameter Pitcher Sample
PMT	Pressuremeter Test (f=failed)
PO	Porter Penetration Test Sample
PT	2.5-inch Outside Diameter Thin-Walled Tube
ROCK	Rock Core Sample
SCORE	Soil Core (as in Sonic Core Borings)
SH1	1-inch Plastic Sheath
SH2	2-inch Plastic Sheath with Soil Recovery
SH3	2-inch Plastic Sheath with no Soil Recovery
SPT	2-inch Outside Diameter Split-Spoon Sample
SS	Split-Spoon
ST	3-inch Outside Diameter Thin-Walled Tube
STW	3-inch Outside Diameter Thin-Walled Tube
TEST	Sample Test Interval
TW	Thin Wall Sample
UNDIST	Undisturbed Sample
VANE	Vane Shear
WATER	Water Sample for Probe Logs
XCORE	Core Sample

DRAFT

LABORATORY TEST SUMMARY

Boring	Top Depth (ft)	Sample Number	Sample Type	Blow Count	USCS	WC (%)	% Gravel	% Sand	% Fines	C_u	C_c	LL	PL	NP	Soil Description
MB-1	2.5	S-1	SPT	50		6.8									
MB-1	5	S-2	SPT	51	ML	7.8		33*	67*						Sandy Silt
MB-1	7.5	S-3	SPT	51		16.0									
MB-1	10	S-4	SPT	52		26.1									
MB-1	12.5	S-5	SPT	48	ML	27.2						30	25		Silt
MB-1	15	S-6	SPT	45		18.8									
MB-1	17.5	S-7	SPT	48		14.1									
MB-1	20	S-8	SPT	56		22.6									
MB-1	25	S-9	SPT	63	ML	10.2		29*	71*						Silt with Sand
MB-1	30	S-10	SPT	65		16.4									
MB-1	35	S-11	SPT	45		13.2									
MB-1	40	S-12	SPT	47		16.8									
MB-2	2.5	S-1	SPT	44		13.7									
MB-2	5	S-2	SPT	31	ML	7.9		46	54						Sandy Silt
MB-2	7.5	S-3	SPT	26		4.3									
MB-2	10	S-4	SPT	39		13.6									
MB-2	12.5	S-5	SPT	38		4.8									
MB-2	15	S-6	SPT	40	SM	5.8		75*	25*						Silty Sand
MB-2	17.5	S-7	SPT	81	ML	11.5			86						Silt
MB-2	20	S-8	SPT	76		9.8									
MB-2	25	S-9	SPT	65		28.5									
MB-2	30	S-10	SPT	22	ML	33.0						40	27		Silt
MB-2	35	S-11	SPT	41		24.7									
MB-2	40	S-12	SPT	42	ML	26.6						35	26		Silt
MB-3	2.5	S-1	SPT	11		16.2									
MB-3	5	S-2	SPT	18		19.3									
MB-3	5.5	S-2	SPT	18		9.2									
MB-3	7.5	S-3	SPT	6	SM	5.8	17	55	28						Silty Sand with Gravel
MB-3	10	S-4	SPT	24		4.8									
MB-3	12.5	S-5	SPT	18		11.3									
MB-3	15	S-6	SPT	23	ML	12.5			55						Sandy Silt
MB-3	17.5	S-7	SPT	19		20.0									

DRAFT

LABORATORY TEST SUMMARY

Boring	Top Depth (ft)	Sample Number	Sample Type	Blow Count	USCS	WC (%)	% Gravel	% Sand	% Fines	C_u	C_c	LL	PL	NP	Soil Description
MB-3	20	S-8	SPT	23		17.2									
MB-3	25	S-9	SPT	38		13.0									
MB-3	30	S-10	SPT	42		19.2									
MB-3	35	S-11	SPT	36	ML	24.8						31	28		Silt
MB-3	40	S-12	SPT	42		30.6									
MB-3	45	S-13	SPT	64	ML	29.0						33	25		Silt
MB-3	50	S-14	SPT	50/4"		27.2									
MB-3	55	S-15	SPT	29		24.9									
MB-3	55.5	S-15	SPT	29		25.0									
MB-3	60	S-16	SPT	44		7.7									
MB-4	2.5	S-1	SPT	14		8.9									
MB-4	5	S-2	SPT	7		8.4									
MB-4	7.5	S-3	SPT	25		12.3									
MB-4	10	S-4	SPT	27	ML	24.2						29	23		Silt
MB-4	12.5	S-5	SPT	28		15.8									
MB-4	15	S-6	SPT	27		21.1									
MB-4	17.5	S-7	SPT	18		5.8									
MB-4	20	S-8	SPT	25	SM	5.4		82*	18*						Silty Sand
MB-4	25	S-9	SPT	46		18.3									
MB-4	25.5	S-9	SPT	46		9.6									
MB-4	30	S-10	SPT	34		21.0									
MB-4	35	S-11	SPT	51	ML	28.8						24	23		Silt with Sand
MB-4	40	S-12	SPT	51		14.2									
MB-4	45	S-13	SPT	33		14.3									
MB-4	50	S-14	SPT	62		4.9									
MB-4	55	S-15	SPT	60		29.4									
MB-4	60	S-16	SPT	50/6"		27.2									
MB-5	2.5	S-1	SPT	19	SM	10.5			31						Silty Sand
MB-5	5	S-2	SPT	17		14.6									
MB-5	7.5	S-3	SPT	15		16.7									
MB-5	8	S-3	SPT	15		10.3									
MB-5	10	S-4	SPT	5		16.8									

DRAFT

LABORATORY TEST SUMMARY

Boring	Top Depth (ft)	Sample Number	Sample Type	Blow Count	USCS	WC (%)	% Gravel	% Sand	% Fines	C_u	C_c	LL	PL	NP	Soil Description
MB-5	12.5	S-5	SPT	42		15.0									
MB-5	15	S-6	SPT	44	SP-SM	4.8		90	10	4.9	1.6				Poorly Graded Sand with Silt
MB-5	17.5	S-7	SPT	33		21.7									
MB-5	20	S-8	SPT	46		16.6									
MB-5	25	S-9	SPT	55	SM	7.3		83*	17*						Silty Sand
MB-5	30	S-10	SPT	63		10.2									
MB-5	35	S-11	SPT	56	ML	22.6			82						Silt with Sand
MB-5	40	S-12	SPT	53		16.5									
MB-6	3	S-1	SPT	2		34.9									
MB-6	5	S-2	SPT	3	SP-SM	18.6	44	49	6.9	70.2	0.1				Poorly Graded Sand with Silt and Gravel
MB-6	10	S-4	SPT	19		12.5									
MB-6	15	S-6	SPT	24		12.4									
MB-6	17.5	S-7	SPT	23	SP-SM	6.5	33*	57*	9.7*	36.9	#####				Poorly Graded Sand with Silt and Gravel
MB-6	20	S-8	SPT	45		8.2									
MB-6	25	S-9A	SPT	35	SP-SM	10.1	31*	59*	9.2*	35.9	0.7				Poorly Graded Sand with Silt and Gravel
MB-6	26.3	S-9	SPT	35		17.4									
MB-6	35	S-12	SPT	62	GP-GM	8.2	49	42	8.5	84.7	0.6				Poorly Graded Gravel with Silt and Sand
MB-6	40	S-13	SPT	25		12.0									
MB-6	40.3	S-13	SPT	25		17.2									
MB-6	45	S-14	SPT	21		16.4									
MB-6	50	S-15	SPT	67		23.7									
MB-6	55	S-16	SPT	82	SP-SM	25.9	0*	88*	11*						Poorly Graded Sand with Silt
MB-6	60	S-17	SPT	77		19.5									
MB-6	65	S-18	SPT	70		22.2									
MB-6	70	S-19	SPT	81		21.4									
MB-6	75	S-20	SPT	23	SP-SM	25.3	1*	93*	5.9*	2.2	0.8				Poorly Graded Sand with Silt
MB-6	80	S-21	SPT	76		22.8									
MB-6	85	S-22	SPT	50/6	SP-SM	20.8		91*	9.1*						Poorly Graded Sand with Silt
MB-6	90	S-23	SPT	70		23.1									
MB-6	90.8	S-23B	SPT	70	ML	24.4						26.18	27.95	NP	Silt
MB-6	95	S-24	SPT	84		24.6									
MB-6	100	S-25	SPT	50/6		22.9									

DRAFT

LABORATORY TEST SUMMARY

Boring	Top Depth (ft)	Sample Number	Sample Type	Blow Count	USCS	WC (%)	% Gravel	% Sand	% Fines	C_u	C_c	LL	PL	NP	Soil Description
MB-6	105	S-26	SPT	50/6		21.3									
MB-6	110	S-27	SPT	50/5		21.9									
MB-6	115	S-28	SPT	50/5.5		22.9									
MB-6	120	S-29	SPT	50/4		23.4									
MB-6	125	S-30	SPT	50/5		22.7									
MB-6	130	S-31	SPT	50/4.5		23.1									
MB-7	2.5	S-1	SPT	4		29.6									
MB-7	5	S-2	SPT	1	SM	29.8									Silty Sand
MB-7	7.5	S-3	SPT	9		29.3									
MB-7	10	S-4	SPT	1		23.8									
MB-7	10.8	S-4B	SPT	1	ML	24.6						26.49	22.41		Silt
MB-7	12.5	S-5	SPT	1		30.9									
MB-7	15	S-6	SPT	26		11.8									
MB-7	17.5	S-7	SPT	29	SP-SM	12.2	35*	59*	5.5*	1.5	1.2				Poorly Graded Sand with Silt and Gravel
MB-7	20	S-8	SPT	22		17.9									
MB-7	25	S-9A	SPT	18	ML	19.7						20.77	18.61		Silt with Sand
MB-7	26	S-9	SPT	18		15.8									
MB-7	30	S-10	SPT	23	GP	8.7	51	45	3.6	30.8	0.9				Poorly Graded Gravel with Sand
MB-7	35	S-11	SPT	14		10.1									
MB-7	40	S-12	SPT	39	SP-SM	9.1	39*	55*	6.3*	41.8	0.3				Poorly Graded Sand with Silt and Gravel
MB-7	45	S-13	SPT	32		34.9									
MB-7	55	S-15	SPT	59		8.7									
MB-7	56	S-15	SPT	59		20.8									
MB-7	60	S-16	SPT	50/6	GW-GM	8.5	46	45	9.2	74.9	1.1				Well-Graded Gravel with Silt and Sand
MB-7	65	S-17	SPT	32		14.8									
MB-7	70	S-18	SPT	52		7.7									
MB-7	80	S-19	SPT	91	SM	20.4		88*	12*						Silty Sand
MB-7	85	S-20	SPT	92		21.3									
MB-7	90	S-21	SPT	90		22.9									
MB-7	95	S-22	SPT	91		20.7									
MB-7	100	S-23	SPT	78		23.3									
MB-7	105	S-24	SPT	50/6		21.7									

DRAFT

LABORATORY TEST SUMMARY

Boring	Top Depth (ft)	Sample Number	Sample Type	Blow Count	USCS	WC (%)	% Gravel	% Sand	% Fines	C_u	C_c	LL	PL	NP	Soil Description
MB-7	110	S-25	SPT	50/4		23.5									
MB-7	115	S-26	SPT	50/6		21.7									
MB-8	5	S-2	SPT	1	SM	22.7	7*	71*	21*						Silty Sand
MB-8	7.5	S-3	SPT	9		19.8									
MB-8	10	S-4	SPT	9		22.0									
MB-8	12.5	S-5	SPT	3	CL	25.1						31.09	21.58		Lean Clay with Sand
MB-8	15	S-6	SPT	13		23.7									
MB-8	15.3	S-6	SPT	13		22.3									
MB-8	17.5	S-7	SPT	35	ML	18.4		50*	50*						Sandy Silt
MB-8	20	S-8	SPT	30	SM	21.8		79*	21*						Silty Sand
MB-8	25	S-9A	SPT	38	CL-ML	22.7						29.39	22.29		Silty Clay
MB-8	25.3	S-9	SPT	38		17.1									

DRAFT

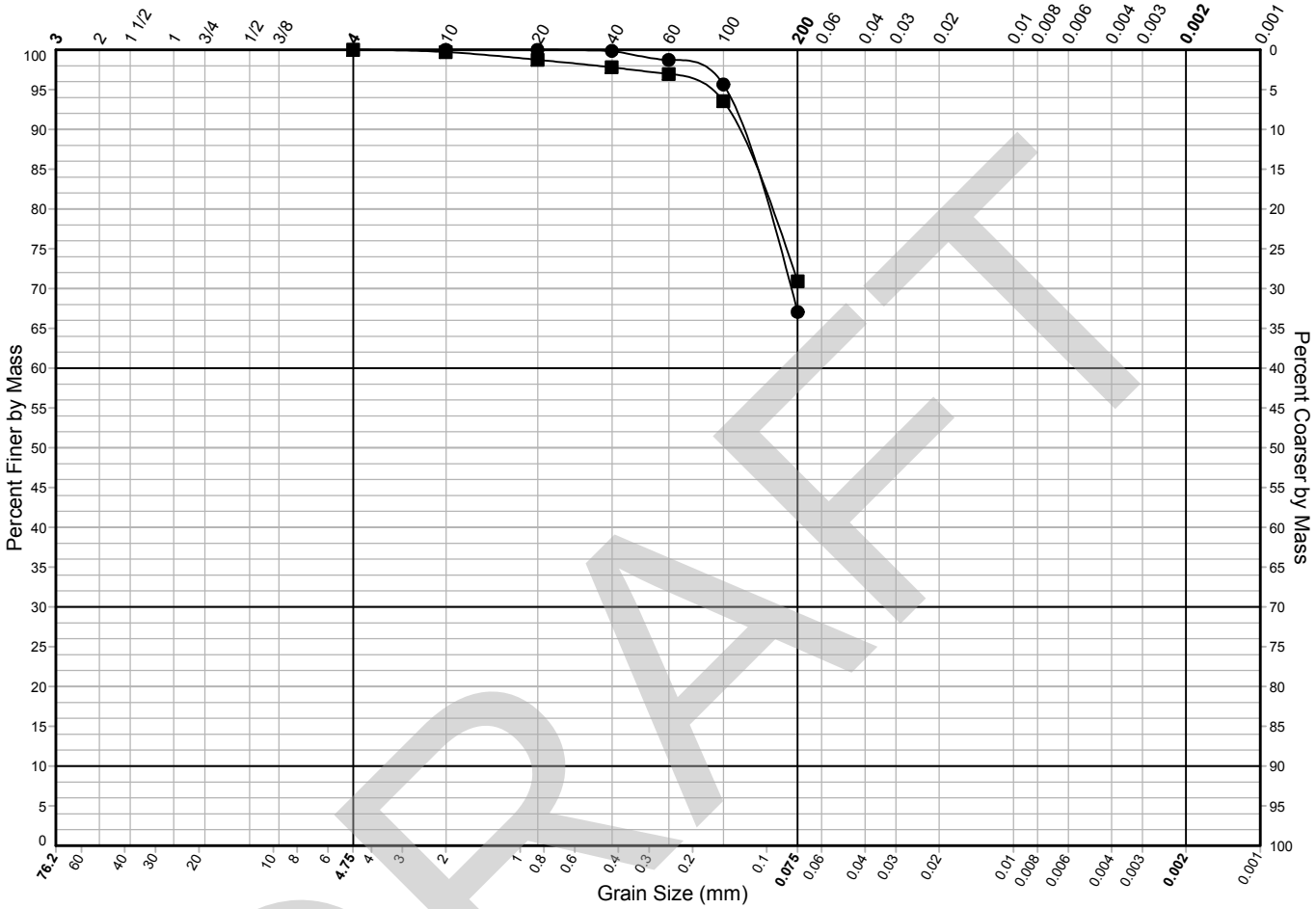
SHANNON & WILSON, INC.

GRAIN SIZE DISTRIBUTION PLOT

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

BORING MB-1

Gravel		Sand			Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay-Size
Mesh Opening in Inches		Mesh Openings per Inch, U.S. Standard			Grain Size in Millimeters	



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	Gravel %	Sand %	Fines %	< 20µm %	< 2µm %	WC %	Tested By	Review By	ASTM Std.
● MB-1, S-2*	5.0	ML	Sandy Silt		33	67			7.8	AKV	JFL	C136
■ MB-1, S-9*	25.0	ML	Silt with Sand		29	71			10.2	AKV	JFL	C136

* *Test specimen did not meet minimum mass recommendations.*

DRAFT

SHANNON & WILSON, INC. • 400 NORTH 34TH STREET • SUITE 100 • SEATTLE, WASHINGTON • 98103 • MAIN (206) 632-8020 • FAX (206) 695-6777

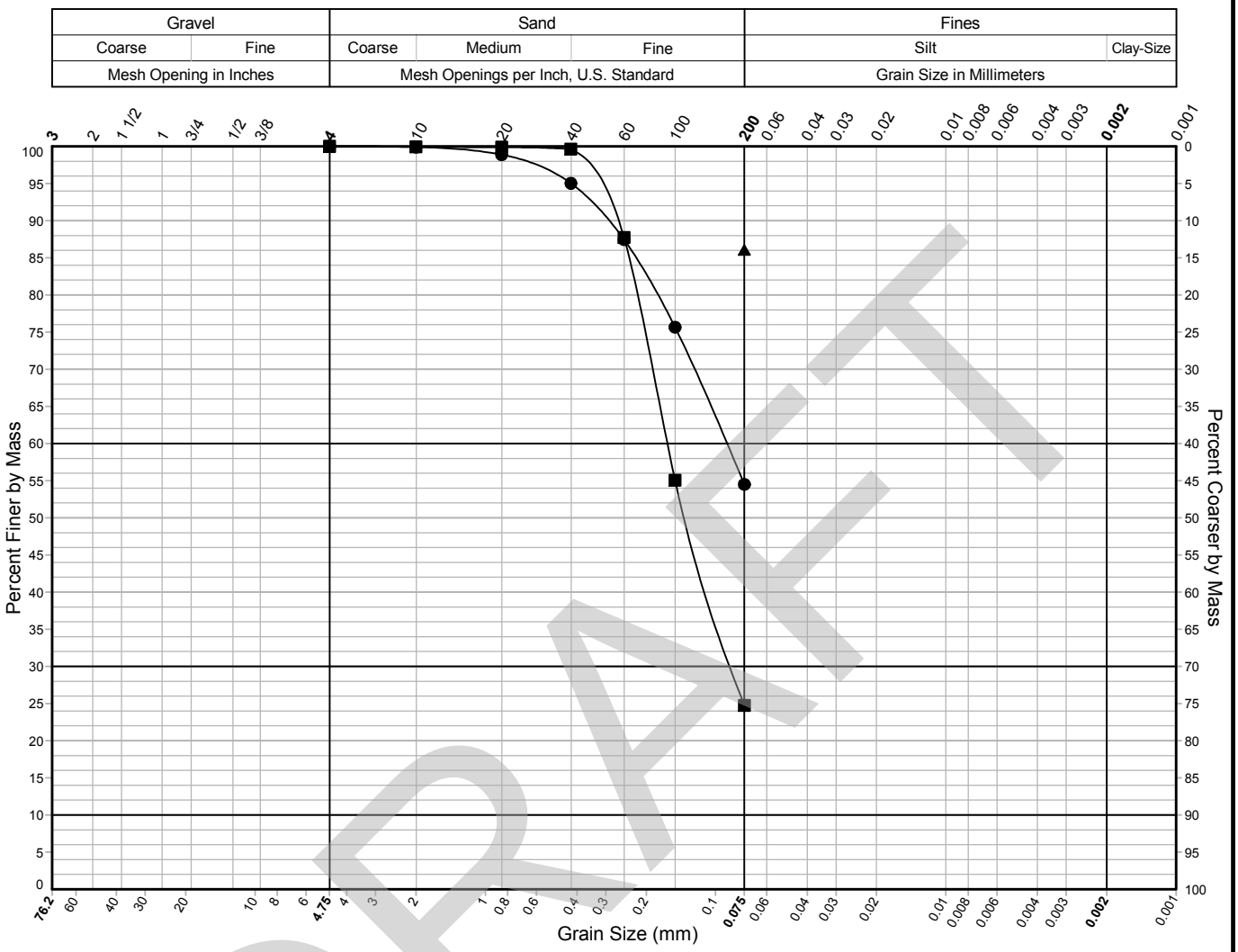
DRAFT

SHANNON & WILSON, INC.

GRAIN SIZE DISTRIBUTION PLOT

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

BORING MB-2



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	Gravel %	Sand %	Fines %	< 20µm %	< 2µm %	WC %	Tested By	Review By	ASTM Std.
● MB-2, S-2	5.0	ML	Sandy Silt		46	54			7.9	AKV	JFL	C136
■ MB-2, S-6*	15.0	SM	Silty Sand		75	25			5.8	AKV	JFL	C136
▲ MB-2, S-7	17.5	ML	Silt			86			11.5	AKV	JFL	D1140

* *Test specimen did not meet minimum mass recommendations.*

DRAFT

SHANNON & WILSON, INC. • 400 NORTH 34TH STREET • SUITE 100 • SEATTLE, WASHINGTON • 98103 • MAIN (206) 632-8020 • FAX (206) 695-6777

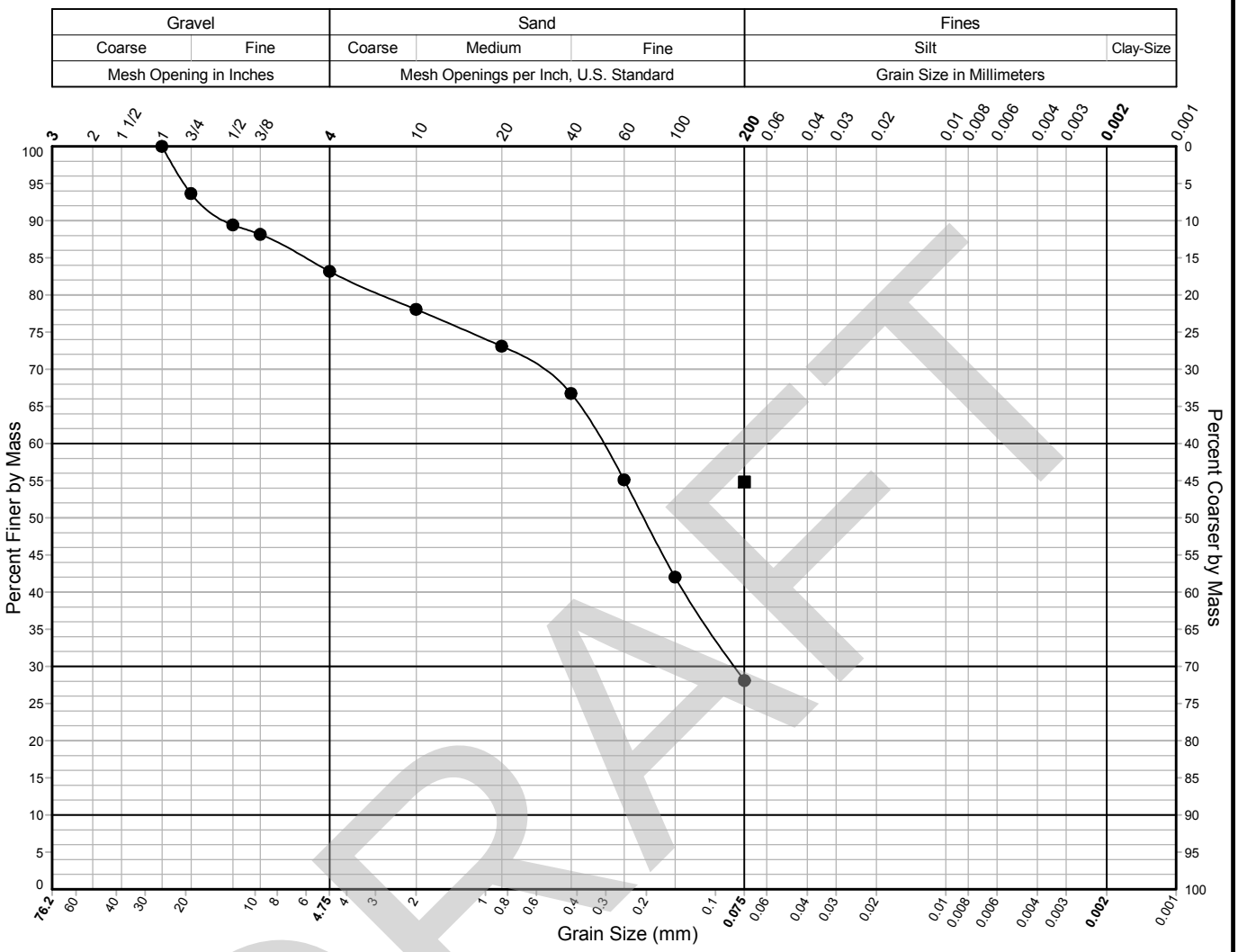
DRAFT

SHANNON & WILSON, INC.

