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Engineering Design Report

Cornet Bay Marina, Whidbey Island, Washington

25 September 2013

Prepared for

Washington State Department of Ecology
Toxics Cleanup Program
3190 160th Avenue SE
Bellevue, Washington 98008-5452

K/J Project No. 1396010.00

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List of Acronyms

µg/L	micrograms per liter
AST	aboveground storage tank
bgs	below ground surface
BMP	best management Practice
BTEX	benzene, toluene ethylbenzene, and xylene
CAP	Corrective Action Plan
COC	constituent of concern
CSTC	crushed surfacing top course
dba	doing business as
DQO	data quality objective
DRO	diesel-range organics
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESC	Erosion and Sediment Control
ft/ft	feet per foot
GAC	granular-activated carbon
GRO	gasoline-range organics
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
ICC	Island County Code
JARPA	Joint Aquatic Resources Permit Application
LWD	large woody debris
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MTCA	Model Toxics Control Act
NPDES	National Pollutant Discharge Elimination System
NTU	nephelometric turbidity unit
OHWM	Ordinary High Water Mark
ORC®	Oxygen Releasing Compound
OVM-PID	organic vapor meter-photoionization detector
PAH	polycyclic aromatic hydrocarbon
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation and Feasibility Study
SAP	Sampling and Analysis Plan
SEPA	State Environmental Policy Act
SPCC	Spill Prevention Control and Countermeasures
SWPPP	Stormwater Pollution Prevention Plan
UST	underground storage tank
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WAC	Washington Administration Code
WSDOT	Washington State Department of Transportation

Section 1: Introduction

This Engineering Design Report (EDR) describes specific activities and engineering design requirements for implementing the remedial action at the site located at 200 Cornet Bay Road in Oak Harbor, Washington (site). This EDR has been prepared to satisfy the requirements of the Model Toxics Control Act (MTCA) regulations published in Washington Administrative Code (WAC) 173-340-400(4)(a), (Ecology 2007). The site is listed on the Washington State Department of Ecology's (Ecology's) Site Information System and Hazardous Sites List as Deception Bay Marina (originally listed as Cornet Bay Marina). Ecology has assigned the site a hazard ranking of 5 (Ecology 2002).

1.1 Project Description

A remedial action is planned to address petroleum hydrocarbon-affected soil and groundwater at the Cornet Bay Marina. Hydrocarbons detected in soil and groundwater have been attributed to a release from ruptured underground fuel lines at the marina that was discovered In January 1989.

In January 1993, Ecology entered into Consent Decree No. 93-2-00018-3 with Mr. Milton A. Woods, owner of Cornet Bay Marina, to perform a remedial investigation and feasibility study (RI/FS) at the site. After completion of the RI/FS, the Consent Decree requires performance of a cleanup action to protect human health and the environment in accordance with MTCA regulations. The RI/FS and a Cleanup Action Plan (CAP) were finalized in July 2013, and the remedial action is expected to begin in the fall of 2013 (Kennedy/Jenks Consultants 2013a and 2013b).

1.2 Remedial Action Contacts and Information

Site and project contact information are summarized below.

Site Location:	Cornet Bay Marina 200 Cornet Bay Road Oak Harbor, Washington 98277 Phone: (360) 675-5411 Currently Deception Pass Marina, Inc. Owned and operated by Mr. Milton A. Woods
Site Cleanup:	Ecology Site Cleanup No. 2011 Consent Decree No. 93-2-00018-3 Established between Mr. Milton A Woods, doing business as (dba) Cornet Bay Marina Company and Ecology Effective Date of Decree: 12 January 1993
Environmental Consultant:	Kennedy/Jenks Consultants 32001 32nd Avenue South, Suite 100 Federal Way, Washington 98001 Phone: (253) 835-6400 Contact: Ty C. Schreiner, LG, LHg, Vice President Contract No. C1100140

Ecology Administrator: Ecology Project Coordinator: Jing Liu
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1.3 Purpose of the Engineering Design Report

The purpose of this EDR is to satisfy the requirements of WAC 173-340-400(4)(a) and those established under the 1993 Consent Decree. The EDR documents engineering concepts and criteria used during design of the cleanup action and provide sufficient information to develop and review construction plans and specifications. Specific information required by WAC 173-340-400(4)(a) and provided in this EDR includes:

- Site owner, operator, and other remedial action contact information.
- General site information, including a summary of the RI/FS and current conditions.
- Remedial action goals and cleanup requirements.
- Facility maps to show the location of contaminants and planned removal areas.
- Waste characteristics, quantity, and location of materials to be treated or removed.
- Schedule for final design and construction.
- Conceptual plan of the planned remedial action.
- Engineering design criteria and assumptions and facility-specific design issues.
- Permit requirements.
- Design features to control hazardous material spills and manage hazardous materials.
- Design features to assure short- and long-term safety of site workers and local residents.
- Quality control measures that will be used to demonstrate adequate quality control.
- Compliance monitoring measures taken during and after the cleanup to meet WAC 17-340-410 requirements.
- Health and safety measures to comply with the safety and health requirements of WAC 173-340-810.
- Financial assurance information.
- Institutional controls information, including drafts of restrictive covenants and other draft documents establishing institutional controls.

1.4 Report Organization

This report consists of 12 sections and three appendices:

Section 1- Introduction. Provides a project overview, remedial action contact information, purpose, and organization of the report.

Section 2 - Site Description and Background. Summarizes site background information including the site description, site history, and nature and extent of soil and groundwater contamination at the site.

Section 3 - Cleanup Requirements. Presents remedial action objectives, cleanup levels, points of compliance, and permit requirements for the planned remedial action.

Section 4 - Engineering Design. Presents the cleanup action design considerations, including a conceptual plan of the remedial actions, engineering design criteria, facility-specific design issues, and measures to manage hazardous materials, spills, and safety of site workers and residents.

Section 5 - Remedial Action. Provides a detailed description of the remedial action methods.

Section 6 - Construction Quality Assurance/Quality Control Procedures. Describes quality assurance/quality control procedures to be followed during construction activities for the remedial action.

Section 7 - Compliance Monitoring. Identifies compliance monitoring activities that will be performed to evaluate the safety of site workers, assess the effectiveness of the removal action, and monitor long-term performance.

Section 8 - Operation and Maintenance Plan. Identifies long-term operation and maintenance requirements.

Section 9 - Financial Assurance. Presents financial information relevant to the remedial action.

Section 10 - Institutional Controls. Describes restrictive covenants or other institutional controls related to the remedial action.

Section 11 - Remedial Action Schedule. Presents a preliminary schedule of final design and construction activities.

Section 13 - References. Includes references cited or used to prepare this report.

Appendix A - Geotechnical Investigation and Sheet Pile Bulkhead Wall Report. Documents geotechnical data collected to support design of the sheet pile bulkhead and excavation.

Appendix B - Cornet Bay Marina Mitigation Plan. Documents wetlands and delineates a wetland mitigation plan.

Appendix C - Proposed Plan for Archaeological Monitoring and Inadvertent Discovery Protocol. Provides an archaeological monitoring plan to be implemented during the remedial action.

Section 2: Site Description and Background

2.1 Site Description

The Cornet Bay Marina is located at 200 Cornet Bay Road on Whidbey Island, on the southern side of Deception Pass (Figure 1). The Cornet Bay Marina property is located at Island County Tax Lot No. R13436-506-2420 (ID No. 45249) and C153-000-89-000 (ID No. 438262). The site is located at the northern end of Whidbey Island, Island County, in Section 25 of Township 34 North, Range 01 East. The upland portion of the marina is centered approximately at latitude 48.397640° longitude -122.626689°. The site is bounded on the west by Cornet Bay and on the east by Cornet Bay Road (Figure 2). Deception Pass State Park is north of and adjacent to the site. The tidelands adjacent to the site are privately owned, rather than property of Washington State.

Floating docks for boat moorage and a fuel dock make up the marina located west of the site, which is within Cornet Bay and opening to Deception Pass. Single-family residential homes on large lots lie east of the site, across Cornet Bay Road. A dry (upland) marine service facility belonging to Marine Services is southeast of the site. Mudflats, including a small manmade excavated depression, are south of the site on tidelands of Cornet Bay.

The site, which covers approximately 1.1 acres of upland area, includes a flat gravel parking area with a marina store near the western (water) side. An underground fuel tank vault is on the eastern side of the site within a grassy area. A mounded septic leach field is north of the tank vault on the western side. A covered shed area on the southern side of the property is used for waste oil storage.

The site was built on fill material that extends the road grade westward to a wooden piling-and-waler bulkhead wall that extends over the tidelands. A ramp extends from near the center of the bulkhead to the floating marina docks, including a fuel dock close to shore. A second ramp extends from the covered shed on the southern end of the property to additional floating docks.

The topography to the east rises on a slope of about 2 feet per foot (ft/ft) on average, with the slope increasing eastward. The site is at the base of a hillside area that includes residential and other buildings to the east.

In general, no surface water bodies other than Cornet Bay are present onsite. On the northern side of the property, a small drainage pipe intermittently contains surface water and appears to convey surface water runoff from the eastern side of Cornet Bay Road. The drainage pipe discharges directly to Cornet Bay at approximately the high-water mark.

2.2 Site History

The Cornet Bay Marina and associated facilities, including a wooden bulkhead that measures about 330 feet long and separates the upland facilities (general store and parking areas) from the marina, were constructed in the 1960s.

In 1964, four underground storage tanks (USTs) with a total capacity of 18,000 gallons of gasoline and 3,000 gallons of diesel were installed at the site. In January 1989, a release from ruptured underground fuel lines affected soil and groundwater behind the bulkhead. A hydrocarbon sheen extending from the bulkhead was observed on the surface of Cornet Bay.

The USTs and piping were emptied and removed in April 1989. According to the removal documentation, the USTs were located in the same area as the current underground tank vault system [an aboveground storage tank (AST) contained in a belowground vault], and the piping ran in approximately the same location as the current piping, directly from the vault to the bulkhead.

A limited soil investigation conducted by Roxbury Construction (Nelson 1990) indicated that ruptured underground fuel lines had caused the petroleum release. The four USTs were removed in March 1990 by Technical Services, Inc., under contract to Welch Enterprises. Soil from the tank excavation was reportedly placed back into the excavation. The tank removal activities are summarized in a report by Welch (1990).

In 1990, petroleum-containing soil and free product were observed when the current underground tank vault system was installed within a portion of the former UST excavation. An unknown volume of petroleum-containing water from the excavation was pumped into a drainage ditch along Cornet Bay Road (Ecology 1990). Approximately 10,000 gallons of petroleum-containing groundwater was reportedly pumped out of the excavation and disposed offsite (Nelson 1990). In addition, an unknown volume of petroleum-containing soil was removed from the excavation and disposed offsite.

Test pits were excavated at four widely spaced locations onsite, and soil and groundwater samples were collected for analysis. Elevated concentrations of gasoline-range organics (GRO), diesel-range organics (DRO), and benzene, toluene ethylbenzene, and xylene (BTEX) constituents were detected at the locations sampled (Welch 1990).

After confirmation of the release, Ecology and the Cornet Bay Marina site owner/operator entered into a Consent Decree, in accordance with MTCA requirements, to assess the extent and degree of gasoline and diesel impacts onsite (Ecology 1993). The scope of work outlined in the Consent Decree included completion of a RI/FS as directed by Ecology. Since the Consent Decree was signed in 1993, Ecology has conducted a series of investigations to assess the distribution of hydrocarbon-containing site media.

A draft FS report was prepared for the site in June 2008 by EA Engineering, Science, and Technology, Inc. (EA 2008). In August 2011, Ecology authorized Kennedy/Jenks Consultants to prepare an RI/FS Work Plan (Work Plan) to collect supplemental information regarding the distribution of affected soil and groundwater, assess the potential for vapor intrusion at the onsite building, evaluate overall site conditions, perform an FS, and select a cleanup action for the site (Kennedy/Jenks Consultants 2011a). The Work Plan was implemented from September through November 2011. In December 2011, Kennedy/Jenks Consultants prepared a Draft Remedial Investigation/Feasibility Study Report – Cornet Bay Site, Cornet Bay, Washington (Kennedy/Jenks Consultants 2011b).

Complete descriptions of the site history, environmental investigations, and remedial alternatives are provided in the final Remedial Investigation/Feasibility Study Report submitted in July 2013 (Kennedy/Jenks Consultants 2013a).

2.3 Nature and Extent of Contamination

The following sections describe the nature and extent of contamination at the site and identify areas requiring cleanup. The discussion is based on the findings of the Kennedy/Jenks Consultants 2011 RI, which includes the most current and comprehensive data set for the site.

2.3.1 Current Soil and Groundwater Conditions

2.3.1.1 Soil

The distribution of site soils containing hydrocarbon compounds at concentrations exceeding MTCA Method A soil cleanup levels for unrestricted land use is shown in Figure 3. The primary constituents of concern (COCs) exceeding cleanup levels include gasoline-range hydrocarbons and benzene. In general, the approximate footprint of petroleum-affected soils covers about 0.8 acre, or 70 to 75 percent of the property.

In general, petroleum-affected soils are typically present within 2 to 5 feet of the ground surface and extend to approximately 5 to 12 feet below grade, but these depths vary with proximity to the timber bulkhead. Affected soils are generally thickest in the central portion of the site and adjacent to the northern portion of the bulkhead. Petroleum-affected soils are generally thinner toward Cornet Bay Road and toward the northeastern and southwestern portions of the site.

Results of metals analyses from samples collected during the 2011 RI activities indicate lead or other metals analytes were not detected at concentrations above MTCA Method A/B residential soil cleanup values. Detected chromium concentrations ranged from 16 to 47 milligrams per kilogram (mg/kg). Seven of the eight samples submitted for chromium analysis contained total chromium at concentrations exceeding the 19 mg/kg MTCA Method A cleanup level for hexavalent chromium. No speciation of chromium was performed as part of these analyses, but no source for hexavalent chromium appears to be present at the site. Furthermore, the detected chromium concentrations fall within the range of background concentrations measured in Puget Sound, where the maximum background concentration was 235 mg/kg (Ecology 1994). Concentrations of total carcinogenic polycyclic aromatic hydrocarbons (PAHs) in soil are well below MTCA Method B soil cleanup levels.

2.3.1.2 Groundwater

During 2011 RI activities, groundwater samples were collected from nine reconnaissance borings and 10 new or existing monitoring wells. Groundwater reconnaissance boring and monitoring well locations and GRO, DRO, and benzene results from the 2011 RI are shown on Figure 4.

GRO concentrations ranged from below detectable levels [<250 micrograms per liter (µg/L)] to 3,400 µg/L; the highest GRO concentration in a completed monitoring well (MW-4) was 3,400 µg/L. DRO concentrations ranged from below detectable levels (<100 µg/L) to 3,600 µg/L, which was detected in reconnaissance groundwater sample from boring B-21. Benzene concentrations ranged from below detectable levels (<1 µg/L) to 4,000 µg/L, which was detected in a sample from monitoring well MW-2.

In addition to GRO, DRO, and benzene, other gasoline components (toluene, ethylbenzene, and xylenes) were also detected in groundwater samples from the site. The range of concentrations of these compounds is as follows:

- Toluene ranged from below detectable levels (<1 µg/L) to 170 µg/L
- Ethylbenzene ranged from below detectable levels (<1 µg/L) to 1,200 µg/L
- Total xylene ranged from below detectable levels (<1 µg/L) to 1,752 µg/L.

Dibenzofuran,1-methylnaphthalene, 2-methylnapthalene, and total and dissolved arsenic were detected in groundwater at concentrations exceeding MTCA Method B surface water cleanup levels. The source of these compounds at the site is not certain; however, they may be present in coal tar and creosote products. Therefore, the creosote-treated bulkhead is the likely source of these compounds at the site. Total and dissolved arsenic concentrations [detected at a maximum concentration of 0.18 milligram per liter (mg/L) in well MW-7] are similar to naturally occurring background concentrations. Total or dissolved arsenic was not detected in other site wells above the laboratory reporting limit of 0.05 mg/L. All carcinogenic PAHs were reported at concentrations below the laboratory reporting limit.

2.3.2 Areas Requiring Cleanup

During the RI, several COCs were detected at concentrations above applicable site cleanup levels. Although some constituents such as toluene, ethylbenzene, toluene, and lead were detected in soil and/or groundwater at concentrations above cleanup levels, gasoline-range hydrocarbons and benzene are the indicator hazardous substances that were used to define cleanup areas. For purposes of the remedial design, it is assumed that remediation of gasoline-range hydrocarbons and benzene in soil and groundwater will also remediate other COCs to acceptable site cleanup levels.

2.3.2.1 Soil

The current distribution of site soils exceeding the MTCA Method A cleanup levels (unrestricted land use) for gasoline-range hydrocarbons and benzene is shown on Figure 3. The lateral extent of petroleum-containing soils for both gasoline-range hydrocarbons and benzene is lower than for benzene alone. The area of petroleum-containing soils is estimated to be approximately 0.8 acre (34,850 square feet).

A location map and geologic cross-sections of the site, taken from the 2013 RI/FS, are presented on Figures 5 through 7. The cross-sections show the soil stratigraphy and vertical extent of petroleum-affected soil and estimated soil removal areas. Petroleum-containing soils at the site consist primarily of fill material and do not extend appreciably into the upper portion of the native materials underlying the fill. In general, petroleum-affected soils are encountered from a few feet below grade to 12 feet below ground surface (bgs), but extend to 18 feet bgs at some locations, particularly in the western portion of the site (adjoining Cornet Bay) near the timber bulkhead.

Laboratory analytical results and field screening information (i.e., visually stained soils, odor, and sheen) were used to estimate the volume of assumed clean overburden and petroleum-affected soils. The estimated volumes, as presented in the Remedial Investigation and Feasibility Study Report (Kennedy/Jenks Consultants 2013a) are as follows:

- Assumed clean overburden – 6,700 cubic yards
- Petroleum-affected soils – 8,400 cubic yards.

2.3.2.2 Groundwater

In general, the distribution of petroleum hydrocarbon compounds in groundwater is consistent with the extent of petroleum-affected soils at the site. Similarly to petroleum-affected soils, the lateral extent of benzene is greater than that of gasoline-range hydrocarbon in groundwater (refer to Figures 3 and 4).

Section 3: Cleanup Requirements

3.1 Remedial Action Objectives

The objective of the cleanup action is to reduce potential risks to human health and the environment. Specific risk-based remedial action objectives include:

- Reduce the potential for human direct contact/ingestion of site soil containing COCs at concentrations exceeding the selected cleanup levels.
- Reduce the potential for human exposure to vapors (primarily vapor intrusion into buildings) associated with soil and groundwater containing COCs at concentrations exceeding the selected cleanup levels.
- Reduce the potential for impacts to terrestrial and aquatic organisms in the site vicinity.
- Protect groundwater and surface water quality by addressing the source of petroleum hydrocarbons to the extent required to limit their mobility in the environment.

3.2 Cleanup Levels

The cleanup standards for soil and groundwater include:

- MTCA Method A unrestricted land use values for fuel components (GRO, DRO, and BTEX) will be used for soil.
- MTCA Method A values for fuel components (GRO, DRO, and BTEX) will be used for groundwater and surface water.

MTCA Method A soil cleanup levels are protective of human exposure (direct contact pathway) as well as groundwater and surface water. MTCA Method A groundwater cleanup levels for GRO, DRO, and BTEX were selected for fuel components because they are the most applicable and protective standards for gasoline-range and diesel-range hydrocarbon compounds (including BTEX). MTCA allows the use of potable drinking water standards for non-potable water when these standards are protective of human health and the environment and completion of a site-specific risk assessment is not warranted.

The specific cleanup levels for site COCs are summarized in Table 1.

Table 1: Site Cleanup Levels

	Site Cleanup Level		
Constituent	**Soil (mg/kg)**	**Groundwater (µg/L)**	**Basis**
Gasoline Range Organics	30	800	MTCA Method A
Diesel Range Organics	2,000	500	MTCA Method A
Benzene	0.03	5	MTCA Method A
Toluene	7	1,000	MTCA Method A
Ethylbenzene	6	700	MTCA Method A
Xylenes	9	1,000	MTCA Method A

3.3 Points of Compliance

The point of compliance, based on the expected exposure route, is the point (or points) where cleanup levels established for the site are to be achieved. The points of compliance for site media were established as follows:

- Soil: Throughout the site to a depth of 15 feet bgs for direct contact.
- Soil: Throughout the site to the depth of groundwater for protection of groundwater and terrestrial ecological receptors.
- Groundwater: Typically, the groundwater point of compliance is throughout the site unless Ecology approves a conditional point of compliance, because it is not practicable to meet the cleanup level throughout the site within a reasonable restoration timeframe. Groundwater is not a potable water source at the site, and protection of surface water and sediments is the primary objective. Therefore, the point of compliance is throughout the site for groundwater and, for surface water, as close as technically possible to the point where groundwater flows to surface water. This point will be assessed in monitoring wells located onsite, including wells located directly adjacent to the point where groundwater discharges to surface water.
- Surface Water: In general, no surface water bodies other than Cornet Bay are present or in proximity to the site. On the northern side of the property, a small drainage pipe intermittently contains surface water and appears to convey surface water from the eastern side of Cornet Bay Road. The drainage pipe discharges to Cornet Bay at approximately the high-water mark. The point of compliance for surface water will be in Cornet Bay.

3.4 Permits

All actions carried out by Ecology or Ecology's contractor must be performed in accordance with all applicable federal, state, and local requirements, including requirements to obtain necessary permits, except as provided in RCW 70.105D.090 which allows an exemption from the procedural requirements of State and local permits. The permits or other federal, state, or local requirements that the agency has determined are applicable and that are known at this time include:

Federal Requirements

- Clean Water Act (Section 401)
- Clean Water Act (Section 404)
- Resource Conservation and Recovery Act (RCRA)
- Occupational Safety and Health Act (29 CFR 1910)
- Rules for Transport of Hazardous Waste (29 CFR 107, 49 CFR 171)
- Safe Drinking Water Act
- National Pollutant Discharge Elimination System (NPDES)
- Endangered Species Act (ESA)
- Magnuson-Stevens Fishery Conservation and Management Act
- 1996 Sustainable Fisheries Act
- Protection of Historical Properties (36 CFR 800)
- National Historical Preservation Act of 1966 (Section 106)

State Requirements

- Model Toxics Control Act (WAC 173-340)
- Dangerous Waste Regulations (WAC 173-303)
- State Environmental Policy Act (RCW-43.21C)
- Environmental Checklist (WAC 197-11-960)
- Minimum Standards for Construction and Maintenance of Wells (WAC 173-160)
- State Clean Air Act (RCW 70.94)
- Washington Industrial Safety and Health Act Regulations (WAC 296-62)
- Water Pollution Control Act (RCW 90.48)
- Water Quality Standards for Surface Waters of the State of Washington (WAC 173-201A)
- Water Quality Standards for Groundwater of the State of Washington (WAC 173-200)
- Maximum Environmental Noise Levels (WAC 173-60)

- Shoreline Management Act of 1971 (RCW 90.58)
- Archaeological Sites and Resources (RCW 27.53)
- Indian Graves and Records (RCW 27.44)
- Washington State Regulations for Handling Human Remains (RCWs 68.50.645, 27.44.055, and 68.60.055).

Local Requirements

- Island County Code (ICC) Chapter 17.02A.070 – Critical Area Mitigation
- Island County Shoreline Development review
- Island County Plumbing and Mechanical review
- Puget Sound Clean Air Agency Regulations.

Under RCW 70.105D.090(1), Ecology and its consultants are exempt from the procedural requirements of Chapters 70.94, 70.95, 70.105, 77.55, 90.48, and 90.58 RCW and of any laws requiring or authorizing local government permits or approvals. However, Ecology and its consultants shall comply with the substantive requirements of such permits or approvals.

During remedial action, Ecology and its consultants must continue to determine whether additional permits or approvals addressed in RCW 70.105D.090(1) would otherwise be required for the remedial action under the Consent Decree. Ecology will be responsible for contacting the appropriate state and/or local agencies and working with those agencies to determine the substantive requirements those agencies believe are applicable to the remedial action. Pursuant to RCW 70.105D.090(2), if Ecology determines that the exemption from complying with procedural requirements of the laws referenced in RCW 70.105D.090(1) would result in the loss of approval from a federal agency that is necessary for the State to administer any federal law, the exemption will not apply and Ecology and its consultants will comply with both the procedural and substantive requirements of the laws referenced in RCW 70.105D.090(1), including any requirements to obtain permits.

The State Environmental Policy Act (SEPA) requires governmental agencies to evaluate environmental impacts for the proposed remedial action before finalizing the planning decisions. As part of the SEPA process, Ecology completed an Environmental Checklist (submitted on 26 June 2013). The purpose of the Environment Checklist is to help determine whether significant environmental impacts will occur during the project, which will lead to the decision of whether or not an Environmental Impact Statement (EIS) is required. Ecology as the lead agency for this proposal, determined in July 2013 that the project does not have a probable significant adverse impact on the environment and therefore an EIS is not required.

Two federal permits required for the project were identified on the Environmental Checklist:

1. NPDES Permit
2. Joint Aquatic Resources Permit Application (JARPA).

The NPDES permit is required to discharge treated construction dewatering water and stormwater to Cornet Bay. The United States Environmental Protection Agency (USEPA) delegates issuance of the NPDES permit to Ecology.

A JARPA permit from the U.S. Army Corps of Engineers (COE) is required for in-water work associated with installing a new sheet pile bulkhead. The JARPA permit combines requirements of numerous regulatory agencies into a single combined permit in order to streamline the environmental permitting process. Ecology is currently pursuing a JARPA permit with the COE.

Section 4: Engineering Design

4.1 Conceptual Plan of the Remedial Action

The planned remediation areas and primary elements of the remedial action are shown on Figure 8. The remedial action involves replacing the existing timber bulkhead with a steel sheet pile bulkhead, excavating and disposing of affected soils offsite, in situ bioremediation through strategic placement of backfill amended with Oxygen-Releasing Compound (ORC®), and groundwater compliance monitoring.

The marina store building and site utilities will be temporarily relocated or abandoned before sheet pile installation and excavation activities. The building will be temporarily relocated to an area northeast of the planned excavation. Before the excavation of affected soils, a steel sheet pile bulkhead will be installed outside of and parallel to the existing timber bulkhead, extending approximately 330 feet along the shoreline. The existing timber bulkhead, which consists of pilings, walers, and supports, will be demolished and removed at the base of the excavation concurrent with excavation activities. The new steel sheet pile bulkhead will be designed to prevent upgradient accumulation of groundwater by installing a drain system that conveys groundwater around the ends of the bulkhead.

Excavation activities will likely take place in phases to minimize the total excavation footprint, minimize groundwater infiltration, and maximize the area of the site to be used for soil stockpiling, equipment and materials staging, and customer access to the marina dock. Petroleum hydrocarbon-containing soil will be excavated to the maximum extent practicable. Based on the vertical extent determined during the 2011 RI (see Figures 6 and 7), excavation depths are estimated to be between approximately 2 and 18 feet bgs, depending on the site location.

Assumed clean overburden soil will be temporarily stockpiled onsite, and representative soil samples will be collected and submitted for chemical analysis to determine whether the soil can be used as excavation backfill. Petroleum hydrocarbon-containing soil will be transported and disposed of at a licensed Subtitle D landfill facility as a non-hazardous waste. The excavation will be backfilled to existing grade with stockpiled overburden soil deemed acceptable for reuse and imported clean fill. A portion of the backfill may be amended with ORC® (or equivalent) to promote biological degradation of residual petroleum hydrocarbons.

Dewatering will be performed during excavation activities, with the water treated via a temporary treatment system consisting of oil/water separation, particle separation and granular-activated carbon (GAC) treatment to remove petroleum hydrocarbon compounds. The treated water will be discharged directly to the bay under an NPDES permit and an associated administrative order issued by Ecology.

Upon completion of the excavation backfilling, the temporarily relocated marina store, waste oil storage building (including two aboveground waste oil tanks), site utilities, and septic tank will be restored.

After site restoration, quarterly confirmation groundwater monitoring will be conducted for at least one year to assess the effectiveness of remediation activities (including biological degradation of petroleum residuals, if any) and evaluate groundwater quality.

4.2 Design Criteria

The following sections describe the design elements of the remedial action and present the design criteria and rationale.

4.2.1 Utility Replacement

Existing site utilities, which interfere with the sheet pile bulkhead installation and excavation, must be demolished or relocated. The utilities will be restored after completion of the excavation and backfill activities. Electricity to the docks will be maintained throughout the remedial action by establishing a new electrical connection to the dock via a temporary electrical conduit located outside of the sheet pile bulkhead and excavation work areas.

4.2.2 Sheet Pile Bulkhead Installation

A deep shoring system is required to allow excavation of petroleum hydrocarbon-containing soil to depths of up to 18 feet adjacent to the timber bulkhead and Cornet Bay. A steel sheet pile bulkhead was selected for this purpose because:

- The sheet pile bulkhead will provide sufficient support for removing the existing timber bulkhead and excavating soil to depths of up to 18 feet.
- The sheet pile bulkhead will act as a cut-off wall, limiting infiltration of groundwater and sea water into the excavation.
- The sheet pile bulkhead provides containment, minimizing risk of releasing petroleum hydrocarbons or high turbidity water to Cornet Bay during excavation activities.
- Replacing the aging timber bulkhead with a permanent steel sheet pile bulkhead will improve site infrastructure and access to marina operations.

A geotechnical investigation was conducted in June 2013 to determine site-specific soil properties and recommended design criteria (GRI 2013). The geotechnical investigation report is included in Appendix A.

4.2.3 Building Relocation

The marina store building, which is in the footprint of the planned excavation, will require temporary relocation during excavation. Building relocation was selected over demolition and new construction because it is less intrusive to the property owner and a more cost-effective, sustainable approach. The buildings will be temporarily relocated to State Park property northeast of the planned excavation.

A hazardous materials survey will be required to test for the presence of asbestos-containing material in the floor tiles of the building and to determine whether asbestos abatement will be required before demolishing the building slab.

4.2.4 Excavation Extent

The planned excavation extent, which was determined based on analytical results and field observations from the RI, is shown on Figure 8. Excavation depths will range from 2 to 18 feet, as indicated in the cross-sections presented on Figures 6 and 7. Other design criteria are as follows:

- Site soil cleanup levels established in Section 3.2:
  - 30 mg/kg GRO
  - 2,000 mg/kg DRO
  - 0.03 mg/kg benzene
  - 7 mg/kg toluene
  - 6 mg/kg ethylbenzene
  - 9 mg/kg xylenes.
- Excavation will terminate at the edge of the new sheet pile bulkhead.
- The excavation will only extend beneath the mounded drain field and existing fuel system underground reinforced concrete vault if confirmation samples collected at the edge of these structures indicate soil exceeding cleanup levels is present beneath the structures. In event that the excavation needs to be extended beneath the fuel system vault and/or mounded drainfield, then a decision will be made on how to excavate contaminated soil from beneath the structures. Methods may include shoring and bracing of the structures during excavation or demolition and reinstallation of the structures following excavation. Through traffic and pedestrian access along Cornet Bay Road will be maintained throughout the remedial action.

Final excavation extents will be determined during excavation activities based on physical constraints and the results of confirmation soil sampling.

4.2.5 Excavation Stabilization

Excavations will be supported to meet all applicable requirements of WAC 296-155-650 and 29 CFR 1910.120. Worker protection from cave-in is required for any excavation more than 4 feet in depth. The deepest side of the excavation, adjacent to Cornet Bay, will be stabilized by the new sheet pile bulkhead. Other areas of the excavation will be stabilized by either being sloped 1.5H:1V (horizontal to vertical) or by benching or use of a temporary shoring system, as needed.

4.2.6 Excavation Dewatering, Treatment, and Discharge

The design excavation depth, ranging from 2 to 18 feet bgs, extends below the water table. Therefore, dewatering will be required during excavation and backfill placement and compaction activities. Based on groundwater level monitoring conducted between 22 October and 9 November 2011, depth to groundwater ranges from 6 to 9 feet bgs for wells nearest Cornet Bay to 1.5 to 2.5 feet bgs for well MW-7, which is approximately 125 feet east of Cornet Bay.

Dewatering fluids, including water pumped from excavations, soil stockpile drainage, and rainfall runoff that contacts petroleum hydrocarbon-containing soil, will be treated via a temporary

dewatering treatment system, and the effluent will be discharged to Cornet Bay. Excavation dewatering, treatment, and discharge design criteria are as follows:

- The dewatering system and treatment system must be of sufficient capacity to handle dewatering in all open excavations, drainage from soil stockpiles, and contaminated stormwater runoff.

- Treatment system discharge must meet the effluent limits listed in the NPDES permit.

- An administrative order will be established between Ecology and the remediation contractor establishing effluent limits, monitoring, and analysis requirements.

- The treatment system must be equipped with a flow totalizer and sampling ports for recording and reporting discharge volumes, and samples will be collected as required by the NPDES permit.

- The treatment system must include a minimum of two GAC vessels connected in series as a safeguard in case breakthrough occurs in the lead GAC vessel.

- The discharge point to Cornet Bay must be located a minimum of 100 feet offshore to prevent agitation of sediments at the discharge point.

4.2.7 Excavation Backfill

Backfilling the excavations with suitable fill material and placement methods is necessary to restore the site to its original condition. Excavation backfill materials to be used on this project will consist of three types: imported, native, and amended backfill (as needed).

Imported backfill will be pit run material from a local borrow source. Native backfill consists of overburden soil that was stockpiled during excavation and deemed acceptable for reuse as backfill, based on stockpile sampling results. Amended backfill (if used) will consist of native backfill (deemed acceptable for reuse) or imported backfill amended with ORC®. The amended backfill will be prepared by manually mixing ORC® into stockpiled soil using an excavator or equivalent equipment. Excavation backfill design criteria are as follows:

- Imported backfill (pit run) will have the following characteristics:
  - Non-expansive soil with a liquid limit <40 percent and a plasticity index <15 percent
  - No clods or rocks larger than 2 inches in greatest dimension
  - <10 percent passing the #200 sieve
  - No organic material
  - Documentation or clean fill certification (free of inorganic and organic contaminants).

- Native backfill material and amended native backfill material:
  - No clods or rocks larger than 2 inches in greatest dimension
  - No organic material
  - DRO, GRO, benzene, toluene, ethylbenzene, and xylene concentrations below site cleanup levels.

- Backfill material must be conditioned to obtain a moisture content of 2 percent of optimum.

- Native backfill may have to be conditioned to achieve compaction due to the high percentage passing the #200 sieve. This material could be very wet during the fall/winter construction period. If so, it may not compact to initially meet the 95 percent compaction requirement. If that happens, the contractor may augment it with granular material. If it is not possible to compact, with Ecology approval it shall be hauled away to a disposal site.

- Backfill must be placed in 8-inch lifts compacted to 95 percent of maximum density.

- Groundwater levels must be kept a minimum of 1 foot below the level of fill compaction.

- Backfill amended with ORC® will be placed strategically in areas of residual contamination based on confirmation soil sampling results.

4.2.8 Recontamination of Remediated Areas

As described previously, the excavation will be completed in phases, in which one area of the excavation is completed and backfilled with clean fill before another area is excavated. A critical design element is to prevent recontamination of the clean backfilled area from infiltration of contaminated groundwater from the adjacent areas that have not yet been remediated. This will be accomplished by placing plastic liners along the walls of the excavation cells during backfilling to minimize seepage of potentially contaminated groundwater from the adjacent cell.

4.3 Facility-Specific Design Issues

Facility-specific design issues include maintaining operation of the marina throughout the remedial action; protecting the water quality and aquatic environment of Cornet Bay during in-water work; and mitigating construction impacts to wetlands.

4.3.1 Marina Operations

The marina will remain open throughout the remedial action. Design elements to allow continued operation of the marina include:

- Temporary access to the marina dock will be established when the existing dock access ramps are removed to install the sheet pile bulkhead. Temporary access will be via an access path that extends from Cornet Bay Road, along the northwestern side of the excavation area, to the temporary access ramp, which will be installed at the northwestern end of the sheet pile bulkhead.

- Electricity will be supplied to the marina dock via a temporary electrical line that extends outside the construction areas.

- Temporary sanitation facilities will be provided and maintained for marina customers to use during the period when the septic system is out of commission.

- Operation of the marina store, fuel, and water supply to the marina dock will be suspended during the remedial action.

4.3.2 Aquatic Environment

The sheet pile bulkhead will be installed within Cornet Bay and is therefore, subject to specific requirements for in-water work to protect water quality and the aquatic environment. In-water construction requirements are discussed in the following sections.

4.3.2.1 Fish Window

The sheet pile bulkhead installation and wetland excavation and mitigation must be completed during the approved in-water work window - "fish window," which occurs from 16 July through 15 February. All other work related to the remedial action is not considered in-water work and may be completed outside of the approved in-water work window.

4.3.2.2 Water Quality During Construction

In-water construction activities are subject to the requirements of a NPDES permit and the Water Quality Standards for Surface Waters of the State of Washington (WAC 173-201A). These requirements include:

- The remediation contractor will develop and implement a Water Quality Protection Monitoring Plan, which will include:
  - The location of turbidity monitoring sites at background monitoring locations and at compliance monitoring locations located less than 150 feet from the in-water construction area.
  - Number of and frequency of turbidity measurements.
  - Specifications and calibration procedures for turbidity monitoring equipment.
  - Description of best management practices (BMPs) that will be used during in-water construction to protect water quality.

- The remediation contractor will be required to:
  - Monitor to confirm that turbidity measured at compliance monitoring points does not exceed 5 nephelometric turbidity units (NTU) over background when the background is less than 50 NTU, or a 10 percent increase in background when the background turbidity exceeds 50 NTU.
  - Take immediate action to stop, contain, and prevent unauthorized discharges if the turbidity criteria are exceeded.
  - Deploy a containment boom and absorbent pads around the perimeter of the in-water work area to capture wood debris and potential petroleum hydrocarbon-containing water during construction.
  - Deploy a turbidity curtain around the perimeter of the in-water work area in order to minimize turbidity and re-suspension.

4.3.3 Wetland Mitigation

A wetland area was identified at the southwestern end of the site during wetland delineations performed in June 2013. Excavation and sheet pile bulkhead installation will affect the wetland and aquatic environment; therefore, wetland mitigation is included as a requirement of the JARPA Permit. Wetland mitigation will be accomplished by implementing the Cornet Bay Marina Mitigation Plan (Mitigation Plan), dated July 2013, prepared by Grette Associates Environmental Consultants and included in Appendix B (Grette Associates 2013). Wetland mitigation will consist of post-cleanup enhancement of the affected wetland and buffer area,

which includes re-grading, placement of large woody debris (LWD), plant installation, and long-term monitoring and maintenance. Because the work will include in-water construction, it will have to be completed between 16 July and 15 February, during the fish window.

4.3.4 Cultural Resources

Cultural Resources Consultants, Inc., completed a cultural resources assessment at the site in June 2013. The cultural resources assessment did not identify any historical properties that might be affected by the remedial action; however, the assessment indicated a high potential for the presence of intact cultural deposits within the project area (CRC 2013a). Based on these findings, the COE requires archaeological monitoring as a JARPA Permit requirement (USACE 2013). Archaeological monitoring will be accomplished by implementing the Proposed Plan for Archaeological Monitoring and Inadvertent Discovery Protocol for the Cornet Bay Marina MTCA Cleanup Project, which has been included in Appendix C (CRC 2013b).

4.3.5 Tidal Effects During Construction

The excavation will extend below the Ordinary High Water Mark (OHWM) over much of its extent and will be subject to inundation from tidal waters at the southwestern end of the excavation and tidal influenced groundwater inflow in other areas. Tidal water and groundwater inflow will be controlled by the following design elements:

- The sheet pile bulkhead will act as a hydraulic barrier to limit inflow of tidal water and reduce groundwater inflow along the northern and northwestern sides of the excavation.
- Dewatering pumps will be operated to remove groundwater from the excavations.
- The excavation and wetland restoration activities at the southwestern end of the excavation will be scheduled to coincide with periods of low tide.

4.4 Spill Control During Construction

Spill potential during the remedial action is limited to fuel and lubrication oil from construction equipment, fuel leakage during demolition of marina fuel conveyance piping, and spills of petroleum hydrocarbon-containing water from the temporary dewatering and treatment system. Spill potential during the remedial action will be addressed as follows:

- The remediation contractor will prepare a Spill Prevention Control and Countermeasures (SPCC) Plan, which will include procedures for spill control, including containment and regular inspections during construction.
- The remediation contractor will maintain a spill control kit for equipment-related spills on land and water.
- The remediation contractor will drain fuel from the marina fuel supply tanks and fuel lines, and the lines will be flushed out before being disconnected and demolished.
- The temporary dewatering treatment system will be equipped with safeguards to prevent spills (e.g., overflow shutoffs, alarms, or secondary containment).

4.5 Contaminated Soil Management

Excavation of petroleum hydrocarbon-containing soil, dewatering, and removal of the timber bulkhead could produce fugitive dust and/or organic vapors that may be harmful to construction workers. Construction workers also might contact petroleum hydrocarbon-containing soil and groundwater during cleanup activities. In addition, vehicle could transport petroleum hydrocarbon-containing soil via tracking. The following measures will be implemented to mitigate risks related to contaminated soil:

- All personnel working with petroleum hydrocarbon-containing soil and dewatering fluids will be Hazardous Waste Operations and Emergency Response (HAZWOPER) certified.
- Site workers shall use appropriate personal protective equipment to prevent exposure to contaminants.
- Water spraying will be performed as needed during excavation and soil loading to minimize fugitive dust.
- Air monitoring for volatile organic compounds (VOCs) using an organic vapor meter-photoionization detector (OVM-PID) and benzene detection tubes will be performed when excavating petroleum hydrocarbons to prevent worker exposure to VOCs at potential harmful concentrations.
- Excavated soil will be placed either in lined stockpiles or directly loaded into haul trucks. Soil stockpiles and loaded haul trucks will be covered to prevent dust emissions.
- Assumed clean overburden soil will be stockpiled, and prior to placement, representative soil samples will be collected and submitted to the laboratory to confirm concentrations are below site cleanup levels.
- Petroleum hydrocarbon-containing soil will be transported and disposed of at a licensed Subtitle D landfill facility as a non-dangerous waste.
- Soils that are excavated wet and not passing a standard paint filter test will be placed in temporary stockpiles and allowed to dry. Stockpiles will be sufficiently bermed to prevent overflow of draining fluids, and fluids will be processed through the temporary dewatering treatment system.
- BMPs will be implemented to prevent offsite tracking of contaminants via vehicles and equipment (e.g., quarry spalls lined construction entrance, dry brushing of tires, etc.).

4.6 Protection of Human Health and the Environment

Short-term protection of human health and the environment pertains to implementation of the remedial action. Long-term protection involves the period beginning at the completion of excavation backfill and site restoration. Based on site conditions, the most likely exposure routes of concern are the potential inadvertent ingestion or inhalation of soil or dust, inhalation of VOCs, and dermal absorption of site surface materials.

4.6.1 Short-Term Protection

Short-term protection of human health and the environment involves risks associated with the hazardous constituents in site material and risks typically related to construction activities.

Materials at the surface and slightly below the surface of the site may present potential risks to human health or the environment during construction. Installing the sheet pile bulkhead, removing the timber bulkhead, excavating petroleum hydrocarbon-containing soil, and treating contaminated dewatering fluids may expose workers to hazardous substances. Remediation workers will use personal protective equipment to reduce the risks involved with handling hazardous site materials. If site construction activities produce visible dust, the contractor will apply water to surface materials to control fugitive dust emissions. Air monitoring for harmful VOC levels will be conducted using an OVM-PID and benzene detector tubes.

The contractor will decontaminate all equipment that may be exposed to contaminated site materials and describe such decontamination procedures as part of the construction submittals. The contractor will dispose of all waste materials in accordance with applicable federal, state, and local laws and regulations.

This remedial action also involves activities typically associated with construction sites that could pose risks to human health. These activities include working near moving heavy equipment, noise from driving sheet piles, tripping and falling hazards, and lifting heavy objects. A security fence will surround the site to prevent unauthorized personnel from entering the construction areas. The remediation contractor's Health and Safety Plan (HASP) will address construction-related safety hazards to site workers and customers accessing the marina during construction.

BMPs (e.g., silt fence) will be implemented around the construction area to prevent stormwater runoff from entering Cornet Bay. A turbidity curtain and oil-absorbent booms will be deployed in Cornet Bay surrounding the sheet pile bulkhead installation area to prevent turbidity or petroleum hydrocarbon-containing water from affecting Cornet Bay. The remediation contractor's Stormwater Pollution Prevention Plan (SWPPP) and Water Quality Protection Monitoring Plan will address the protection of Cornet Bay water quality from stormwater and in-water construction impacts.

4.6.2 Long-Term Protection

Long-term protection is achieved by removing contaminated materials and reducing exposure to COCs that remain onsite. Removing the petroleum hydrocarbon-containing soil will reduce impacts to groundwater and the surface water of Cornet Bay, thereby protecting aquatic organisms.

Section 5: Remedial Action

Engineering plans and specifications have been developed to provide details of the remedial design and to serve as a basis for contractor bidding. The engineering drawings and specifications will be submitted separately from the EDR. The following section summarizes the remedial action work elements that are set forth in the engineering plans and specifications.

5.1 Sequencing of Work

It is anticipated that the contractor implementing the work will complete this project in phases in order to maintain continuous access to the marina dock during construction. These anticipated phases are summarized as follows:

- Phase 1. Relocate existing buildings and facilities to the area northeast of the excavation area. Demolish building foundations, septic tank, and utilities. Reconnect water with temporary piping for construction activities. Install a temporary power feed to docks and temporary portable sanitation facilities.