GRAIN SIZE DISTRIBUTION PLOT

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

BORING MB-3



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	Gravel %	Sand %	Fines %	< 20µm %	< 2µm %	WC %	Tested By	Review By	ASTM Std.
● MB-3, S-3*	7.5	SM	Silty Sand with Gravel	17	55	28			5.8	AKV	JFL	C136
■ MB-3, S-6	15.0	ML	Sandy Silt			55			12.5	AKV	JFL	D1140

* *Test specimen did not meet minimum mass recommendations.*

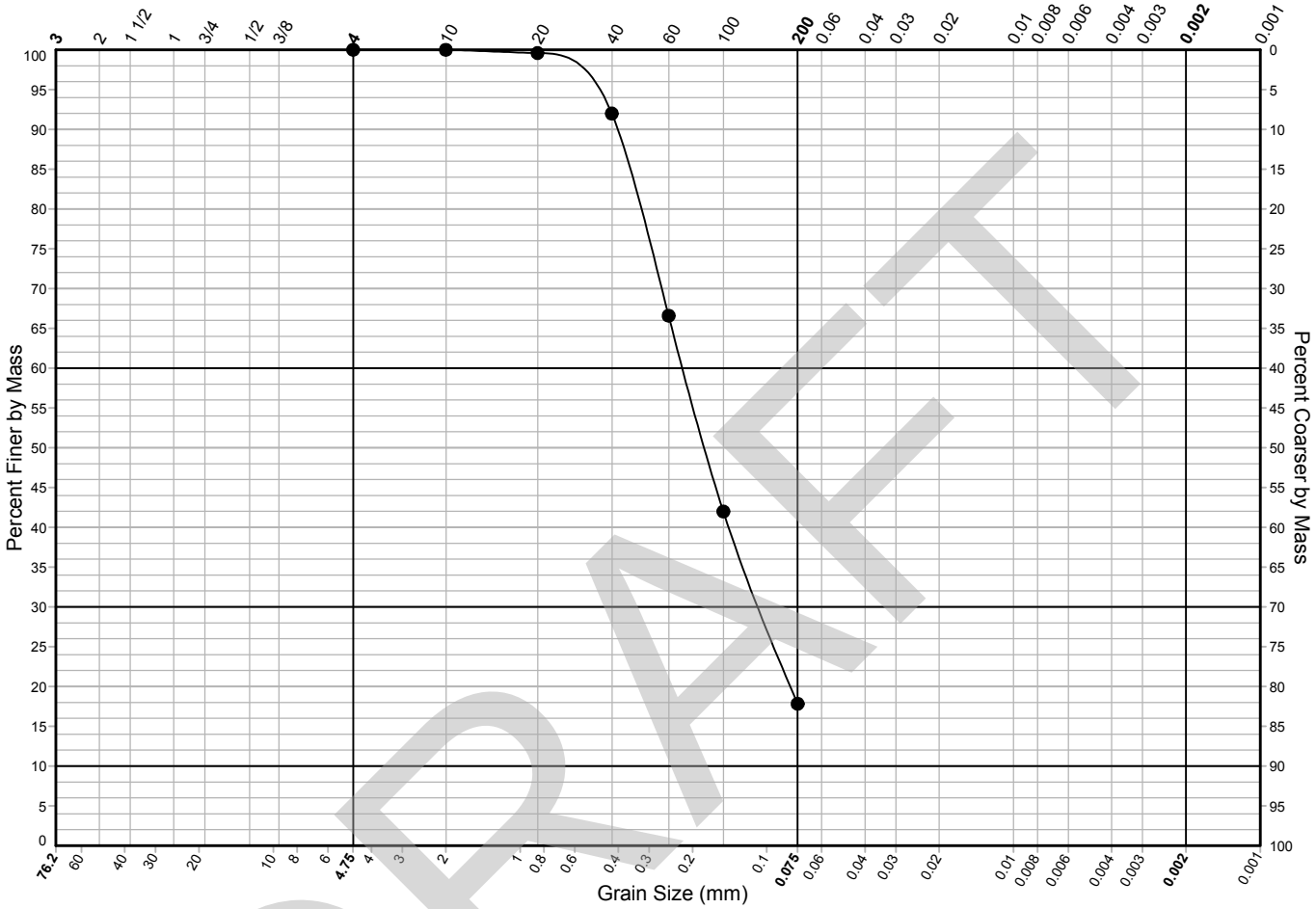
21-1-22288-060 A_GSA_MAIN 21-22288-040.GPJ SHAN_WIL.GDT 6/6/17

GRAIN SIZE DISTRIBUTION PLOT

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

BORING MB-4

Gravel		Sand			Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay-Size
Mesh Opening in Inches		Mesh Openings per Inch, U.S. Standard			Grain Size in Millimeters	



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	Gravel %	Sand %	Fines %	< 20µm %	< 2µm %	WC %	Tested By	Review By	ASTM Std.
● MB-4, S-8*	20.0	SM	Silty Sand		82	18			5.4	AKV	JFL	C136

* *Test specimen did not meet minimum mass recommendations.*

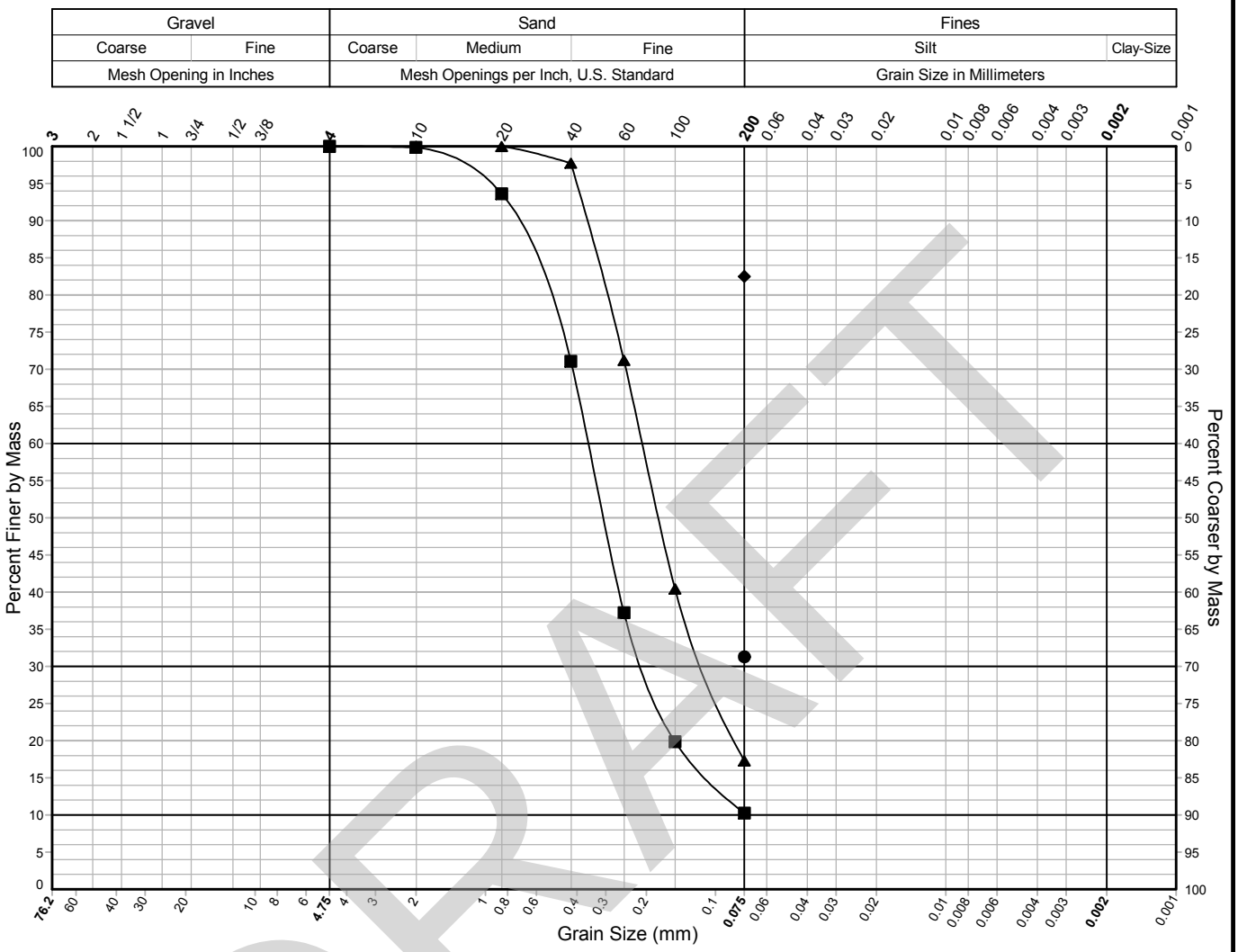
DRAFT

SHANNON & WILSON, INC.

GRAIN SIZE DISTRIBUTION PLOT

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

BORING MB-5



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	Gravel %	Sand %	Fines %	< 20µm %	< 2µm %	WC %	Tested By	Review By	ASTM Std.
● MB-5, S-1	2.5	SM	Silty Sand			31			10.5	AKV	JFL	D1140
■ MB-5, S-6*	15.0	SP-SM	Poorly Graded Sand with Silt		90	10			4.8	AKV	JFL	C136
▲ MB-5, S-9*	25.0	SM	Silty Sand		83	17			7.3	AKV	JFL	C136
◆ MB-5, S-11	35.0	ML	Silt with Sand			82			22.6	AKV	JFL	D1140

* *Test specimen did not meet minimum mass recommendations.*

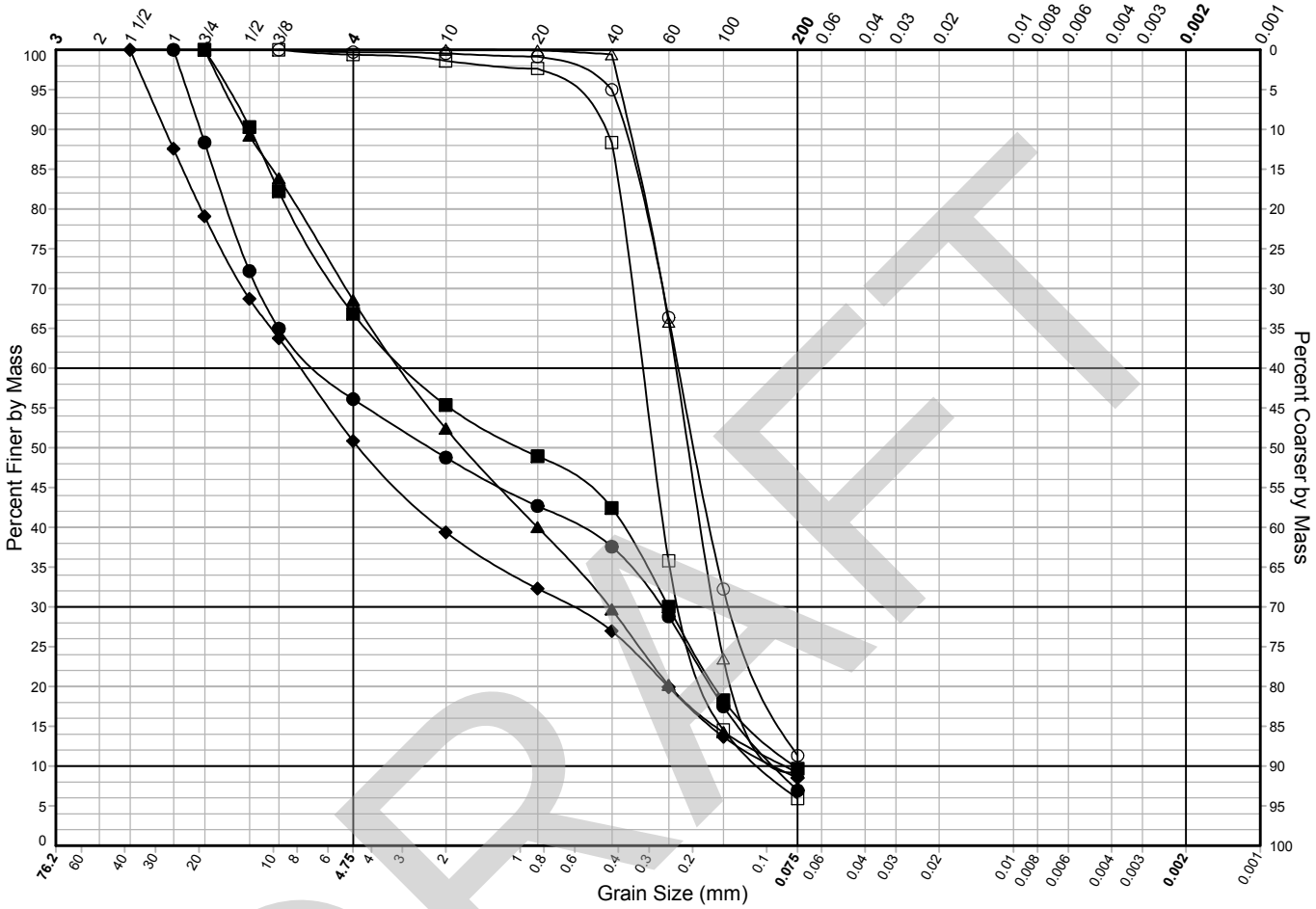
21-1-22288-060 A_GSA_MAIN 21-22288-040.GPJ SHAN_WIL.GDT 6/6/17

GRAIN SIZE DISTRIBUTION PLOT

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

BORING MB-6

Gravel		Sand			Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay-Size
Mesh Opening in Inches		Mesh Openings per Inch, U.S. Standard			Grain Size in Millimeters	



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	Gravel %	Sand %	Fines %	< 20µm %	< 2µm %	WC %	Tested By	Review By	ASTM Std.
● MB-6, S-2*	5.0	SP-SM	Poorly Graded Sand with Silt and Gravel	44	49	6.9			18.6	BMC	JFL	C136
■ MB-6, S-7*	17.5	SP-SM	Poorly Graded Sand with Silt and Gravel	33	57	9.7			6.5	BMC	JFL	C136
▲ MB-6, S-9A*	25.0	SP-SM	Poorly Graded Sand with Silt and Gravel	31	59	9.2			10.1	BMC	JFL	C136
◆ MB-6, S-12*	35.0	GP-GM	Poorly Graded Gravel with Silt and Sand	49	42	8.5			8.2	BMC	JFL	C136
○ MB-6, S-16	55.0	SP-SM	Poorly Graded Sand with Silt	0	88	11			25.9	BMC	JFL	C136
□ MB-6, S-20*	75.0	SP-SM	Poorly Graded Sand with Silt	1	93	5.9			25.3	BMC	JFL	C136
△ MB-6, S-22	85.0	SP-SM	Poorly Graded Sand with Silt		91	9.1			20.8	BMC	JFL	C136

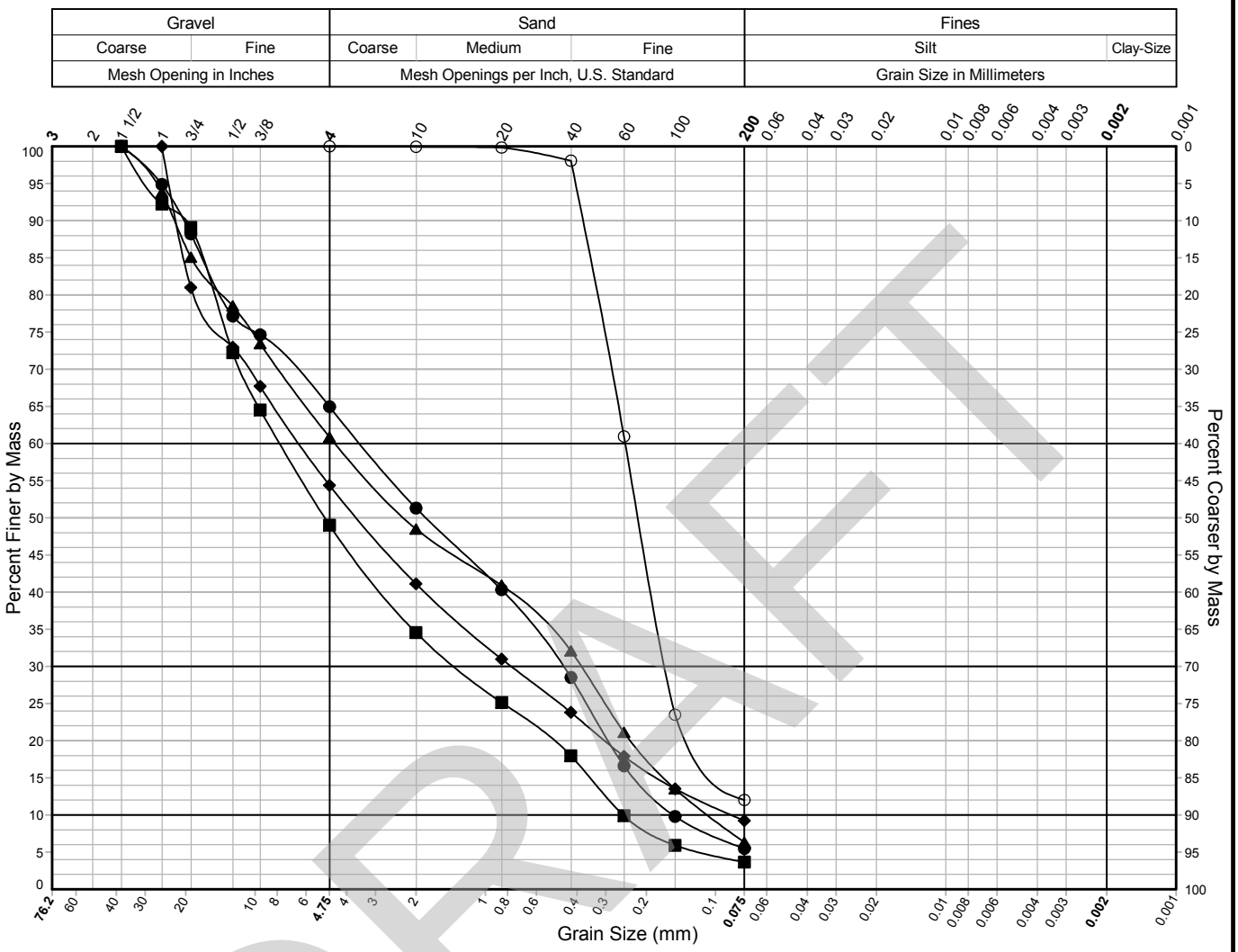
* *Test specimen did not meet minimum mass recommendations.*

DRAFT

GRAIN SIZE DISTRIBUTION PLOT

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

BORING MB-7



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	Gravel %	Sand %	Fines %	< 20µm %	< 2µm %	WC %	Tested By	Review By	ASTM Std.
● MB-7, S-7*	17.5	SP-SM	Poorly Graded Sand with Silt and Gravel	35	59	5.5			12.2	BMC	JFL	C136
■ MB-7, S-10*	30.0	GP	Poorly Graded Gravel with Sand	51	45	3.6			8.7	BMC	JFL	C136
▲ MB-7, S-12*	40.0	SP-SM	Poorly Graded Sand with Silt and Gravel	39	55	6.3			9.1	BMC	JFL	C136
◆ MB-7, S-16*	60.0	GW-GM	Well-Graded Gravel with Silt and Sand	46	45	9.2			8.5	BMC	JFL	C136
○ MB-7, S-19*	80.0	SM	Silty Sand		88	12			20.4	BMC	JFL	C136

* *Test specimen did not meet minimum mass recommendations.*

DRAFT

SHANNON & WILSON, INC.

GRAIN SIZE DISTRIBUTION PLOT

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

BORING MB-8

Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	Gravel %	Sand %	Fines %	< 20µm %	< 2µm %	WC %	Tested By	Review By	ASTM Std.
● MB-8, S-2*	5.0	SM	Silty Sand	7	71	21			22.7	BMC	JFL	C136
■ MB-8, S-7*	17.5	ML	Sandy Silt		50	50			18.4	BMC	JFL	C136
▲ MB-8, S-8*	20.0	SM	Silty Sand		79	21			21.8	BMC	JFL	C136

* *Test specimen did not meet minimum mass recommendations.*

DRAFT

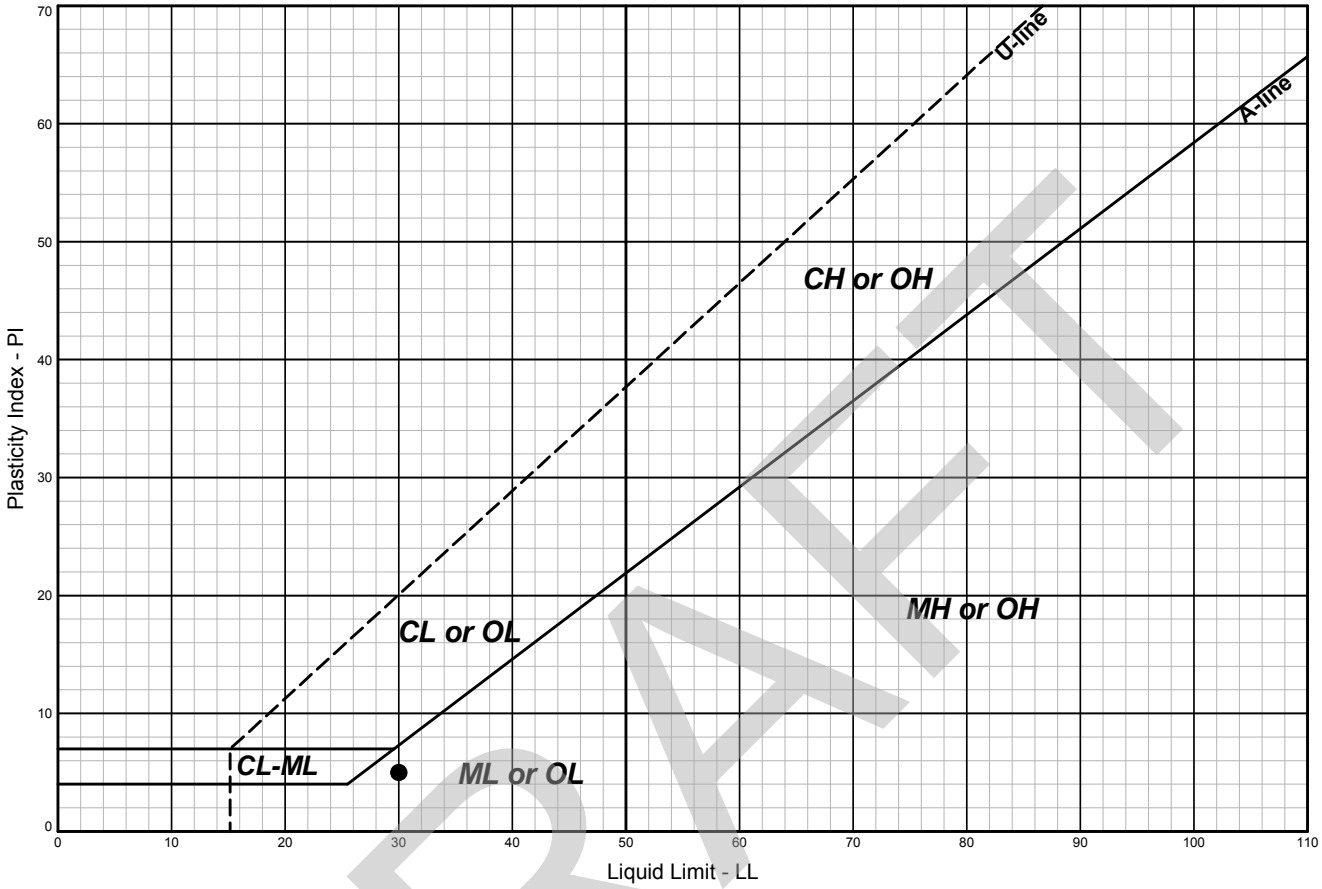
SHANNON & WILSON, INC. • 400 NORTH 34TH STREET • SUITE 100 • SEATTLE, WASHINGTON • 98103 • MAIN (206) 632-8020 • FAX (206) 695-6777

DRAFT

PLASTICITY CHART

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

BORING MB-1



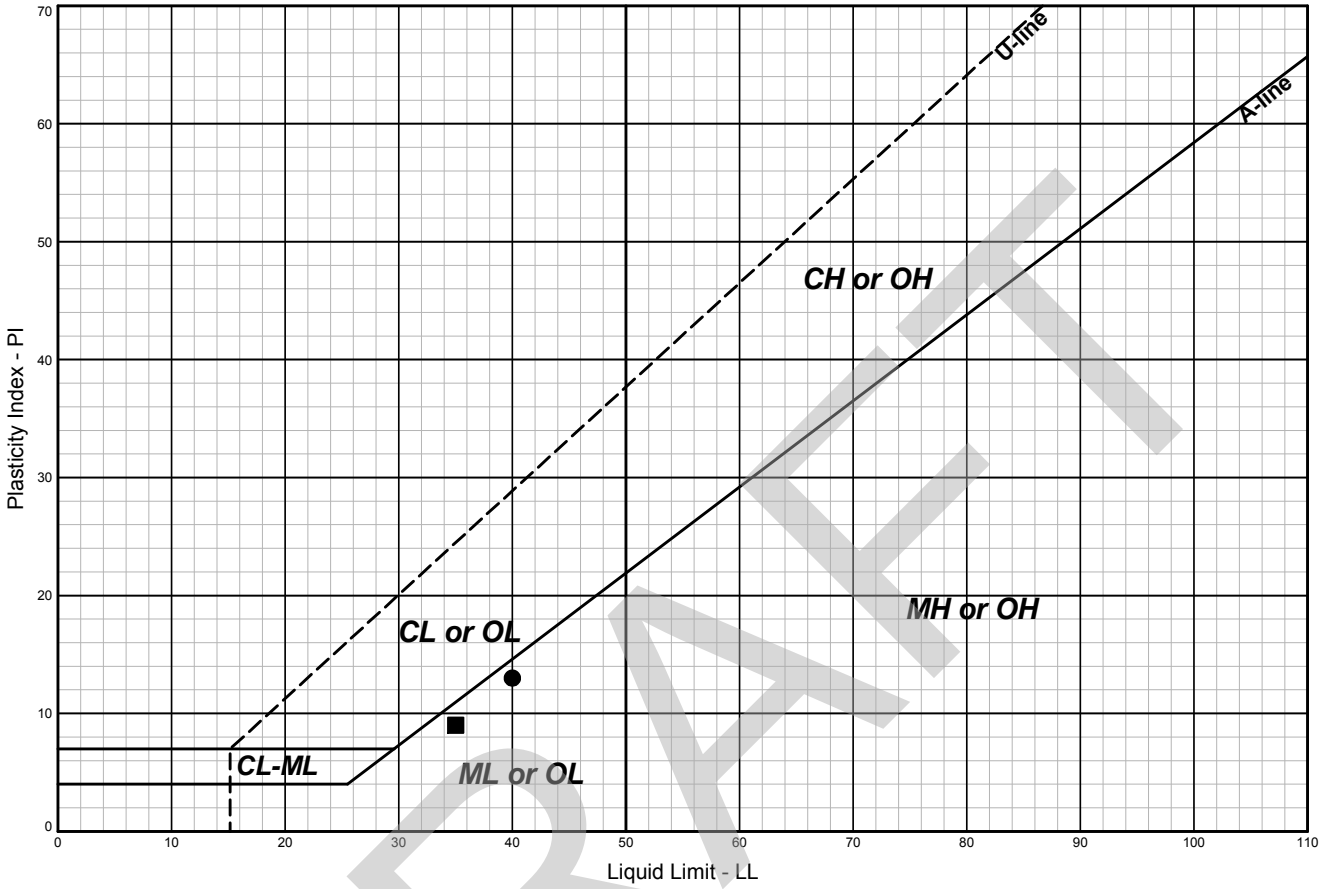
Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	LL	PL	PI	WC %	Gravel %	Sand %	Fines %	< 2µm %	Tested By	Review By	ASTM Std.
● MB-1, S-5	12.5	ML	Silt	30	25	5	27.2					AKV	JFL	D4318

DRAFT

PLASTICITY CHART

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

BORING MB-2



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	LL	PL	PI	WC %	Gravel %	Sand %	Fines %	< 2µm %	Tested By	Review By	ASTM Std.
● MB-2, S-10	30.0	ML	Silt	40	27	13	33.0					AKV	JFL	D4318
■ MB-2, S-12	40.0	ML	Silt	35	26	9	26.6					AKV	JFL	D4318

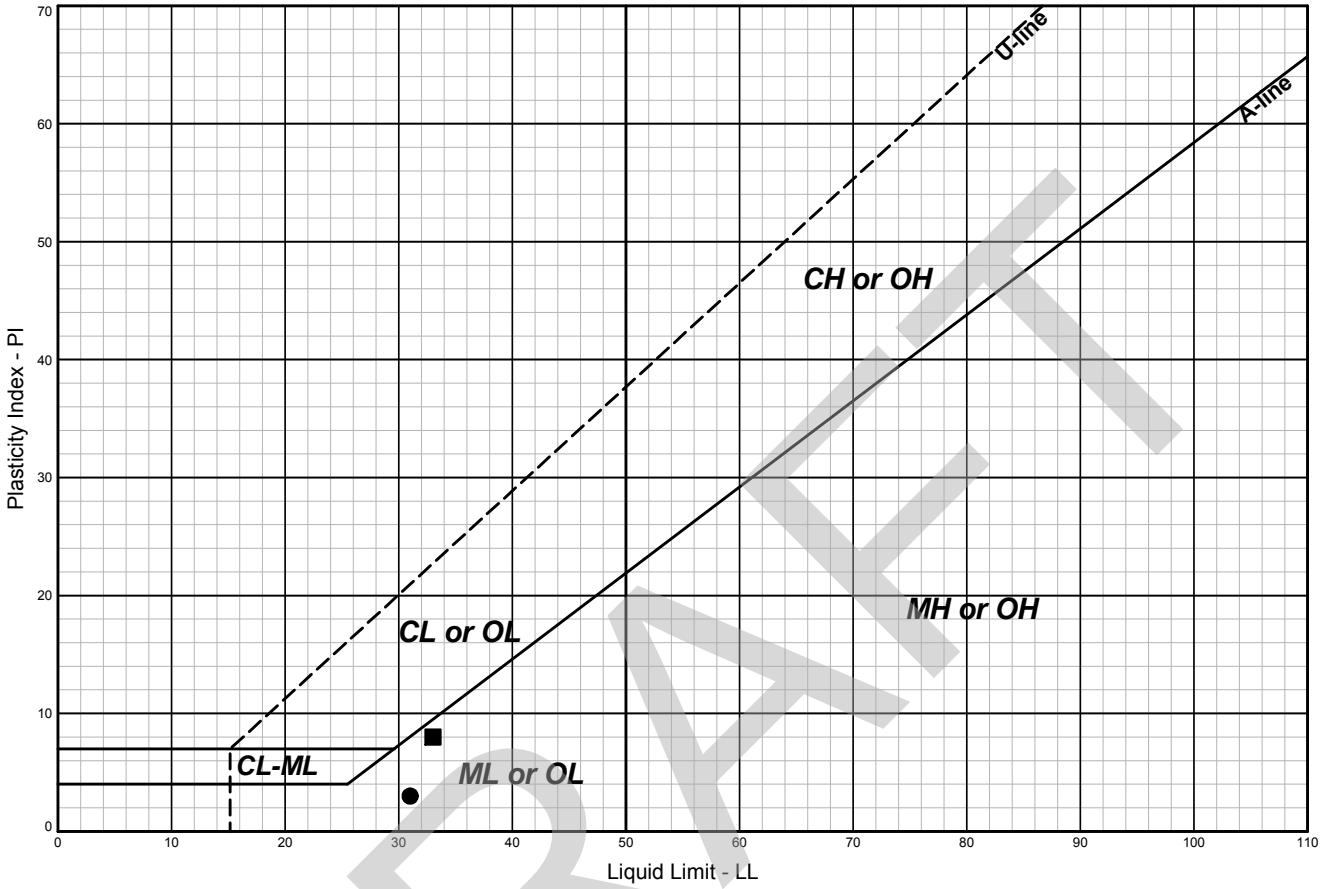
DRAFT

DRAFT

PLASTICITY CHART

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

BORING MB-3



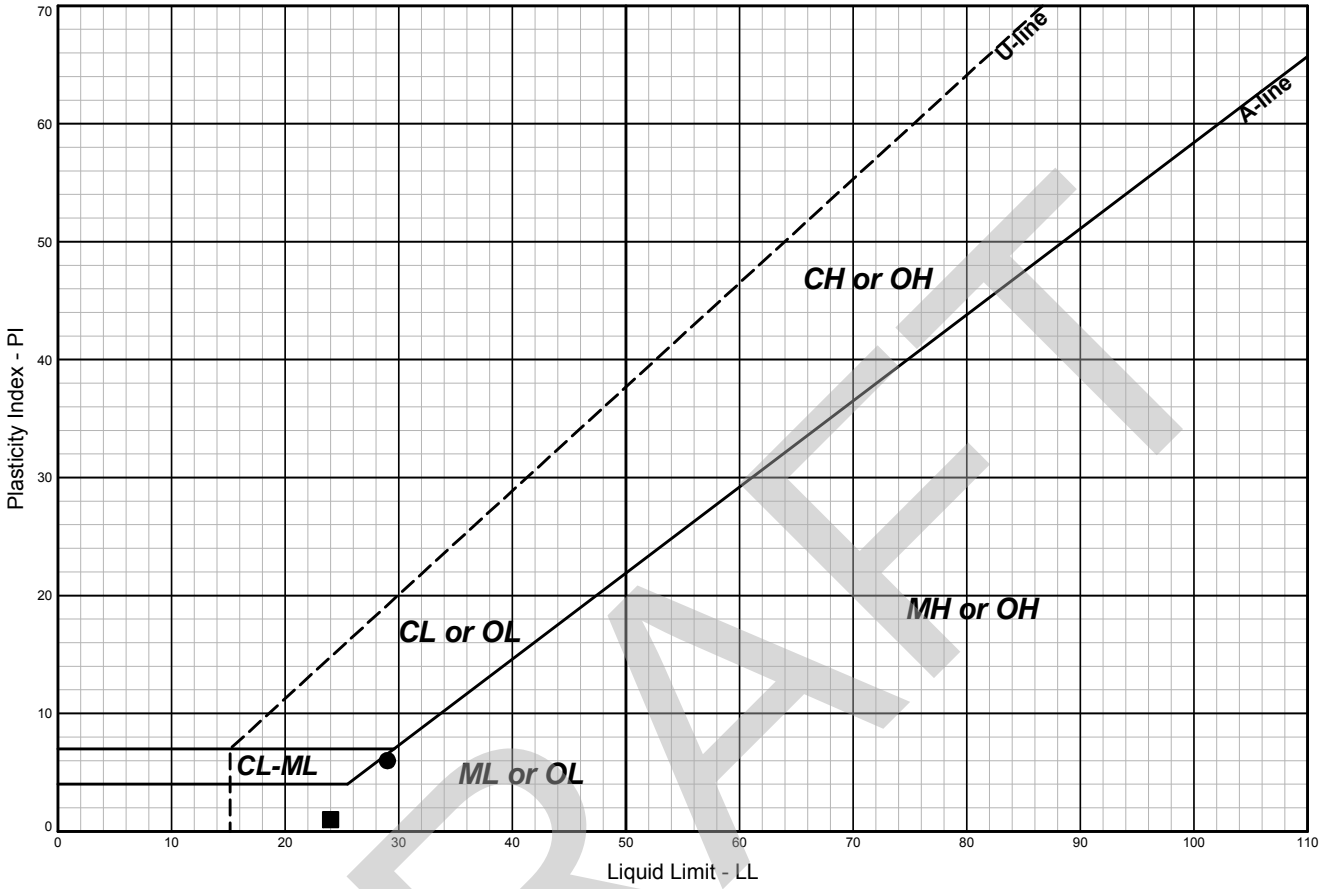
Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	LL	PL	PI	WC %	Gravel %	Sand %	Fines %	< 2µm %	Tested By	Review By	ASTM Std.
● MB-3, S-11	35.0	ML	Silt	31	28	3	24.8					AKV	JFL	D4318
■ MB-3, S-13	45.0	ML	Silt	33	25	8	29.0					AKV	JFL	D4318

DRAFT

PLASTICITY CHART

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

BORING MB-4



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	LL	PL	PI	WC %	Gravel %	Sand %	Fines %	< 2µm %	Tested By	Review By	ASTM Std.
● MB-4, S-4	10.0	ML	Silt	29	23	6	24.2					AKV	JFL	D4318
■ MB-4, S-11	35.0	ML	Silt with Sand	24	23	1	28.8					AKV	JFL	D4318

DRAFT

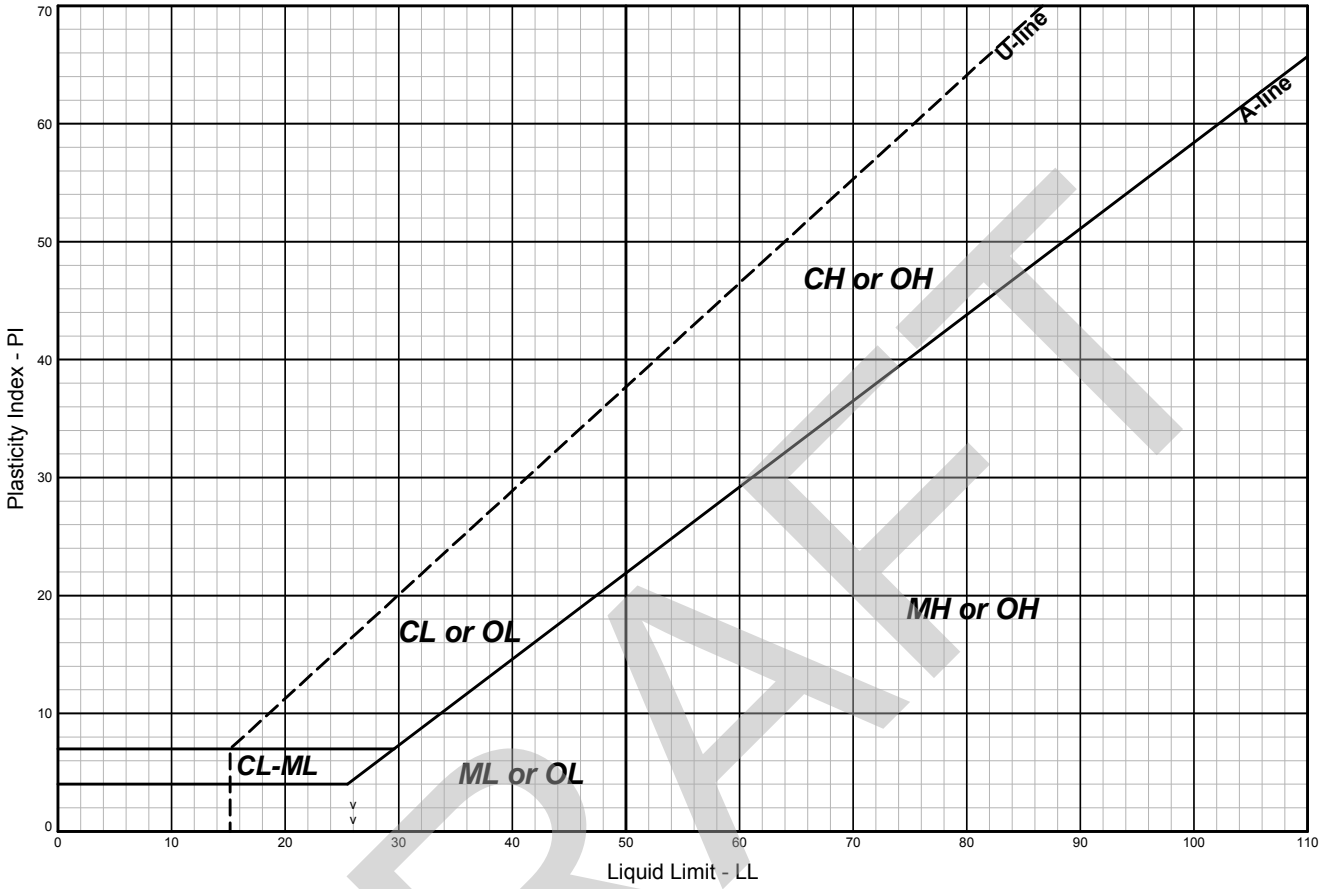
SHANNON & WILSON, INC. • 400 NORTH 34TH STREET • SUITE 100 • SEATTLE, WASHINGTON • 98103 • MAIN (206) 632-8020 • FAX (206) 695-6777

DRAFT

PLASTICITY CHART

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

BORING MB-6



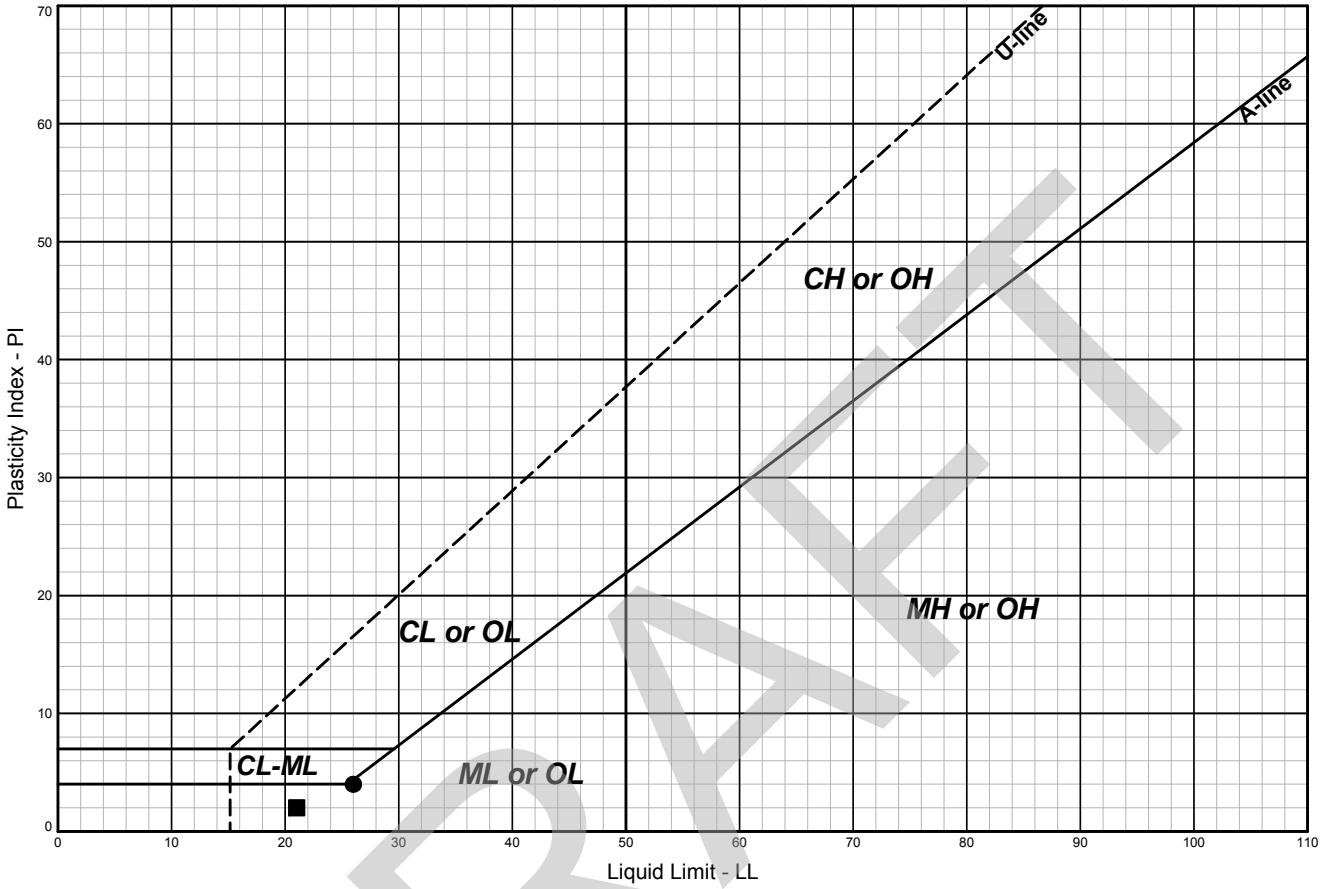
Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	LL	PL	PI	WC %	Gravel %	Sand %	Fines %	< 2µm %	Tested By	Review By	ASTM Std.
MB-6, S-23B	90.8	ML	Silt	26	28	**NP**	24.4					AKV	JFL	D4318

DRAFT

PLASTICITY CHART

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

BORING MB-7



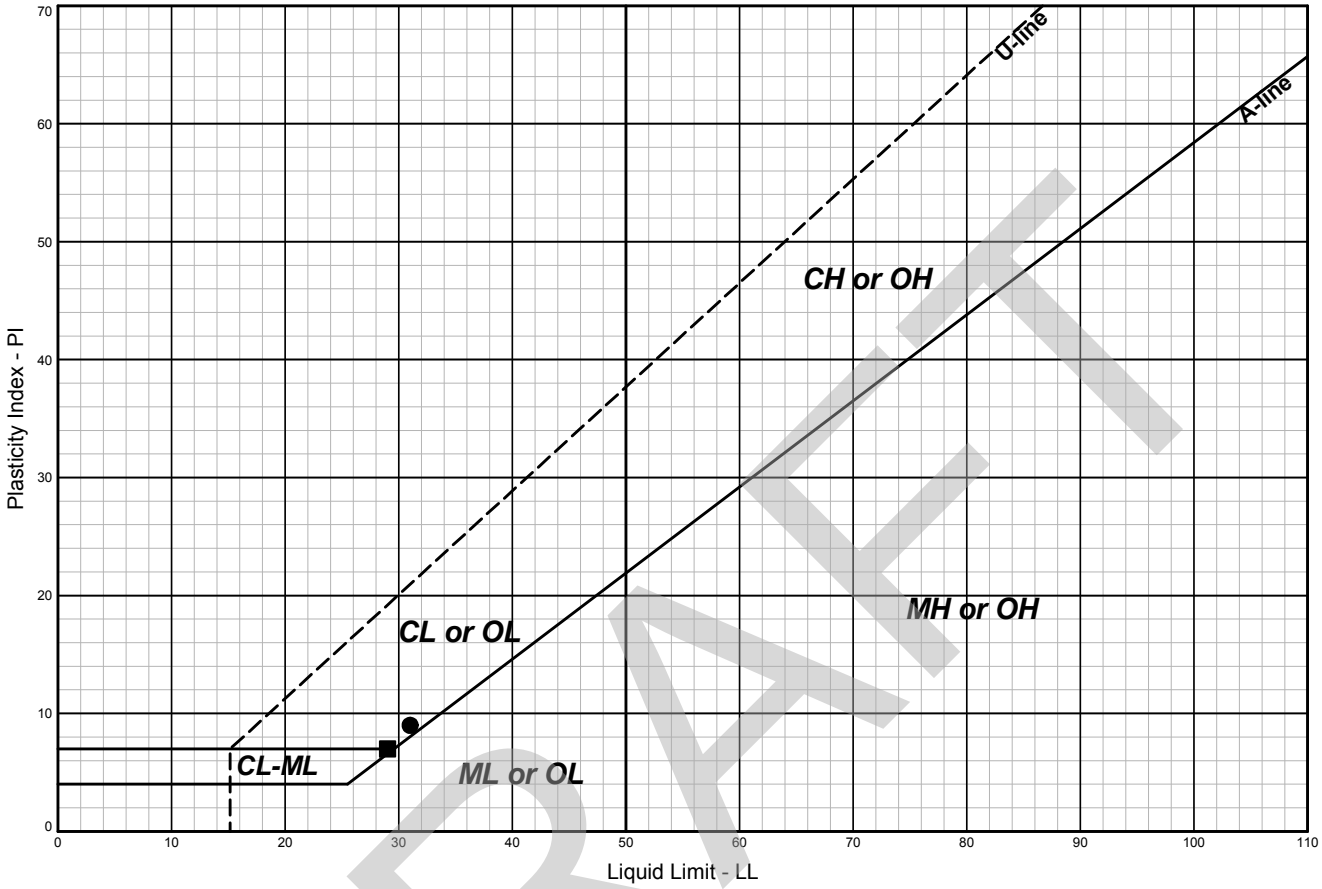
Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	LL	PL	PI	WC %	Gravel %	Sand %	Fines %	< 2µm %	Tested By	Review By	ASTM Std.
● MB-7, S-4B	10.8	ML	Silt	26	22	4	24.6					AKV	JFL	D4318
■ MB-7, S-9A	25.0	ML	Silt with Sand	21	19	2	19.7					AKV	JFL	D4318

DRAFT

PLASTICITY CHART

Meadowdale Beach
Park and Estuary Restoration
Snohomish County, Washington

BORING MB-8



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	LL	PL	PI	WC %	Gravel %	Sand %	Fines %	< 2µm %	Tested By	Review By	ASTM Std.
● MB-8, S-5	12.5	CL	Lean Clay with Sand	31	22	9	25.1					AKV	JFL	D4318
■ MB-8, S-9A	25.0	CL-ML	Silty Clay	29	22	7	22.7					AKV	JFL	D4318

DRAFT

APPENDIX C

GEOPHYSICAL SURVEYS

DRAFT

APPENDIX C

GEOPHYSICAL SURVEYS

TABLE OF CONTENTS

REPORTS

Global Geophysics, 2016, Report for the ground penetration radar survey at Meadowdale Beach Park, Edmonds, WA: Report prepared by Global Geophysics, Redmond, Wash., 105-0419.001, for Shannon & Wilson, Inc., Seattle, Wash., December 7.

Global Geophysics, 2017a, GPR survey line location map (fig. 1-A) and interpreted GPR anomalies (fig. 1-B) [rev.], in, Report for the ground penetration radar survey at Meadowdale Beach Park, Edmonds, WA: Report prepared by Global Geophysics, Redmond, Wash., 105-0419.001, for Shannon & Wilson, Inc., Seattle, Wash., February 7.

Global Geophysics, 2017b, Report for the ground penetration radar and electrical resistivity tomography surveys at Meadowdale Beach Park, Edmonds, WA: Report prepared by Global Geophysics, Redmond, Wash., 105-0419.002, for Shannon & Wilson, Inc., Seattle, Wash., May 1.

DRAFT

GLOBAL GEOPHYSICS REPORT, 2016

DRAFT

21-1-22288-060

Global Geophysics

P. O. Box 2229
Redmond, WA 98073-2229

Tel: 425-890-4321
Fax: 206-582-0838

December 7, 2016 Our ref: 105-0419.001

Shannon & Wilson, Inc.
400 North 34th Street, Suite 100
Seattle, Washington, 98103

ATTENTION: Mr. Matthew Gibson

RE: REPORT FOR THE GROUND PENETRATION RADAR SURVEY AT MEADOWDALE BEACH PARK, EDMONDS, WA

Dear Mr. Gibson:

This letter report presents the results of the geophysical survey performed by Global Geophysics on November 8, 2016 at Meadowdale Beach Park, Edmonds, WA. The objectives of the studies are to locate buried objects, such as foundations.

GEOPHYSICAL METHODS, INSTRUMENTATION AND FIELD PROCEDURES

Ground penetrating radar (GPR) was used to detect any discrete objects.

Ground Penetrating Radar

The GPR method uses electromagnetic pulses, emitted at regular intervals by an antenna to map subsurface features. The electromagnetic pulses are reflected where changes in electrical properties of materials occur such as changes in lithology or where underground utilities are present. The reflected electromagnetic energy is received by an antenna, converted into an electrical signal, and recorded on the GPR unit. The data is recorded and viewed in real time on a graphical display that depicts a continuous profile or cross-section image of the subsurface directly beneath the path of the antenna.

The depth of penetration of the GPR signal varies according to antenna frequency and the conductivity of the subsurface material. The depth of subsurface penetration with GPR decreases with an increase in the frequency of the antenna and an increase in soil conductivity. Low frequency antennas (50 to 500 MHz) provide the best compromise between obtaining good subsurface penetration and resolution.

The data were collected along the same EM transects at a 2.5 foot interval using Geophysical Survey Systems, Inc. (GSSI) SIR 2000 GPR system with antennas having a center frequency of 200 MHz. The data was digitally recorded for post processing.

RESULTS

The GPR anomalies are shown in Figure 1. The GPR anomalies are the inverted hyperbolic curves, which are the refracted waves from discrete objects, such as debris and boulders. The clusters of GPR anomalies within dashed orange lines are likely related to the remnant of abandoned structures. The area within the dashed blue line is interpreted as buried swimming pool due to the flat concrete floor with reinforced rebars.

LIMITATIONS OF GEOPHYSICAL METHODS

Global Geophysics services are conducted in a manner consistent with the level of care and skill ordinarily exercised by other members of the geophysical community currently practicing under similar conditions subject to the time limits and financial and physical constraints applicable to the services. GPR is a remote sensing geophysical method that may not detect all buried objects. Furthermore, it is possible that interpreted features may upon intrusive sampling prove to have been misinterpreted or mis-located. Where interpretation from geophysical data is an important element for cost or safety of operations, it should always be checked for reasonableness against known or expected subsurface data, and verified at critical locations by physical means such as probing or drilling. Cautious and safe operating practices that will preserve the integrity of subsurface objects should always be used above and in the vicinity of known or possible objects.

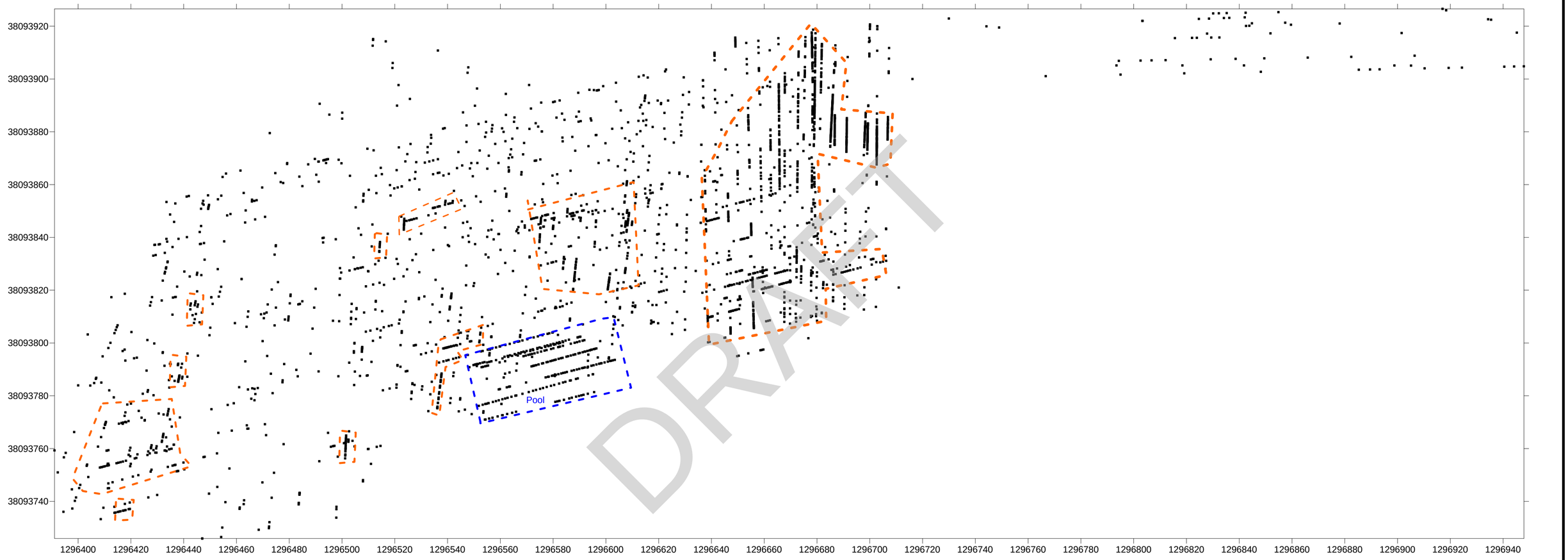
If you have any comments or questions, please contact Dr. John Liu at 425-890-4321.