- Phase 2. Construct a new steel sheet piling bulkhead on the waterward side of the existing timber bulkhead.

- Phase 3. Complete remediation, including removal of the timber bulkhead, excavation and transport of contaminated material to an approved landfill for final disposal. Import clean fill, backfill it into the excavation area, and compact to specifications.

- Phase 4. Construct a new foundation and septic tank for the relocated buildings. Provide utilities in the location to support the establishment of the building onto the new foundation. Move the building onto the new foundation and connect the utilities. Install double-contained piping for all fuel lines back to the dock. Replace the dock access walkways in compliance with current code requirements. Construct a new guardrail along the new bulkhead. Replace existing marina items that were removed during previous phases of construction with new items, as appropriate.

5.2 Mobilization and Site Preparation

Contractor mobilization and site preparation includes preparation of construction plans, mobilization of equipment, materials and staff, and preparing the site for construction activities. Mobilization and site preparation for the sheet pile bulkhead installation and excavation consist of:

- Prepare construction plans, including a HASP, Work Plan, Bulkhead Construction Plan, Construction SWPPP, and a Water Quality Protection Monitoring Plan.

- Install a temporary chain-link fence along the perimeter of the Cornet Bay Marina and adjacent State Park property to prevent unauthorized access to work areas. Install locking gates at the two construction entrances.

- Construct a temporary access path along the southwestern side of the perimeter fence to provide access for customers to the marina dock from Cornet Bay Road.

- Install a new temporary dock access ramp at the southwestern end of the timber bulkhead to provide access for customers to the dock during construction.

- Place a temporary office trailer at the site and establish a parking area at the State Park property, directly northeast of the site. The boat launch parking lot, located east of the site will also be utilized for equipment staging and truck parking.

- Provide temporary utilities to support construction, including power, water, phone, and sanitation.

- Place signs announcing the construction activities, safety warnings, and traffic control.

- Construct clean soil and contaminated soil holding and transport areas with berms and impermeable liners to prevent water loss or the release of potential contaminants during storage.

- Construct a decontamination facility for site equipment and construction personnel.

- Mobilize equipment and materials to the site.

- Construct temporary erosion and sedimentation control BMPs for upland areas and in-water work, including:
  - Quarry spalls or equivalent stabilized construction entrances.
  - Filter fabric silt fence along the northeastern and southwestern sides of the site.
  - A floating debris boom, oil-absorbent boom, and turbidity curtain surrounding the in-water work area.
  - Plastic liner and cover for the soil holding areas.

- Complete a pre-construction survey of the excavation area and photograph pre-construction conditions.

- Complete an underground utility locate.

- Decommission groundwater monitoring wells located within the excavation footprint in accordance with WAC 173-160.

5.3 Utility and Replacement and Dock Access

Existing site utilities including electrical lines, water, and sewer lines to the marina store and electrical lines, fuel lines, and water lines to the marina dock will be relocated or demolished prior to sheet pile bulkhead installation and excavation activities. The two access ramps to the dock will also be removed. A new temporary electrical connection located outside of the sheet pile bulkhead and excavation area will be installed to maintain power to the marina dock during the remedial action. As discussed in the previous section, temporary power, water, telephone, and sanitation facilities will be provided for the construction office. All utilities will be restored upon completion of the remedial action.

The septic tank and sewer line extending to the raised drain field will be demolished and replaced after remedial action completion. Portable sanitation facilities will be provided for the marina customers when the sewer system is out of commission.

Underground fuel supply lines extend from the combined gasoline and diesel tank, located in the tank vault adjacent to Cornet Bay Road, to the marina fuel dock. Fuel tanks and fuel supply lines will be drained and cleaned of fuel in accordance with applicable laws before demolition. After the pipelines have been drained and cleaned, the fuel hoses at the main dock access platform will be disconnected and the underground fuel lines will be demolished. The fueling system will remain out of service throughout the excavation work. New double-walled fuel lines and a leak detection system will be reinstalled and the fueling system will be brought back online after excavation activities are complete.

The two existing access ramps to the marina dock will be removed. Access during the remedial action will be via a new temporary access ramp at the southwestern end of the timber bulkhead. The two existing dock access ramps will be restored after completion of the remedial action.

5.4 Temporary Relocation of the Building

The marina store building will be temporarily relocated to the State Park property before the sheet pile bulkhead is installed. A hazardous material survey will be completed before relocating the building to test for asbestos-containing materials. If hazardous materials are identified, abatement will be required in compliance with federal, state, and local regulations during relocation of the building and demolition of the building foundation.

After the building contents have been removed, the building will be disconnected from the foundation, reinforced to facilitate moving, and moved to the temporary storage location. The existing building foundation, utility connection points, and anchor bolt locations will be surveyed to a 0.01-foot accuracy to provide reference for new foundation construction. The foundation will be demolished after the survey is completed.

5.5 Sheet Pile Bulkhead Installation

The steel sheet pile bulkhead will be installed on the waterward side of the existing timber bulkhead, extending approximately 330 feet along the shoreline, as shown on Figure 8. The sheet piles will extend from approximately 11 feet above the mud line to 20 feet below the mud line; the final design will be provided in the engineering plans and specifications. To provide stability and drainage, a soil stabilization wall and drainage system will be constructed behind the sheet pile bulkhead during backfilling of the petroleum hydrocarbon-containing soil excavations. The remediation contractor will submit a Bulkhead Construction Plan to provide details on bulkhead installation and how public safety, property, and the water quality of Cornet Bay will be protected during construction.

The water quality of Cornet Bay will be protected by installing and maintaining the in-water BMPs described in Section 5.2. Surface water quality will be monitored in accordance with the remediation contractor's Water Quality Protection Monitoring Plan described in Section 4.3.2.2.

5.6 Soil Excavation and Disposal

Construction activities related to soil excavation and disposal are described in this section, including handling of dewatering fluids and removal of the timber bulkhead.

5.6.1 Excavation

Standard earth moving equipment, which may include excavators, dozers, and loaders, will be used to excavate overburden and petroleum hydrocarbon-containing soil and load it to soil stockpile areas or haul trucks. Excavation will initially be completed to the lateral extent shown on Figure 8. Excavation depths will vary by location, generally following the depths shown on Figures 6 and 7. Field screening of excavated soil will be used to direct excavated soil to the clean overburden stockpile, the petroleum-containing soil stockpile, or direct loading into trucks. Field screening and analytical results from confirmation samples will be used (along with the information shown on Figures 6 and 7) to determine actual excavation depths.

Field screening will consist of one or more of the following methods:

- Observation for visible staining or petroleum hydrocarbon odors
- VOC head-space screening using an OVM-PID
- Water/hydrocarbon sheen testing.

The final excavation depth and extent will be determined based on analytical results from confirmation soil samples collected from the sidewalls and floor of the excavation and analyzed for COCs (refer to Section 5.6.5). If confirmation soil sample results exceed site cleanup levels, the excavation will be expanded to remove the affected soil.

The remediation contractor will determine the actual methods to complete the excavation; however, it is assumed that the excavation will be completed in a phased approach of multiple smaller cells that are excavated and backfilled.

The timber bulkhead will be removed during excavation. All existing piles, walers, filler boards, and tie-backs will be removed and piles cut off flush with the bottom of the excavation. Bulkhead materials will be recycled or disposed of at an Ecology-approved facility.

5.6.2 Soil Stockpiling and Waste Profiling

A minimum of three lined and bermed soil holding areas will be established, one for assumed clean overburden (overburden holding area), one for petroleum hydrocarbon-containing soil (contaminated soil holding area), and an additional holding area for materials removed during demolition of the timber bulkhead. As soil is excavated, it will be segregated and stockpiled at the appropriate holding area or direct loaded to haul trucks based on field-screening results.

Petroleum hydrocarbon-containing soil that is dry enough to pass the paint filter test can be direct loaded into haul trucks for transport as non-dangerous waste to a Subtitle D landfill. Petroleum hydrocarbon-containing soil that is too wet to pass the paint filter test will be placed in the contaminated soil holding area until it is dry enough for transport to the landfill. Soil will be dried by stockpile dewatering. Petroleum-containing soil will be profiled for disposal using 2011 RI soil sampling results.

Details regarding soil stockpile sampling protocols will be provided in a Sampling and Analysis Plan (SAP) prepared before the remedial action. Stockpiles with COCs exceeding cleanup levels will be transported to the Subtitle D landfill for disposal. Stockpiles with COCs below cleanup levels will be reused as excavation backfill. Soil will be moisture conditioned by

stockpile dewatering prior to placement. Native soil will be amended with granular material to achieve target compaction criteria, as needed. In event that native soil cannot meet target compaction, the soil will be disposed of at an offsite landfill, under the approval of Ecology.

Soil stockpiles will be covered with plastic and secured from the wind and rain to prevent dust and stormwater runoff. All fluids accumulated in the soil holding areas will be pumped to the temporary dewatering treatment system.

5.6.3 Soil Transport and Disposal

Petroleum hydrocarbon-containing soil in the contaminated soil holding area or directly excavated from the excavation will be loaded into lined haul trucks by a front end loader or excavator. After the trucks are loaded, the load will be covered and secured to prevent dust generation during transport. The soil will be transported to a Subtitle D landfill for disposal as non-dangerous waste.

5.6.4 Excavation Dewatering, Treatment, and Discharge

A temporary dewatering treatment system will be installed at the site to treat dewatering fluids, stormwater that comes into contact with contaminated soil, water drained from the soil holding areas, and equipment decontamination water.

The remediation contractor will determine the actual methods to dewater the excavations, but it is anticipated that dewatering will be accomplished using a combination of sumps, temporary dewatering wells, and dewatering pumps to pump water from the excavation or accumulation area to the temporary dewatering treatment system. A dewatering system capable of keeping groundwater a minimum of 1 foot below the bottom of the excavation will be required.

The temporary treatment system will consist of one or more ASTs (e.g., frac tanks) for temporary dewatering fluid storage and settling of suspended sediment. A combination of gravity settling, filters, and GAC will be used to reduce suspended sediment and petroleum hydrocarbon concentrations to meet the effluent limits set forth in the NPDES permit and associated administrative order. The system will include two high-capacity GAC vessels configured in series as a safeguard to prevent breakthrough in the lead GAC vessel and potential exceedance of effluent limits. The system will be configured with sufficient valves, pressure gauges, flow totalizers, bypass valves, and sampling ports to allow monitoring of the flow rate, collection of water samples, and monitoring and change-out of expired filters and GAC vessels. The treated effluent will be discharged at a point located a minimum of 100 feet from the shoreline of Cornet Bay to prevent agitation of sediment at the discharge point.

The remediation contractor will be required to collect a daily sample from a sampling port located between the two GAC vessels and a weekly sample from the system effluent. Samples will be submitted to the laboratory for analysis of all NPDES permit monitoring parameters on a 24-hour turnaround basis. Ecology will establish an administrative order with the remediation contractor for operation and monitoring of the temporary dewatering treatment system, which will include all NPDES permit requirements.

5.6.5 Confirmation Soil Sampling

Soil samples from excavation bottoms and sidewalls will be collected and analyzed to verify that cleanup levels have been met. Soil samples will be collected at a frequency of one sample per 30 feet of excavation sidewall and one sample per approximately 900 square feet (30- by 30-foot area) of excavation bottom. Samples will be submitted for analysis of the site COCs listed in Table 1. Laboratory analysis will be performed on an accelerated turnaround basis as needed to minimize delays.

If a confirmation sample exceeds one or more COC clean-up levels, further excavation will be performed to remove the affected soil, if feasible, and additional confirmation samples will be collected.

5.6.6 Excavation Backfill

Completed excavations will be backfilled with clean imported fill, clean native soil, or amended backfill. Prior to backfilling, each excavation will be surveyed to provide a record of the final excavation extent and for the remediation contractor's basis of payment. A post-backfill survey of the site will also be completed to document final conditions.

As discussed in Section 5.6.2, samples will be collected from the stockpile of native soil to confirm that COC concentrations do not exceed site cleanup levels. Representative soil samples will also be collected from the clean imported fill and analyzed for site COCs to confirm that the fill meets site cleanup levels. The remediation contractor must provide documentation that clean imported fill and native soil to be used for backfill has been tested and meets the criteria listed in Section 4.2.7.

Fill will be placed only in excavations that have been completely dewatered. Backfill areas and subgrade conditions will be checked and approved by the engineer prior to placement of fill. Fill will be placed in the excavation in 8-inch lifts, as measured before compaction. Each lift will be compacted to 95 percent of maximum density using appropriate equipment prior to placing the subsequent lift. The remediation contractor will be required to conduct compaction testing at a frequency of one test for every 500 square feet for each 2 feet of fill. Compaction testing documentation will be provided to Ecology as part of the construction record.

As described in Section 5.5, a soil stabilization wall and drainage system will be constructed on inside the sheet pile wall during backfill of the excavations. Construction details will be provided in the remediation contractor's Bulkhead Construction Plan.

5.7 Oxygen Releasing Compound

If needed, a portion of the imported backfill or native soil backfill may be amended with ORC® (or equivalent) to promote in situ biological degradation of residual petroleum hydrocarbons after the excavation has been backfilled. The amended backfill will be placed strategically alongside slopes and the floor of the excavation in areas where affected soils may be inaccessible to further excavation. The volume of imported fill to be amended with ORC® is unknown at this time, but estimated to be approximately 1,500 cubic yards. Decisions regarding if and where amended backfill will be placed will be made in consultation with Ecology and based on the results of confirmation soil samples.

Amended backfill will be prepared by manually mixing ORC® with fill using an excavator or equivalent equipment at concentrations recommended by the manufacturer (Regenesis). The amended backfill will be moisture conditioned and placed and compacted following the procedures described in Section 5.6.6.

5.8 Site Restoration

Site restoration includes replacement of site utilities, the marina store building, access ramps, and surface pavement.

A new septic tank, effluent pumps, and drain field (if damaged) will be installed. A sewage effluent pipeline will be installed and connected to the distribution piping at the sand mound. Underground propane lines, gasoline and diesel piping, water lines, and electrical lines will be installed and reconnected at the store and marina dock. Replacement of the fuel lines will include installation of double-walled piping and a fuel leak detection system.

A new building foundation for the marina store and any demolished concrete walkways will be constructed, and the store building and all associated items will be relocated to the new foundation. New utilities will be connected at the building, new flooring will be installed, and the building will be painted at the completion of the project, prior to tenant reoccupation of the building. The flowerpots and fire pit will be restored at their original location next to the store building. The fish-cleaning sink and all other temporarily removed facilities, such as the drinking fountain, also will be restored.

A concrete cap and new guardrail system will be installed on the new sheet pile bulkhead. The two permanent dock access ramps and platforms will be reinstalled or reconstructed.

Disturbed site surface areas will be restored by placing and compacting a 6-inch layer of crushed surfacing top course (CSTC) gravel paving to meet the final site grades. The wetland area at the southwestern end of the site will be restored per the Mitigation Plan in Appendix B.

Section 6: Construction Quality Assurance/Quality Control Procedures

6.1 Materials

Materials used in construction of the remedial action will be tested for compliance with the specifications listed below:

- Imported backfill (pit run): Imported backfill will be non-expansive soil with a liquid limit <40 percent and a plasticity index <15 percent, contain no clods or rocks greater than 2 inches in greatest dimension, contain <10 percent passing the #200 sieve, and contain no organic material. Clean fill documentation will be required. Independent chemical testing of imported material may be performed by Ecology.

- Crushed Rock: CSTC will meet Washington State Department of Transportation (WSDOT) Standard Specifications 9-03.9(3).

- Gravel Backfill for Pipe Zone Bedding (spring line to one foot above the top of the pipe): Gravel backfill will meet WSDOT Standard Specifications 9-03.12(4).

- Gravel Backfill for Drains: Gravel backfill will meet WSDOT Standard Specifications 9-03.12(4).

- Bedding Material for Rigid Pipe: Bedding material will meet WSDOT Standard Specifications 9-03.15.

- Bedding Material for Thermoplastic Pipe: Bedding material will meet WSDOT Standard Specifications 9-03.16.

- Structural Backfill: Structural backfill will be crushed rock as specified above.

- Steel Sheet Pile: Steel sheet piles will be of Type AZ12-700R.

Additional specific tests (as referenced in WSDOT Standard Specifications Section 9 03.20) may be conducted for all materials listed above in accordance with WSDOT Test Nos. 101, 102, 103, 104, 109, 113, and other pertinent tests deemed necessary. The contractor will submit the test results to Kennedy/Jenks Consultants for review. Upon favorable review, the contractor will be allowed to ship the materials onsite. The submitted and reviewed test results are considered representative of all material stock.

6.2 Construction

The engineer will monitor and enforce compliance with the following construction quality assurance activities during the remedial action.

- The remediation contractor will be responsible for providing an Erosion and Sediment Control (ESC) Plan and a SWPPP that documents measures to identify, prevent, and control the contamination of stormwater. The SWPPP will be prepared in accordance

with the Washington State NPDES stormwater baseline general permit for construction, and will include procedures for dewatering excavations, containing site runoff, and controlling erosion.

- The remediation contractor will prepare an SPCC plan that documents measures to identify, plan, prevent, and control potential spills of hazardous materials.

- Sheet Pile Bulkhead Installation and Excavating. All construction limits will be laid out in the field and marked with stakes and flagging. Quarry spalls or equivalent material will be placed at the construction entrances to Cornet Bay Road. A filter fabric fence will be installed along the southwestern and northeastern sides of the site, and a turbidity curtain and absorbent boom will be deployed surrounding the in-water work area to prevent impacts to Cornet Bay.

  The contractor will inspect all land- and water-based BMPs daily to ensure their integrity. All construction equipment will be kept above intertidal areas. With the exception of the sheet pile bulkhead installation, all work near the shoreline will be limited to periods of low tide. The remediation contractor will implement a Surface Water Quality Protection Monitoring Plan to confirm that in-water work does not affect Cornet Bay. Additional measures will be taken as appropriate to prevent spills and releases of contaminated material to Cornet Bay.

- Backfilling. All materials will be tested before installation to meet the criteria listed in Section 4.2.7. Material will be placed to bring the finished site grade to elevations indicated on the engineering drawings. All materials will meet 95 percent compaction as specified by ASTM Method D1557 Modified. The remediation contractor will perform compaction testing at a frequency of one test for every 500 square feet for every 2 feet of fill.

- Treatment of Dewatering Fluids. The remediation contractor will perform daily sampling at the sampling point between the two GAC vessels and weekly sampling at the treatment system effluent. Samples will be tested and results compared to the effluent limits listed on the NPDES permit for compliance.

- Storing, Loading, and Transporting Materials. All stockpiled materials will be lined, bermed, and covered when not in use to prevent those materials from being dispersed via wind or rainfall. When materials are loaded onsite, proper measures shall be in place in order to prevent dispersion of materials in areas other than original or final locations. All soils taken offsite for disposal shall be properly manifested, and final disposition of materials shall be recorded.

6.3 Documentation

After completion of the remedial action, a construction completion report will be prepared and provided to Ecology. The construction completion report will provide the following information:

- As-built drawings showing the area and volumes of soil removed for disposal, location of the sheet pile bulkhead, and location of ORC® amended backfill placement.

- Waste disposal documentation, including soil disposed of at the Subtitle D landfill, debris from the timber bulkhead removal and other demolition activities, and discharges performed under the NPDES permit.

- Performance monitoring results and sample locations.

- A description of the actual sheet pile bulkhead design, including significant deviations from the proposed design.

- Appendices providing pertinent information cited in the construction completion report.

Section 7: Compliance Monitoring

This section describes the objectives, locations, and methods for compliance monitoring activities that will be performed at the site as part of the remedial action. Compliance monitoring activities identified in this section will fulfill requirements for ongoing monitoring of this remedial action in accordance with MTCA (WAC 173-340-410). A SAP, meeting the requirements of WAC 173-340-820, will be prepared to identify the soil and groundwater sampling frequencies and analytical tests to be performed during cleanup activities (protection and performance monitoring) and for the duration of the compliance period (confirmation monitoring).

Some of the existing site monitoring wells will be decommissioned prior to excavation activities (see Figure 8). Wells not expected to be impacted by remediation activities may remain onsite for possible future use during conformational monitoring. A portion of those wells will be replaced with new wells in similar locations as needed for monitoring. The existing and possible locations of replacement monitoring wells to be included in the confirmation monitoring program are shown on Figure 9. The actual replacement well locations will be identified following completion of the remedial action activities.

7.1 Protection Monitoring

Health and safety measures are required for those individuals working at and visiting the site. The remediation contractor will prepare a site HASP, which will describe health and safety measures, including any protection monitoring necessary during construction activities.

7.2 Performance Monitoring

Performance monitoring to be completed during construction activities will include soil screening and sampling. Excavation areas, including sidewalls and bottom of the excavation, will be sampled. Excavation sidewall samples will be collected every 30 feet and excavation bottom samples will be collected every approximately 900 square feet (30- by 30-foot area), to be further described in the SAP.

Grab soil samples from within the excavation areas will be collected for field-screening purposes, including:

- Visual assessment of soil conditions, soil type logging, and documentation of visible stains and odors.
- Water/hydrocarbon sheen testing.
- VOC head-space screening.

Field-screening techniques and laboratory analyses to be performed are listed in Table 2, Summary of Soil Sampling and Analyses.

Table 2: Summary of Soil Sampling and Analyses

Sample Type	Number of Samples	Field Screening	Laboratory Analyses
Soil	TBD	HS, ST, VI	NWTPH-Gx
Soil	TBD	HS, ST, VI	NWTPH-Dx
Soil	TBD	HS, ST, VI	BTEX

Definitions:
TBD = to be determined
HS = headspace VOC screening for soils
ST = water/hydrocarbon sheen test for soils
VI = visual inspection of soils

Soil samples will be submitted for chemical analysis of total petroleum hydrocarbons as gasoline- and diesel-range hydrocarbons by Northwest Total Petroleum Hydrocarbon Method NWTPH-Gx and NWTPH-Dx, and BTEX using EPA Method 8021B. Soil samples for chemical analysis will be stored in a cooled ice chest pending transportation to a certified analytical laboratory under chain-of-custody protocol.

Quality assurance/quality control (QA/QC) samples to be collected during each field sampling activity. Data quality objectives (DQOs) will be provided in the SAP and will be consistent with those previously submitted (see Appendix D of the RI/FS Work Plan, Kennedy/Jenks Consultants 2011a).

7.3 Confirmation Monitoring

A post-remediation confirmation groundwater monitoring plan will be completed that identifies specific requirements for future groundwater monitoring activities at the site. The possible confirmation monitoring well locations are shown on Figure 9. Confirmation monitoring groundwater sampling methods, analyses performed, and sampling frequency will be identified in the SAP.

7.4 Clean Fill and Soil Disposal Profiling

Representative soil samples will be collected from soil stockpiled in the overburden holding area and analyzed for site COCs to determine whether overburden soil is suitable for reuse as excavation backfill. As described in Section 5.6.2, stockpile soil sampling procedures will be presented in a SAP that will be prepared prior to the remedial action.