Sincerely,

Global Geophysics

John Liu, Ph.D., R.G.
Principal geophysicist

DRAFT



Legend:

Clusters of GPR anomalies likely related to buried foundations or structures

Interpreted pool location

0 ft 25 ft 50 ft

PROJECT
Meadowdale Beach Park
Edmonds, WA

TITLE
GPR Survey For Locating Buried Objects

Global Geophysics
P.O. Box 2229
Redmond, WA 98073-2229
Tel: 425-890-4321

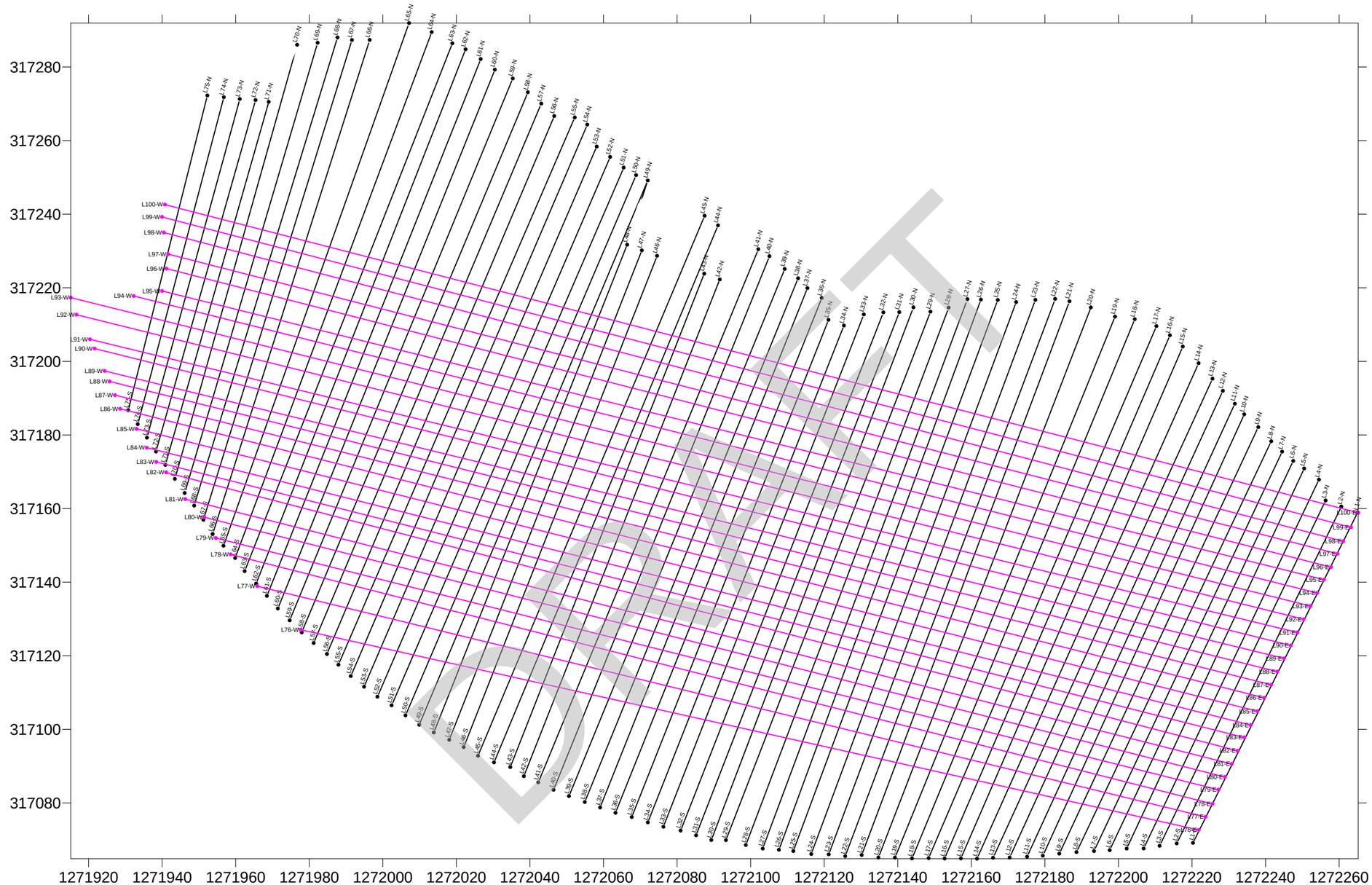
Project #: 105-0419.000		FILE No. GPR.EW
DESIGN	--	SCALE AS SHOWN / REV
CADD	JL	
CHECK	JL	**FIGURE 1**
REVIEW	--	

DRAFT

GLOBAL GEOPHYSICS REPORT, 2017A

DRAFT

21-1-22288-060



PROJECT

Meadowdale Beach Park
Edmonds, WA

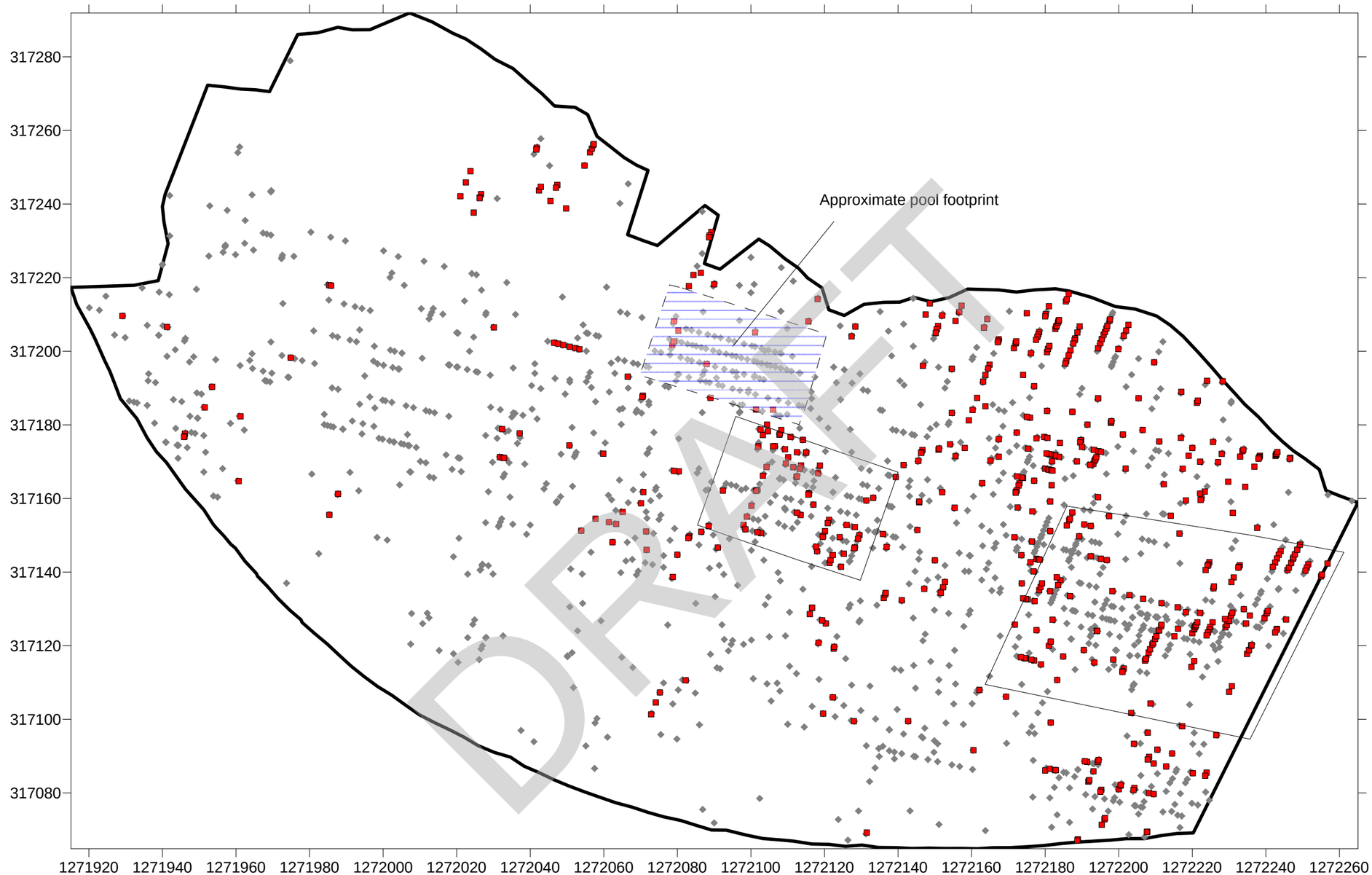
TITLE

GPR survey line location map

Global Geophysics
P.O. Box 2229
Redmond, WA 98073-2229
Tel: 425-890-4321

Project #: 106-0419.000		FILE No. GPR NS / EW Profile Line Locations
DESIGN	--	SCALE AS SHOWN REV.
CADD	JL	**FIGURE 1-A**
CHECK	JL	
REVIEW	--	

DRAFT



Legend:

- Shallow GPR Anomalies (mostly less than 4')
- Deep GPR Anomalies (mostly greater than 5')

0 ft 30 ft 60 ft

PROJECT
Meadowdale Beach Park
Edmonds, WA

TITLE
Interpreted GPR anomalies

Global Geophysics
P.O. Box 2229
Redmond, WA 98073-2229
Tel: 425-890-4321

Project #: 106-0419.000		FILE No. GPR NS / EW 3D Picks
DESIGN	--	SCALE AS SHOWN REV.
CADD	JL	**FIGURE 1-B**
CHECK	JL	
REVIEW	--	

GLOBAL GEOPHYSICS REPORT, 2017B

DRAFT

21-1-22288-060

Global Geophysics

P. O. Box 2229
Redmond, WA 98073-2229

Tel: 425-890-4321
Fax: 206-582-0838

May 1, 2017 Our ref: 106-0419.002

Shannon & Wilson, Inc.
400 North 34th Street, Suite 100
Seattle, Washington, 98103

ATTENTION: Mr. Tyler Stephens

RE: REPORT FOR THE GROUND PENETRATION RADAR AND ELECTRICAL RESISTIVITY TOMOGRAPHY SURVEYS AT MEADOWDALE BEACH PARK, EDMONDS, WA

Dear Mr. Stephens:

This letter report presents the results of the geophysical surveys performed by Global Geophysics on April 11th and 12th, 2017 at Meadowdale Beach Park, Edmonds, WA. The objectives of the studies are to locate buried objects in the abutment of the railroad tracks.

GEOPHYSICAL METHODS, INSTRUMENTATION AND FIELD PROCEDURES

Ground penetrating radar (GPR) and electrical resistivity tomography were used for this project. The followings describe the methods, field procedures and results.

Ground Penetrating Radar

The GPR method uses electromagnetic pulses, emitted at regular intervals by an antenna to map subsurface features. The electromagnetic pulses are reflected where changes in electrical properties of materials occur such as changes in lithology or where underground utilities are present. The reflected electromagnetic energy is received by an antenna, converted into an electrical signal, and recorded on the GPR unit. The data is recorded and viewed in real time on a graphical display that depicts a continuous profile or cross-section image of the subsurface directly beneath the path of the antenna.

The depth of penetration of the GPR signal varies according to antenna frequency and the conductivity of the subsurface material. The depth of subsurface penetration with GPR decreases with an increase in the frequency of the antenna and an increase in soil

conductivity. Low frequency antennas (50 to 500 MHz) provide the best compromise between obtaining good subsurface penetration and resolution.

The data were collected along four transects using Geophysical Survey Systems, Inc. (GSSI) SIR 2000 GPR system with antennas having a center frequency of 200 MHz. The data was digitally recorded for post processing.

Electrical Resistivity Tomography (ERT)

The electrical resistivity tomography technique maps differences in the electrical properties of geologic materials. These differences can result from variations in lithology, water content, and pore-water chemistry. The method involves transmitting an electric current into the ground between two electrodes and measuring the voltage between two other electrodes. The direct measurement is an apparent resistivity of the area beneath the electrodes that includes deeper layers as the electrode spacing is increased. Recent advances in technology permit rapid collection of multiple soundings, using up to 56 electrodes for each spread. The data are modeled to create a 2-D geo-electric cross-section that is useful for mapping both vertical and horizontal variations of the subsurface strata.

The data were acquired along two transects with an AGI SuperSting R8 using up to 56 electrodes spaced at a 5 feet interval. Once the electrode array was installed in the ground, multiple soundings were automatically carried out by the control unit. Downloading and routine modeling of the data was done on-site to provide preliminary analysis and QA/QC of the data. These results were displayed on a color monitor as cross-section that highlight changes in resistivity with depths along the transects.

RESULTS

The line locations are shown in Figure 1. The GPR profiles with interpreted anomalies are presented in Figure 2. The GPR anomalies are the inverted hyperbolic curves, which are the refracted waves from discrete objects, such as boulders. The dashed green line is interpreted as bottom of the fill. There are more GPR anomalies on Transect 1 and less GPR anomalies on Transect 4. The thickness of the fill increases from Transect 1 toward Transect 4.

The resistivity profiles are presented in Figure 3. Three resistivity layers are evident. The first layer is inhomogeneous, which correlates with fill materials with mix of coarse and fine materials (higher resistivity correlates with coarser materials such as boulder and gravels). The 2nd layer with resistivity less than 100 ohm-m is interpreted as beach sand with brine water. The basal layer with high resistivity is interpreted as coarse materials with freshwater discharge.

DRAFT

LIMITATIONS OF GEOPHYSICAL METHODS

Global Geophysics services are conducted in a manner consistent with the level of care and skill ordinarily exercised by other members of the geophysical community currently practicing under similar conditions subject to the time limits and financial and physical constraints applicable to the services. GPR and ERT are remote sensing geophysical methods that may not detect all buried objects. Furthermore, it is possible that interpreted features may upon intrusive sampling prove to have been misinterpreted or mis-located. Where interpretation from geophysical data is an important element for cost or safety of operations, it should always be checked for reasonableness against known or expected subsurface data, and verified at critical locations by physical means such as probing or drilling. Cautious and safe operating practices that will preserve the integrity of subsurface objects should always be used above and in the vicinity of known or possible objects.

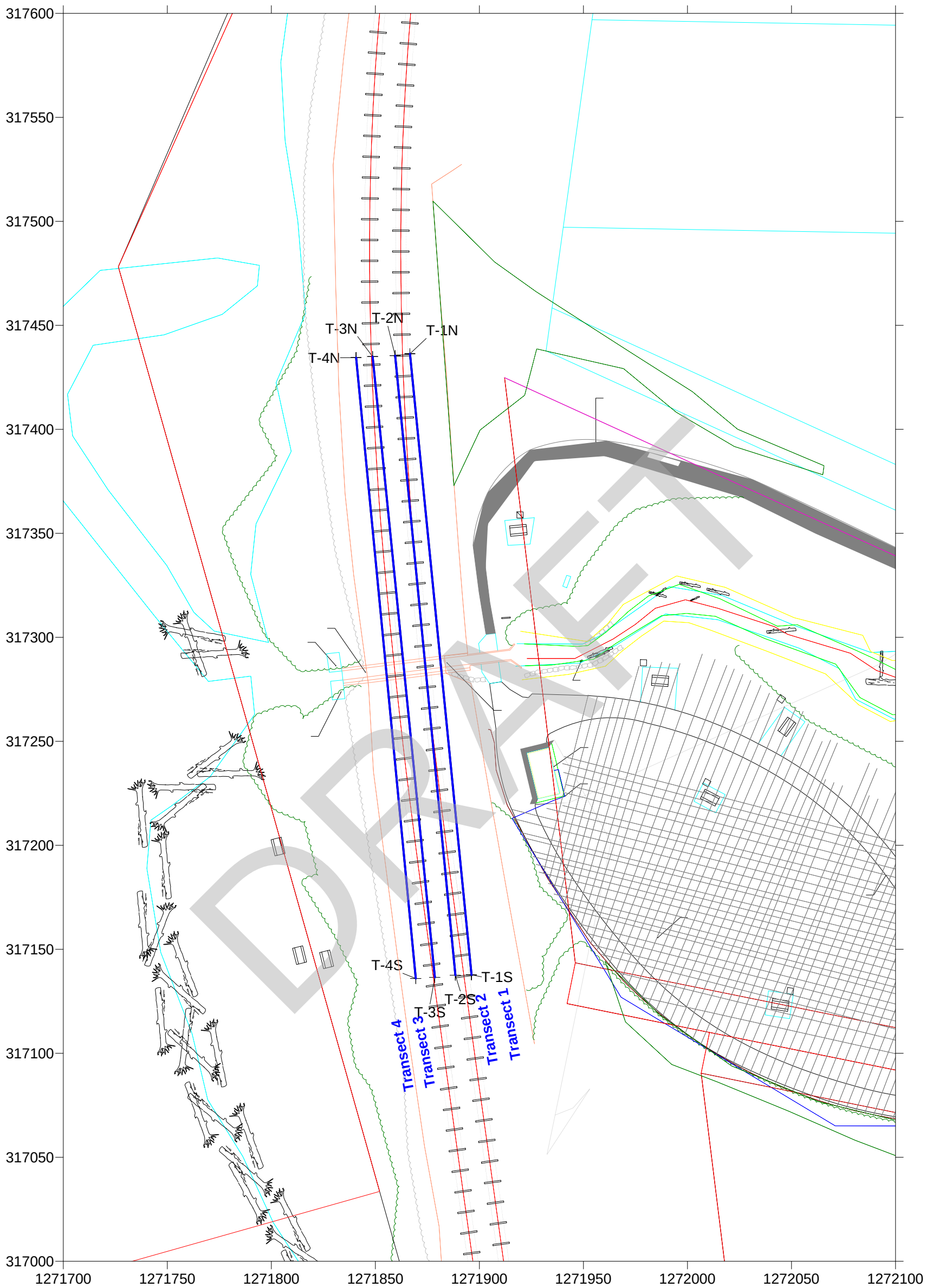
If you have any comments or questions, please contact Dr. John Liu at 425-890-4321.

Sincerely,

Global Geophysics

John Liu, Ph.D., R.G.
Principal geophysicist

DRAFT



0 ft 50 ft 100 ft

PROJECT

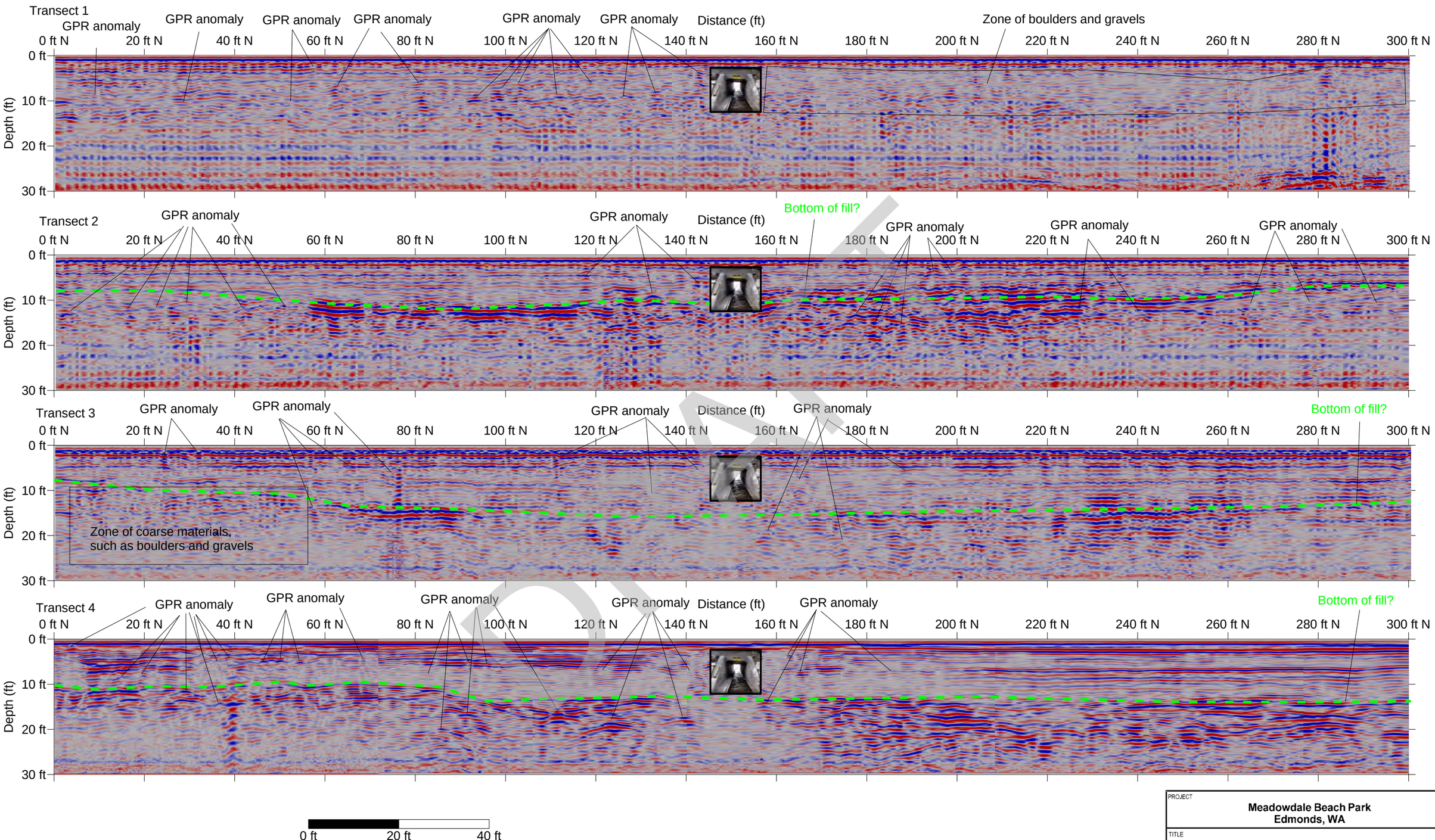
Meadowdale Beach Park
Edmonds, WA

TITLE

Site Plan

Global Geophysics
P.O. Box 2229
Redmond, WA 98073-2229
Tel: 425-890-4321

Project #: 106-0419.002		FILE No. GPR EW
DESIGN	--	SCALE AS SHOWN REV.
CADD	JL	**FIGURE 1**
CHECK	JL	
REVIEW	--	



PROJECT

Meadowdale Beach Park
Edmonds, WA

TITLE

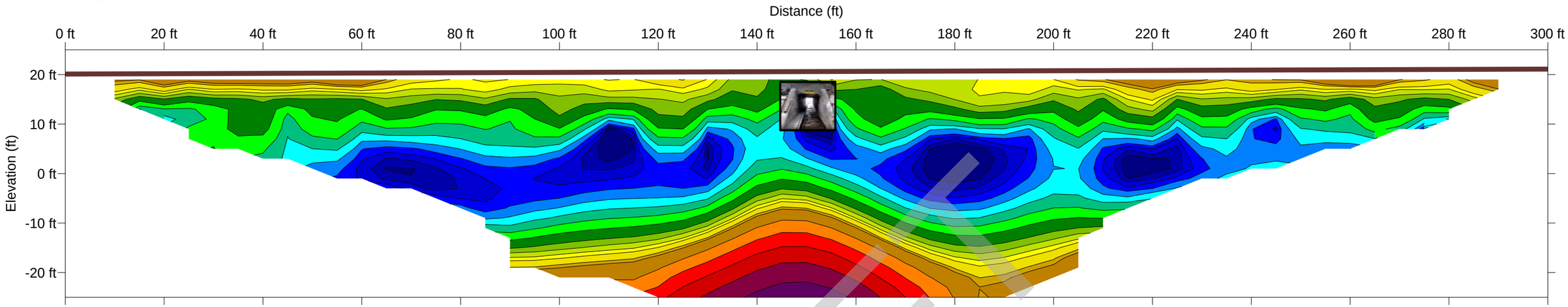
GPR Profiles

Global Geophysics
P.O. Box 2229
Redmond, WA 98073-2229
Tel: 425-890-4321

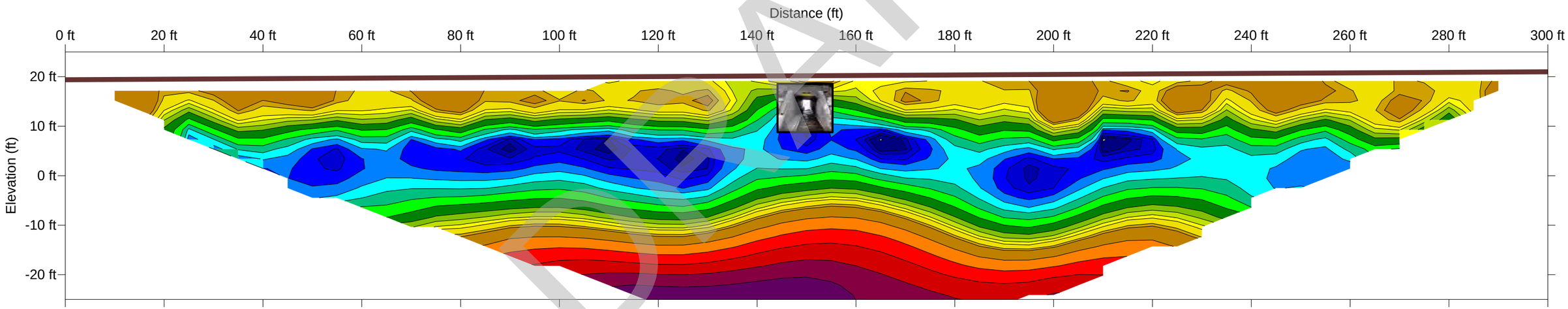
Project #: 105-0419.000			FILE No. GPR EW
DESIGN	--		SCALE AS SHOWN REV.
CADD	JL		**FIGURE 2**
CHECK	JL		
REVIEW	--		

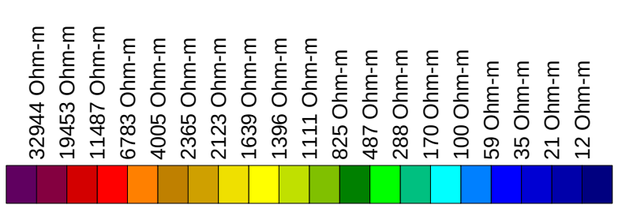
DRAFT

Transect 2



Transect 4





0 ft 20 ft 40 ft

PROJECT
Meadowdale Beach Park
Edmonds, WA

TITLE
Inverted Resistivity Profiles

Global Geophysics
P.O. Box 2229
Redmond, WA 98073-2229
Tel: 425-890-4321

Project #: 106-0419.000		FILE No. GPR EW
DESIGN	--	SCALE AS SHOWN / REV.
CADD	JL	
CHECK	JL	**FIGURE 3**
REVIEW	--	

DRAFT

DRAFT

APPENDIX D

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

DRAFT

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors which were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

DRAFT

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the
ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland

DRAFT

Appendix F-2
Geotechnical Evaluation:
Test Pit Excavation Photos

Photo 1: Test Pit TP-1 Location.

Photo 2: TP-1 Sidewall looking east.

Photo 3: TP-1 sidewall looking southeast.

Photo 4: TP-1 backfilled.

Photo 1: Test Pit TP-2 Location.

Photo 2: TP-2 Sidewall looking northeast.

Photo 3: TP-2 construction debris.

Photo 4: TP-2 backfilled.

Photo 1: Test Pit TP-3 Location.

Photo 2: TP-B Sidewall looking northeast.

Photo 3: TP-3 construction debris.

Photo 4: TP-3 backfilled.

Photo 1: Test Pit TP-B Location.

Photo 2: TP-B Sidewall looking northeast.

Photo 3: TP-B construction debris.

Photo 4: TP-B backfilled.

Photo 1: Test Pit TP-RE-1 Location.

Photo 2: TP-RE-1 Sidewall looking east.

Photo 3: TP-RE-1 sidewall looking northeast.

Photo 4: TP-RE-1 backfilled.

Appendix G
Type Selection Report

Type Selection Report

Proposed Bridge 21.8 over Lunds Gulch Creek

Meadowdale Beach County Park

Prepared for:

Snohomish County Department of Parks and Recreation

Prepared by:

Hanson Professional Services Inc.

7625 N. University St.

Peoria, IL 61614

August 18, 2017

TABLE OF CONTENTS

1. PROJECT OVERVIEW …….1

2. STRUCTURE DATA AND DESIGN CRITERIA ……...2

3. HYDRAULICS AND ENVIRONMENTAL ……..2

4. STRUCTURE LAYOUT ……..……2

5. SUBSTRUCTURE AND FOUNDATIONS …….……..3

6. SUPERSTRUCTURE ……..3

7. STRUCTURE EVALUATION AND RECOMMENDATION ……....4

8. REFERENCES …….4

APPENDICES

APPENDIX 1……..BNSF Comments on 10% Plans

APPENDIX 2……..….…..Bridge 21.8 30% Plans

1. Project Overview

The Meadowdale Beach Park Project consists of environmental, stream, and beach access improvements to the area around the Lunds Gulch Creek. One main feature of the project is replacing the existing reinforced concrete box culvert with a bridge. The overall purpose of the project is to "address beach access, flooding, maintenance, and fish barrier issues associated with sediment deposition." The existing culvert provides beach access from the park. At times of high water or after large sediment deposits, the pedestrian access is blocked.

A feasibility study was conducted in 2015 and updated in 2016 to determine the overall feasibility of the project and gather public comment and support. The results of this study helped determine an overall stream opening and structure type. This configuration was submitted to BNSF for comment as a 10% level design. The comments received from BNSF and the original configuration were together used as the basis for this report.

This report details the structure type selection procedure for the proposed Bridge 21.8 over Lunds Gulch Creek.

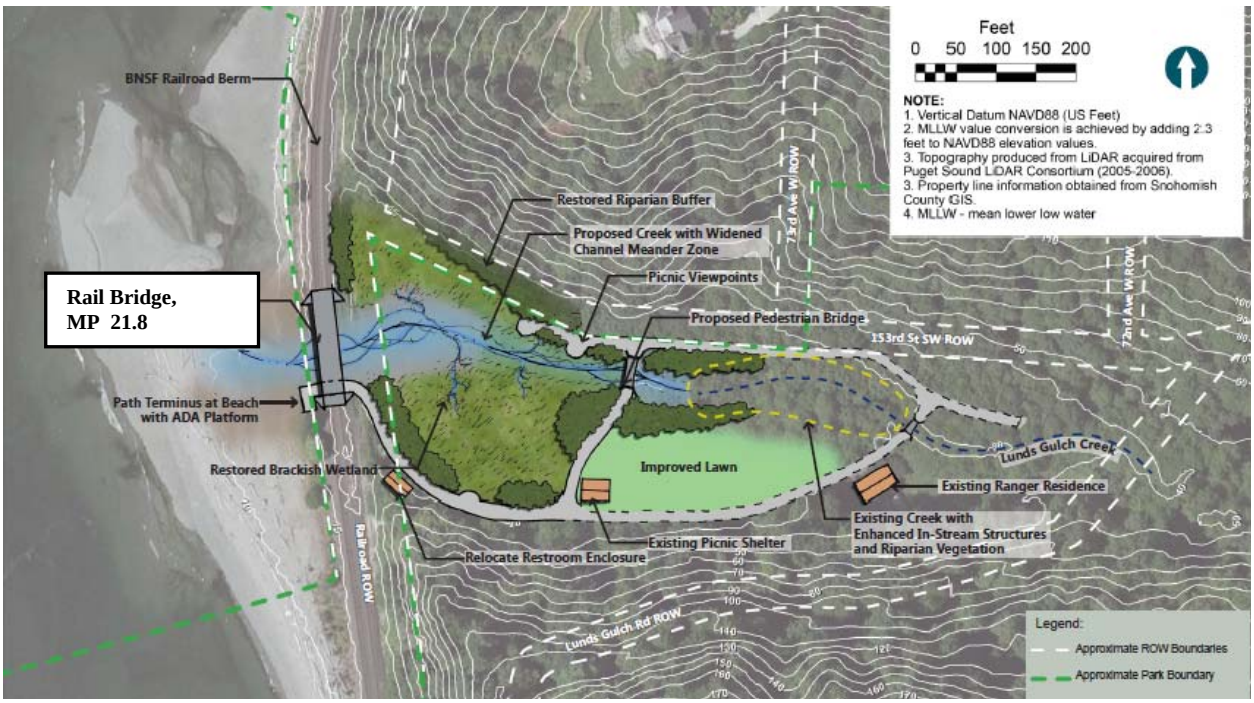


Figure 1: Project site plan indicating the proposed railroad bridge. (Feasibility Study, 2016)

2. Structure Data and Design Criteria

The existing concrete box culvert is located at the end of an approximately 4 degree curve in the double track BNSF line. The proposed bridge is positioned in the spiral to this curve. The proposed structure will follow a tangent alignment that has been adjusted to minimize the offset between the centerline of track and centerline of bridge. The rail profile over the bridge is relatively flat with a grade of approximately 0.23%.

The structure length over Lunds Gulch Creek will be 128 feet 2 inches from face to face of abutment. The vertical clearance is not controlled by the requirements of Lunds Gulch Creek. The 80 inches of vertical clearance provided to the walking trail under the southernmost span is required by ADA access requirements.

The bridge deck for the structure will be a ballasted, precast concrete deck supporting a typical track roadbed with 17 inch tall concrete curbs and concrete walkways.

The following structure data and design criteria are applicable to the bridge:

- Track Spacing: 14 feet 9 inches (varies)
- Bridge Centerline Spacing: 15 feet 1 inches
- Superstructure: Precast, prestressed concrete beams
- Design Live Load: Cooper E80 / Alt. LL on 4 Axles
- Design Dead Load: Self weight plus 30 inches of total ballast
- Specifications: AREMA (supplemented by BNSF)
- Utilities: None anticipated on the bridge
- Deck Drains: None over Lunds Gulch Creek
- Walkways: Concrete walk
- Foundation: Driven H-pile

3. Hydraulics and Environmental

The project is designed to increase the hydraulic opening of the existing concrete box culvert. The existing 72 inch x 90 inch culvert will be increased to provide approximately 90 feet of width for the creek. This width was determined in the feasibility study to provide natural stream migration.

4. Structure Layout

The project feasibility study determined the preferred waterway opening width to be provided by the proposed bridge. Within this width, the configuration of bridge span lengths was controlled by two constrains:

- Provide 80 inches of vertical clearance for the beach access trail
- Use span lengths no longer than 28 feet.

The span over the walking trail had to provide a shallow structure depth to allow for an ADA clearance of 80 inches. This span is adjacent to the abutment, so the span length had to also be great enough to allow for typical embankment slopes extending from the abutment.

The restriction of 28 feet maximum span lengths is based on our past experience on railroad projects that were constructed with rail mounted cranes. These cranes have limited lifting capacity which makes 28 feet double voided, box beam spans the longest reasonable spans to use. This length restriction was in place to allow the eventual contractor some flexibility in their method of construction.

The 10% bridge plans included the use of shooflys during construction and final track centers of 20 ft. The comments that were received from BNSF on these plans stated that adjustments to the rail alignment were not allowed. In response to those comments, the proposed 30% bridge design plans show the track centers remaining at their current distance which is approximately 14 feet 9 inches. The bridge is detailed using BNSF bridge standards for 15 feet 1 inch track centers.

The chosen bridge configuration shown in Appendix 1 meets the above requirements and follows the latest BNSF *Standard Bridge & Component Plans* dated June 1, 2016.

5. Substructure and Foundations

The proposed substructure is BNSF standard precast concrete bent and abutment caps. These components are economical, durable, and able to withstand salt spray. Their standard configuration will be known to contractors and has been proven to work for the BNSF Railway.

Preliminary geotechnical investigations have been completed by Shannon and Wilson, Inc. The results of these investigations have shown that driven H-pile foundations are feasible at this location. No bedrock was found within the 130 foot length of the two borings. The driven piles will be driven to capacity in the sand which underlays the project location.

The project constraints for clearance and opening are able to be met with standard substructure and pile foundation components. There is no need to consider more exotic configurations or components to meet the project's needs.

6. Superstructure

BNSF Standard precast, prestressed slab beams and double voided box beams were chosen for the simple span superstructure. These components are cost effective and commonly used by bridge contractors. Since the desired bridge length and walking trail clearance could be met with standard components, no additional configurations were considered.

The proposed configuration includes solid concrete walkways and handrails with kick angles to keep falling ballast off of the walking trail below. The curbs are standard BNSF height of 17 inches.

7. Structure Evaluation and Recommendation

The proposed configuration shown in Appendix 1, meets the requirements of the project as well as the guidance set forth in the BNSF *Guidelines for Railroad Grade Separation Projects.* The proposed double track structure consists of BNSF standard precast, prestressed concrete superstructure elements and standard precast concrete caps on driven H-pile foundations.

8. References

Anchor QEA, LLC, 2015. *Feasibility Report, Meadowdale Beach County Park Feasibility Study.*

Anchor QEA, LLC 2016. *Addendum: Feasibility Report, Meadowdale Beach County Park Feasibility Study.*

APPENDIX 1

BNSF Comments on 10% Plans

10% Plan Submittal Comments

Received from BNSF Manager of Public Projects, Rick Wagner, on September 19, 2016.

Public Projects/Engineering Services:

- BNSF will not consider conceptual plans which require the following for construction or finished use along the coast at this location:
  - Changes to the horizontal track alignment of the existing track(s);
  - Changes to the vertical track alignment of the existing track(s);
  - BNSF will not change their current operational practices or sacrifice any current operational flexibility except for brief periods during construction under specific short-term circumstances, i.e. hours in length;
  - Shoofly tracks of any speed at this location, due to constructability and impacts to operation;
  - BNSF will not participate in funding of this Project.

Structures Review:

- No additional comments.

APPENDIX 2

Bridge 21.8 30% Plans

Appendix H
Memorandum: Hydraulic Model Update

1605 Cornwall Avenue
Bellingham, Washington 98225
360.733.4311

Memorandum

April 7, 2017

To: Logan Daniels, Snohomish County Parks and Recreation

From: Kathy Ketteridge, PhD, P.E., and Kyle List, Anchor QEA, LLC

cc: Peter Hummel, FASLA, LEED®AP, Anchor QEA, LLC

Re: Meadowdale Beach County Park and Habitat Design – Hydraulic Model Update

Background and Purpose of Model Update

As part of the Meadowdale Beach Park Feasibility Study (Anchor QEA 2016), a 1-D hydraulic model (HEC-RAS; Brunner 2010a, 2010b) was developed and used to estimate hydraulic conditions in Lund's Gulch Creek. The previous hydraulics evaluation was conducted to evaluate the minimum opening required to convey estimated sediment loads predicted for Lund's Gulch Creek and to evaluate the relative hydraulic performance of proposed alternatives for creek flow conveyance. Model development and results of the previous hydraulic evaluation are documented in Appendix B of the Feasibility Study.

As part of the Park and Habitat Design work, the original hydraulic model was updated to reflect new site survey data that were collected within the project extents in October of 2016. High flow simulations conducted as part of the original study were repeated using the updated model, and results of the original and updated model were compared. This Draft Memorandum summarizes the model update and the results of the revised model simulations and comparison with the original model results.

The updated model will also be used to complete hydraulic modeling of the final railroad bridge design to inform design of the bridge abutments (rock size) and estimate scour at the abutments and any intermediate bridge piers. This work will be conducted after submittal of this Draft Memorandum, and discussion of those results will be included in the Final Memorandum.

Model Update

The original model geometry was updated based on new site survey elevation data collected as part of the design work for the project, which was converted to a three-dimensional surface using CAD, (Duane Hartman and Associates, Inc. 2016). The alignment of Lund's Gulch Creek and location and length of the sections in the 1-D HEC-RAS model were not modified; only the elevation data used to define the cross-section geometry of the channel and floodplains were revised based on the CAD surface elevations. The model sections for the existing conditions model scenario were modified between the downstream end of the model (cross-section 32) and upstream to cross-section 1245 in

the areas that the survey overlapped with the existing model. Model transect 1324 overlaps with the upstream boundary of the CAD surface, but the channel was not well defined in this area; therefore, this transect was not updated. Figure 1 shows the alignment and sections for the original model, and highlights which sections were updated with new elevation information based on the new site survey.

Downstream of the railway/culvert, the cross-section geometry of the beach and channel is very different than the existing conditions model because of changes in the channel alignment on the beach due to recent heavy rains and large creek flows. Upstream of the railway/culvert, the cross-sections of the floodplain were consistent with the existing conditions cross-section elevations; no significant geomorphological changes were observed. The updated surface elevations provided some additional detail/resolution for the model geometry of the floodplain. The updated survey data showed very similar channel width and general alignment compared to the previous model existing conditions cross-sections. However, some of the cross-section thalweg elevations in the updated survey contour surface show variations from the existing conditions model thalweg elevations:

- Upstream of the railway/culvert to cross-section 580, the channel thalweg elevations for the updated surface were typically slightly lower than the previous existing conditions model by an average of 0.5 foot.
- Upstream of cross-section 580, the channel thalweg elevations for the updated surface were typically slightly higher than the previous existing conditions model by an average of 0.75 foot.

High Flow Simulations

High flow conditions were simulated in Lund's Gulch Creek (for existing with-culvert conditions) using the same hydrology as the original model and the predicted water surface elevation results were compared, as described below.

Hydrology

Discharges in the creek associated with a number of return periods were taken from the *Puget Sound Tributaries Drainage Needs Report* (Snohomish County 2002). Snohomish County utilized a Hydrological Simulation Program-Fortran (HSPF) model to estimate extreme discharge volumes in Lund's Gulch Creek.

Output from the County's HSPF model for 2-year, 10-year, 25-year, and 100-year return interval storm flows at the mouth of Lund's Gulch Creek for existing and future predicted flows are shown in Table 1. Some land use alterations[1] have occurred since the date of the report that will likely reduce future

[1] For example, a 13-acre parcel of land that was assumed to be developed when the drainage needs report was completed has been recently purchased by the City of Lynnwood with Conservation Futures funding for the purpose of maintaining natural spaces.

runoff within the basin; however, the future values as stated in the 2002 report are still used as the baseline hydrology for this evaluation as a conservative value for analysis.

Additional flows higher than the 100-year storm flow (Snohomish County 2002) were also used in this evaluation to take into account uncertainties in predicted hydrology modeling and maintenance issues associated with upstream stormwater control systems, as well as future conditions associated with climate change[2] and unanticipated development. An upper bound for hydrology used in the evaluation was taken from previous hydrology developed for the Lund's Gulch Basin in 1989 (Snohomish County 1989). Flows reported in an earlier study at the mouth of Lund's Gulch ranged from 94 cubic feet per second (cfs) for a 2-year peak flow to 361 cfs for a 100-year peak flow. The difference between flow rates in the 2002 study versus the 1989 report is primarily due to construction of stormwater detention infrastructure upstream of the site at 52nd Avenue.

In the absence of additional run-off modeling to bound uncertainty in modeled hydrology or evaluate potential increase in creek flows due to climate change scenarios, a number of additional high discharges were used in the assessment. These discharges range from a factor of safety of 1.5 applied to the HSPF 100-year storm flow to a factor of safety of 1.5 applied to the previous 100-year flow in the creek estimated in the 1989 basin report from the County. The additional high discharge value of 550 cfs was used as an upper bound for this feasibility evaluation. The purpose of including an upper bound for creek hydrology in the evaluation is to ensure that all proposed alternatives have the ability to convey higher flows and associated sediment loads that may occur in the future without additional modifications to the opening once constructed.

Table 1
Assessment Discharges

Peak Flow Event	Discharge (cfs)
2-year[a]	57
10-year[a]	89
25-year[a]	106
100-year[a]	135
Additional High Discharges	200
	300
	400
	550

Notes:
a. Taken from Snohomish County 2002
cfs: cubic feet per second

[2] Climate change studies for this region generally predict that winter precipitation will increase in the future due to climate change in the region (U.S. Global Change Research Program 2009).

Model Results

The 100-year and 500-year flood event scenarios (see Table 1) were run for the existing conditions railway/culvert scenario with the updated model. Figure 2 shows a comparison of water surface elevations predicted in Lund's Gulch Creek for the original and updated hydraulic model for the hydraulic conditions considered. Figure 2 also shows a comparison of the original and updated channel thalweg elevations in the model. Overall, predicted water surface elevations were similar between the two models with no hydraulically significant differences observed. The following is a summary of this comparison:

- For the 100-year flood: water surface elevations were predicted to be slightly lower (average 0.4-foot decrease) starting from the railway/culvert upstream to cross-section 619. Upstream of cross-section 619, the predicted water surface elevations for the update model typically showed an increase (average 0.6 foot).
- For the 500-year flood: water surface elevations experience a backwater effect from the railway/culvert upstream to cross-section 439 with negligible difference between the updated and previous existing conditions model. Upstream of cross-section 439, the water surface elevation varies between higher and lower than for the previous existing conditions model, but on average predicted an increase of the water surface elevation by an average of 0.3 foot.
- Upstream of cross-section 1438, there is negligible difference in water surface elevation between the updated and previous existing conditions model for both the 100-year and 500-year flood events.

References

Anchor QEA, 2016. Meadowdale Beach County Park Feasibility Study. Developed for Snohomish County Department of Parks and Recreation. 2016.

Brunner, G.W., 2010a. *HEC-RAS River Analysis Systems User's Manual Version 4.1*. CDP-68. U.S. Army Corps of Engineers. Hydrologic Engineering Center. Davis, California.

Brunner, G.W., 2010b. *HEC-RAS River Analysis Systems Hydraulic Reference Manual*. CDP-69. U.S. Army Corps of Engineers. Hydrologic Engineering Center. Davis, California.

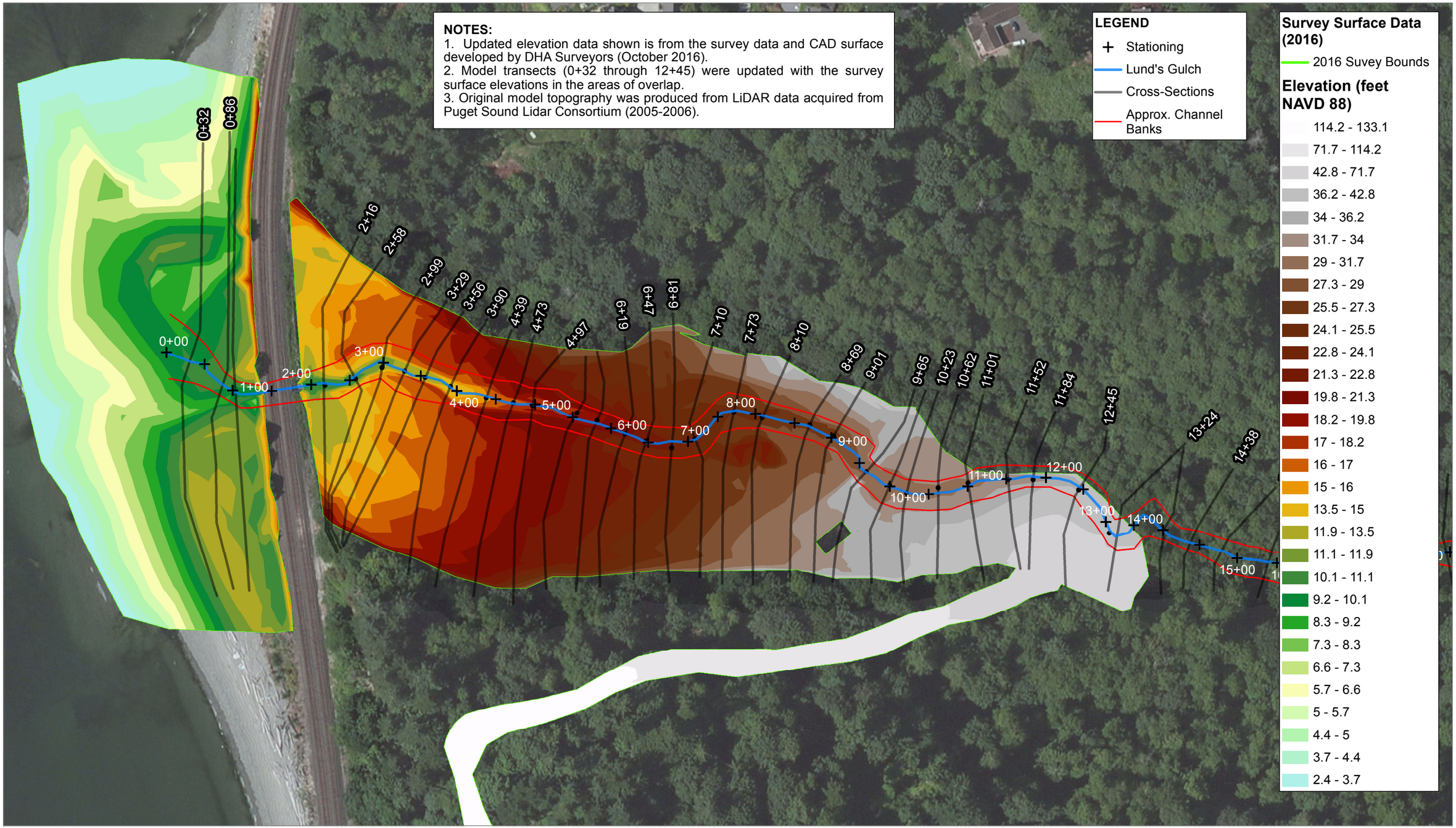
Duane Hartman and Associates, Inc., 2016. Meadowdale Beach Park Estuary Restorations. Survey and Mapping Data. October 2016.

Snohomish County, 1989. *Lunds Gulch Basin Study Draft Report*. Snohomish County Public Works, Surface Water Management. April 1989.

Snohomish County, 2002. *Puget Sound Tributaries Drainage Needs Report.* DNR No. 11. Snohomish County Public Works Department, Surface Water Management Division. December 2002. Available from: http://snohomishcountywa.gov/1079/Urban-Drainage

U.S. Global Change Research Program, 2009. *Global Climate Change Impacts in the United States*. Karl, T.R., J.M. Melillo, and T.C. Peterson (eds.). Cambridge University Press, 2009.

Figures

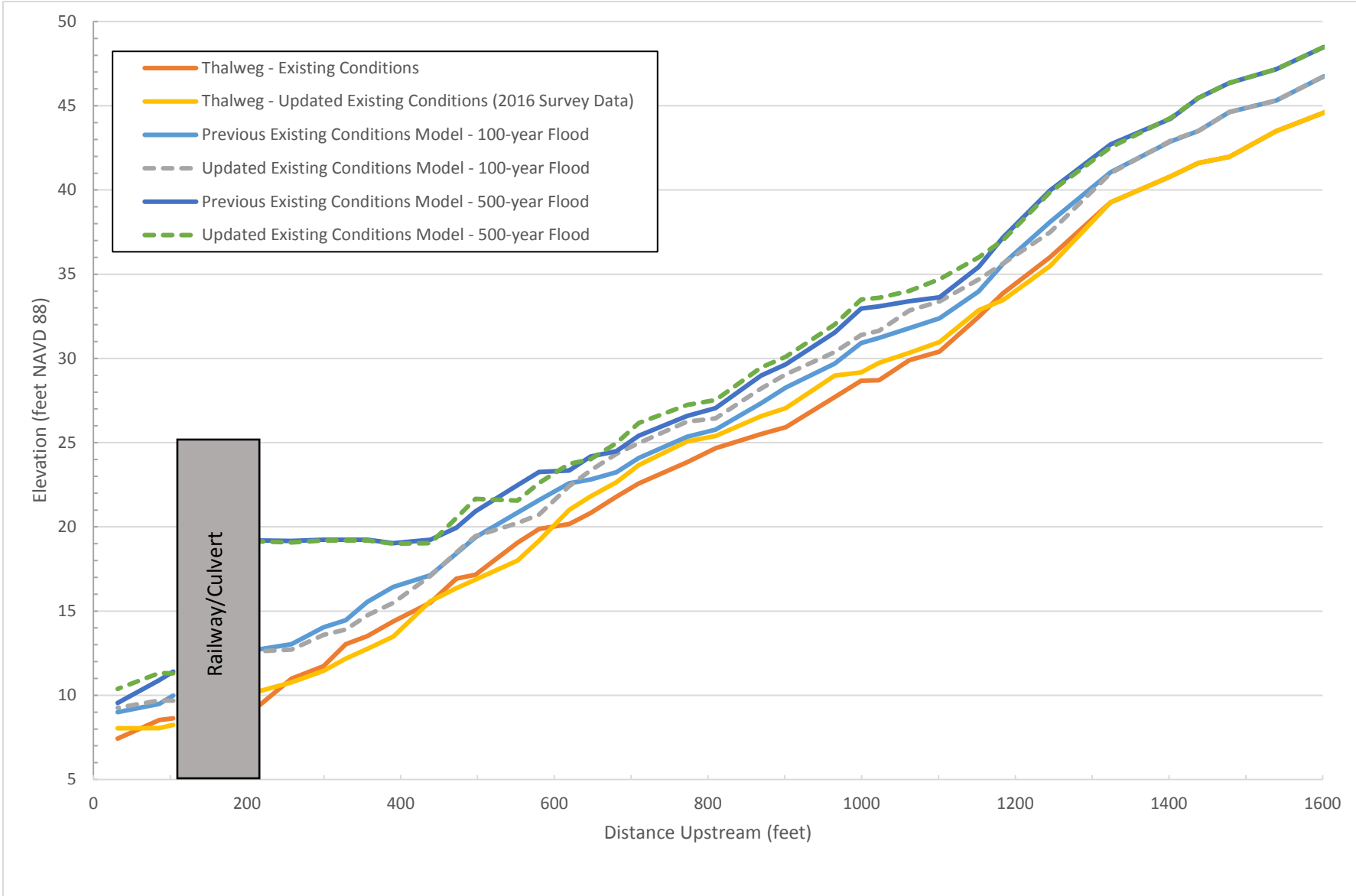


Publish Date: 2017/04/07, 11:15 AM | User: klist
Filepath: I:\Projects\Snohomish County\Meadowdale Beach Park\Feasiblity Study\Task 5 - Studies\H&H\HEC-RAS_Model\meadowdale aerial\HECGeoRAS_Map_Aerial_AB_v3_2016.mxd

ANCHOR QEA

0 200
Feet

Figure 1
Updated Model Elevations - Survey Surface Data
Meadowdale Beach County Park and Habitat Design – Hydraulic Model Update
Snohomish County, WA



ANCHOR QEA

Figure 2

Existing Conditions Water Level Results Comparison (100- and 500-year Flood Events)

Meadowdale Beach County Park and Habitat Design – Hydraulic Model Update

Snohomish County, WA

Appendix I
Lund's Gulch Creek Fish Habitat Assessment

CONFLUENCE
ENVIRONMENTAL COMPANY

To: Ann Costanza, Anchor QEA, LLC

From: Kerrie McArthur and Paul Schlenger

Date: December 27, 2016

Re: Lund's Gulch Creek Fish Habitat Assessment

Enclosures: Figure 1 Lower Reach Location
Appendix A Fish Habitat and LWD Survey Data

1.0 INTRODUCTION

Several species of salmonids utilize Lund's Gulch Creek including Chinook, coho, chum, steelhead, and sea-run cutthroat trout. Currently, Lund's Gulch Creek flows through a 6-foot-wide by 7-foot-tall box culvert through the railroad embankment at the mouth of the creek. A narrow ledge in the box culvert is also the only legal access for park users to reach the beach. The box culvert does not function adequately either as the creek conduit or as a means to access the beach. The box culvert is significantly undersized for a creek system the size of Lund's Gulch Creek. As a result, creek flows are partially impounded upstream of the culvert during high flows, which causes flooding in the park and deposition of large quantities of stream sediment. The sediments accumulate in and upstream of the box culvert, resulting in impacts to creek habitat, fish movements, and park visitor access to the beach. Maintenance of this culvert by Snohomish County requires several permits and can only be performed during specific time periods ("work windows") defined in the permits. In the last several years, maintenance actions have been unable to sustain clear access for fish or people due to the excessive volume and frequency of gravel deposition within and upstream of the culvert.

Snohomish County Parks conducted a feasibility study in 2015 to evaluate restoration alternatives for the Lund's Gulch Creek estuary in Meadowdale Beach County Park. The preferred alternative has been chosen and a conceptual plan designed. This assessment was prepared to document existing fish habitat conditions in support of the restoration design and associated permitting.

2.0 METHODS

The following methods were used to characterize fish habitat in the lower reach of Lund's Gulch Creek. The lower reach was defined as the 760 linear feet of Lund's Gulch Creek

beginning at the upstream end of the railroad culvert to the downstream end of the foot bridge adjacent to the ranger's home (Figure 1).

2.1 Fish Habitat Survey

Because no single measure of physical habitat is sufficient to describe habitat conditions in a reach, several habitat parameters were evaluated to aid in describing conditions within the lower reach of Lund's Gulch Creek. The physical habitat parameters for this assessment followed modified methods described in U.S. Forest Service's Stream Inventory Handbook – Level I & II (USFS 2003) and the Washington State Watershed Analysis Methods (WFPB 2011).