It is anticipated that petroleum-containing soil will be profiled for disposal using the existing 2011 RI soil data. If the soil disposal facility requires additional analytical data for waste characterization, the remediation contractor will be responsible for collecting soil samples at the frequency and for the laboratory analysis required by the disposal facility.

Section 8: Operations and Maintenance Plan

The completed sheet pile bulkhead and backfilled excavations are permanent features and will not require an operations and maintenance plan. Site monitoring wells will be maintained as part of the quarterly confirmational groundwater monitoring events conducted during the year after completion of the remedial action.

As described in the Mitigation Plan (Appendix B), long-term monitoring and maintenance will be required for the wetland mitigation area in the southwestern side of the site. Wetland mitigation area monitoring will include site inspections conducted 1, 2, 3, 5, 7, and 10 years after completion of the remedial action. However, the full monitoring plan may not need to be implemented: if the Performance Standards are met at the end of Year 3, the COE will be consulted regarding closing out the site monitoring as no additional measures of site success would need to be met. Maintenance activities will include removing trash and non-native, invasive, and noxious vegetation and replanting native species, as needed. Results of the wetland monitoring will be documented in a monitoring report submitted to the COE per requirements of the permit.

Section 9: Financial Assurance

Financial assurance is not applicable to this remedial action, and no discussion of financial assurance is provided.

Section 10: Institutional Controls

Based on this remedial action achieving an estimated 95 to 100 percent reduction in contaminant mass, land use restrictions are not expected to be necessary for this remedial action. If confirmation monitoring indicates that the remedial action did not succeed in reducing COC concentrations to below site cleanup levels, the need for land use restrictions will be reevaluated. Possible land use restrictions could include restricting the use of groundwater, requiring ongoing groundwater and/or indoor air monitoring, or restricting future site construction or development activities.

Section 11: Remedial Action Schedule

The remedial action is scheduled to start in October 2013, assuming approval of the NPDES and JARPA permits and selecting and contracting with a remediation contractor. The remedial action is expected to be completed in 6 months of continuous work as outlined below.

Estimated Project Schedule

Project Phases	Estimated Duration
Phase 1. Mobilization, Building Relocation, and Utility Demolition	2 to 3 weeks
Phase 2. Construction of Steel Pile Bulkhead	2 to 4 weeks
Phase 3. Excavation, Removal of Timber Bulkhead, Backfill	6 to 8 weeks
Phase 4. Site Restoration	2 to 3 weeks

As indicated above, each phase will be completed consecutively. The actual time required to complete the remedial action may vary depending on site conditions, weather conditions, and the volume of soil requiring removal and disposal.

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Figures

Figures

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Engineering Design Report
Cornet Bay, Washington

Site Location Map

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August 2013

Figure 1

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Legend

- Approximate Property Boundary
- Timber Bulkhead

NOTE:
Approximate property boundary obtained from Survery performed on 17 November 2011.Boundary located on east portion of site is identified as right-of-way. Aerials Express 0.3 to 0.6m resolution imagery for metropolitan areas and the best available United States Department of Agriculture (USDA) National Agriculture Imagery Program (NAIP) imagery and enhanced versions of United States Geological Survey (USGS) Digital Ortho Quarter Quad (DOQQ) imagery for other areas. For more information on this map, visit us online at http://goto.arcgisonline.com/maps/World_Imagery

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Scale: Feet
1 inch = 50 feet

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Engineering Design Report
Cornet Bay, Washington

Site Plan

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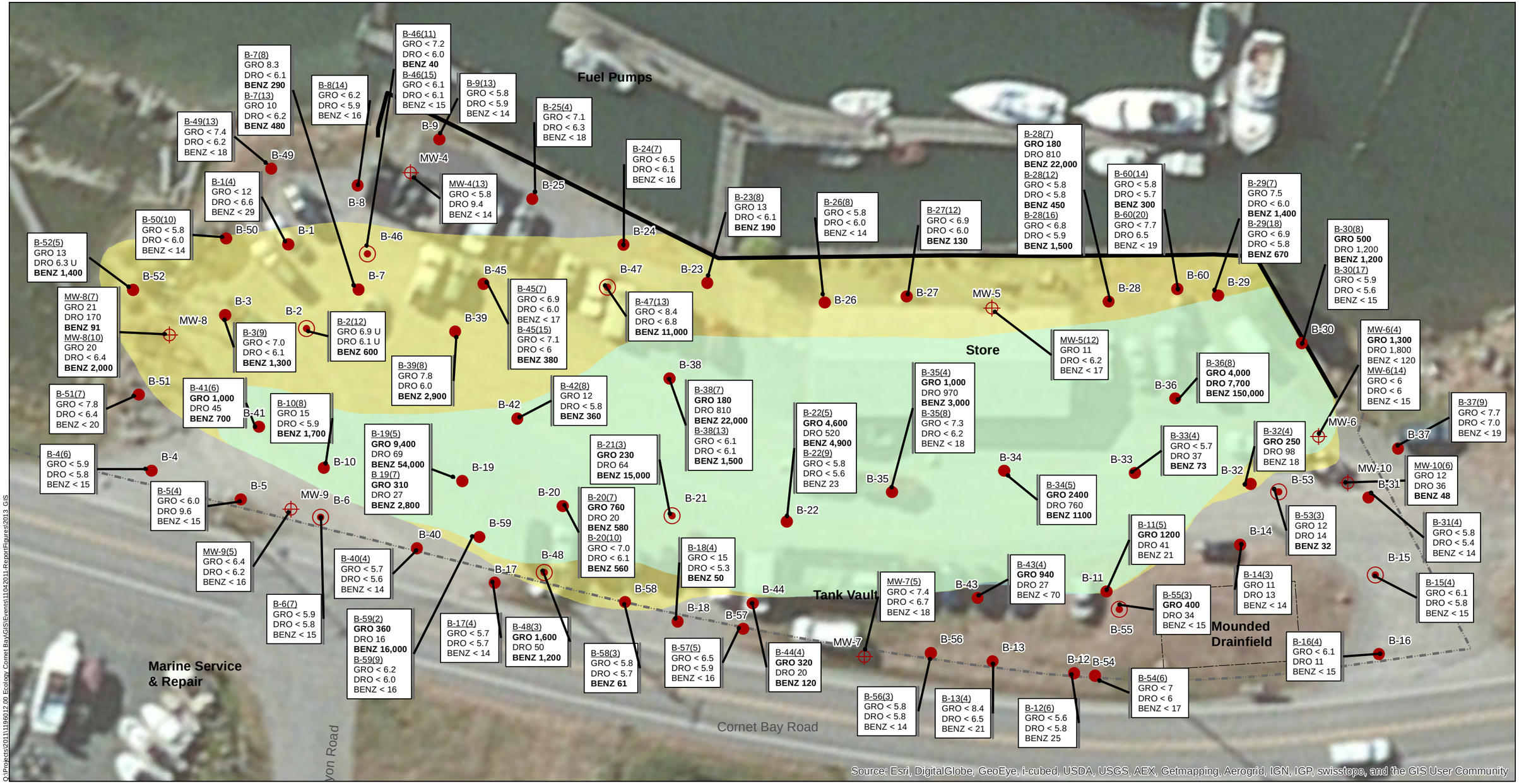
Figure 2



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Legend

- 2011 Soil Boring
- 2011 Soil boring and Groundwater
- 2011 Monitoring Well
- Benzene Area Exceeding MTCA Method A Soil Cleanup Levels
- Gas and Benzene Area Exceeding MTCA Method A Soil Cleanup Levels
- Timber Bulkhead
- Approximate Property Boundary

(#) Indicates depth of soil sample.
GRO - Gasoline Range Organics (mg/kg)
DRO - Diesel Range Organics (mg/kg)
BENZ - Benzene (µg/kg)
< - Indicates a nondetect at the laboratory reporting limit.
BOLD - Indicates the value may exceed current MTCA Method A Soil Cleanup Levels
GRO - 30 mg/kg
DRO - 2000 mg/kg
BENZ - 30 µg/kg

NOTE:
All locations are approximate.
Approximate property boundary obtained from Survery performed on 17 November 2011.Boundary located on east portion of site is identified as right-of-way.
Aerials Express 0.3 to 0.6m resolution imagery for metropolitan areas and the best available United States Department of Agriculture (USDA) National Agriculture Imagery Program (NAIP) imagery and enhanced versions of United States Geological Survey (USGS) Digital Ortho Quarter Quad (DOQQ) imagery for other areas. For more information on this map, visit us online at http://goto.arcgisonline.com/maps/World_Imagery

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0 30 60

Scale: Feet
1 inch = 30 feet

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Engineering Design Report
Cornet Bay, Washington

2011 Soil Investigation Results, Petroleum Hydrocarbon and Benzene Affected Area

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Figure 3

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Legend

- 2011 Monitoring Well
- Prior Monitoring Well
- 2011 Soil Boring with Reconnaissance Groundwater Sample
- Property Boundary
- Timber Bulkhead

GRO - Gasoline Range Organics (mg/L)
DRO - Diesel Range Organics (mg/L)
BENZ - Benzene (µg/L)
< - Indicates a nondetect at the laboratory reporting limit
BOLD - Indicates the value may exceed current MTCA Method A Groundwater Cleanup Levels
GRO - 0.8 mg/L
DRO - 0.5 mg/L
BENZ - 5 µg/L

NOTE:
All locations are approximate.
Approximate property boundary obtained from Survery performed on 17 November 2011.Boundary located on east portion of site is identified as right-of-way.
Aerials Express 0.3 to 0.6m resolution imagery for metropolitan areas and the best available United States Department of Agriculture (USDA) National Agriculture Imagery Program (NAIP) imagery and enhanced versions of United States Geological Survey (USGS) Digital Ortho Quarter Quad (DOQQ) imagery for other areas. For more information on this map, visit us online at http://goto.arcgisonline.com/maps/World_Imagery

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Scale: Feet
1 inch = 30 feet

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Engineeing Design Report
Cornet Bay, Washington

2011 Groundwater Investigation Results

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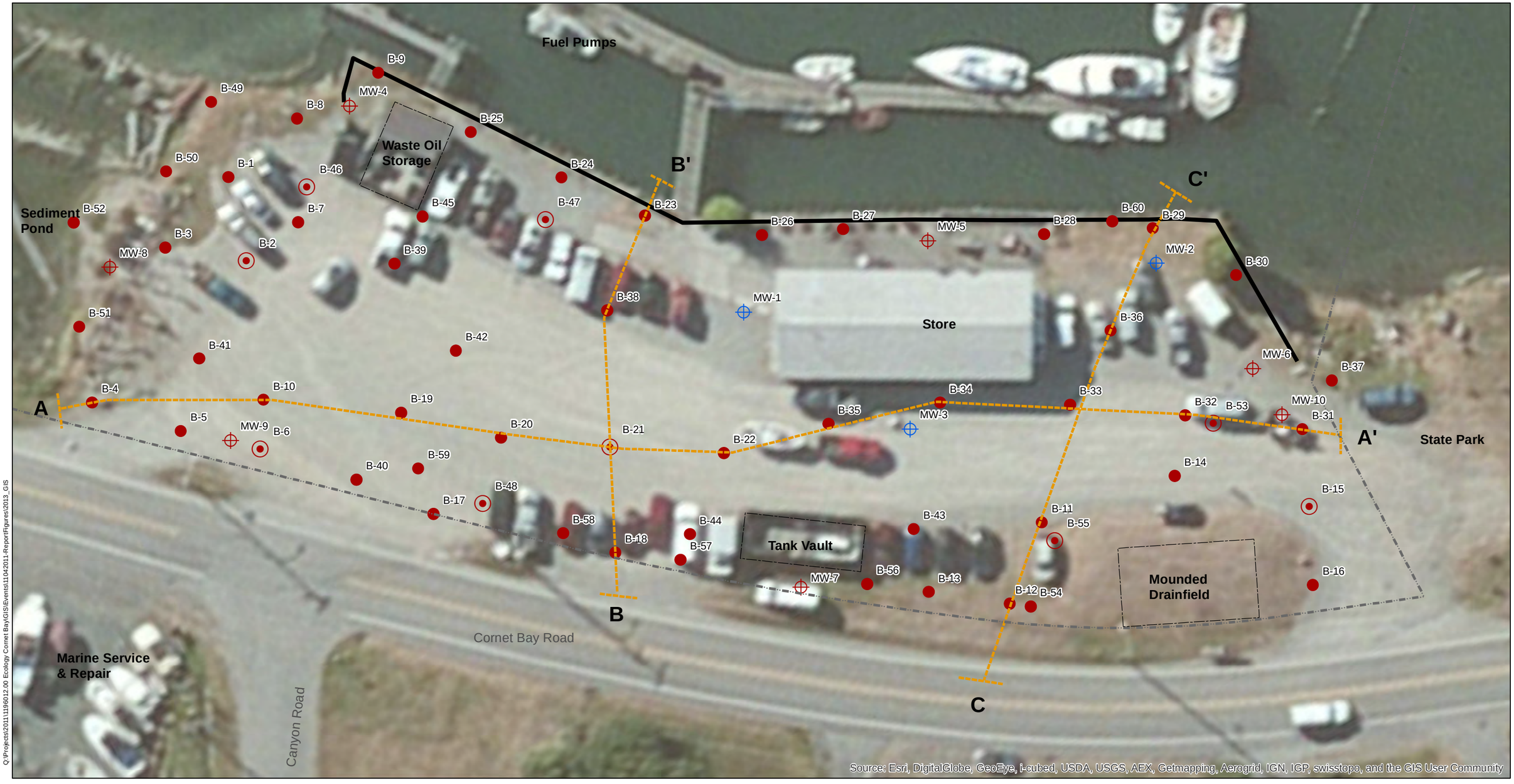
August 2013

Figure 4



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Legend

- 2011 Soil Boring
- 2011 Soil Boring and GW
- 2011 Monitoring Well
- Prior Monitoring Well
- Geologic Cross Section
- Timber Bulkhead

NOTE:
All locations are approximate.
Approximate property boundary obtained from Survery performed on 17 November 2011.Boundary located on east portion of site is identified as right-of-way.
Aerials Express 0.3 to 0.6m resolution imagery for metropolitan areas and the best available United States Department of Agriculture (USDA) National Agriculture Imagery Program (NAIP) imagery and enhanced versions of United States Geological Survey (USGS) Digital Ortho Quarter Quad (DOQQ) imagery for other areas. For more information on this map, visit us online at http://goto.arcgisonline.com/maps/World_Imagery

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Scale: Feet
1 inch = 30 feet

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Engineering Design Report
Cornet Bay, Washington

Generalized Geologic Cross Section Locations

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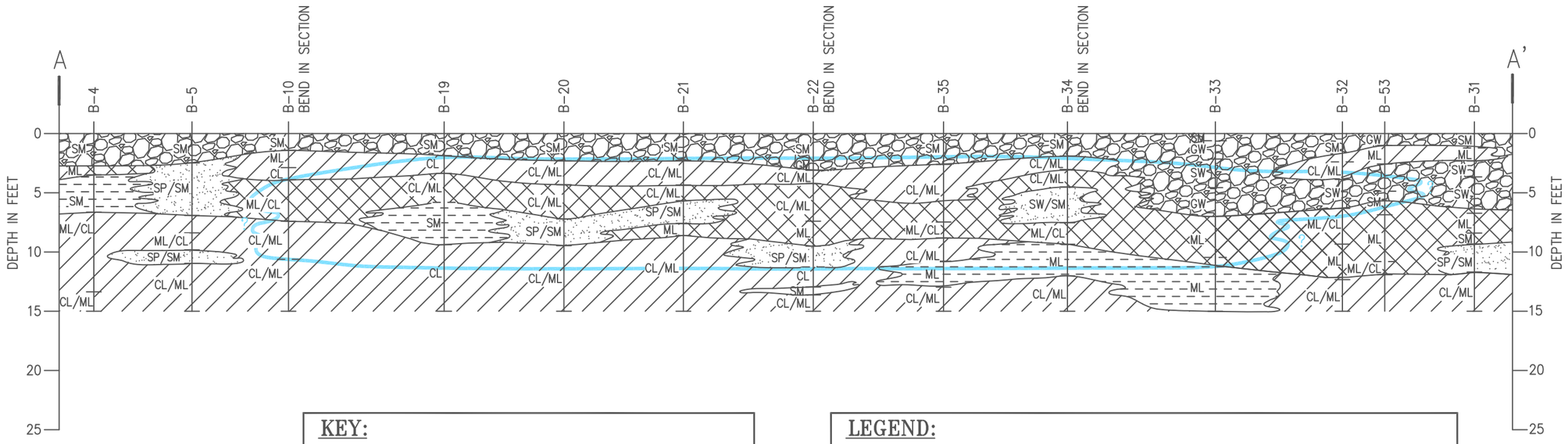
Figure 5



KEY:

SM = SILTY SAND; MAY INCLUDE GRAVEL
ML = SILT OR SANDY SILT; MAY INCLUDE GRAVEL
CL = CLAY; MAY INCLUDE SAND AND/OR GRAVEL
CL/ML = SILTY CLAY; MAY INCLUDE SAND AND/OR GRAVEL
MC/CL = CLAYEY SILT; MAY INCLUDE SAND AND/OR GRAVEL
SP = POORLY GRADED SAND
SP/SM = POORLY GRADED SAND WITH SILT
SW/SM = WELL GRADED SAND WITH SILT; MAY INCLUDE GRAVEL
GM = SILTY GRAVEL; MAY INCLUDE SAND
SW = WELL GRADED SAND; MAY INCLUDE GRAVEL

SOIL BORINGS

– SHARP OR GRADED CONTACT

– – APPROXIMATE CONTACT (DEPTH UNCERTAIN)

NOTE:
REFER TO BORING LOGS FOR ADDITIONAL INFORMATION REGARDING LITHOLOGY

LEGEND:

PREDOMINANTLY SAND/GRAVEL/SILT FILL MATERIALS.

PREDOMINANTLY STIFF SILT AND CLAY MATERIALS; SOME SAND/GRAVEL LOCALLY.

PREDOMINANTLY SOFT SILT AND CLAY MATERIALS INCLUDING SILTY CLAY, CLAYEY SILT, AND SANDY SILT/CLAY; SOME GRAVEL LOCAL.

PREDOMINANTLY STIFF SILT/SANDY SILT.

PREDOMINANTLY POORLY GRADED SAND; SOME SILT LOCALLY.

APPROXIMATE IMPACTED SOIL REMOVAL AREA BASED ON ANALYTICAL RESULTS AND FIELD OBSERVATIONS.

SCALE: 1=10 VERTICAL (0, 5, 10)

SCALE: APPROXIMATE 1=30 HORIZONTAL (0, 15, 30)

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ENGINEERING DESIGN REPORT
CORNET BAY, WASHINGTON

GENERALIZED GEOLOGIC
CROSS SECTION A–A'

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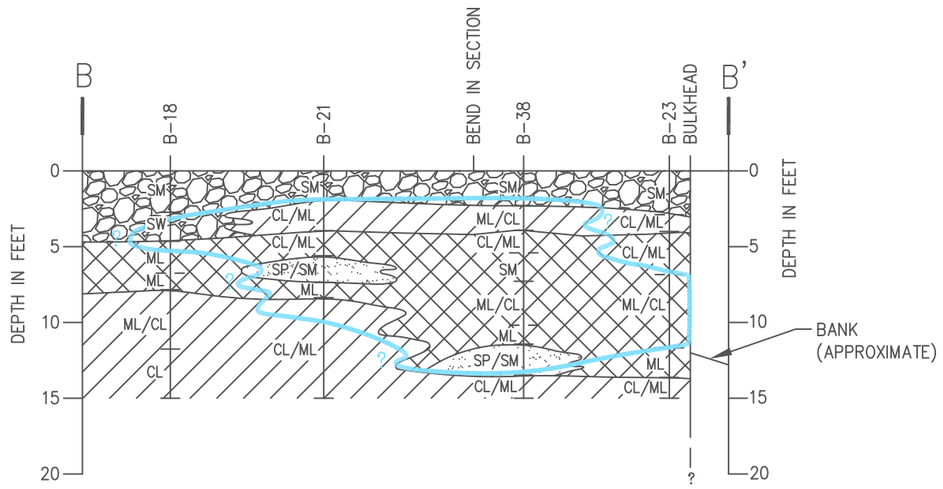
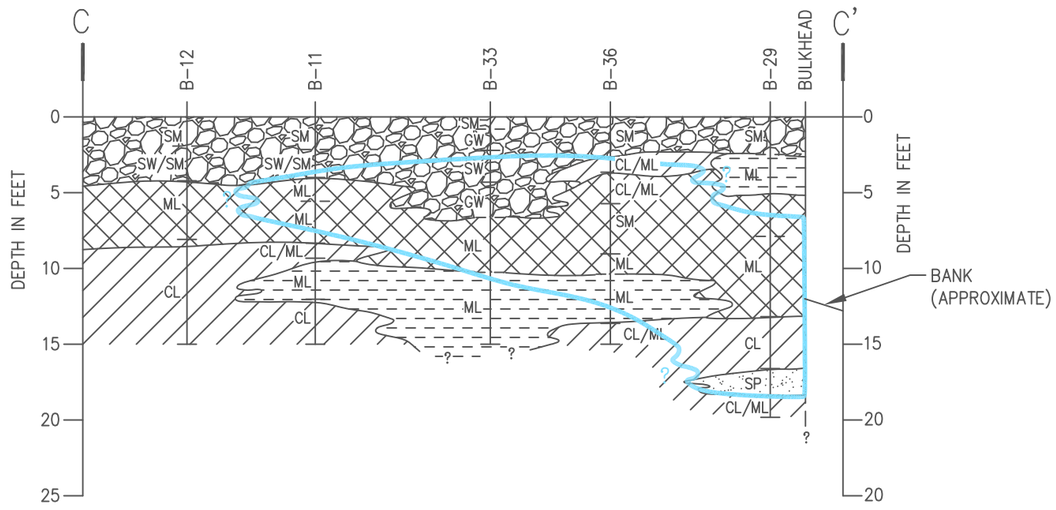
FIGURE 6





KEY:

SM = SILTY SAND; MAY INCLUDE GRAVEL
ML = SILT OR SANDY SILT; MAY INCLUDE GRAVEL
CL = CLAY; MAY INCLUDE SAND AND/OR GRAVEL
CL/ML = SILTY CLAY; MAY INCLUDE SAND AND/OR GRAVEL
MC/CL = CLAYEY SILT; MAY INCLUDE SAND AND/OR GRAVEL
SP = POORLY GRADED SAND
SP/SM = POORLY GRADED SAND WITH SILT
SW/SM = WELL GRADED SAND WITH SILT; MAY INCLUDE GRAVEL
GM = SILTY GRAVEL; MAY INCLUDE SAND
SW = WELL GRADED SAND; MAY INCLUDE GRAVEL

SOIL BORINGS

– SHARP OR GRADED CONTACT

– – APPROXIMATE CONTACT (DEPTH UNCERTAIN)

NOTE:
REFER TO BORING LOGS FOR ADDITIONAL INFORMATION REGARDING LITHOLOGY

LEGEND:

PREDOMINANTLY SAND/GRAVEL/SILT FILL MATERIALS.