The survey area of Lund's Gulch was divided into two reaches: a lower reach encompassing the restored estuary area and an upper reach encompassing the remainder of the stream length up to the bridge near the Park Ranger's residence. The survey area was further divided into 18 segments, based on channel type. Eleven segments encompassing 308 feet upstream from the outlet culvert comprised the Restored Estuary reach and seven segments encompassing 452 feet comprised the Stream reach.

Data were collected on the length of each segment defined in the field, channel type (pool, riffle, single, multiple, etc.), flow regime, substrate (dominant, subdominant, etc.), wetted width and depth, and pool characteristics (pool former, residual pool depth) at each change in channel type. Fish observations were also recorded. Details of the data collected are below.

2.1.1 Channel Type

Data was collected on the channel type of each segment. The channel type is a general characterization of the channel morphology of each segment and was categorized as either riffle or pool. The channel type was identified as pool only if the pool spanned most the channel.

2.1.2 Flow Regime

Flow regime refers to perennial or intermittent flow condition. The flow regime can be classified as permanently flowing or intermittently flowing.

2.1.3 Substrate

Data on substrate were collected to determine the presence and quality of spawning habitat in the lower reach of Lund's Gulch Creek for both resident and anadromous salmonids. Factors considered were dominant and subdominant substrate, spawning gravel presence, and embeddedness. These characteristics are described below.

Dominant and Subdominant Substrate

The dominant and subdominant substrate were visually estimated for each segment. Observations on surface substrate size were recorded using the substrate classification codes for IFIM analysis (WDFW and Ecology 2016). This substrate classification code uses a scale of 1 to 9, with 1 representing fines (i.e., silt and clays) and 9 representing bedrock.

Substrate codes use the format "ab.c" where "a" is the component code for dominant particle size[a], "b" is the component code for the subdominant particle size, and "c" is tenths of cell area covered by dominant (50% or greater) substrate type. For example, the code 46.8 indicates 80% medium gravel and 20% small cobble (WDFW and Ecology 2016).

Spawning Gravel Presence

The presence of spawning gravel was determined within each segment. The presence of spawning gravel was identified for both anadromous and resident salmonids. Spawning gravel for anadromous salmonids was determined as present if there was at least one patch of suitably sized gravel (medium gravel to large cobble) that was equal to or greater than 22 square feet. Spawning gravel for resident salmonids was determined as present if there was at least one patch of suitably sized gravel (small gravel) that was equal to or greater than 3 square feet.

Embeddedness

Embeddedness is defined as the degree to which rocks (gravel, cobble, and boulders) and snags are covered or sunken into the silt, sand, or mud of the stream bottom. Generally, as rocks become embedded, the surface area available to macroinvertebrates and fish (shelter, spawning, and egg incubation) is decreased. Therefore, embeddedness was used to rate the quality of the spawning present.

Substrate was classified as embedded (i.e., inferring less suitable for egg incubation) if the amount of fines in the interstitial spaces was visually estimated at more that 25 percent (Flosi et al 1998).

2.1.4 Wetted Width and Depth

Data on the average wetted width and depth were recorded for each segment. The average wetted depth was used to calculate residual pool depths (see below).

2.1.5 Pool Data

Data on pools were collected to evaluate the quality rearing habitat in the lower reach of Lund's Gulch Creek. Data collected for pools included information on what formed the pool and the

[a] The type of substrate that covers the greatest area of bottom surface in a particular cell, not necessarily the largest-diameter particle; e.g., sand may be dominant over cobble.

residual depth of the pool. The NMFS (1996) pool quality was defined as pools greater than 3 feet in residual depth with good cover and cool water, and minor reduction of pool volume by fine sediment. This definition is best suited for large river systems, where adult salmon "hold" in these larger pools until the smaller tributaries discharge sufficient flow to trigger upstream migration and spawning in these smaller streams. Because of the relatively small size of Lund's Gulch Creek, holding pools would not develop in the creek. Therefore, pools were defined based on the definition of pools as described in the Timber Fish and Wildlife Monitoring Program's Method Manual for the Habitat Unit Survey (Pleus et al. 1999). For streams the size of Lund's Gulch Creek, pools were defined as areas at least 5 square feet in size and 4 inches in residual depth (Pleus et al. 1999).

Pool Former

Data were recorded on how pools were formed. Pool forming structures can include large woody debris (LWD), boulders, or other structures, such as heavily rooted banks. Identifying the pool forming structures is important in understanding what physical processes are forming fish habitat.

Residual Pool Depth

Residual pool depth is the difference in depth or bed elevation between the deepest depth of a pool and the downstream riffle crest. Residual pool depth is the depth that, if flow were reduced to zero, water would fill pools just up to the downstream riffle crest. Residual depths represent extreme low flow conditions, which can limit a stream's capacity to support fish populations.

2.2 Large Woody Debris Survey

The LWD survey followed a modified method described in the Washington State Watershed Analysis Methods (WFPB 2011). NMFS (1996) defined LWD as wood larger than 24 inches diameter and more than 50 feet in length. However, this definition of LWD was too large for smaller streams like Lund's Gulch Creek; therefore, the definition of LWD for Lund's Gulch Creek was based of the definition described in the Washington Watershed Analysis Manual (WFPB 2011), which defined a key piece of LWD for a stream the size of Lund's Gulch Creek as larger than 4 inches in diameter and more than 6 feet in length.

Data on location (distance from start of reach), length, diameter class (4-12 inches, 12-24 inches, etc.), recruit process, and function (scour pool, dam pool, sediment storage, etc.) were recorded for any woody debris identified as LWD.

LWD was then categorized as a key piece if the LWD met the WFPB (2011) minimum volume of 35 cubic feet. Although the overall LWD count is important, it is also important to identify key pieces that are large enough to remain in place for a significantly longer period (often even

during extreme flood events) and are more effective at trapping other smaller woody debris pieces and sediment (WFPB 2011).

2.3 Habitat Ratings

Snohomish County evaluated habitat in the lower reach of Lund's Gulch Creek in 2002 as part of Snohomish County's Puget Sound Tributaries Drainage Needs Report (Snohomish 2002). The Drainage Needs Report (2002) rated habitats using a modified matrix of properly functioning habitat condition indices developed by National Marine Fisheries Service (NMFS 1996). To provide comparable ratings to the Drainage Needs Report, the habitat ratings in this report were also assigned using NMFS (1996). The NMFS habitat indices are presented in Table 1. The indicators of the pathways described in the properly functioning matrix recognize that there would be circumstances where the range of numerics in the matrix do not apply to a specific watershed or basin (NMFS 1996). Lund's Gulch Creek is such a basin because of its small size. Specifically, indicators for some pathways, such as LWD and pool frequency, were presented by NMFS (1996) as a value per mile. Because of the small size of the Lund's Gulch Creek, these values were converted to a value per 500 feet in Table 1.

Habitat ratings were evaluated for two reaches of the Lund's Gulch Creek lower reach: (1) the Restored Estuary Reach, which begins at the upstream end of the railroad culvert and goes upstream to 308 feet; and (2), the Stream Reach, which extends across the remaining 452 feet of the survey area from the Restored Estuary Reach to the foot bridge near the Park Ranger's house. These two reaches were rated separately because of the different restoration options being proposed for the two reaches.

Table 1. Habitat Ratings Modified from NMFS (1996)

Pathway	Indicators	Properly Functioning (good habitat)	At Risk (fair habitat)	Not Properly Functioning (poor habitat)
Habitat Access:	Physical Barriers	any man-made barriers present in watershed allow upstream and downstream fish passage at all flows	any man-made barriers present in watershed do not allow upstream and/or downstream fish passage at base/low flows	any man-made barriers present in watershed do not allow upstream and/or downstream fish passage at a range of flows
Habitat Elements:	Substrate	dominant substrate is gravel or cobble (interstitial spaces clear), or embeddedness <20%[a]	gravel and cobble is subdominant, or if dominant, embeddedness 20-30%[a]	bedrock, sand, silt or small gravel dominant, or if gravel and cobble dominant, embeddedness >30%[b]
	Pool Frequency channel width # pools per 500 ft. [c] 5 ft. 17.4 10 ft. 9.1 15 ft. 6.6 20 ft. 5.3	meets pool frequency standards (left) and LWD recruitment standards for properly functioning habitat (below)	meets pool frequency standards but LWD recruitment inadequate to maintain pools over time	does not meet pool frequency standards
	Pool Quality[d]	most pools at least 5 square feet in size and 4 inches in residual depth with good cover and cool water[a]; minor reduction of pool volume by fine sediment	few pools (> 5 square feet and 4 inches) present or inadequate cover/temperature[a]; moderate reduction of pool volume by fine sediment	no pools (5 square feet and 4 inches) and inadequate cover/temperature[a]; major reduction of pool volume by fine sediment
	Large Woody Debris	>7.57 pieces/ 500 ft., >4 inches diameter, >6 ft. length[a], and adequate sources of woody debris	currently meets standards for properly functioning, but lacks potential sources from riparian areas of woody debris recruitment to	does not meet standards for properly functioning and lacks potential LWD recruitment

[a] WFPB 2011
[b] Biological Opinion on Land and Resource Management Plans for the: Boise, Challis, Nez Perce, Payette, Salmon, Sawtooth, Umatilla, and Wallowa-Whitman National Forests. National Marine Fisheries Service, Northwest Region, March 1, 1995.
[c] Biological Opinion on Implementation of Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH). National Marine Fisheries Service, Northwest Region, January 23, 1995.
[d] Pleus et al. 1999

		recruitment in riparian areas	maintain that standard	
	Off-Channel Habitat	backwaters with cover, and low energy off-channel areas (ponds, oxbows, etc.)[a]	some backwaters and high energy side channels[a]	few or no backwaters, no off-channel ponds[a]

3.0 RESULTS

Results of the Lund's Gulch Creek habitat assessment are presented below and summarized in Table 2. Appendix A provides tables detailing fish habitat and LWD data collected.

Table 2. Habitat Assessment Summary

Pathway	Indicator	Restored Estuary Reach		Stream Reach	
		Survey Results	Habitat Rating	Survey Results	Habitat Rating
Habitat Access	Physical Barriers	Barriers absent	Properly Functioning	Barriers absent	Properly Functioning
Habitat Element: Spawning and Incubation	Substrate	89% of total length of reach was spawning habitat, 63% of which was embedded with sand	Not Properly Functioning	92% of total length of reach was spawning habitat, 88% of which was embedded with sand	Not Properly Functioning
Habitat Element: Rearing	Pools	Pool frequency was 16.2 pools per 500 feet, but lacked cover	At Risk	Pool frequency was 8.8 pools per 500 feet, but lacked cover	At Risk
		Residual pool depths were greater than 4 inches	Properly Functioning	Residual pool depths were greater than 4 inches	Properly Functioning
	LWD	30.8 pieces per 500 feet	Properly Functioning	44 pieces per 500 feet	Properly Functioning
	Off-Channel	No off-channel habitat exists	Not Properly Functioning	No off-channel habitat exists	Not Properly Functioning

3.1 Habitat Access

Habitat access was rated based on the presence or absence of fish migration barriers. No physical barriers were present in the Restored Estuary or Stream reaches; thus, this pathway is considered Properly Functioning for both reaches.

3.2 Spawning and Incubation Habitat

Spawning and incubation habitat was rated based on the quantity and quality of substrate of the appropriate size for spawning. Substrate was dominated mostly by gravels throughout the reach.

In the Restored Estuary Reach, approximately 89 percent of the stream channel by length (274 feet out of 308 feet) contained gravel sizes suitable for anadromous salmon spawning habitat; however, 63 percent of the available spawning habitat by length was embedded (173 feet out of 274 feet). Overall, 37 percent of the stream channel in the Restored Estuary Reach provided suitably sized spawning substrate that was not embedded. These conditions correspond to a Not Properly Functioning rating for the Restored Estuary Reach.

In the Stream Reach, approximately 92 percent of the stream channel by length (414 feet out of 452 feet) contained gravel sizes suitable for anadromous salmon spawning habitat; however, 88 percent of the available spawning habitat by length was embedded (363 feet out of 414 feet). Overall, 12 percent of the stream channel in the Stream Reach provided suitably sized spawning substrate that was not embedded. These conditions correspond to a Not Properly Functioning rating for the Stream Reach.

3.3 Rearing Habitat

Summer and winter rearing habitat was rated based on pool frequency and LWD quantity, and the presence or absence of off-channel habitat.

3.3.1 Pools

The channel width of Lund's Gulch Creek ranged from 5 to 20 feet, depending on location. Based on an average channel width of 10 feet, 9.1 pools per 500 feet of stream was needed to be rated as Properly Functioning.

Eighteen pools were observed in the survey reach. Of the 18 pools, 10 were located within the Restored Estuary Reach and eight pools in the Stream Reach. Pools were primarily formed as scour or dam pools by LWD or a combination of LWD and boulders. In the Restored Estuary Reach, pool frequency was calculated at 10 pools per 308 feet or 16.2 pools per 500 feet. In the Stream Reach, pool frequency was calculated at eight pools per 452 feet or 8.8 pools per 500 feet. Both the Restored Estuary and the Restored Stream reaches met the pool frequency standards. In addition, while pools were formed primarily by LWD, the LWD was providing little to no cover in the pools, as the LWD lacked structures such as branches or root wads that would provide cover. Thus, the pool frequency was rated as At Risk for both the Restored Estuary or Stream reaches.

The residual depths of pools were mostly less than 6 inches deep, but greater than 4 inches deep, with four pools (two in the Restored Estuary Reach and two in the Stream Reach) having a residual depth of 6 to 12 inches deep and two pools (one in the Restored Estuary Reach and one in the Stream Reach) having a residual depth of 12 to 24 inches deep. All residual pools depths were greater than 4 inches deep; thus, the pool quality in both reaches was rated at Properly Functioning.

3.3.1 Large Woody Debris

LWD in the survey reach was inventoried by counting the number of pieces, identifying the recruitment process delivering the LWD to the creek, the influence zone of each piece, and the functions provided by each piece of LWD. Only the LWD count was used in the habitat rating.

LWD was rated based on the quantity of LWD per 500 feet. A total of 59 pieces of LWD were surveyed in the lower reach, of which 19 pieces of LWD were located within the Restored Estuary Reach (extrapolated to 30.8 pieces of LWD per 500 feet). Of these 19 pieces of LWD, five were classified as a key piece (extrapolated to eight pieces of LWD per 500 feet). A total of 40 pieces of LWD were located within the Stream Reach (extrapolated to 44 pieces of LWD per 500 feet). Of these 40 pieces of LWD, 23 were large enough to be identified as a key piece (extrapolated to 25 pieces of LWD per 500 feet). Thus, the LWD was rated as Properly Functioning for both reaches.

In addition to counting each individual piece of LWD in the lower reach, LWD pieces were recorded as being located within a log jam or not (jam or inner jam zones) (Hart Crowser 2000). A majority (38) of LWD pieces were not part of log jams; rather, they were lone pieces scattered throughout the survey reach (i.e., located in the inner jam zone), providing minimal habitat features and small residual pool depths. Enhancement structures, defined as LWD with clean cut ends placed for enhancement purposes, accounted for 36 pieces. Another 22 pieces of LWD were identified as being naturally recruited into the stream channel by windthrow and five pieces naturally recruited by bank erosion. This indicated that the dominant recruitment process for LWD besides placement for habitat enhancement was by windthrow.

In addition to identifying the recruitment process of each piece of LWD, the influence zone of each piece was recorded. The influence zone was defined as the LWD being within or above the banks of the creek. This allowed us to evaluate if the LWD was currently functioning to alter the stream habitat or had the potential to do so. That is, LWD within creek banks was currently performing some function, although it may only be functioning during specific flow range (recorded as partially functioning). LWD located above creek banks was not currently performing any habitat function, but could once it drops within creek banks, either naturally or by human activity. Eight pieces were identified as being above the influence zone and therefore were not providing any habitat-forming functions at the time of the survey.

The function provided by each LWD piece was also recorded. Functions included

- scour pool creation,
- dam pool creation,
- sediment storage, and
- wood steps.

Most LWD formed scour pools downstream of the LWD and provided sediment storage upstream of the LWD. However, 25 of the 59 pieces/jams were providing partial to no function, typically due to their orientation in the stream channel (e.g., parallel to stream flow to provide some cover function, but no habitat-forming function).

3.3.2 Off-Channel Habitat

Off-channel habitat provides winter rearing habitat, especially for coho salmon (WFPB 2011). Off-channel habitat was rated based on the presence of backwater or low-energy off-channel areas with cover. No backwater or accessible off-channel habitat was observed in the lower reach; thus, this pathway is Not Properly Functioning. Adjacent to the Stream Reach, there is a man-made shallow pond. However, the connection between the pond and the creek was not sufficiently defined so that the pond could be considered as providing off-channel habitat.

4.0 SUMMARY

The fish habitat and LWD survey assessed various pathways and indicators to determine if the pathways were functioning properly. The assessment found conditions in Lund's Gulch Creek within the lower reach to be suitable for specific pathways.

Within the Restored Estuary Reach, the existing stream channel is dominated by substrates suitable for anadromous and resident fish spawning but is not properly functioning due to sedimentation. Because of the large quantity of LWD (including key pieces) within the lower reach, the function of the LWD is providing sufficient rearing habitat. Pool frequency and pool quality, important habitat features for rearing juvenile salmon, were determined to be at risk due to the lack of pool cover provided by LWD.

Similar to the Restored Estuary Reach, the existing stream channel in the Stream Reach is dominated by substrates suitable for anadromous and resident fish spawning but is not properly functioning due to sedimentation. Pool frequency and pool quality were determined to be at risk due to the lack of pool cover provided by LWD, despite the large quantity of LWD (including key pieces) within the Stream Reach.

A geomorphic study is recommended to determine if the sediment load into the lower reach is greater than the capacity of the enhancement structures to store the sediment, thus filling in the

existing pools, or could prevent the creation of new pools. Depending on the results of the geomorphic study, strategic repositioning of LWD either currently located above bankfull depth or parallel to stream flow could result in additional pool formation or the deepening of residual pool depths of existing pools. In addition, enhancing the connection between the existing man-made pond adjacent to the Stream Reach, would provide off-channel rearing habitat.

5.0 REFERENCES

Flosi, G. S. Downie, J. Hopelain, M. Bird, R. Coey, and B. Collins. 1998. California Salmonid Stream Habitat Restoration Manual. California Department of Fish and Game, Inland Fisheries Division. Sacramento, CA.

Hart Crowser. 2000. Work Plan for Lower Eel and Eel River Delta (LEED) Watershed Analysis, Humboldt County, California. Prepared for the Pacific Lumber Company, Scotia, CA.

NMFS (National Marine Fisheries Service). 1996. Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale. National Marine Fisheries Service, Environmental Technical Services Division, Habitat Conservation Branch. Available at https://www.oregon.gov/ODOT/HWY/GEOENVIRONMENTAL/docs/biology/nmfs_matrix.pdf (accessed November 14, 2016).

Pleus, A. D. Schuett-Hames, L. Bullchild. 1999. Method Manual for Habitat Unit Survey. Washington Department of Natural Resources, Forest Practices Division and Northwest Indian Fisheries Commission, Timber Fish and Wildlife Monitoring Program, Olympia WA. Available at http://access.nwifc.org/tfw/documents/TFW_Habitat_Unit_Survey.pdf (accessed December 10, 2016).

Snohomish (Snohomish County). 2002. Puget Sound Tributaries Drainage Needs Report DNR No. 11. Snohomish County Public Works Department, Surface Water Management Division, Everett, WA.

USFS (U.S. Forest Service). 2003. Stream Inventory Handbook – Level I & II, Version 2.3: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region, Portland, Oregon.

WDFW (Washington Department of Fish and Wildlife) and Ecology (Washington State Department of Ecology). 2016. Instream Flow Study Guidelines. Technical and Habitat Suitability Issues Including Fish Preference Curves. Updated March 9, 2016. Available at https://fortress.wa.gov/ecy/publications/publications/0411007.pdf (accessed November 14, 2016).

WFPB (Washington Forest Practices Board). 2011. Methods for Conducting Watershed Analysis, Version 5.0: Washington Department of Natural Resources, Washington Forest Practices Board, Olympia. Available at http://file.dnr.wa.gov/publications/fp_wsa_manual_all_sections.pdf (accessed November 14, 2016).

Lunds Gulch Stream Assessment 122716.doc

Lund's Gulch Creek Fish Habitat Reconnaissance Survey

	Restored Estuary Reach											Stream Reach						
	Subsegment Data																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Start Distance (ft)	0	65	97	115	137	166	198	225	270	283	301	308	318	335	384	405	446	484
End Distance (ft)	65	97	115	137	166	198	225	270	283	301	308	318	335	384	405	446	484	760
Unit Length (ft)	65	32	18	22	29	32	27	45	13	18	7	10	17	49	21	41	38	276
Channel Type	Riffle	Riffle	Pool	Riffle	Pool	Riffle	Pool	Riffle	Pool	Riffle	Pool	Riffle	Pool	Riffle	Pool	Riffle	Pool	Riffle
Dominant Substrate	Sm. Gravel	Med. Gravel	Sm. Gravel	Sm. Gravel	Sm. Gravel	Sm. Gravel	Sand	Sm. Gravel	Sand	Med. Gravel	Sm. Gravel	Sm. Gravel	Sand	Sm. Gravel	Sand	Med. Gravel	Med. Gravel	Med. Gravel
Subdominant Substrate	Sand	Cobble	Med. Gravel	Med. Gravel	Sand	Med. Gravel	Sm. Gravel	Med. Gravel	Med. Gravel	Sm. Gravel	Sand	Med. Gravel	Sm. Gravel	Med. Gravel	Sm. Gravel	Sm. Gravel	Sand	Sm. Gravel
Embedded	Yes	No	No	No	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes	Yes	No	No	Yes
Spawning Gravel Present	A,R	A,R	A,R	A,R	A,R	A,R	R	A,R	A,R	A,R	R	A,R	R	A,R	R	A,R	A,R	A,R
Wetted Depth (in)	6	6	6	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4
Wetted Width (ft)	5-10 ft	5-10 ft	5-10 ft	5-10 ft	5-10 ft	5-10 ft	5-10 ft	5-10 ft	5-10 ft	5-10 ft	5-10 ft	5-10 ft	5-10 ft	20 ft	20 ft	20 ft	20 ft	20 ft
Canopy (% cover)	0	>50 %	>50 %	>50 %	>50 %	>50 %	>50 %	>50 %	>50 %	>50 %	>50 %	>50 %	>50 %	>50 %	>50 %	>50 %	>50 %	>50 %
No. pools	1	0	1	1	1	1	1	2	1	0	1	0	1	1	1	1	1	3
Pool Former	LWD, Rock	-	LWD, Rock	Rock	LWD, Rock	Rock	LWD, Rock	LWD	LWD	-	LWD	-	LWD, Bank	Bank	LWD	LWD	LWD	LWD
Residual Depth (in)	4-6	-	4-6	4-6	6-12	4-6	12-24	4-6	6-12	-	6-12	-	4-6	4-6	12-24	4-6	6-12	4-6
Notes	1 coho			2 coho, 1 redd	3 coho		1 coho							3 coho	7 coho	1 coho	1 coho (dead)	4 coho 2 coho (dead)

Table Notes: A = anadromous, R = resident, blank cell = no fish presence, survey began upstream of railroad culvert and continued upstream to downstream end of foot bridge

Lund's Gulch Creek Large Woody Debris (LWD) Survey

Reach	Distance (ft)	Zone	Length by log diameter group (ft)		Key Piece		LWD/Jam Function				
			Small (4-12 in)	Medium (12-24 in)	Influence Zone	Recruit Process	Scour pool	Dam pool	Split Ch.	Sed. Storage	Wood Step Height (in)
Restored Estuary Reach	60	I	6		i	Enhancement Structure					
	105	I	8		i	Enhancement Structure	✓			✓	
	116	I	8		i	Enhancement Structure					
	144	I		6	i	Enhancement Structure					
	144	I	10		i	Enhancement Structure	p				
	158	J	12		i	Enhancement Structure	✓	✓		✓	6
	158	J	6		i	Enhancement Structure					
	158	J	6		i	Enhancement Structure					
	No individual LWD between these two log jams										
	205	J	12		i	Enhancement Structure	✓	✓		✓	6
	205	J	8		i	Enhancement Structure					
	205	J	18		i	Enhancement Structure					
	205	J		28	i	Enhancement Structure					
	205	J		20	i	Enhancement Structure					
	254	I	18		a	Windthrow					
	258	I		20	i	Enhancement Structure				✓	
	276	I		18	i	Bank Erosion	✓			✓	
	308	J	6		i	Enhancement Structure	✓			✓	6
	308	J	12		i	Enhancement Structure					
	308	J		18	i	Enhancement Structure					

Reach	Distance (ft)	Zone	Length by log diameter group (ft)		Key Piece		LWD/Jam Function				
			Small (4-12 in)	Medium (12-24 in)	Influence Zone	Recruit Process	Scour pool	Dam pool	Split Ch.	Sed. Storage	Wood Step Height (in)
Stream Reach	318	I		40	i	Enhancement Structure					
	336	I		8	i	Enhancement Structure	✓			✓	
	367	I	12		i	Enhancement Structure				✓	
	390	J	18		i	Enhancement Structure	✓	✓		✓	6
	390	J		15	i	Enhancement Structure					
	390	J		18	i	Bank Erosion					
	390	J		12	i	Bank Erosion					
	390	J		12	i	Bank Erosion					
	423	I	12		i	Enhancement Structure				✓	
	423	I		18	i	Enhancement Structure	✓				
	423	I		12	i	Enhancement Structure	✓				
	432	I		24	a	Windthrow					
	432	I		24	a	Windthrow					
	446	I	15		i	Enhancement Structure				✓	
	446	I		24	a	Windthrow					
	457	J	24		i	Enhancement Structure	p			p	
	457	J		18	i	Enhancement Structure					
	457	J		15	i	Enhancement Structure					
	457	J		8	i	Enhancement Structure					
	457	J		8	i	Enhancement Structure					
	475	I	18		i	Windthrow	✓			✓	
	475	I	10		i	Windthrow	✓			✓	
	485	I		18	a	Enhancement Structure					
	493	I		6	i	Unknown		✓			

Reach	Distance (ft)	Zone	Length by log diameter group (ft)		Key Piece		LWD/Jam Function				
			Small (4-12 in)	Medium (12-24 in)	Influence Zone	Recruit Process	Scour pool	Dam pool	Split Ch.	Sed. Storage	Wood Step Height (in)
	530	I	24		i	Windthrow				p	
	530	I		24	i	Windthrow				p	
	530	I		24	i	Windthrow				p	
	530	I		24	i	Windthrow				p	
	530	I		18	i	Windthrow					
	573	I		24	a	Windthrow					
	592	I		18	i	Windthrow					
	592	I		18	a	Windthrow					
	616	I		18	i	Windthrow					
	626	I		18	a	Windthrow					
	626	I		18	i	Windthrow					
	626	I	18		i	Windthrow	✓				
	638	I		18	i	Windthrow	p				
	698	I		24	i	Windthrow	✓				
	700	I		24	i	Windthrow	p				
	719	I		24	i	Windthrow				p	

Table Notes: I = inner jam, J = Jam, Bold = key piece, i = in channel, a = above channel, ✓ = full function, p = partial function, blank cell = not applicable or not performing function

Appendix J-1
Meeting Minutes and Materials: Community Public Meeting

MEADOWDALE COMMUNITY MEETING 6/21/17 – PUBLIC COMMENT STATIONS

HABITAT (Peter Hummel, Anchor QEA)

Q: Where did the pond come from?
A: Adopt-A-Stream created this under a permit action when other stream enhancement work occurred

Q. What is success of chum and Coho spawning, how many return?
A. This is not part of this scope of work but would be a welcome volunteer study that could occur prior to and post construction. This project has utilized information regarding salmonids from previous studies as cited in the Feasibility report.