PREDOMINANTLY STIFF SILT AND CLAY MATERIALS; SOME SAND/GRAVEL LOCALLY.

PREDOMINANTLY SOFT SILT AND CLAY MATERIALS INCLUDING SILTY CLAY, CLAYEY SILT, AND SANDY SILT/CLAY; SOME GRAVEL LOCAL.

PREDOMINANTLY STIFF SILT/SANDY SILT.

PREDOMINANTLY POORLY GRADED SAND; SOME SILT LOCALLY.

APPROXIMATE IMPACTED SOIL REMOVAL AREA BASED ON ANALYTICAL RESULTS AND FIELD OBSERVATIONS.

0 15 30
SCALE: APPROXIMATE 1=30 HORIZONTAL

0 5 10
SCALE: 1=10 VERTICAL

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ENGINEERING DESIGN REPORT
CORNET BAY, WASHINGTON

GENERALIZED GEOLOGIC
CROSS SECTION B–B'
AND CROSS SECTION C–C'

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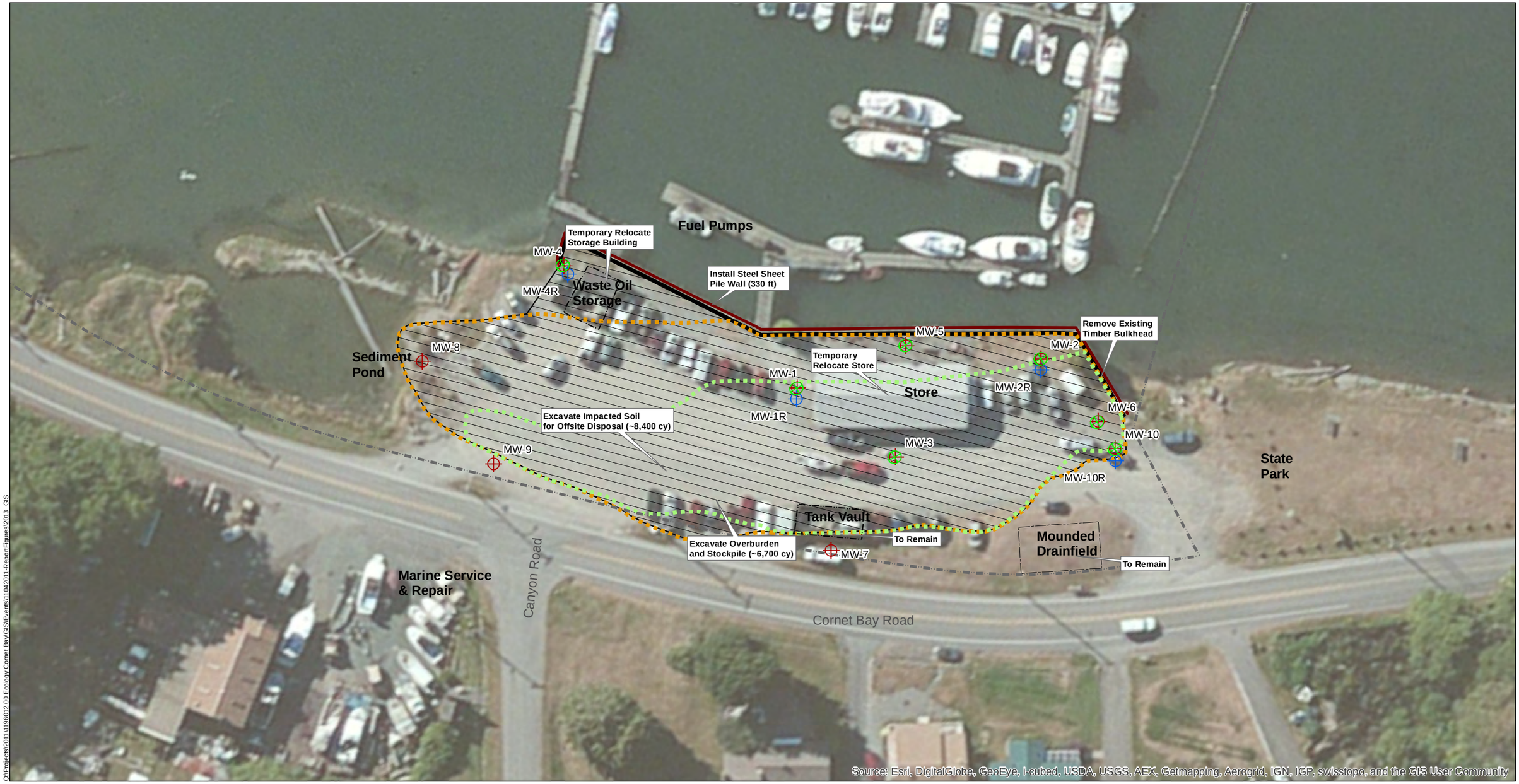
FIGURE 7



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Legend

- Existing Monitoring Wells (Total of 10)
- Abandon Monitoring Wells (Total of 7)
- Proposed New Monitoring Well (Total of 4)
- Gas and Benzene Area Exceeding MTCA Method A Soil Cleanup Levels
- Benzene Area Exceeding MTCA Method A Soil Cleanup Levels
- Excavation Area
- New Steel Sheet Pile Wall
- Approximate Property Boundary
- Existing Timber Bulkhead

NOTE:
All locations are approximate.
Approximate property boundary obtained from Survery performed on 17 November 2011.Boundary located on east portion of site is identified as right-of-way.
Aerials Express 0.3 to 0.6m resolution imagery for metropolitan areas and the best available United States Department of Agriculture (USDA) National Agriculture Imagery Program (NAIP) imagery and enhanced versions of United States Geological Survey (USGS) Digital Ortho Quarter Quad (DOQQ) imagery for other areas. For more information on this map, visit us online at http://goto.arcgisonline.com/maps/World_Imagery

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Scale: Feet
1 inch = 51 feet

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Engineering Design Report
Cornet Bay, Washington

Remedial Action Plan

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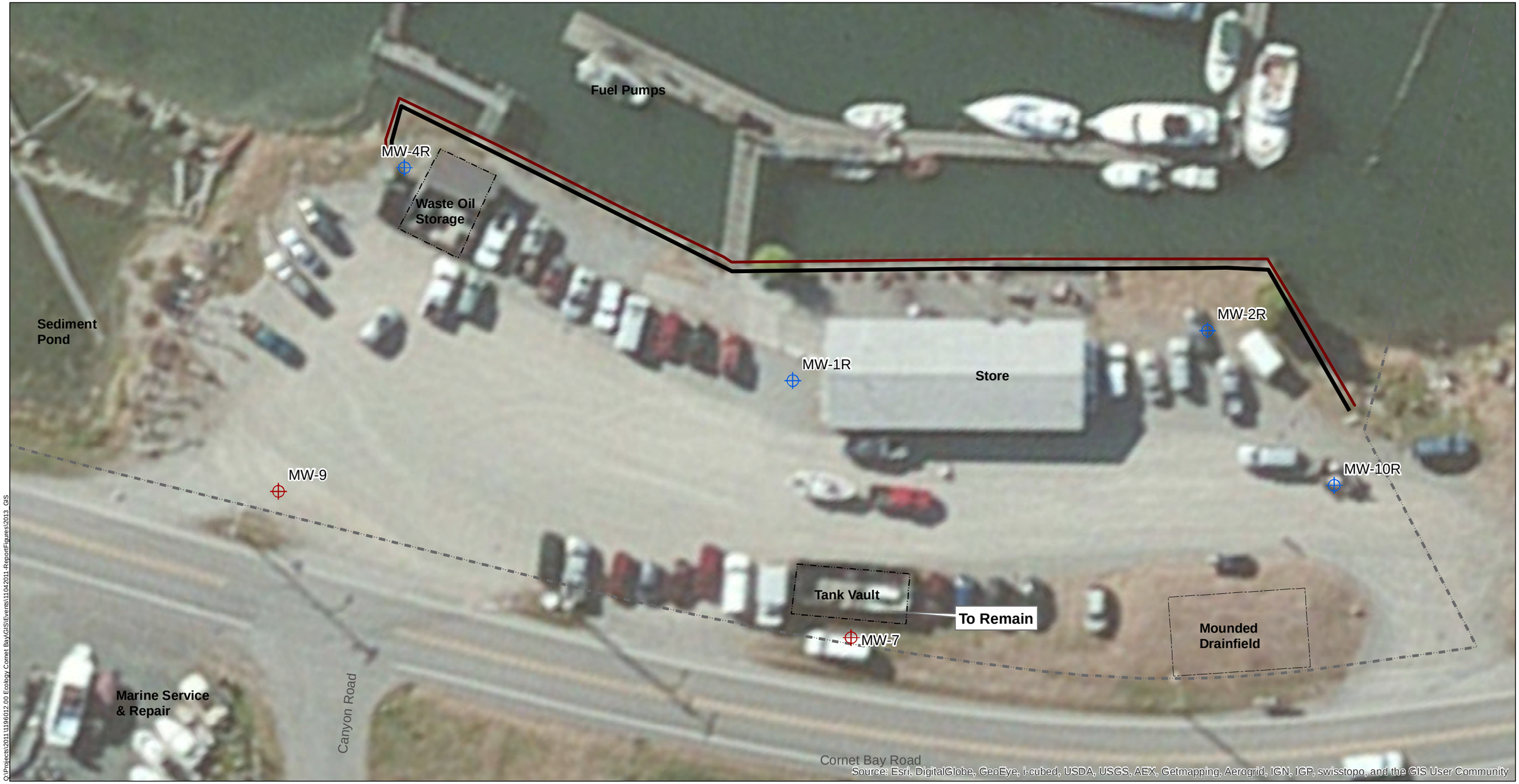
Figure 8



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Legend

- Existing Monitoring Well
- Proposed New Monitoring Well
- Approximate Property Boundary
- Timber Bulkhead

NOTE:
All locations are approximate.
Approximate property boundary obtained from Survery performed on 17 November 2011.Boundary located on east portion of site is identified as right-of-way.
Aerials Express 0.3 to 0.6m resolution imagery for metropolitan areas and the best available United States Department of Agriculture (USDA) National Agriculture Imagery Program (NAIP) imagery and enhanced versions of United States Geological Survey (USGS) Digital Ortho Quarter Quad (DOQQ) imagery for other areas. For more information on this map, visit us online at http://goto.arcgisonline.com/maps/World_Imagery

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Scale: Feet
1 inch = 30 feet

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Engineering Design Report
Cornet Bay, Washington

Groundwater Monitoring Well Location Map

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Figure 9

Appendix A

Geotechnical Investigation Sheet Pile Bulkhead Wall Report

GRI
1101 Broadway, Suite 130
Vancouver, WA 98660
p| 360-213-1690 f| 360-213-1697

August 30, 2013 W1115 GEOTECHNICAL RPT

Kennedy/Jenks Consultants
32001 32nd Avenue S., Suite 100
Federal Way, WA 98001

Attention: Ty Schreiner

SUBJECT: Geotechnical Investigation
Sheet Pile Bulkhead Wall
Cornet Bay Marina
Oak Harbor, Washington

At your request, GRI has conducted a geotechnical investigation for the above-referenced project at the Cornet Bay Marina in Oak Harbor, Washington. The Vicinity Map, Figure 1, shows the general location of the site. The purpose of the investigation was to evaluate subsurface conditions at the site and develop recommendations for design and construction of temporary shoring and a proposed bulkhead wall. The investigation included a review of existing subsurface information for the site, subsurface explorations, laboratory testing, and engineering analyses. This report describes the work accomplished and provides our conclusions and recommendations for the design and construction of the proposed bulkhead wall.

As part of our investigation, GRI reviewed the following reports previously prepared by others:

> "Screening Survey for Petroleum Contamination at Cornet Bay Marina (Island County)," dated September 2005, prepared by the Washington State Department of Ecology (WSDOE).
>
> "Cornet Bay Marina Bulkhead Assessment," dated November 6, 2006, prepared by Reid Middleton, Inc.

PROJECT DESCRIPTION

The site is located on Cornet Bay at the northern end of Whidbey Island in Oak Harbor, Washington. As shown on the Site Plan, Figure 2, an existing 12-ft-tall timber bulkhead wall is located at the edge of the marina shoreline. Lateral support for the existing bulkhead wall is provided by cable tie-backs installed in the backfill behind the bulkhead. We understand there was a release of gasoline and/or diesel fuel from a tank located behind the existing bulkhead, and the Washington State Department of Ecology (Ecology) is requiring removal of a significant amount of the contaminated soil. Our review of preliminary plans developed by Kennedy/Jenks Consultants (KJ) indicates the required excavation will extend up to approximately 120 ft (horizontal distance) behind the existing bulkhead. The excavation will extend to a maximum depth of approximately 18 ft and will typically be less than about 12 ft deep.

As currently planned, a shoring system consisting of cantilevered, tight-joint sheet piles will be constructed on the water side of the existing bulkhead to facilitate the required temporary excavation and removal of the existing timber bulkhead, which is near the end of its useful life. Following removal of the

contaminated soils and the existing timber bulkhead, the sheet piles will remain in place to provide permanent lateral support for the new bulkhead. To provide additional lateral resistance, we understand a mechanically stabilized earth (MSE) retaining wall will be constructed in the backfill area behind the sheets. The maximum height of the finished bulkhead will be about 13 ft above the mudline elevation.

Our scope of work for this project includes performing subsurface investigations at the site, completing a laboratory testing program, and completing engineering analyses that lead to recommendations regarding design and construction of a sheet pile bulkhead wall.

SITE DESCRIPTION

Topography and Existing Conditions

Survey data provided by KJ indicate the ground surface behind the bulkhead is relatively flat at about elevation 14 to 16 ft (NAVD 88). The mudline at the Cornet Bay Marina is near elevation 1 ft and is exposed during low tide. Tidal fluctuations at the site range up to about 13 ft from approximately elevation -1 to 12 ft (MLLW).

The area behind the bulkhead is typically surfaced with gravel and low grass with an area of Portland cement concrete pavement around the existing building and entrance to the marina pier. The building is used as the marina store and office and is located near the center of the site; the gravel areas are used for parking.

Geology

Subsurface explorations completed by GRI and KJ indicate the site is mantled with 10 to 15 ft of fill that primarily consists of clay, silt, sand, and gravel. The fill soils are underlain by Pleistocene glacial drift of the Vashon Stade, which consists of bedded clay, silt, and sand units of varying thicknesses (Pessl, et al., 1989).

SUBSURFACE CONDITIONS

General

Subsurface materials and conditions at the site were evaluated between June 20 and 21, 2013, with three borings, designated B-1 through B-3. The borings were advanced to depths of about 38 to 80 ft at the approximate locations shown on Figure 2. The borings were completed using hollow-stem auger techniques to a depth of about 20 ft and mud-rotary methods below this depth. Details of the field and laboratory testing programs completed for this investigation are provided in Appendix A. Logs of the borings are provided on Figures 1A through 3A. The terms used to describe the materials encountered in the borings are defined in Table 1A.

For the purpose of discussion, the materials disclosed by the borings have been grouped into the following units based on their physical characteristics and engineering properties:

1. **FILL**
2. **SAND**
3. **CLAY**
4. **SILT and SAND**

1. FILL. Fill consisting of silt and sand was encountered at the ground surface in all borings completed at the site and extends to depths of 11.5 to 12.5 ft. A strong petroleum odor was noted in the fill in boring B-3. The silt fill is typically gray and contains a variable sand and clay content, ranging from some fine-grained sand to sandy and a trace to some clay. The sand fill is typically gray, fine grained, and contains a variable silt and clay content ranging from trace to some silt and clay. Scattered gravel and organics are present in the fill. Shell fragments were observed near the transition between the fill and underlying native materials. Based on Standard Penetration Test (SPT) N-values of 2 to 6 blows/ft, the relative consistency of the silt fill ranges from soft to medium stiff, and the relative density of the sand fill ranges from very loose to loose. The natural moisture content of the fill ranges from about 10 to 27%.

2. SAND. Sand was encountered beneath the fill in boring B-1 and extends to a depth of 17 ft. The sand is typically gray, fine grained, silty, and contains some clay and scattered shells and gravel. Based on N-values of 5 and 18 blows/ft, the relative density of the sand ranges from loose to medium dense. The natural moisture content of the sand ranges from about 27 to 36%.

3. CLAY. Clay was encountered beneath the fill soils in borings B-2 and B-3 and beneath the sand in boring B-1. The clay is typically gray and contains a variable sand and silt content, ranging from a trace of fine- to medium-grained sand to sandy and trace of silt to silty. Scattered gravel and shell fragments are present in the clay. Based on N-values of 0 to 33 blow/ft, the relative consistency of the clay ranges from very soft to hard and is typically medium stiff. The upper surface of the clay unit is typically stiff, and zones of very soft to soft clay were encountered at depths of 30 and 35 ft. Atterberg limits testing indicates the clay has a low to medium plasticity, see Figure 4A. The natural moisture content of the clay ranges from about 19 to 41%. Boring B-2 was terminated in clay at a depth of 38 ft.

4. SILT and SAND. Interbedded layers of sand and silt were encountered beneath the clay in borings B-1 and B-3 and extend to a depth of about 80 ft in boring B-1, the maximum depth explored. The thickness of the interbedded layers encountered in the borings range from 5 to 25 ft. The sand is typically gray, fine grained, contains a variable silt and clay content, ranging from some silt to silty and trace to some clay, and contains scattered gravel. The silt is typically gray and contains a variable sand and clay content, ranging from some fine-grained sand to sandy and trace to some clay. Based on N-values of 14 to more than 50 blows/ft, the relative density of the sand ranges from medium dense to very dense. Based on N-values of 8 to more than 50 blows/ft, the relative consistency of the silt ranges from medium stiff to hard. The natural moisture content of the sand ranges from about 15 to 27%. The natural moisture content of the silt ranges from about 19 to 38%. Borings B-1 and B-3 were terminated in the silt and sand at depths of 80.3 and 51.5 ft, respectively.

Groundwater

The borings were advanced using hollow stem auger and mud-rotary drilling methods, which do not allow measurement of groundwater levels during drilling. Review of WSDOE water well logs indicates the depth to groundwater at the site is on the order of 2 to 12 ft below the ground surface. The groundwater level at the site will vary in response to tidal fluctuations and will likely be near the level of the water in the bay. In addition, groundwater from the upland areas to the southeast will affect groundwater levels in the area. Perched groundwater conditions may develop near the ground surface during periods of prolonged or intense precipitation.

CONCLUSIONS AND RECOMMENDATIONS

General

The explorations completed for the project indicate the site is typically mantled with relatively soft or loose silt and sand fill to a maximum depth of about 12.5 ft. The fill soils are underlain by relatively stiff to dense clay, silt, and sand soils of glacial origin. The groundwater level at the site will closely reflect the water level in Cornet Bay and will fluctuate with tidal variations and may approach the ground surface during high tides or during the wet, winter months. Recharge from the upland areas southeast of the site will likely also affect groundwater conditions.

In our opinion, important geotechnical-related aspects of the project include temporary shoring, excavation, dewatering, and the loose, moisture-sensitive fill soils present to the planned depths of excavation. Temporary excavations on the order of 10 ft deep will be required to remove the contaminated soils from behind the bulkhead wall. The bottom of the excavations will extend below groundwater levels, particularly during high tides. The following sections of this report provide our conclusions and recommendations for design and construction of the proposed shoring and bulkhead wall.

Temporary Shoring and Permanent Bulkhead Wall

As currently planned, cantilevered, tight-joint, driven steel sheet piles will be used to support the required temporary excavation behind the existing bulkhead wall. Following excavation and backfilling of the site, the sheet piles will also serve as the permanent bulkhead wall. To develop stability, the sheet piles will be driven below the bottom of the excavation and could be designed to reduce seepage into the temporary excavation and dewatering quantities. Based on preliminary plans provided by KJ, the sheet piles will be driven to a tip elevation of approximately -33 ft. In our opinion, the critical water levels for the stability of the temporary shored excavation will occur at high tide, when the maximum hydrostatic pressure of the bay is acting on the wall, and the excavation is completed to design grade. Lateral earth pressure criteria for design of the sheet pile wall during temporary excavation conditions are provided on Figure 3. Lateral earth pressure criteria for design of the sheet pile wall for the finished conditions are provided on Figure 4. Additional lateral pressures induced by surcharge loads can be estimated using the guidelines provided on Figure 5.

Excavation and Groundwater Control

The method of excavation and design of the temporary shoring and groundwater management system is the responsibility of the contractor. The means, methods, and sequencing of construction operations and site safety are also the responsibility of the contractor. We recommend the contractor submit for review an excavation and dewatering plan prepared by a professional engineer registered in Washington. The information provided below is for use by the owner and engineer and should not be interpreted to mean that GRI is assuming responsibility for the contractor's actions, site safety, or design.

The borings completed at the site encountered fill consisting of silt and sand with scattered gravel and organics. These soils can be readily excavated using conventional equipment. However, some riprap slope protection was observed adjacent to the northwest bulkhead return wall, and larger cobbles, boulders, and construction debris could be encountered in the fill soils. The presence of these materials could require larger excavation equipment and a specialized shoring and dewatering plan specific to those conditions.

The sand fill and underlying native sand may yield substantial inflows of groundwater into the excavations. Significant seepage into excavations in silt and clay can occur through preferential paths consisting of fine voids or holes. It should be noted that during the drilling of boring B-2, a significant loss of drilling fluid occurred at a depth of about 38 ft, and drilling fluid was observed on the exposed mudline below the bulkhead, indicating the presence of a preferential path between the bay and the area behind the bulkhead wall. However, in general, the silt and clay is much less permeable than the sand, and the installation of sheet piles will significantly reduce any seepage through preferential paths that may be present within the depth of the sheets. Positive control of groundwater will be an important consideration during excavation and backfilling activities, particularly in the location of the MSE wall. The dewatering system should be capable of maintaining the groundwater level at a minimum depth of 2 ft below the base of the excavation, or as required to maintain a stable excavation bottom. Control of groundwater will depend on the materials and groundwater levels encountered in the excavation and the contractor's approach to the work. It should be anticipated that dewatering by wells or well points will be necessary if an open cut is used. We anticipate that it may be necessary to complete the excavation in small sections to limit the dewatering quantities that will require treatment and disposal.

We anticipate that side slopes can be excavated to a maximum inclination of about 1.5H:1V following dewatering. Without a dewatering system, the sand fill will tend to cave and "run," forming very flat slopes. It may be feasible to control the inflow of groundwater with ordinary sump pumping if sheet pile shoring is used instead of an open cut.

MSE Wall Design

As currently planned, an MSE retaining wall will be constructed in the excavated area behind the steel sheet pile wall. We understand the purpose of the MSE retaining wall is to provide additional resistance to lateral loading behind the permanent bulkhead. Based on our discussions with KJ, we understand the MSE wall could be designed to range in height from 3 to 12 ft. Design of the MSE wall will be completed by others, and detailed design information is not currently available.