Q. What happens to access road? Does it stay? Is it part of the project?
A. The access road will remain as an ADA/Service/Ranger/Emergency vehicle access only road. Consultants are analyzing how the access road will perform under construction equipment and deliveries. This analysis will inform to what degree the access road will be used during construction and what improvements will be made.

Q. Was salt marsh historically there?
A. Topography on the 1872-T sheet supports this theory

Q. What was the Native American history of the area?
A. This was briefly discussed in the Cultural Resources section of the Feasibility Study, but will be further commented on in the Final Cultural Resources Report for the project.

Comment: Trees to be removed – leave as snags wherever possible
Response: The concern with this request is the topography. Significant cuts will occur within the estuary area to support hydrology and tidal influences; but snags will be considered where feasible.

Q. Will there be access to N. side of creek?
A. A portion of the existing trail north of the creek will be removed for purposes of improved habitat. The trail on the north side will now culminate at a picnic/viewpoint and will connect to the new pedestrian bridge.

Comment: Raise remaining lawn for drainage
Response: The intent of the project is to improve drainage in the lawn to the east of the proposed estuary to extent practical, but there are wetlands and buffers in this area, and area is within stream buffer; so code may limit what activity may occur in this area. Lawn grades must still accommodate the perimeter paths.

Comment: Use of shelter is low since people have to walk in a long way. Not like other drive in parks.
Response: This is an accurate statement; however with the improvements proposed for this project the shelter may have higher use with school activity associated with additional environmental education opportunities; or just by the public with the improved nexus to the beach

Comment: Hauling away soil on path – path too narrow, may need to widen during construction.

Response: This will be considered during design. Most likely the path will require repaving after construction due to activity that will occur.

Comment: What happens to new bridge and estuary if there is a tsunami when the big one hits?
Response: The railroad bridge will be designed to meet BNSF standards and all relevant building codes. Sea Level Rise has been considered up to 2100.

Comment: Like general direction of plan. Commenter remembers area before resort
Response: Parks would be interested in any historical photos.

Comment: Remove remaining lawn and create more marsh & wetland
Response: Comments received during the public process for the Feasibility Study included desire to retain some lawn area.

Comment: Check for bird's nests when removing trees
Response: The SEPA process will address this to some extent. Additionally Parks could consider adding to project specifications.

Comment: Deer use area and beach. River otters along creek. This winter there was a beaver (1st time). Eagles use park & osprey, but no known nests in park
Response: Wildlife use will be addressed during the SEPA review.

Comment: Improve tree frog habitat
Response: This project's primary focus will be on habitat restoration specific to fish and food for fish.

Comment: Provide emergency vehicle access and turnaround. Look at small gravel path. Vehicles get stuck in grass.
Response: The proposed gravel path is not intended for vehicles. It is anticipated to be a narrower path for foot-traffic only. Fire review will be part of the permitting process. Comments received will be incorporated.

RECREATION (Minsoo Doo, Anchor QEA)

Q. How close is the restroom to the picnic shelter?
A. There will be 20 feet of separation.

Q. How far does the wall extend past the bridge?
A. This has not been determined at this phase of design and will partially depend on code and permitting allowances.

Q. Is there going to be trash/recycle?
A. A similar size trash bin as currently located at the existing restroom enclosure will be placed near the new restroom enclosure with appropriate signage. Parks does not currently have a recycling program at most parks.

Q. How high is the Low wall/curb height (x 2)
A. This has not yet been determined but must meet any code or permit restrictions.

Q. Lawn area needs improved drainage (x 2)
A. The intent of the project is too improve drainage in the lawn to the east of the proposed estuary to extent practical, but there are wetlands and buffers in this area; and area is within the stream buffer so code may limit what activity may occur in this area. Lawn grades must still accommodate the perimeter paths.

Q. ADA restriction – what is it?
A. ADA requirements for accessible trails and openings requires 80-inches of height clearance and 60 inches of width clearance. The proposed path has adequate width of 10'; but providing 80 inch height clearance requires a lower path elevation under the bridge than if only 72-inches were provided which will result in more frequent water over the path.

Comment: Lawn area should be removed. Turn the lawn into a salt water estuary.
Response: Comments received during the public process for the Feasibility Study included desire to retain some lawn area. Removing the material for the estuary will be very costly; additional excavation would result in even higher construction costs and would require considerable excavation to establish saltwater connection.

Q. Is there a plan to increase parking? There's a lot of illegal parking.
A. This project only addresses the lower park. Existing ADA stalls will be brought up to current stds. In addition this project will consider adding addl ADA stalls if allowed by code and warranted. Parks will be reviewing parking constraints outside of this project in the near future and in addition to county property hopes to work with City of Lynnwood on future trailheads on City owned property.

Q. Any plan of ADA observation deck and access further past the bridge?
A. There will be a pad and bench on the beach side of the bridge.

Q. Is there a way to prevent illegal trespassing or walking along the railroad track?
A. The County has no enforcement authority within railroad right of way. Signage with BNSF trespass contact information are posted on-site. The bridge is hoped to avert a majority of the trespassing by providing a walking path separated from the creek that is available year round except under certain tide and SLR conditions.

Q. Like gable roof on restroom enclosure (x2).
A. Parks Management has determined that the shed roof will support concerns of ventilation, and believes the shed roof has a "look through" feel as opposed to a "look at" feel; and has the support of Maintenance and Operations.

Q. Like aesthetics proposed. Goes well with the existing elements.
A. At this time, Parks Mgt has determined to replace existing picnic shelter roof so that both can be Parks preferred "Forest Green".

Q. Sani-can truck & emergency vehicles access (x 2) Mini-loop instead of T-turn? Maybe change a portion of gravel path to paved road?
A. The portable restroom vendor has commented that they have no issues with the current site plan. Fire and First Responders will have the opportunity to review the Site Plan and changes will be made as warranted. The gravel path is located within critical area buffer which does not allow new impervious surfaces.

Q. Bathroom – fairly new structure can we reuse (15 years)?
A. Materials will be recycled if possible, but given the type of construction, materials may not be salvageable

Q. Dog waste bags?
A. Parks has a pack it in pack it out policy in most parks. Parks encourages all animal companions to bring their own bags and additional to share for those who forgot.

Q. Is there a way to prevent the erosion on the north side of estuary where steep slopes exist?
A. Erosion is a natural process within a gulch. Steep slopes exist throughout the Park. Identifying any illicit discharge of runoff upstream of slopes and maintaining healthy vegetation are best management practices that help reduce erosion.

RAILROAD (Travis Painter, Hanson,)

Q. How will it be built?
A. To some extent the Contractor awarded this job will determine means and methods of construction. These means and methods must all be approved by BNSF for any work within BNSF right of way. How materials and equipment will get to the site is under evaluation and not yet determined. Piles will be driven initially followed by installation of pile caps and then setting the two bridges (one for each set of rails). All of this work will require work windows approved by BNSF.

Q. Where does the soil go?
A. Offsite to a location to be determined.

Q. How long will it take?
A. Parks anticipates a contract extending 9-12 months but a portion of that time will be for procuring materials, mobilization, demobilization etc. and coordination with BNSF. Installation of the bridge is largely dependent on work windows provided by BNSF; but is anticipated to occur over 2 to 3 month period. Estuary construction will follow and will be dependent on weather, groundwater and planting conditions.

Q. What is added cost for working with railroad?
A. Parks has a preliminary cost estimate from the Feasibility Study of $10-15 million for the entire project. The cost estimate will be updated at the 30%, 60% and 90% submittal phases of design. An actual number cannot be determined until Parks begins process of entering into agreement with BNSF, this is the reason for a large range provided for the project.

Q. Will beach/park be open?
A. The trail will probably be open from upper parking area to the existing bridge; but access to the lower lawn area will be blocked; and there will not be any access via the ADA gate or walk-ins from the neighbor down the ADA access road most likely. We anticipate at this time there will be no beach access during construction of the railroad bridge. Limiting access will potentially help facilitate construction.

Q. Noise?
A. This project will include noise typical of any construction project involving ground disturbance and bridge construction including but not limited to pile driving, and truck traffic for deliveries and hauling

Q. Will stream be open?
A. Construction activity must allow creek flow even if temporary diversion is required. Permits will address all work within the stream and any habitat or fish concerns.

Q. Is BNSF in control?
A. BNSF owns 100 feet of right of way and has sole jurisdiction of activities within this right-of way. The County was required to obtain a license with BNSF for investigative work within that right of way. BNSF had Flaggers on-site during investigative work that were payed for by the County. Snohomish County owns and controls what happens on park property located both landward and seaward of the railroad property. This project will require Snohomish County Parks to enter into an Operation & Maintenance Agreement and Right of Way use agreement with BNSF.

Comment: Glad that marsh is being restored

Q. Can train always blow horn at this location? Give more warning for people crossing?
A. People are not permitted to cross railroad tracks anywhere within the park. This would be considered trespassing. The only approved beach access until this project is built is via the culvert under the tracks. Once the project is built proposed beach access is via the 10' path under the most southern abutment.

Q. How will Amtrak/Sounder trains be affected?
A. This will be determined based on work windows provided by BNSF who contracts with both entities. They will be invited to the Stakeholder meeting to express concerns or provide input

Q. Will landslide affect this location?
A. The majority of the park is located within a Landslide Hazard Area. Permits will address all code requirements.

Comment: Lawn area is good. Needed for overflow when beach is busy.

Comment: Improved path is a benefit for First Responder's access to beach

FLOATER COMMENTS
Q. Why do we need to provide 80-inches of clearance under the bridge, wouldn't a higher path be better for all?
A. Grants (federal and state) may be difficult to obtain without meeting ADA requirements for height which is 80 inches. We will continue to vet this issue as we move into the grant process.

Q. How is the County addressing hazardous trees in the Park?
A. This is outside of the scope of this project and can be answered by Parks Operations Division

Q. Need a loop for emergency vehicles; many calls for emergencies how will they turnaround? Firetrucks? Ambulance/Aid Car?
A. The Site Plan will be reviewed by Fire and Emergency Responders and changes made if warranted.

Q. How will Parks trailer with mow equipment be able to get in and turn around?
A. Maintenance has reviewed the Site Plan and has no concerns with path layout and equipment.

Q. Could materials from existing restroom be re-used, the roof? The stonework?
A. At this time Management has made the decision to use the standard Park "forest green" color for the restroom enclosure and to re-roof the picnic shelter.

Q. Roof shapes currently in the park are working, i.e. steeper slope. There are many trees and site is extremely shady. Shallower slopes are likely to require more maintenance.
A. Parks Management has determined that the shed roof will support concerns of ventilation, and believes the shed roof has a "look through" feel as opposed to a "look at" feel; and has the support of Maintenance and Operations.

Q. Can Parks put a sign out on the beach stating for Public to not block creek with wood/rocks etc.? The concern is the creek being trained to head north with these obstructions which has a tendency to cause sediments to back up in tunnel.
A. This request has been forwarded to Park Operations Supervisor.

Comment: Suggest leaving several of the trees to be removed as just snags
Response: The concern with this request is the topography. Significant cuts will occur in within the estuary area; but snags will be considered where feasible.

Q. Is the County coordinating with Amtrak and Sounder?
A. The County's contact is with BNSF who contracts with both entities. They will be invited to the Stakeholder meeting to express concerns or provide input.

COMMENT SHEET

Meadowdale Beach Park & Estuary Restoration Project
Public Meeting June 21, 2017

We value your input. Please provide any questions, comments, concerns or input you would like to provide or require feedback on. Please place in comment box or send to 6705 Puget Park Drive, Snohomish, WA 98296 Attn: Logan Daniels, P.E. Or scan to/or email Logan.Daniels@snoco.org. Comments need to be rec'd by 6/30/17.

Park Elements: The gable roof design for the new restrooms near the picnic shelter will preserve architectural continuity. A foot shower there will conserve water/sediment in sink.

* Hope to see an artistic element in concrete which reflects nature. * Hope to see Peace Pavilion/Pole near bridges near Ranger Residence. * Hope to see art installation to memorialize recent tragedy victim Diana Oldnichuck.

Habitat: Wetland restoration & estuary development will be paramount for future generations! Reuse & move trees when possible in process.

Railroad: The openness of new bridge design looks great! Slight curve in design needs to be intergrative to ground level.

Other (cont. on back if needed) I hope that the use of nontoxic building supplies for foot bridges prevails. I hope that the designs have architectural continuity & cohesiveness with a long term integrative approach.

Name (Optional) Jennifer Taylor

Preferred Method of Contact/Info (if response is desired):

jennjlt@gmail.com text@ 206 718 0060

Thank you for your interest in and support of Meadowdale Beach County Park

Thank you for your interest in and support of Meadowdale Beach County Park

COMMENT SHEET

Meadowdale Beach Park & Estuary Restoration Project
Public Meeting June 21, 2017

We value your input. Please provide any questions, comments, concerns or input you would like to provide or require feedback on. Please place in comment box or send to 6705 Puget Park Drive, Snohomish, WA 98296 Attn: Logan Daniels, P.E. Or scan to/or email Logan.Daniels@snoco.org. Comments need to be rec'd by 6/30/17.

Park Elements: I LIKE THE PREFERENCE OF THE GABLE STYLE RESTROOM BUILDING THAT MATCHES THE PICNIC SHELTER. THE MORE THINGS CAN MATCH & BLEND TOGETHER LIKE THAT, THE MORE PLEASANT AND LESS TACKY, IT LOOKS AND FEELS. ALSO THE MOST NATURAL OR RUSTIC LOOK IS BEST FOR THIS PARK.

Habitat: THE MORE NATIVE HABITAT, THE BETTER. I LIKE TREES TOO, BUT I HAVE NO PROBLEM WITH NON-NATIVE REMOVALS. EVERGREENS AND WETLANDS ARE GREAT TOO IN PLACE OF THE ALDERS. SOUNDS LIKE THE PARK WILL BE BEAUTIFUL AND FUNCTIONAL. GREAT JOB!

Railroad: CONSIDER HOW ANY GRAFFITI (SP) THAT MIGHT SHOW UP ON THE RAILROAD BRIDGE (OR EVEN THE OTHER BRIDGE) WOULD BE REMOVED. WILL IT BE EASY? ~~SHOULD~~ IS THERE A BETTER CONST. MATERIAL OR PAINT THAT WILL MAKE IT EASY TO REMOVE? (UNFORTUNATELY, THAT COULD HAPPEN.)

Other (cont. on back if needed)

Name (Optional) RICHARD STANGOHR

Preferred Method of Contact/Info (if response is desired):

rstangohr@msn.com

Thank you for your interest in and support of Meadowdale Beach County Park

Thank you for your interest in and support of Meadowdale Beach County Park

COMMENT SHEET

Meadowdale Beach Park & Estuary Restoration Project
Public Meeting June 21, 2017

We value your input. Please provide any questions, comments, concerns or input you would like to provide or require feedback on. Please place in comment box or send to 6705 Puget Park Drive, Snohomish, WA 98296 Attn: Logan Daniels, P.E. Or scan to/or email Logan.Daniels@snoco.org. Comments need to be rec'd by 6/30/17.

Park Elements: I LIKE THE PREFERENCE OF THE GABLE STYLE RESTROOM BUILDING THAT MATCHES THE PICNIC SHELTER. THE MORE THINGS CAN MATCH & BLEND TOGETHER LIKE THAT, THE MORE PLEASANT AND LESS TACKY, IT LOOKS AND FEELS. ALSO THE MOST NATURAL OR RUSTIC LOOK IS BEST FOR THIS PARK.

Habitat: THE MORE NATIVE HABITAT, THE BETTER. I LIKE TREES TOO, BUT I HAVE NO PROBLEM WITH NON-NATIVE REMOVALS. EVERGREENS AND WETLANDS ARE GREAT TOO IN PLACE OF THE ALDERS. SOUNDS LIKE THE PARK WILL BE BEAUTIFUL AND FUNCTIONAL. GREAT JOB!

Railroad: CONSIDER HOW ANY GRAFFITI (SP) THAT MIGHT SHOW UP ON THE RAILROAD BRIDGE (OR EVEN THE OTHER BRIDGE) WOULD BE REMOVED. WILL IT BE EASY? ~~SHOULD~~ IS THERE A BETTER CONST. MATERIAL OR PAINT THAT WILL MAKE IT EASY TO REMOVE? (UNFORTUNATELY, THAT COULD HAPPEN.)

Other (cont. on back if needed)

Name (Optional) RICHARD STANGOHR

Preferred Method of Contact/Info (if response is desired):

rstangohr@msn.com

Thank you for your interest in and support of Meadowdale Beach County Park

Meeting Agenda

Meadowdale Beach Park and Estuary Restoration Project
30% Design Progress Public Meeting

June, 21, 2017, 6:30 pm., Meadowdale High School

- Welcome Introductions and Meeting Purpose (Logan Daniels, Snohomish County Parks and Recreation) 5 min.:
  - Welcome and Introductions
  - Purpose of Meeting

- Project Background (Logan Daniels) 5 min.
  - General Project Overview
  - Current Project Status

- Design Objectives and Preferred Alternative (Peter Hummel, Anchor QEA-Park and Habitat Consultant) 5 min.
  - Evaluation Criteria related to Habitat
  - Preferred Alternative from Feasibility Study

- Existing Conditions/Information Gathering (Peter Hummel) 10 min.
  - Topographic Survey, GPR-Buried Debris Survey, & Tidal Inundation, and Stream Profile
  - Existing Habitat communities and Critical Areas
  - Shallow Groundwater Findings
  - Hydraulic modeling (sediment supply)
  - Geotechnical Investigation
  - Cultural Resources Investigation
  - Stream Assessment

- 30% Design Progress
  - Railroad Bridge Design: (Travis Painter, Hanson-Railroad Bridge Engineering Consultant) 10 min.
  - Recreation Facilities Design: (Peter Hummel) 10 min.
  - Habitat Restoration Design: (Peter Hummel) 10 min.
- Tentative Schedule and Next Steps: (Logan Daniels) 5 min.
- Comment/Q&A Session at Design Topic "Stations": 1 hour
  - Railroad Bridge Station (Travis Painter)
  - Recreation Facilities Station (Minsoo Doo, Anchor QEA)
  - Habitat Restoration Station (Peter Hummel)

Appendix J-2
Meeting Minutes and Materials: Organization/Agency Stakeholder Meeting

Snohomish County Meadowdale Beach Park Estuary Restoration Project
30%-Design Stakeholder Meeting Notes (Anchor QEA)
Snohomish County Parks and Recreation Building
July 31, 2017

Stakeholder Comments

Mike Ehlebracht: Snohomish County MRC

- Concern: Will the design of the project minimize or mitigate excessive sediment into the downstream outlet?
  - Response: Sediment loads into the project area come from the upper parts of the watershed, which are beyond the scope of the project. For this reason, it is hard to address the specifics. Sediment load is more of a county issue. However, the design of the new railroad bridge, which expands the open channel beneath, improves sediment flow through to the beach area instead of capturing it.
- Did the addition of the 5th span impact modeling or evaluation of stream flow, sedimentation, debris entrapment, or other factors?
  - There weren't issues with the modeling, however we had some challenges with the design treatments. We wanted to make sure there would be no channelization.
- Is it possible to raise the level of the railroad bridge to be above the extreme scenario of sea level rise? This could also help with ADA clearance for walkway.
  - BNSF response: They cannot raise the track grades.
  - The walkway grade is set based on the clearance needed to meet American's with Disability Act requirements (80 inches) and the bottom of the bridge. This limits the ability raise it more than is currently shown.

Jason Wilkinson: WRIA 8 Salmon Recovery

- Appreciate the quality of the analysis and design, especially to maximize habitat.
- How build out in the watershed modeled?
  - For the model, the flow was increased several times to account for increased future flows.
- Will wood installations be allowed to move or would they be anchored? Also, is the site designed to allow for natural habitat formation over time, or would there be a point at which maintenance is required?
  - We haven't yet determined whether the wood for habitat would be anchored or not, but when we revisit this issue we will keep this in mind to consider what is best for fish entering the waterway.
  - The design of the creek and estuary allows room for them to adjust naturally. After the first winter, we would expect significant change the design provides space for this.
- Was wood build-up under the railroad bridge considered in the design?

  - At the railroad bridge, we propose woody debris clusters in front columns that would direct stream flows to go in-between. During a high flood event, these would likely collect more wood.
- Would there be a point when the county would begin to maintain the natural area if it changes over time, and if so, at what point would that be?
  - This is hard to anticipate because the site is ever evolving. The hope with this design is that we have provided enough room to accommodate these changes.
- Has Doug, the Meadowdale Park Ranger, been involved in this process?
  - Yes, Doug has provided input to Anchor in the design process and has participated in public forums. There are also other Park Rangers that are useful resources.

Bill Lider: Snohomish Watershed Counsel

- Is the lawn a necessary part of the design? It would be costly to maintain, requiring mowing, fertilizer, weed killers, and pesticides. It would likely be too wet to sit on because of wet weather during most of the year so it wouldn't get used. People mostly use the beach for recreational space instead. It is a non-conforming use and is counter to county code, so it shouldn't be included in the park design. This area instead should be used as enhanced salmon habitat (more estuary) or planted with native species.
  - During the public process and commenting period, there was a lot of support to keep a lawn area in the park. We do intend to use some of the excavated materials to drain and reduce wetness in the lawn area. The County is not currently, or planning to use pesticides and weed killers on the lawn.
- Another consideration would be to keep some standing trees greater than 8-10 inches diameter at base height as snags for cavity nesting birds. It is okay if these standing dead trees fall over.
  - We do plan to utilize any trees we have removed for habitat. If we can keep standing dead trees in and around the estuary we will, but grade changes of 6 feet limit how of this we can do.

Elisa Dawson: Snohomish County MRC/Surface Water Management

- Similar question about the sea-level rise modeling, answered earlier.
- ADA clearance in compliance with Federal standards at the railroad bridge is good. Agree with this approach.

City of Lynnwood: (No comments)

Cary Hite: City of Edmonds Parks Director

- Understand that no further clearance is allowed for the pedestrian walkway under railroad bridge. Has a seat wall (low wall) been considered in the design along the edge of the path to kept the creek away from it?

  - The 30% design does show a 2-foot height seat wall along the walkway on the creek side. The wall is included beside the walkway to prevent water overflow from the creek, and to protect pedestrians from low parts of the bridge structure along the creek side of the path.
- Looking at the rendering of the bridge design, is there a way to make the structure more aesthetically pleasing to fit in the park and not feel like a freeway overpass? Can public art be added?
  - The railroad is all within the jurisdiction of the BNSF, so they would be the ones who would decide and maintain that aspect. It is not standard for BNSF to consider aesthetics, but they could perhaps use a different color concrete.

Todd Zackey: Tulalip Tribes Biologist

- For some of the trees that will be removed, could the wood be used upstream to stabilize eroding areas? Realize that this is beyond current project scope.
- For future pre-application permit related meetings, it would be great to be invited.
  - We can do that. There will also be a formal consultation with the tribes that the County is initiating in the near future.

Betty Young: Utilities and Transportation Commission and Operation Lifesaver

- Utilities and Transportation Commission (UTC) will be involved in terms of grade separation facility (bridge crossing). When project gets to 60% of the design BNSF/County will need to submit a "petition" to UTC to initiate the permit process. If there are any questions about the petition process, people can follow up with Betty
- Operation Lifesaver shares the pedestrian trespass concerns across the train tracks and wants to see how improved fencing and other changes can help reduce that.
- Will the fencing along wither side of the railroad track be replaced or improved?
  - It is a part of the right of way and will be disturbed from the embankment so it will be replaced. Need to determine what kind of fencing standard is used.

Shane Sparks: ICF (consultant)

- Right now, we are in the process of completing the Cultural Resources survey, identifying any resources in the area, completing SEPA documentation, and coordinating with tribes.

Matt Chadsey Earth Economics (Consultant)

- Their work will be evaluating the project benefits to wildlife, natural systems, recreation, education, and several other factors as they relate to economics. They will conduct a cost/benefit analysis that compares the options of maintaining the current site conditions against the proposed project.

Snohomish County
Parks and Recreation

Snohomish County
Public Works Department
Surface Water Management Division

Snohomish County
Marine Resources
Committee

Meeting Agenda

Meadowdale Beach Park and Estuary Restoration Project
30% Design - Stakeholder Meeting
July 31, 2017 10 am – 12 pm

1. Welcome/Introductions/Meeting Purpose (Logan Daniels, SCPR) 3 min

2. Project Overview/Background/Progress to Date (Logan Daniels) 5 min

3. Preferred Alternative from Feasibility Study (Peter Hummel, Anchor QEA) 3 min

4. Existing Conditions/Information Gathering – 20 min
   - Topograhic & Boundary Survey/Groundwater/Tidal Inundation (Peter Hummel)
   - Existing Habitat/Critical Areas (Betsy Severtsen, Anchor QEA)
   - Stream Assessment (Paul Schlenger, Confluence)
   - Hydraulic Modeling (Sediment Supply) (Kathy Ketteridge, Confluence)
   - Geotechnical Investigation (Logan Daniels/Peter Hummel)
   - Cultural Resources Investigation (Shane Sparks, ICF)

5. 30% Design Progress (30 min)
   - Railroad Bridge Design (Tristan Rickett, Hanson)
   - Recreation Facilities/Habitat Restoration Design (Peter Hummel)

6. Tentative Schedule and Next Steps (Logan Daniels) 2 min

7. Stakeholder Input/Q&A Session (50 min. split equally among Attendees including Skype participants)

More Info: https://snohomishcountywa.gov/2710/Meadowdale

THANK YOU FOR YOUR PARTICIPATION!

Appendix J-3
Meeting Minutes and Materials: Regulatory Agency and Tribal Staff Meeting

SITE VISIT: MEADOWDALE BEACH PARK

Meadowdale Beach Park and Estuary Restoration Design Project

Monday, August 28, 2017 | 9:00–11:00 a.m.

Attachment 1: Sign-in Sheet
Attachment 2: Meeting Agenda and Handout

Meeting Highlights

1. Project History – Logan Daniels, P.E.. Project Manager, Snohomish County Parks and Recreation

Logan briefly reviewed the history of the site, which was homesteaded in 1898 by John Lund, shortly after the Great Northern Railroad line was constructed along Puget Sound between Seattle and Everett (now owned and operated by BNSF). Past uses on the site include a period of ownership by the Meadowdale Country Club, featuring a clubhouse (later destroyed by fire), manicured lawns, an Olympic-size swimming pool with bath houses, and a fish hatchery. Snohomish County Parks acquired the land in 1968 to develop a public park with beach access and filled in the swimming pool. The park was closed for safety reasons in 1979 and re-opened in 1988 after park improvements including the hike-in only access trail, looped paved trail, Ranger residence, pedestrian bridge, and boardwalk within the concrete box culvert were constructed and repairs made to the emergency ADA access road.

Under a County agreement with BNSF, park users currently make use of a large concrete culvert beneath the railroad tracks to access the park's beach area. The culvert provides the outlet for Lund's Gulch Creek to Puget Sound, and is frequently impacted by gravels deposited upstream and downstream, which causes flooding, and can affect both fish passage and pedestrian safety (beach users have opted to trespass/walk over the BNSF tracks if the culvert is impassable). To address the problems associated with the culvert and identify options for habitat improvements, the Parks Department led an alternatives analysis as part of Feasibility Study (2014-2015), which resulted in a preferred option that has been carried forward into the current design. A stakeholder group has been involved with the project since that time, with participation from citizens, community interest groups, agencies, the City of Edmonds, and the Tulalip Tribes. More information on the project and background is found on the project website at:

https://snohomishcountywa.gov/2710/Meadowdale

2. Review of Project Design Features – Peter Hummel, ASLA, Project Design Lead, Anchor QEA

Peter briefly reviewed the existing conditions of the site, referencing several studies that have taken place over the last six months, including wetland and stream surveys, groundwater monitoring (using piezometers) geotechnical exploration, and cultural resource investigation. (An eelgrass survey took place two days following the agency site visit.)

Peter then used the site plan, currently at a 30% level of design to briefly describe the key features of the project in four general areas: park uplands, estuary, railroad bridge, and beach. These features are also provided in the handout (Attachment 2).

3. Site Tour

The group then walked through the site, beginning in the uplands and finishing on the beach. The discussion topics included various features of the existing conditions, proposed design, and construction methods. Highlights of this conversation are provided here.

Lund's Gulch Creek

The group was able to observe the existing conditions of the creek, noting the work of Adopt-a-Stream who has installed woody debris in the creek channel and planted native conifers in the riparian area. The group noted that the large wood has helped to create some gravel bars.

The group also reviewed the location of the proposed pedestrian bridge, discussing the bridge span and placement of the bridge footings in relationship to the creek channel. These components of the bridge design will be a key element during permit reviews, as agency staff look to avoid impacts to fish habitat.

Agency feedback/recommendations:

- In placing additional large woody debris (LWD) in the creek channel, keep the root ball and do not include any hardware (e.g. anchoring) during the installation. Also note that re-use of a variety of on-site species for LWD is acceptable/encouraged, such as alder and cottonwood, as well as Douglas fir and conifers. Importing species like Douglas fir and cedar for exclusive use as LWD is discouraged since natural streams recruit a wide variety of species.
- Consider opportunities for additional coniferous understory/riparian plantings; possibly relocating young conifers (planted by Adopt-a-Stream) that are being removed in the proposed estuary area.
- Do not place pedestrian bridge supports in water. Ensure the hydraulic analysis that is used to inform the bridge design accounts for potential changes in both the width *and* the movement of creek channel over time. Use data from upstream and downstream of the proposed bridge location; maximize bridge span to account for potential lateral changes in the channel as well.

Wetlands

The group reviewed the location of wetlands within the project area and how they may be affected by the project. In general, the design will avoid or minimize direct impacts to wetlands, although restoration of the estuary would occur within wetland buffers (mostly park lawn areas, but some forested areas at Wetland A).

Agency feedback/recommendations:

- The wetland buffer areas that may be impacted by the project would be largely improved as they transition from lawn to estuarine habitat, so potential buffer impacts are not concerning at this time.
- Quantify all potential impacts and demonstrate how the project will mitigate for these.

Proposed estuary restoration

The group observed the large expanse of lawn area immediately east of the railroad tracks, and noted that the existing restroom in this area would be removed, along with a section of paved pedestrian trail, and several trees. With the replacement of the existing box culvert under the railroad tracks with a 5-span 130 LF bridge, and excavation of approximately 15,000 cubic yards of material east of the tracks, the area would be restored to an estuarine habitat. The design accounts for a predicted sea-level rise of 2 feet (year 2100), and has a goal of maximizing estuarine habitat for juvenile Chinook salmon. Coastal engineering and hydraulic analyses that have been completed for the project anticipate that the general location of the existing beach delta will remain, although there will be some adjustments in the sediment transport and tidal processes as the system reaches a new equilibrium.

Agency feedback/recommendations:

- Consider using information from geotechnical borings to identify depths of historic tidal soils, and help inform the depth of excavation in the proposed estuary area.
- Consider incorporating some of the history of the site into interpretive features with the park improvements; much of the history may not be known to park visitors.

Railroad bridge

The preliminary design of the bridge was reviewed, including the proposed new pedestrian access beneath the southern end of the bridge. The pedestrian access would be approximately 1.5 to 2 feet above the estuary surface, and would meet ADA access requirements. Three sets of bridge columns supporting the five bridge spans would be necessary within the estuary/intertidal creek mouth area in order to meet BNSF design standards. Some anchoring of large wood is proposed on the upstream side of bridge columns and abutments to direct stream flow away from the columns.

Agency feedback/recommendations:

- Demonstrate purpose/need for log deflections at bridge columns; wood will naturally accumulate at the bridge columns, so building log structures may be redundant.
- Consider reaching out to US Coast Guard to confirm whether or not a bridge permit may be required.

Beach area

The group observed the existing beach area and delta, noting that there are seasonal fluctuations in where the creek empties into Puget Sound. The group discussed that with the removal of the culvert, the surges of sediment transport from the creek to the Sound would decrease significantly as material would no longer 'back up' behind the culvert before finally pushing through during a storm event. A recent winter high flow event cut through the protective sand/gravel spit and the creek now bypasses a pocket estuary that formed behind the spit. The bridge and wider channel is anticipated to provide a more steady and natural sediment transport regime. This could be beneficial for continuation of pocket estuary formation on the Puget Sound side of the tracks, and for eelgrass, presumed to occur offshore (eelgrass locations confirmed following site visit).

The group also reviewed the plans for construction staging in the beach area, with preliminary plans from the bridge engineering consultant. Staging working pads are proposed on either side of the tracks.

The removal of the railroad berm and temporary pads will result in removal of native trees, shrubs, and supratidal grasses and herbaceous perennials on the Sound side of the tracks.

Agency feedback/recommendations:

- Describe and define limits of sand lance habitat; within permit drawings, clearly delineate work zones and the habitat areas on a single figure to identify potential impact area.
- Sand lance monitoring during would be necessary if construction is occurring during the spawning window of August – February (and construction may be halted if eggs were observed).
- Identify species of plants currently on beach within permit documents.

Construction access and methods

The group confirmed that the project would make use of the existing access road (with some improvements) into the park for delivery of construction equipment and materials. (Barge-based delivery of materials and/or use of a trestle from Puget Sound to the site that was discussed during the Feasibility Study phase is not currently under consideration). There is a chance that the railroad may be able to use their own contractors for some of the construction, but this possibility will not be realized until a later date so project is advancing under the ADA access road for mobilization.

A general construction sequence plan was discussed as such:

1. Install work pads and access berms and deliver materials
2. Provide diversion for creek
3. Install shoring between Main 1 and Main 2 tracks
4. Drive piles, install pier caps, bridge on one side
5. Excavate materials
6. Install rails
7. Repeat for second set of tracks
8.
9. Excavate area east of tracks for estuary, stockpile and haul
10. Final material placement, park restoration, and planting at beach area west of tracks (and in estuary and riparian buffer).

In-water work is generally planned to accommodate work windows for fish species as much as possible, and a temporary stream diversion for Lund's Gulch Creek is anticipated.

Agency feedback/recommendations:

- Work window for anadromous fish species is July 1 – October 1; WDFW can be flexible but needs to ensure impacts are minimized and to protect fish life to the greatest extent possible.
- Work window for sand lance is March – July.
- For the temporary stream diversion using the existing culvert through a temporary pipe, provide for dispersion as water is discharged; preferable to extend outfall as far as practicable off the beach area. Consider monitoring diversion to avoid build-up of sediment within the pipe and subsequent pulse of material.
- Provide sediment curtain to minimize water quality impacts

4. Schedule Overview

Logan reviewed the overall schedule for the project (provided in Attachment 2), which calls for permit applications to be submitted this fall. The project has funding for the design, and the County is continuing to pursue grants for construction. The County is also working in cooperation with the railroad, with a 30% design review meeting planned in the next few weeks. The railroad provided the necessary access agreement for the surveying work, geotechnical explorations, and cultural resources surveys that occurred over the past several months, and the coordination with the railroad has gone very well.

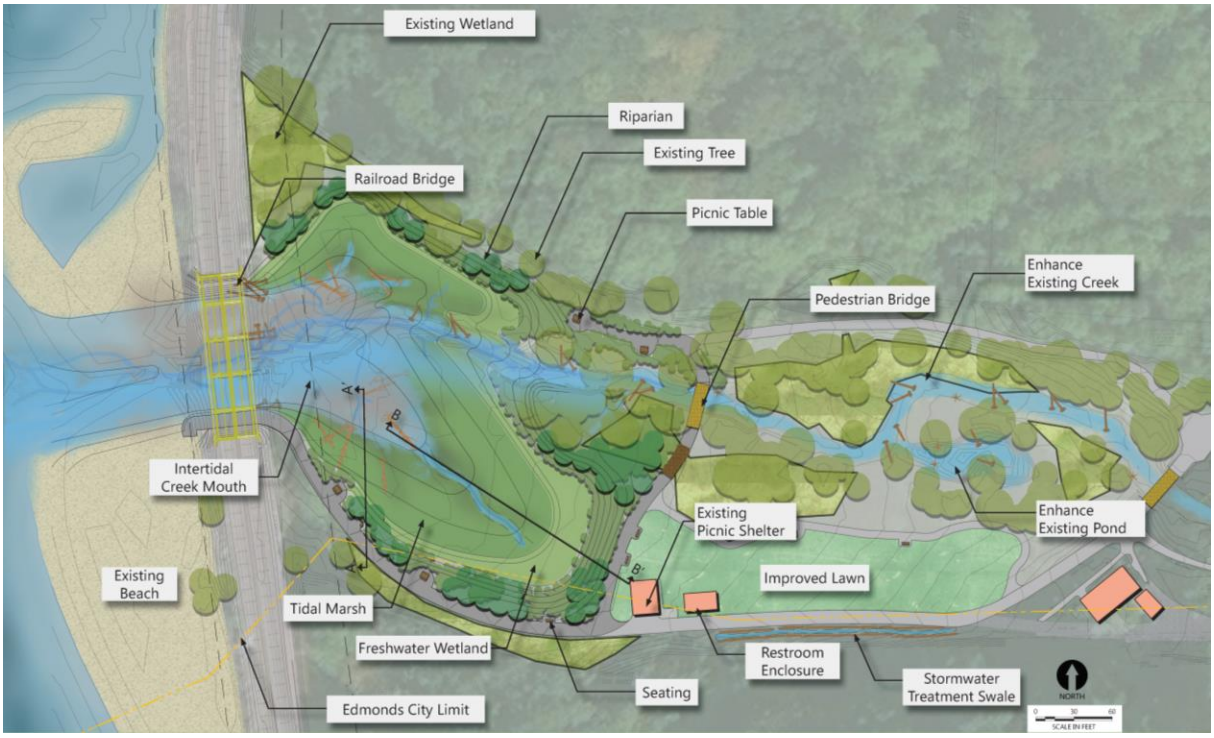
MEADOWDALE BEACH PARK SITE VISIT

Monday, August 28, 2017
9:00 – 11:00 AM

Agenda

- Brief Project History
- Review of Project Design Features
- Site tour – Agency Feedback
  - Park uplands
  - Estuary area
  - Railroad bridge
  - Beach area
- Construction Access
- Schedule Overview

Meadowdale Beach Park and Estuary Restoration Design Project
30% Design Site Plan August 2017



Existing park uplands and lawn area

PARK UPLANDS

Upland improvements to park and recreation facilities would focus on areas east of the restored estuary.

Structures/Elements Proposed for Removal

- Remove some lawn and sand volleyball court

Planned Improvements and Relocations

- Pedestrian bridge
- Pedestrian paths
- Restroom enclosure and site furnishings (foot wash, drinking fountain, picnic tables)
- Improved lawn
- Riparian and in-stream habitat enhancements including conifer planting and large woody debris placement
- Improve connectivity and habitat function of a man-made off-channel pond
- Access road and ADA parking improvements
- Storm water treatment

To meet parking needs for the Project, the existing upper parking area and existing ADA lower parking area will be retained. One additional ADA parking stall will be added in the lower area.

ESTUARY AREA

The proposed changes would convert much of an existing lawn area to a restored estuarine environment, with habitat improvements in Lund's Gulch Creek.

Structures/Elements Proposed for Removal

- Remove restroom enclosure
- Remove pedestrian paths, and site furnishings (picnic tables and pads)
- Remove lawn and ornamental and invasive vegetation
- Some native and non-native trees will be removed to restore the estuary area; trees will be re-used for habitat
- Lower creek bank armoring

Planned Improvements

- Replace existing developed park areas with riparian and estuary habitat, including restored freshwater emergent wetland, tidal marsh
- Create sufficient space and grades to allow Lund's Creek to naturally meander and deposit sediment in the restoration estuary area

Conceptual view of estuary area, looking west from proposed improved park uplands

RAILROAD BRIDGE

Conceptual design of 5-span railroad bridge looking west from Park

Existing culvert looking west from Park

Replacing the existing culvert will improve public safety and ADA access, address flooding and maintenance issues associated with sediment deposition, and improve habitat for multiple fish and wildlife species.

Structures/Elements Proposed for Removal

- Remove existing railroad berm
- Remove existing culvert under the BNSF railroad
- Native and non-native tree and vegetation removal on railroad berm and within railroad easement

Planned Improvements

- Support double track railroad with 5-span130 LF rail bridge
- Provide a separate ADA-accessible pathway under southern section of bridge.
- Replace railroad safety fencing
- Widen creek channel to 90 foot width to allow for natural meandering, sediment transport, and tidal prism

- Address public access, safety, flooding, maintenance, and fish barrier issues
- Revegetation with native riparian, estuarine, and freshwater marsh vegetation.
  Large woody debris placement in restored estuary

BEACH AREA

Existing culvert from beach area.

Existing beach area looking west.

A portion of the beach area will be temporarily graded to support railroad bridge construction, and final graded 1) to support the widened creek mouth at the railroad bridge which will allow for continued natural spit/barrier beach pocket estuary habitat development; and 2) to accommodate the ADA pedestrian path elevation.

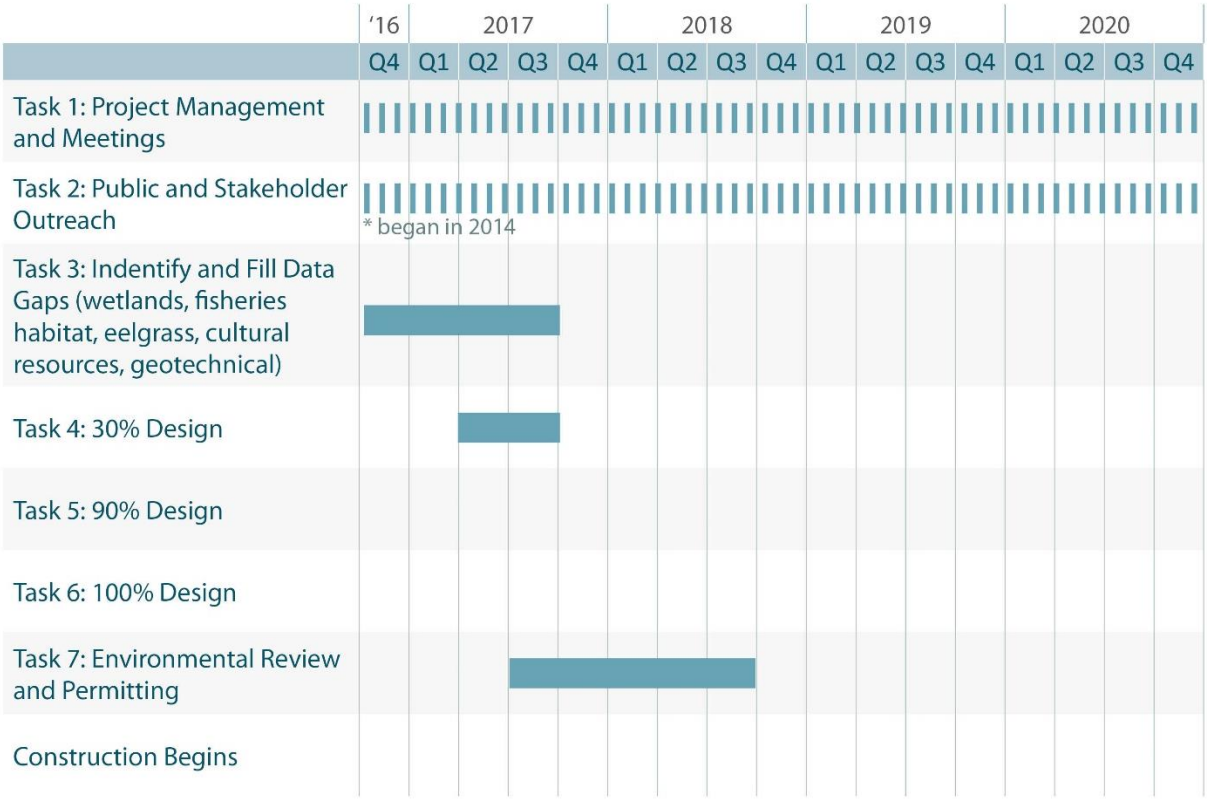
Structures/Elements Proposed for Removal

- None (see Railroad Bridge for structure removal).

Planned Improvements

- Temporary regrading including temporary work platform fill
- Regrading to support widened creek mouth following bridge construction and ADA pedestrian path on beach side and restoration of sand substrate
- Revegetation of beach backshore/supratidal vegetation in areas impacted by regrading

MEADOWDALE BEACH PARK ANTICIPATED SCHEDULE



	Begin	End
Feasibility Study	2014	2016
Task 1. Project Management and Meetings	Q4 – 2016	Q2 2019
Task 2 Public and Stakeholder Outreach	Q4 – 2014	Q3- 2018
Task 3 Coordination and Grant Support	Q4 2016	Q3 2018
Task 4 Identify and Fill Data Gaps (wetlands, fisheries habitat, eelgrass, cultural resources, geotechnical)	Q4 – 2016	Q3 – 2017

Task 5.1: 30% Design incl BNSF Submittal	Q2- 2017	Q3 – 2017-completed
Task 5.2: 60% Design incl BNSF Submittal	Q4-2017	Q1-2018
Task 5.3: 90% Design incl BNSF Submittal	Q2 -2018	Q3-2018
Task 5.4: 100% Design (Plans/Specs/Estimate)	Q4-2018	Q2-2019
Task 6: Environmental Review and Permitting	Q3 – 2017	Q2 – 2019
BNSF Coordination/O&M Agreement	Q4 - 2017	Q3 - 2019
Task 7: Bidding Support (Timing depending on funding)	Q3-2019	Q4-2019
Construction	Q4-2019	Q4-2020

Appendix J-4
Meeting Minutes and Materials:
BNSF Meeting

HANSON

MEETING MINUTES

DATE: 12/11/2017	BY: Tristan Rickett (Hanson)

PROJECT NO.: 14L006802

PROJECT NAME: Meadowdale Beach Park Railroad Bridge

PROJECT MEETING LOCATION: 2454 Occidental Avenue South Ste 1A Seattle, WA 98134

MEETING DATE: 12/5/17

PARTICIPANTS: Logan Daniels, Tom Teigen, Kathleen Pozarycki, and Elisa Dawson (Snohomish County), Stephen Semenick (BNSF Railway), Tyler Stephens (Shannon & Wilson), Ann Costanza (Anchor QEA), Mathew Fletcher, Travis Painter, and Tristan Rickett (Hanson)

DISTRIBUTION: Email

The following minutes express our understanding of the items discussed. Please respond in writing within five (5) days of receipt if any changes are required. ***Action items noted in bold italics (including persons responsible for taking actions):***

1. Safety Briefing
2. Introductions
3. Meeting Goals
4. Project Overview
5. BNSF's 30% Design Comments
    - ***a. Provide typical section of pedestrian walkway under bridge in the 60% submittal (Hanson)***
    - b. Shoofly discussion
        - i. BNSF agrees that a shoofly in this location is challenging
        - ***ii. Provide BNSF background information/design on previous shoofly discussions with Rick Wagner in 2016 (Hanson and Snohomish County)***
6. Constructability Discussion
    - a. County would like BNSF to build railroad bridge
        - i. BNSF talked with Manager of Structures, Jeff Swanson, and he indicated interest.
        - ***ii. BNSF to provide the County with a decision by end of 2017***
    - b. Discussed laydown areas needed for BNSF bridge construction; ***BNSF to provide more details pending BNSF decision to build the bridge***
    - c. Sequence of shoring
        - i. Temporary culverts by contractor
        - ii. Drive piles by BNSF
        - iii. Sheeting – sheet or soldier pile and lagging
        - iv. Install caps and beams by BNSF
        - v. Contractor performs excavations
        - vi. BNSF thinks contractor would build shoring under track windows
        - vii. Discussed various ways to prepare shoring designs by Hanson, a structural contractor or both.
        - ***viii. BNSF and County need to decide the extent of shoring design to provide in plans***
    - d. Tentative Construction Schedule
        - i. Obtain grant funds in Summer 2019
        - ii. Bid in Fall 2019
        - iii. Review submittals in Winter 2019

iv. Begin construction in February 2020

7. Additional Design Elements
    a. Lighting
        i. Clarified proposed lighting not fully placed under the bridge because of negative impacts to fish
        ii. Lighting will be adjacent to bridge to improve visibility for the park ranger at nighttime
        iii. Lighting cannot interfere with BNSF locomotive operations
        iv. Stephen will look for examples to send to County (BNSF)
    b. Root wad on piers
        i. Not sure on wad size – will be specified in 60% submittal to BNSF
        ii. Need to accommodate BNSF structural inspections
        iii. Consider wrapping in concrete to protect steel pile
        iv. Stephen will review the general approach with BNSF Structures
        v. BNSF will review proposed detail at the 60% design submittal (Hanson and Anchor)
    c. Aesthetics and Artwork on Bridge
        i. Ideas include tinted concrete, and/or stenciling/decorative molding on concrete pier caps on ends; decorative railing was discussed but dismissed due to appeal to public
        ii. BNSF commented that aesthetics cannot hinder BNSF inspections and maintenance activities
        iii. Hanson to provide preliminary options to County for potential bridge aesthetics improvements
8. Permitting
    a. Anchor: How will BNSF be involved in the permitting effort?
        i. BNSF to check with their environmental group for response
    b. Discussed that team should await BNSF's answer on bridge construction involvement before moving ahead with permitting
    c. Shoring by contractor may need work pad on beach side
        i. Hanson to look into excavating methods to avoid crossing tracks
    d. No FRA permit needed for bridge work
    e. BNSF would not submit for County building permit
    f. Small WUTC crossing permit required
    g. Note pedestrian walkway clearances and reference standards on bridge design (Hanson)
9. C&M Agreement
    a. Includes easement to cross under tracks
    b. Exhibit C and C1 covers contractor responsibilities
    c. Discuss pre-qualifying contractors with rail experience
    d. Right of entry agreement is included with C&M
    e. Developing the C&M agreement with BNSF's law team takes about 6 to 12 months
        i. Need 100% approved design plans to sign agreement
        ii. Agreement includes maintenance responsibilities and future BNSF access to the bridge
    f. BNSF does not need any additional information from County to prepare Draft Agreement. BNSF will provide the County with a draft agreement and supporting exhibits once decision from Structures is made regarding participation
    g. For public outreach, County can coordinate with Courtney Wallace and/or Gus Melonas, Stephen to provide contact information
10. Future Correspondence
    a. Future general correspondence to BNSF will be through Logan and CC the rest of the design team

b. BNSF can directly coordinate bridge design with Hanson and CC Logan and the rest of the design team as necessary

11. Other comments
    a. Elisa commented that the project cost should not exceed the ecosystem's value so the design team should look for opportunities to reduce project costs
    b. Pending BNSF decision to build the bridge, BNSF can provide a letter of support for the project
    c. Stephen still working on obtaining existing culvert plans from BNSF Structures

Version Dated 2017-08-17

No Comment / All Items CLOSED* ☐

Submittal Essentials in RED **

Project Engineer Review Items; KC Structures Review Items

BNSF Engineering Services-Structures Review Comments

Grade Separation (Underpass Design) Review Comments Sheet

Check for compliance with current AREMA and Union Pacific - BNSF Guidelines for Railroad Grade Separation Projects

Project Name:	*Meadowdale Beach Park Underpass*	BNSF Point of Contact:	Stephen Semenick
Submittal Name:	30% design submittal	Project CM Contact:	Tristan Rickett
Plan File Name:	Meadowdale Beach Park 30 percent submittal	Asset MP Name:	**0021.90, Scenic Subdivision**
Plan File Date:	8/18/2017	Plan %:	30%

Spans, abutments & Piers Numbered low to high MP
☐No Exceptions Taken ☒ Comments Below ☐ N/A

Geotechnical Report Provided and Boring Location(s) Near Bridge on GP&E
☐No Exceptions Taken ☒ Comments Below ☐ N/A

Individual Span Types/Lengths & Total BR Length face to face backwalls
☒No Exceptions Taken ☐ Comments Below ☐ N/A

Distance from CL tracks to Handrail / Fence (Section View) & AREMA Clearance
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Track Geometry & Spacing (Curves, run off, grades, track spacing, etc.) - labels
☒No Exceptions Taken ☐ Comments Below ☐ N/A

Skew Angles (Substructure & Bridge w/ respect to CL Roadway)
☐No Exceptions Taken ☒ Comments Below ☐ N/A

Vertical Clearance from Roadway to Bridge
☐No Exceptions Taken ☒ Comments Below ☐ N/A

Foundation Depth Below Roadway (Elevation View)
☐No Exceptions Taken ☐ Comments Below ☒ N/A

Timetable direction arrows, nearest and ending stations, increasing MP shown
☒No Exceptions Taken ☐ Comments Below ☐ N/A

Profile Grade of Bridge – Include TOR Elevations at Ends
☒No Exceptions Taken ☐ Comments Below ☐ N/A

Show BNSF ROW & Fence Limits & Include Access Road / Turnarounds
☒No Exceptions Taken ☐ Comments Below ☐ N/A

Rail, Tie, Ballast system w/ Distance TOT to TOD Shown (Section View)
☒No Exceptions Taken ☐ Comments Below ☐ N/A

Depth of Superstructure & Girder Spacing (Section View)
☒No Exceptions Taken ☐ Comments Below ☐ N/A

Show Limits of Handrail/Fence (Elevation View)
☒No Exceptions Taken ☐ Comments Below ☐ N/A

Drainage Direction of Flow for all Drainage Systems
☒No Exceptions Taken ☐ Comments Below ☐ N/A

Calculations Provided w/ PE Seal for Non-Standard Bridge Components
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Indicate Fixed or Exp Bearings (Elevation) & Dimension Bearing Plate Assembly
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Substructure Locations & Type w/ Elevations and Stick Log shown
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Depth of Superstructure w/ Deck Waterproofing Detail (Section View)
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Temporary Shoring Limits Shown w/ Min Dist. To CL Tracks (See Temp Shoring)
☐No Exceptions Taken ☐ Comments Below ☐ N/A

If water crossing, show ordinary high water (OHW), 50 yr, 100 yr Energy Grade Line (EGL) Elevations
☐No Exceptions Taken ☐ Comments Below ☐ N/A

Item No.	Sheet No.	Reviewer Comment Date:	Initial	Designer's Response Date:	Reviewer's Comment Date:	Initial	Designer's Response Date:	Reviewer's Comment Date:	Initial	Designer's Response Date:	Reviewer's Comment Date:	Initial	Status (Open or Closed
1.		Please number abutments from low to high MP	SAS	11/27/2017									
2.		Please include geotechnical report and boring location on GP&E	SAS	11/27/2017									
3.		Provide skew angles with respect to CL of walking path	SAS	11/27/2017									
4.		Do you have typical section of walking path as it passes under railroad bridge?	SAS	11/27/2017									
5.													
6.													
7.													

Add Row

*BNSF has reviewed these submittals and no exceptions are taken with regard to BNSF's ability to use or accommodate the project as intended. BNSF has not reviewed the design details or calculations for structural integrity or engineering accuracy. BNSF accepts no responsibility for errors or omissions in the design or execution of the project.

**** Check Submittal Essentials prior to transmittal to Structures Review. If not included, Project Engineer to reject and request resubmittal.**