To facilitate drainage of the reinforced and retained zones and limit lateral deformations, we recommend using relatively clean, granular backfill in the reinforced zone of the wall. Sand, sand and gravel, or crushed rock with less than 5% passing the No. 200 sieve (washed analysis) would be appropriate for this purpose. We anticipate the general wall backfill behind the reinforced zone will consist of native on-site soils and imported granular fill consisting of sand, sandy gravel, or similar materials.

Proper drainage is an essential part of retaining wall design and will be particularly important at this site due to high groundwater levels and tidal fluctuations. We recommend constructing a chimney drain between the MSE wall backfill and the fascia and also between the MSE reinforced zone fill and general backfill. In addition, a drainage blanket should be installed at the base of the reinforced zone to connect the two chimney drains. In our opinion, an 18-in.-wide chimney drain (vertical drainage blanket) will be suitable if the fill in the reinforced zone consists of relatively clean granular material that contains less than about 5% passing the No. 200 sieve (washed analysis). The drainage blankets should consist of crushed rock that conforms to WSDOT Standard Specifications Section 9-03.12(4) Gravel Backfill for Drains. Recommended drainage details are shown on Figure 6. We have assumed the design will incorporate sufficient drainage of the chimney drains and drainage blanket through the wall fascia to provide essentially drained backfill conditions. However, to account for partially drained conditions in the retained zone due

to high groundwater conditions and fluctuating tides, we recommend designing for a minimum 5-ft height of hydrostatic water pressure above the bay mudline. The design should assume submerged conditions for the MSE foundation soils. The following table summarizes our recommended soil parameters for design of the MSE wall.

	Soil Properties				
Soil Type	**Total Unit Weight, γ_T, pcf**	**Buoyant Unit Weight, γ', pcf**	**ϕ'**	**c, psi**	**Ka**
Native Sand and Clay (Foundation Soil)	128	66	30°	0	NA
Free-Draining Granular Structural Fill (Reinforced Zone)	130	68	34°	0	0.28
Drain Rock (Drainage Blanket)	130	68	34°	0	0.28
On-Site Structural Fill (Retained Zone)	128	66	32°	0	0.30

All fill should be compacted as structural fill to 95% of the maximum dry density determined in accordance with ASTM D 698.

Additional lateral load due to seismic forces on retaining walls can be evaluated based on a triangular lateral earth pressure distribution with a maximum pressure of 14H at the ground surface and 0 at the base of the wall, where H is the height of the wall. The resultant force acts at a point above the base of the wall equal to 60% of the wall height. Additional lateral pressures induced by surcharge loads can be estimated using the guidelines provided on Figure 5. New foundations should not be located within the limits of the reinforced zone or within the active zone located behind the reinforced zone. We recommend that new foundations be set back at least 1.5H from the reinforced zone, where H is the total wall height.

The MSE foundation subgrade soils consist of silty sand, silt, and clay soils that are moisture sensitive and will be easily disturbed by construction actives. Therefore, the contractor should use construction equipment and procedures that minimize disturbance and softening of the subgrade soils, particularly if wet conditions are encountered. Subgrade soils that are disturbed or softened during construction should be overexcavated and backfilled with compacted granular structural fill. The soil properties we have recommended for design of the MSE wall are based on foundation soils that are firm and undisturbed. In our opinion, the MSE wall foundation subgrade should be evaluated by a qualified geotechnical engineer, and any areas of soft subgrade, loose fill, or other unsuitable material should be overexcavated and replaced with compacted crushed rock. We anticipate the governing design codes will require a minimum wall embedment of at least 2 ft based on the sloping mudline conditions in front of the wall.

Construction of the MSE wall and backfill will induce consolidation of the underlying silt and clay soils and settlement at the ground surface. Based on the anticipated depth of excavation required to remove the contaminated soils and establish the base of the MSE wall, the underlying soils will experience unloading and re-loading during construction, which will help reduce the total amount of primary consolidation settlement. We anticipate the majority of the consolidation settlement will occur during placement of the MSE wall backfill, and consolidation will be essentially complete within 1 month after the fill has been placed.

Structural Fill

All new fill in structural areas should be compacted as structural fill. In our opinion, on-site soils that are free of organics and other deleterious materials and debris are suitable for use in structural fills. As noted above, it should be anticipated that near-surface, silty soils will be encountered locally. Silty soils are sensitive to moisture content and can be placed and adequately compacted only during the dry, summer months. Fills constructed in wet conditions, fills should be constructed using imported granular materials that are relatively clean.

In general, approved on-site or imported, organic-free, fine-grained sand and silty soils used to construct structural fills within areas of mass filling, structures, and pathways should be placed in 9-in.-thick lifts (loose) and compacted using medium-size (48-in.-diameter), segmented-pad or vibratory rollers to a density not less than 95% of the maximum dry density as determined by ASTM D 698. Pieces of rock or concrete larger than about 6 in. should be removed from the fill prior to compaction. Fill placed in landscaped areas should be compacted to a minimum of about 90% of the maximum dry density as determined by ASTM D 698. In our opinion, the moisture content of silty sand, silt, and clay soils at the time of compaction should be controlled to within 3% of optimum. Some moisture conditioning of silty sand, silt, and clay soils may be required to achieve the recommended compaction criteria. All structural fills should extend a minimum horizontal distance of 5 ft beyond the limits of building and pavement areas.

On-site or imported granular material used to construct structural fills or work pads during wet weather can consist of relatively clean granular material, such as sand, sand and gravel, or crushed rock with a maximum size of about 4 in. and with not more than about 5% passing the No. 200 sieve (washed analysis). The first lift of granular fill material placed over silt subgrade should be in the range of 12 to 18 in. thick (loose). Subsequent lifts should be placed 12 in. thick (loose). All lifts should be compacted to at least 95% of the maximum dry density as determined by ASTM D 698 using a medium-weight (48-in.-diameter drum), smooth, steel-wheeled, vibratory roller. Generally, a minimum of four passes with the roller are required to achieve compaction.

Depending on actual soil and groundwater conditions at the time of construction, we anticipate it will be necessary to overexcavate the subgrade to allow installation of bottom stabilization material to provide a relatively firm base and facilitate dewatering of the excavations by pumping with sumps. The actual amount of overexcavation will need to be evaluated on the basis of field observations made during construction; however, we anticipate approximately 1 to 2 ft of stabilization material may be needed. The bottom stabilization material should consist of clean, well-graded crushed rock with a maximum size of about 4 in. and less than 2% passing the No. 200 sieve (washed analysis). The stabilization rock should be placed in a single lift and tamped into place until well-keyed using hand compaction equipment. If needed the stabilization material may be capped with about 6 in. of compacted 3/4-in.-minus crushed rock to serve as a leveling course and choke off the surface of the coarser-graded stabilization material.

Seismic Considerations

We understand the project will be designed in accordance with the 2012 International Building Code (IBC). Seismic design in accordance with the 2012 IBC is based on the ASCE 7-10 document. The IBC design methodology uses two spectral response coefficients, S_S and S_1, corresponding to periods of 0.2 and 1.0 second, to develop the design-level earthquake spectrum. The S_S and S_1 coefficients for the site located at the approximate latitude and longitude coordinates of 48.40°N and 122.63°W are 1.21 and 0.48 g,

respectively. The site is designated Site Class E based on the estimated SPT N-value profile for the upper 100 ft in accordance with Chapter 20 of ASCE 7-10. We recommend using the Site Class E designation for design of the project.

Based on the relative density and plastic fines content of the sandy soils at the site, it is our opinion the risk of widespread liquefaction and lateral spreading is low. There is some risk of liquefaction in isolated, discontinuous zones of looser, lower-plasticity sands at the site; however, we do not anticipate significant settlement or lateral spreading will occur as a result of isolated liquefaction. Based on our review of available geologic information for the project area, the risk of earthquake-induced fault displacement at the site is very low, unless occurring on a previously unmapped fault. The USGS deaggregations for the site (USGS, 2013) indicate several faults are present in the project area. The risk of damage by tsunami and/or seiche at the site is present.

Design Review and Construction Services

The contractor is responsible for design of temporary excavation shoring and dewatering. In this regard, the shoring and dewatering plans should be designed and stamped by a licensed engineer and submitted to the design team for review. This report addresses geotechnical considerations regarding the general approach to design and construction of the shoring and dewatering and is for informational purposes only. The information in this report should not be interpreted to mean that GRI is providing design of the shoring and dewatering systems, which is solely the responsibility of the contractor.

We welcome the opportunity to review and discuss construction plans and specifications for this project as they are being developed to evaluate whether they are in conformance with the recommendations provided in our report. In addition, to observe compliance with the intent of our recommendations and the plans and specifications, we are of the opinion that all construction operations dealing with earthwork and shoring should be observed by a GRI representative. Our construction-phase services will allow for timely design changes if site conditions are encountered that are different from those described in this report. If we do not have the opportunity to confirm our interpretations, assumptions, and analyses during construction, we cannot be responsible for the application of our recommendations to subsurface conditions that are different from those described in this report.

Limitations

This report has been prepared to aid in the design of the project. The scope is limited to the specific project and location described herein, and our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of the excavations and shoring. In the event that any changes in the design and location of the improvements as outlined in this report are planned, we should be given the opportunity to review the changes and to modify or reaffirm our recommendations in writing.

The analyses and recommendations submitted in this report are based on the data obtained from the borings recently made at the site, laboratory test results, and other sources of information discussed in this report. In the performance of subsurface investigations, specific information is obtained at specific locations at specific times. However, it is acknowledged that variations in soil conditions may exist between exploration locations and that groundwater levels will fluctuate with time. This report does not reflect any variations that may occur between these explorations. The nature and extent of variations may

not become evident until construction. If, during construction, subsurface conditions different from those described in this report are observed or encountered, we should be advised at once so that we can observe these conditions and reconsider our recommendations where necessary.

Please contact the undersigned if you have any questions regarding this report.

Submitted for GRI,

Expires 4/2014

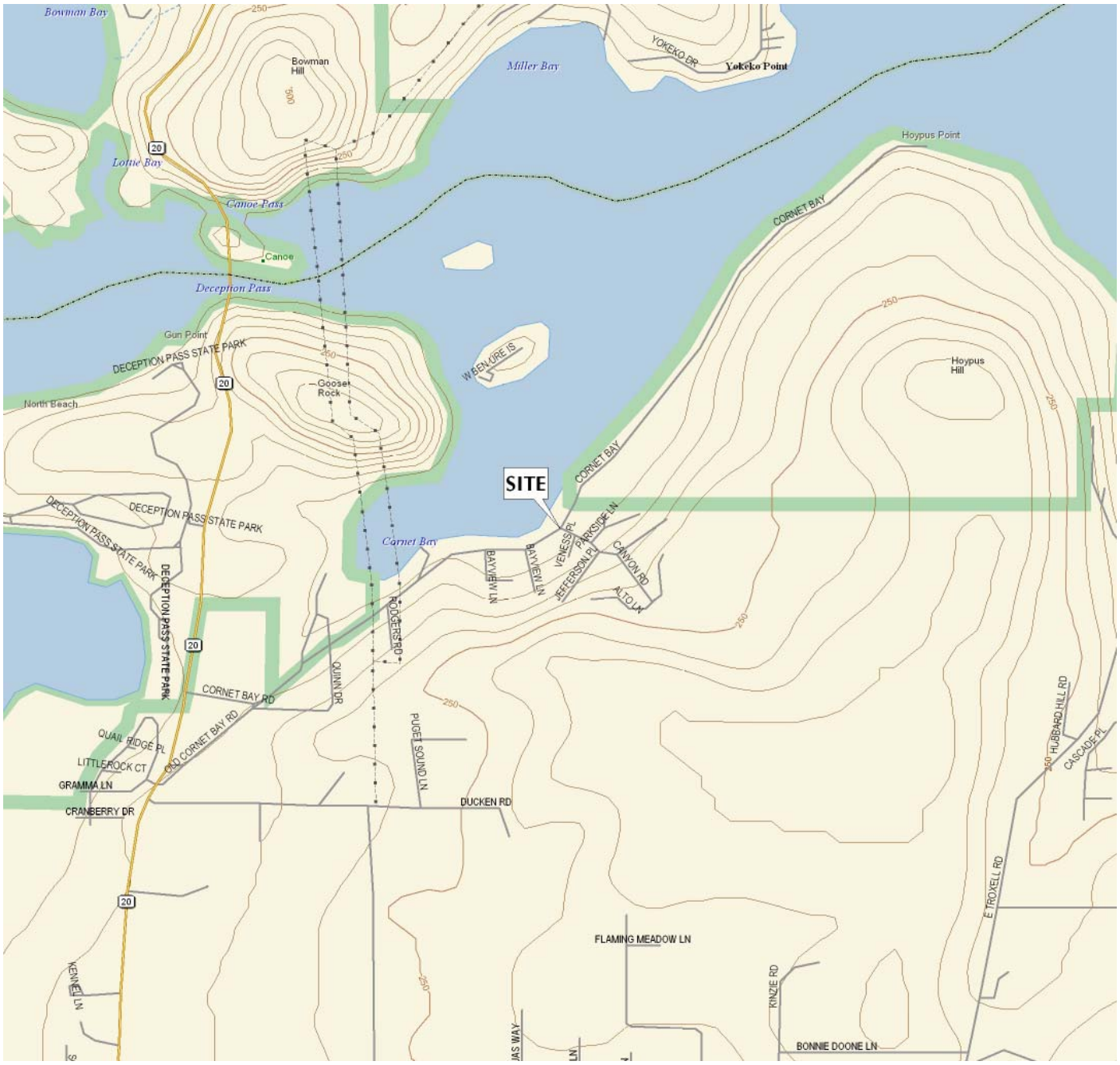
Matthew S. Shanahan, PE Associate	Michael W. Reed, PE Principal	John K. (Jack) Gordon, PE Project Engineer

This document has been submitted electronically.

References

Pessl, F., Dethier, D.P., Booth, D.B., and Minard, J.P., Surficial geologic map of the Port Townsend 30- by 60-minute quadrangle, Puget Sound region, Washington: U.S. Geological Survey, Miscellaneous Investigations Series Map I-1198-F

U.S. Geological Survey, 2013, Probabilistic hazard lookup by latitude, longitude, accessed 7/11/13, from USGS website: https://geohazards.usgs.gov/deaggint/2008/



DELORME 3-D TOPOQUADS, WASHINGTON
DECEPTION PASS, WASH. (4da) 2004

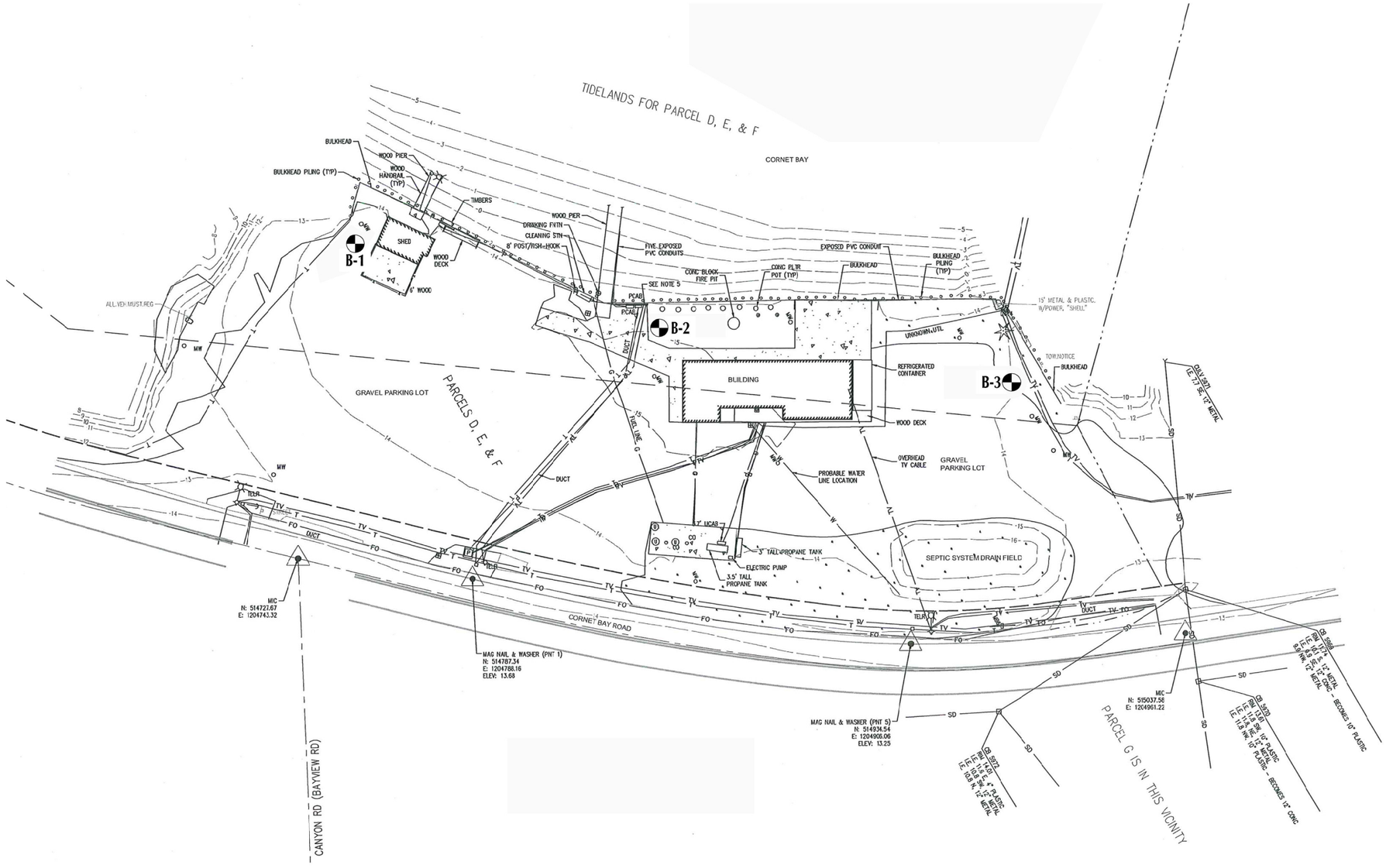
North

0 1/2 1 MILE

GRI KENNEDY / JENKS CONSULTANTS
CORNET BAY MARINA

VICINITY MAP

AUG. 2013 JOB NO. W1115 FIG. 1



DATUM AND ROW NOTES

1. BASIS OF BEARINGS IS WASHINGTON STATE PLANE COORDINATE SYSTEM, NORTH ZONE, NORTH AMERICAN DATUM OF 1983, 1991 ADJUSTMENT (NAD 83/91).
2. THE VERTICAL DATUM IS THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88), AS DERIVED FROM GPS OBSERVATIONS.
3. BOUNDARY ESTABLISHED PER RECORD OF SURVEY FILED IN VOLUME 7 OF SURVEYS, PAGES 233 AND 234, RECORDING NO. 91001920, RECORDS OF ISLAND COUNTY, WA.
4. HELD FOUND MONUMENTS AT THE INTERSECTION OF CORNET BAY ROAD WITH BAY VIEW ROAD AND AT THE NORTH QUARTER CORNER OF SECTION 36.
5. PARCELS A-G ARE PER QUIT CLAIM DEED RECORDED IN BOOK 811, PAGES 2437-2449, RECORDS OF ISLAND COUNTY, WA.

BORING MADE BY GRI
(JUNE 19 - 21, 2013)

SITE PLAN FROM 50% SUBMITTAL PLAN SET BY KENNEDY / JENKS CONSULTANTS

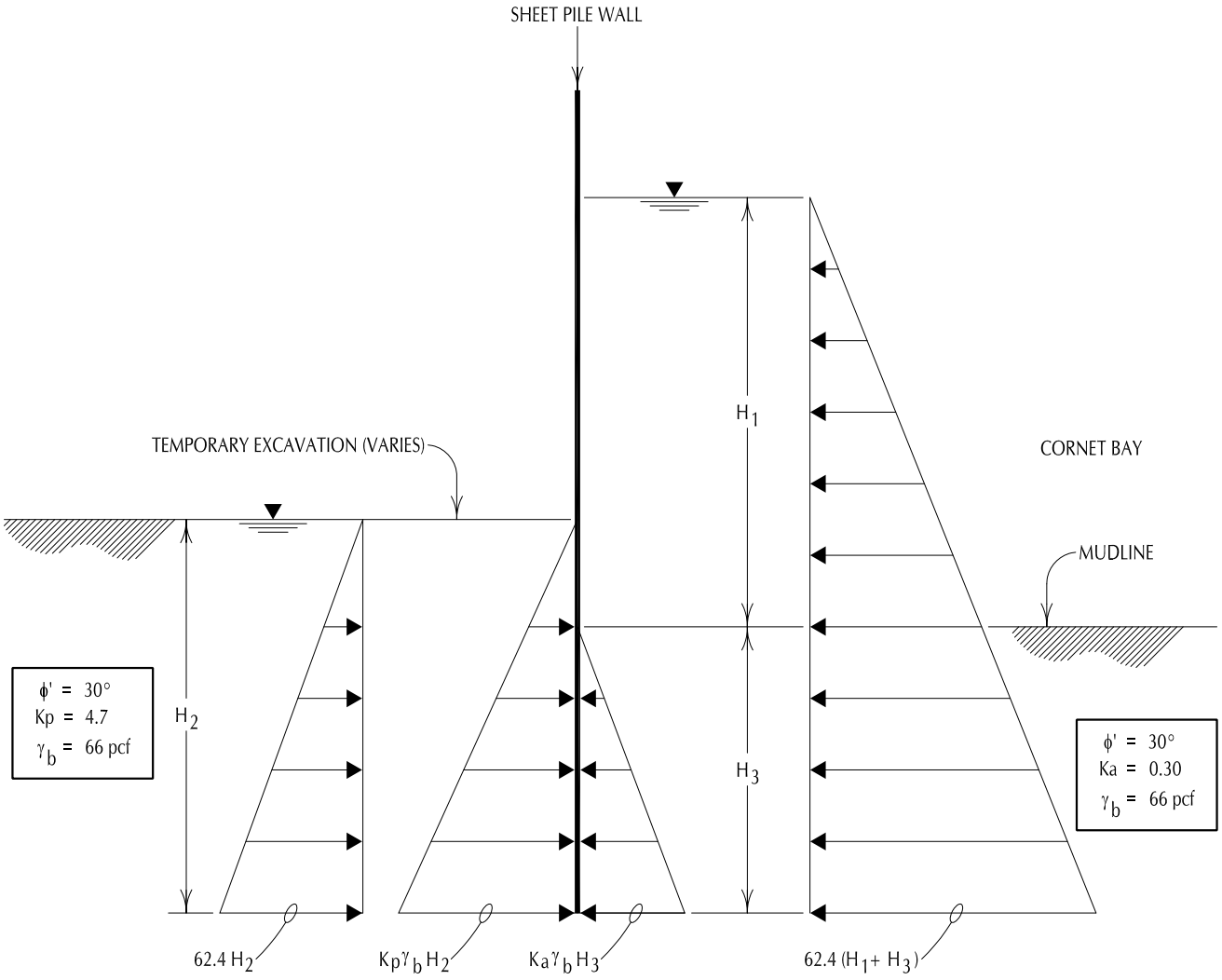
North

0 50 100 FT

GRI KENNEDY / JENKS CONSULTANTS
CORNET BAY MARINA

SITE PLAN

AUG. 2013 JOB NO. W1115 FIG. 2



NOTES:

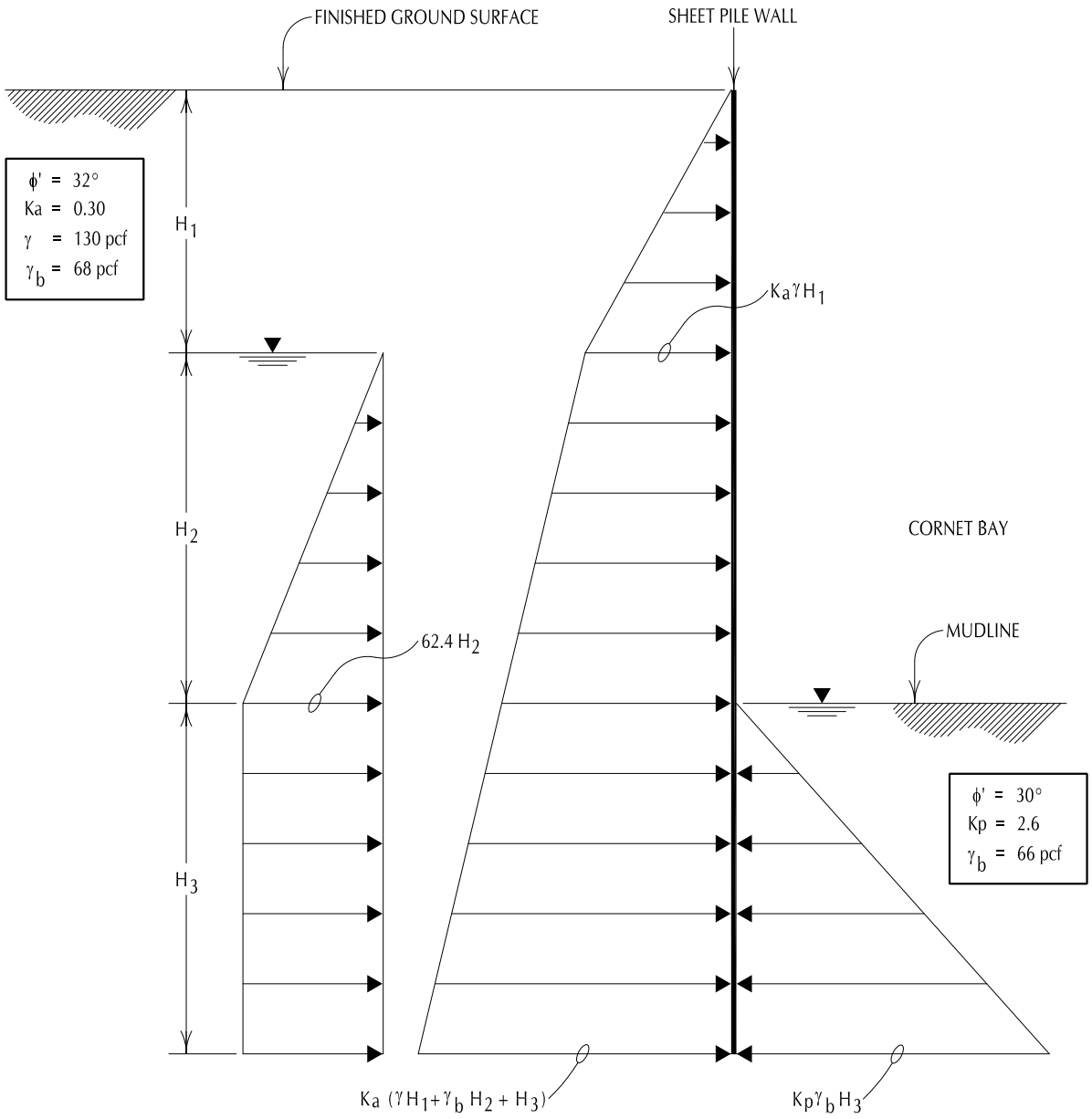
1) EARTH PRESSURES SHOWN ARE FOR CRITICAL WATER LEVELS AT HIGH TIDE.

2) EARTH PRESSURES ARE UNFACTORED, AND PASSIVE RESISTANCES HAVE NOT BEEN DECREASED TO LIMIT WALL DEFORMATION.

GRI KENNEDY / JENKS CONSULTANTS
CORNET BAY MARINA

LATERAL EARTH PRESSURES FOR TEMPORARY EXCAVATION

AUG. 2013 JOB NO. W1115 FIG. 3



NOTES:

1) ASSUMES EXCAVATION WILL BE BACKFILLED WITH RELATIVELY CLEAN GRANULAR STRUCTURAL FILL.

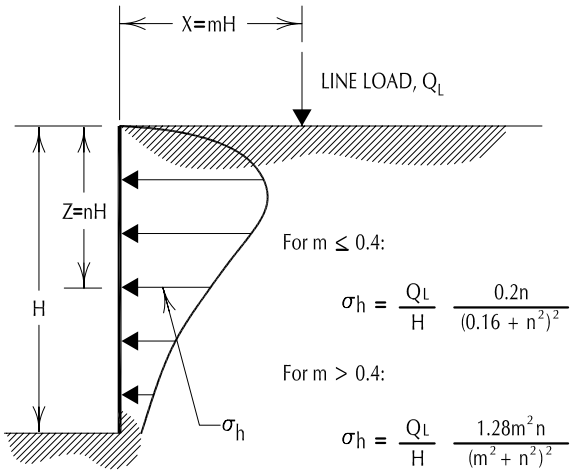
2) PASSIVE EARTH PRESSURE IS LOWEST FOR BAY LEVEL AT OR ABOVE MUDLINE.

3) EARTH PRESSURES ARE UNFACTORED, AND PASSIVE RESISTANCE HAS NOT BEEN DECREASED TO LIMIT WALL MOVEMENT.

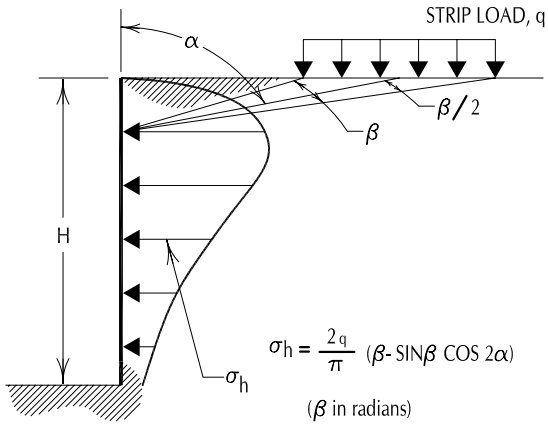
GRI KENNEDY / JENKS CONSULTANTS
CORNET BAY MARINA

LATERAL EARTH PRESSURES FOR FINISHED CONDITIONS

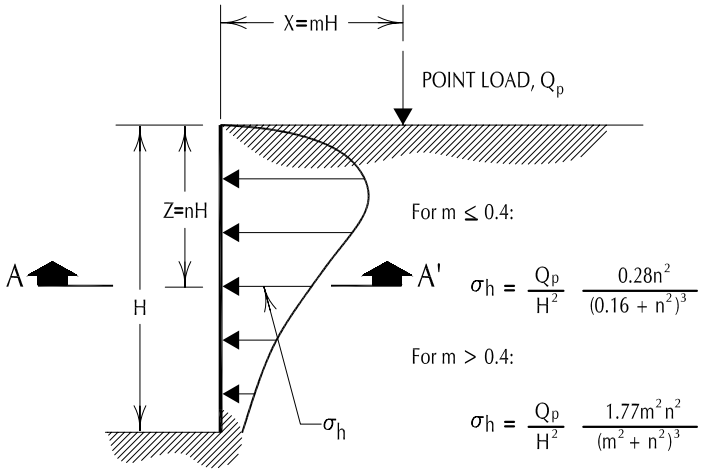
AUG. 2013 JOB NO. W1115 FIG. 4

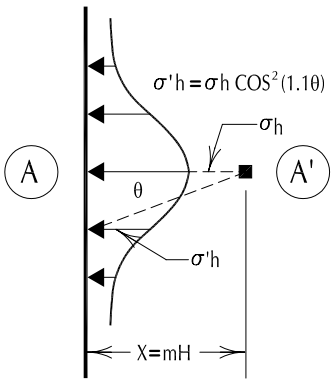


LINE LOAD PARALLEL TO WALL



STRIP LOAD PARALLEL TO WALL





DISTRIBUTION OF HORIZONTAL PRESSURES

VERTICAL POINT LOAD

NOTES:

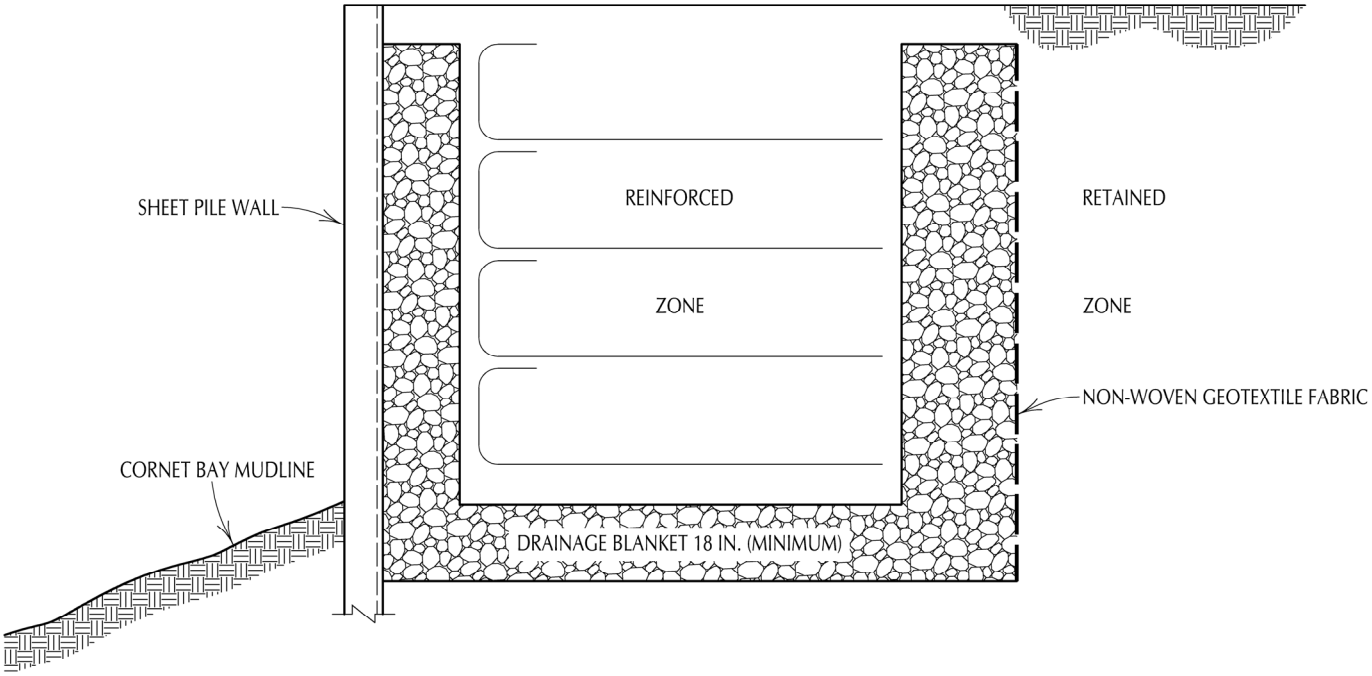
1. THESE GUIDELINES APPLY TO RIGID WALLS WITH POISSON'S RATIO ASSUMED TO BE 0.5 FOR BACKFILL MATERIALS.

2. LATERAL PRESSURES FROM ANY COMBINATION OF ABOVE LOADS MAY BE DETERMINED BY THE PRINCIPLE OF SUPERPOSITION.

GRI KENNEDY / JENKS CONSULTANTS
CORNET BAY MARINA

SURCHARGE-INDUCED LATERAL PRESSURE

AUG. 2013 JOB NO. W1115 FIG. 5



SOIL PROPERTIES FOR MSE WALL DESIGN

CORNET BAY MARINA REMEDIATION (GRI #W1115)

Soil Type	Soil Properties				
	γ, pcf	γ′, pcf	ϕ′	c, psi	Ka
Native Sand & Clay (Foundation Soil)	128	66	30°	0	NA
Compacted Crushed Rock (Reinforced Zone)	130	68	34°	0	NA
Compacted Crushed Rock (Retained Zone)	130	68	34°	0	0.28
Compacted Native Fill (Retained Zone)	128	66	32°	0	0.30

NOTES:

1) THE SOIL PROPERTIES ASSUME THE MSE WALL IS DESIGNED TO PROVIDE ESSENTIALLY DRAINED CONDITIONS. HOWEVER, TO ACCOUNT FOR PARTIALLY DRAINED CONDITIONS IN THE RETAINED ZONE DUE TO HIGH GROUNDWATER AND TIDAL FLUCTUATIONS, WE RECOMMEND DESIGNING FOR A MINIMUM 5-FT HEIGHT OF HYDROSTATIC WATER PRESSURE ABOVE THE BAY MUDLINE.

2) GRANULAR STRUCTURAL FILL WITH LESS THAN 5% PASSING THE NO. 200 SIEVE (WASHED ANALYSIS) RECOMMENDED FOR THE REINFORCED ZONE.

3) DRAIN ROCK SHOULD CONFORM TO WSDOT STANDARD SPECIFICATIONS 9-03.12(4) GRAVEL BACKFILL FOR DRAINS.

4) ALL MSE WALL BACKFILL SHOULD BE COMPACTED AS STRUCTURAL FILL TO 95% OF THE MAXIMUM DRY DENSITY DETERMINED IN ACCORDANCE WITH ASTM D 698.

5) ADDITIONAL LATERAL LOAD DUE TO SEISMIC FORCES ON RETAINING WALLS CAN BE EVALUATED BASED ON A TRIANGULAR LATERAL EARTH PRESSURE DISTRIBUTION WITH A MAXIMUM PRESSURE OF 14H AT THE GROUND SURFACE AND 0 AT THE BASE OF THE WALL, WHERE H IS THE HEIGHT OF THE WALL. THE RESULTANT FORCE ACTS AT A POINT ABOVE THE BASE OF THE WALL EQUAL TO 60% OF THE WALL HEIGHT.

GRI KENNEDY / JENKS CONSULTANTS
CORNET BAY MARINA

MSE WALL DRAINAGE DETAIL

AUG. 2013 JOB NO. W1115 FIG. 6

APPENDIX A

Field Explorations and Laboratory Testing

APPENDIX A

FIELD EXPLORATIONS AND LABORATORY TESTING

FIELD EXPLORATIONS

Subsurface materials and conditions at the site were investigated between June 20 and 21, 2013, with three borings, designated B-1 through B-3. The approximate locations of the borings are shown on Figure 2. The borings were advanced to depths of about 38 to 80 ft using a using a truck-mounted drill rig provided and operated by Cascade Drilling of Woodinville, Washington. The upper 20 ft of the borings were completed using hollow-stem techniques, and mud-rotary techniques were used below that depth. All drilling and sampling operations were observed by a geologist from GRI, who maintained a detailed log of the materials and conditions disclosed during the course of the work.

Disturbed and undisturbed soil samples were typically obtained at 2.5-ft intervals of depth in the upper 20 ft and at 5-ft intervals below this depth. Disturbed samples were obtained using a standard split-spoon sampler. At the time of sampling, the Standard Penetration Test was conducted. This test consists of driving a standard split-spoon sampler into the soil a distance of 18 in. using a 140-lb hammer dropped 30 in. The number of blows required to drive the sampler the last 12 in. is known as the standard penetration resistance, or SPT N-value. The N-values provide a measure of the relative density of granular soils, such as sand, and the relative consistency, or stiffness, of cohesive soils, such as silt. The split-spoon samples were carefully examined in the field and representative portions were saved in airtight jars. All samples were returned to our laboratory for further examination and physical testing.

Relatively undisturbed 3.0-in.-O.D. Shelby tube samples were obtained by pushing the tubes into undisturbed soil using the hydraulic ram on the drill rig. The soils exposed in the ends of the Shelby tubes were examined and classified in the field. The ends of the tubes were sealed with rubber caps and returned to our laboratory for further examination and physical testing.

Logs of the borings are provided on Figures 1A through 3A. Each log presents a descriptive summary of the various types of materials encountered in the boring and notes the depth at which the materials and/or characteristics of the materials change. To the right of the descriptive summary, the numbers and types of samples are indicated. Farther to the right, N-values are shown graphically, along with natural moisture content values, percent passing the No. 200 sieve, Torvane shear strength values, and Atterberg limits. The terms used to describe the materials encountered in the borings are defined in Table 1A.

LABORATORY TESTING

General

All samples obtained from the field were returned to our laboratory for examination and testing. The physical characteristics were noted, and the field classifications were modified where necessary. The soil samples were field-screened for the presence of organic vapors using a photo-ionization detector (PID). Additional laboratory tests included determinations of natural moisture content, Atterberg limits, Torvane shear strength, undisturbed unit weight, and grain size.

Natural Moisture Content

Natural moisture content determinations were made in conformance with ASTM D 2216. The results are provided on Figures 1A through 3A.

Atterberg Limits

Atterberg limits determinations were performed on samples of the clay obtained from each boring. The tests were performed in substantial conformance with ASTM D 4318. The test data were used for soil classification purposes and as indicators of engineering properties of the silt and clay soils at the site. The results of the Atterberg limit determinations are shown on Figures 1A through 3A and the Plasticity Chart, Figure 4A.

Grain Size Analysis

Dry Sieve. Dry sieve analyses were performed for selected soil samples to evaluate grain size distribution and assist in material classification and permeability estimates. The testing was completed in substantial conformance with ASTM D 6913-04. Test results are show on the grain size distribution curves, Figures 5A through 7A.

Washed Sieve. Washed sieve analyses were performed on representative soil samples to assist in their classification. The test is performed by taking a sample of known dry weight and washing it over a No. 200 sieve. The material retained on the sieve is oven-dried and weighed, and the percentage of material passing the No. 200 sieve is calculated. The test results are provided on Figures 1A through 3A.

Undisturbed Unit Weight

The unit weight, or density, of six undisturbed soil samples was determined in the laboratory in substantial conformance with ASTM D 2937. The unit weight determinations are summarized in the following table.

SUMMARY OF UNIT WEIGHT DETERMINATIONS

Boring	Sample	Depth, ft	Dry Unit Weight, pcf	Natural Moisture Content, %	Soil Type
B-1	S-4	10.5	110	20	Silty SAND; some clay, scattered organics and gravel (FILL)
	S-11	35	89	35	CLAY; trace to some silt, trace sand
B-2	S-3	8	102	26	Sandy SILT; trace to some clay, scattered gravel (FILL)
	S-7	18	105	26	Sandy CLAY; some silt
B-3	S-6	16.5	100	29	Silty CLAY; some sand, scattered gravel
	S-10	31	109	23	Silty CLAY; some sand, scattered gravel

Torvane Shear Strength

The approximate undrained shear strength of relatively undisturbed soil samples was determined using a Torvane shear device. The Torvane is a hand-held apparatus with vanes that are inserted into the soil. The torque required to fail the soil in shear around the vanes as the instrument is rotated is measured using a calibrated spring. The results of the Torvane shear tests are shown on Figures 1A through 3A.

Table 1A

GUIDELINES FOR CLASSIFICATION OF SOIL

Description of Relative Density for Granular Soil

Relative Density	Standard Penetration Resistance (N-values) blows per foot
very loose	0 - 4
loose	4 - 10
medium dense	10 - 30
dense	30 - 50
very dense	over 50

Description of Consistency for Fine-Grained (Cohesive) Soils

Consistency	Standard Penetration Resistance (N-values) blows per foot	Torvane Undrained Shear Strength, tsf
very soft	2	less than 0.125
soft	2 - 4	0.125 - 0.25
medium stiff	4 - 8	0.25 - 0.50
stiff	8 - 15	0.50 - 1.0
very stiff	15 - 30	1.0 - 2.0
hard	over 30	over 2.0

Sandy silt materials, which exhibit general properties of granular soils are given relative density description.

Grain-Size Classification

Boulders
12 - 36 in.

Cobbles
3 - 12 in.

Gravel
1/4 - 3/4 in. (fine)
3/4 - 3 in. (coarse)

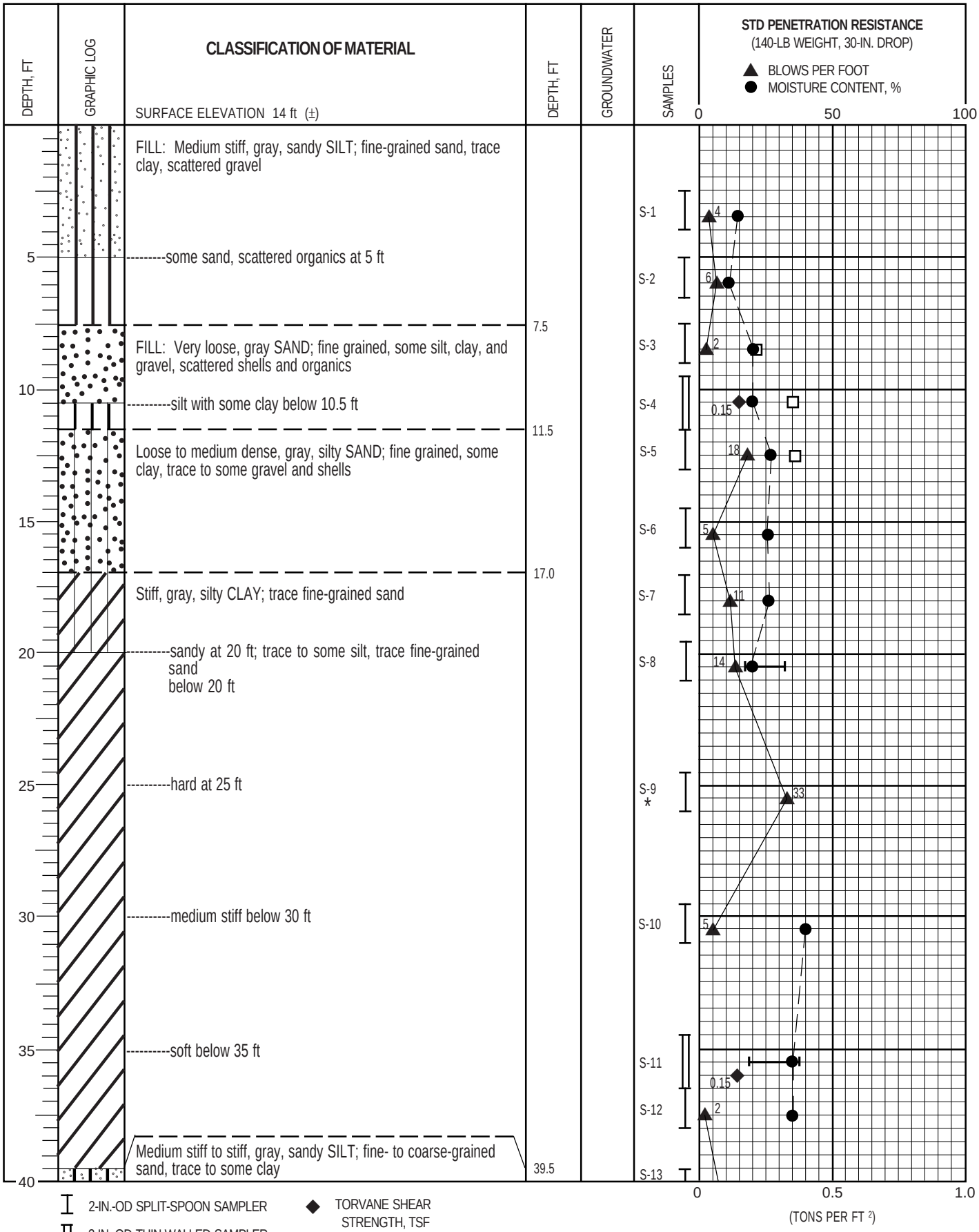
Sand
No. 200 - No. 40 sieve (fine)
No. 40 - No. 10 sieve (medium)
No. 10 - No. 4 sieve (coarse)

Silt/Clay - pass No. 200 sieve

Modifier for Subclassification

Adjective	Percentage of Other Material In Total Sample
clean	0 - 2
trace	2 - 10
some	10 - 30
sandy, silty, clayey, etc.	30 - 50

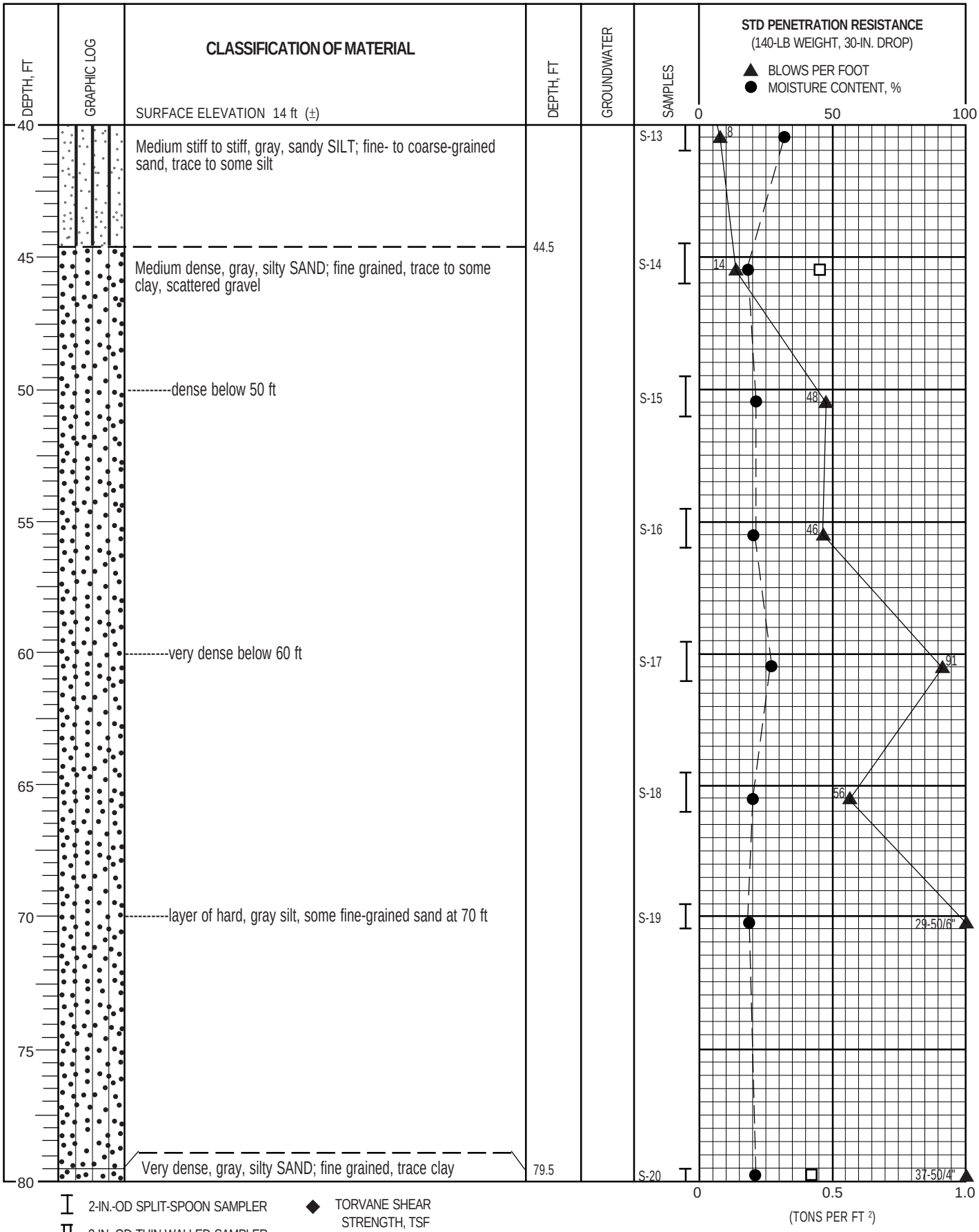
GRI



GRI

BORING B-1

AUG. 2013 JOB. NO. W1115 FIG. 1A



2-IN.-OD SPLIT-SPOON SAMPLER

3-IN.-OD THIN-WALLED SAMPLER

G GRAB SAMPLE OF DRILL CUTTINGS

NX CORE RUN

SLOTTED PVC PIPE

Water Level (date)

TORVANE SHEAR STRENGTH, TSF

PERCENT PASSING NO. 200 SIEVE (WASHED)

* NO RECOVERY

Liquid Limit

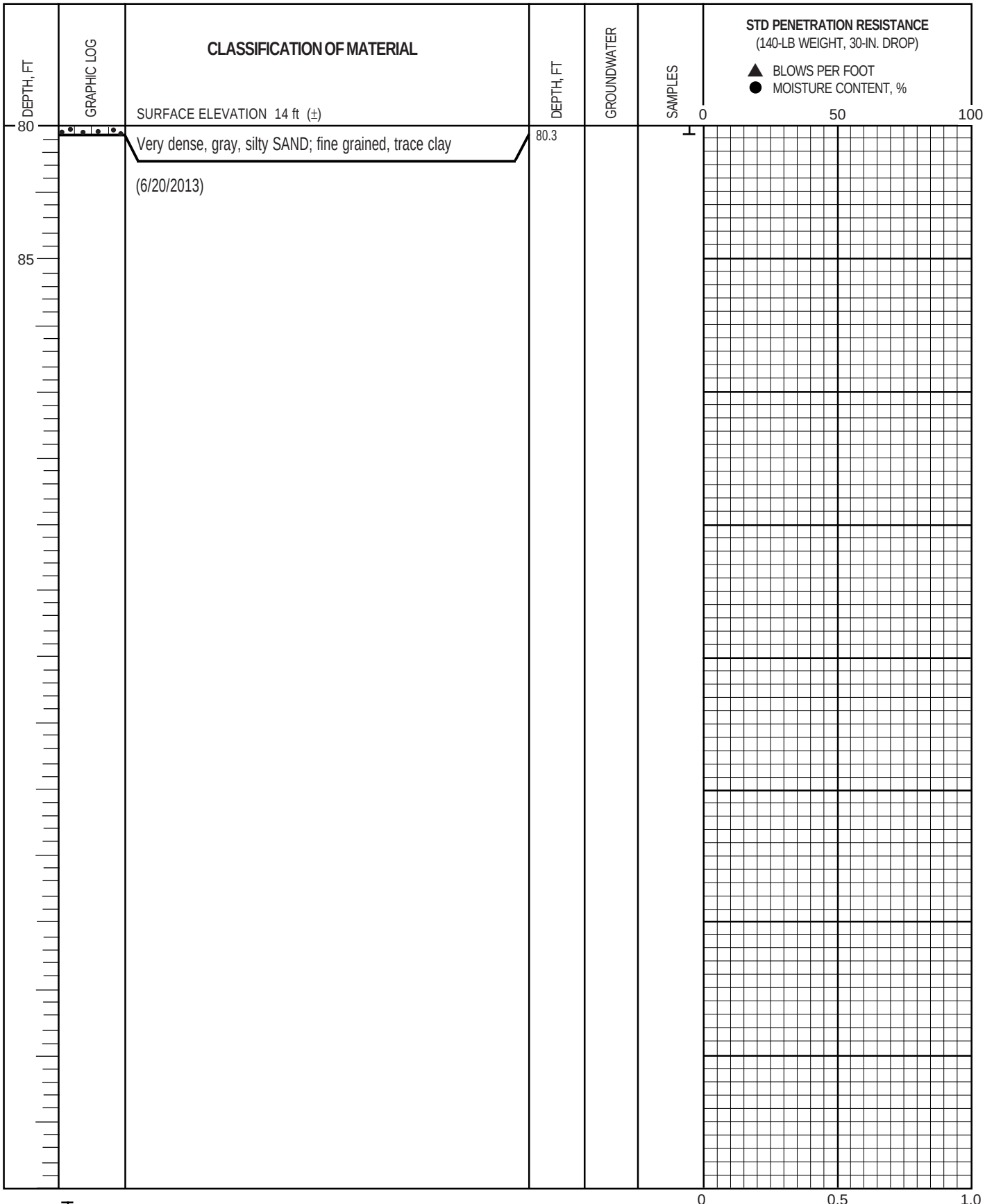
Moisture Content

Plastic Limit

GRI

BORING B-1 (cont.)

AUG. 2013 JOB. NO. W1115 FIG. 1A



2-IN.-OD SPLIT-SPOON SAMPLER

3-IN.-OD THIN-WALLED SAMPLER

G GRAB SAMPLE OF DRILL CUTTINGS

NX CORE RUN

SLOTTED PVC PIPE

Water Level (date)

TORVANE SHEAR STRENGTH, TSF

PERCENT PASSING NO. 200 SIEVE (WASHED)

* NO RECOVERY

Liquid Limit

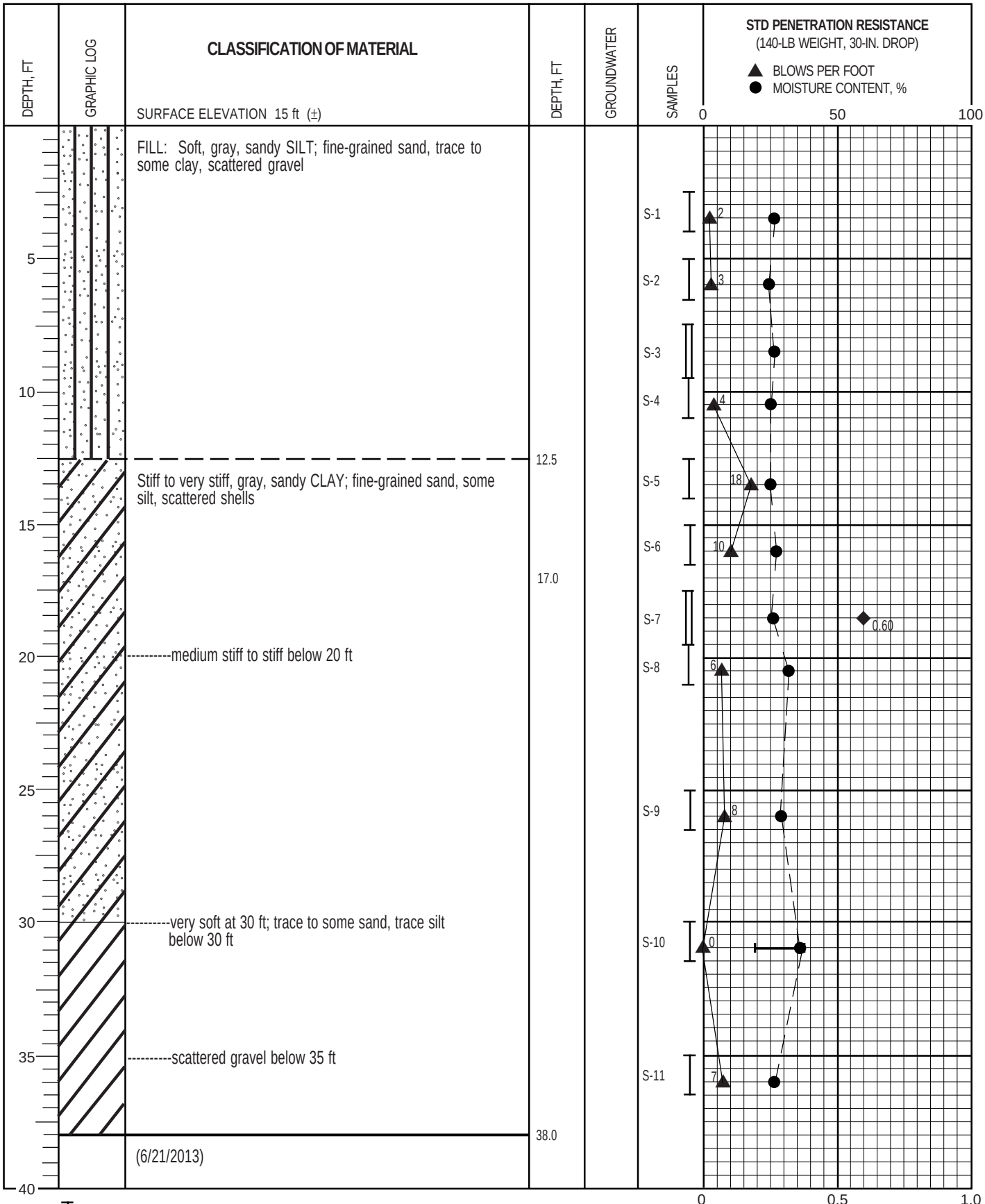
Moisture Content

Plastic Limit

GRI

BORING B-1 (cont.)

AUG. 2013 JOB. NO. W1115 FIG. 1A



2-IN.-OD SPLIT-SPOON SAMPLER

3-IN.-OD THIN-WALLED SAMPLER

G GRAB SAMPLE OF DRILL CUTTINGS

NX CORE RUN

SLOTTED PVC PIPE

Water Level (date)

TORVANE SHEAR STRENGTH, TSF

PERCENT PASSING NO. 200 SIEVE (WASHED)

* NO RECOVERY

Liquid Limit

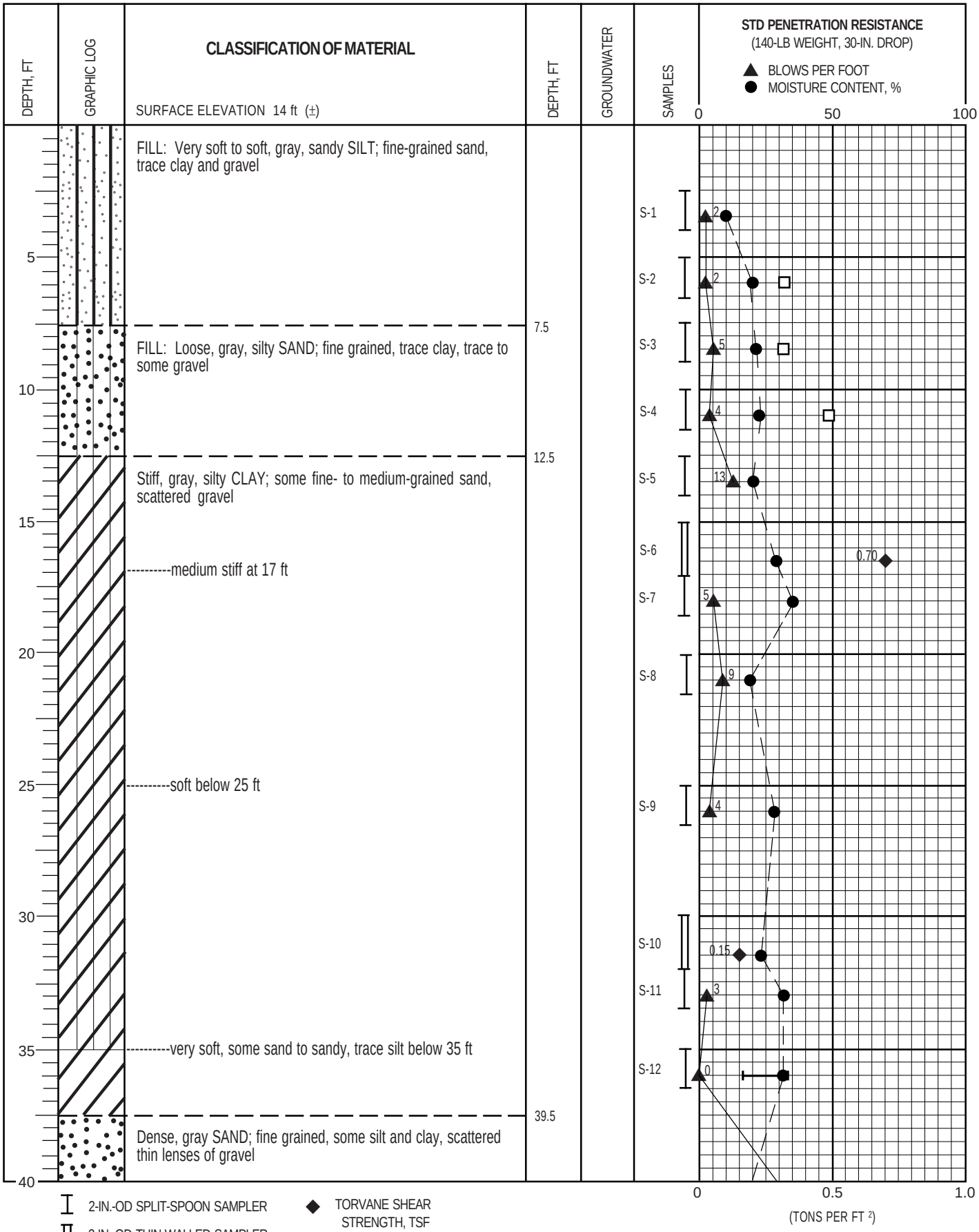
Moisture Content

Plastic Limit

GRI

BORING B-2

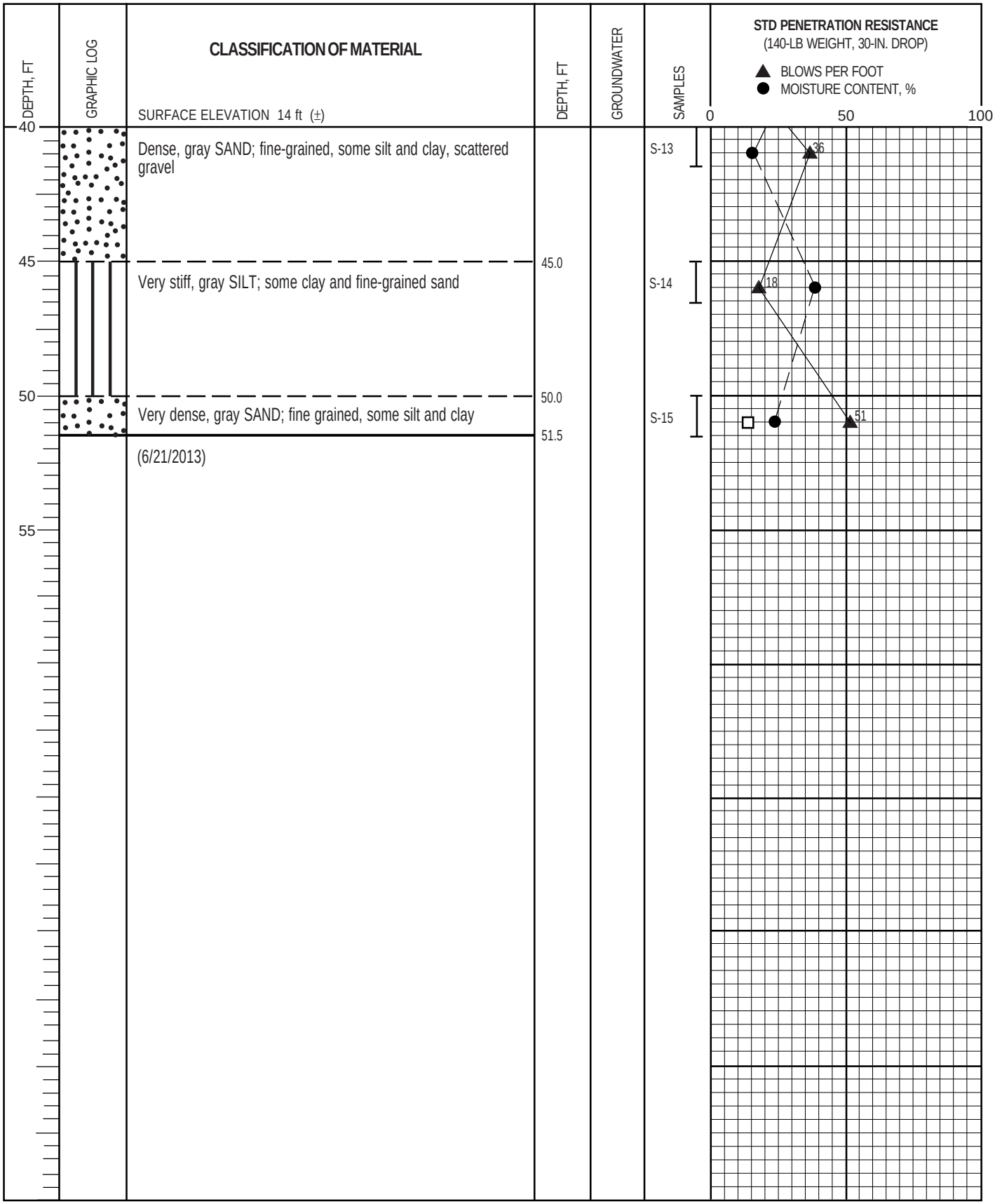
AUG. 2013 JOB. NO. W1115 FIG. 2A



GRI

BORING B-3

AUG. 2013 JOB. NO. W1115 FIG. 3A



2-IN.-OD SPLIT-SPOON SAMPLER
3-IN.-OD THIN-WALLED SAMPLER
G GRAB SAMPLE OF DRILL CUTTINGS
NX CORE RUN
SLOTTED PVC PIPE
Water Level (date)

TORVANE SHEAR STRENGTH, TSF
PERCENT PASSING NO. 200 SIEVE (WASHED)
* NO RECOVERY
Liquid Limit
Moisture Content
Plastic Limit

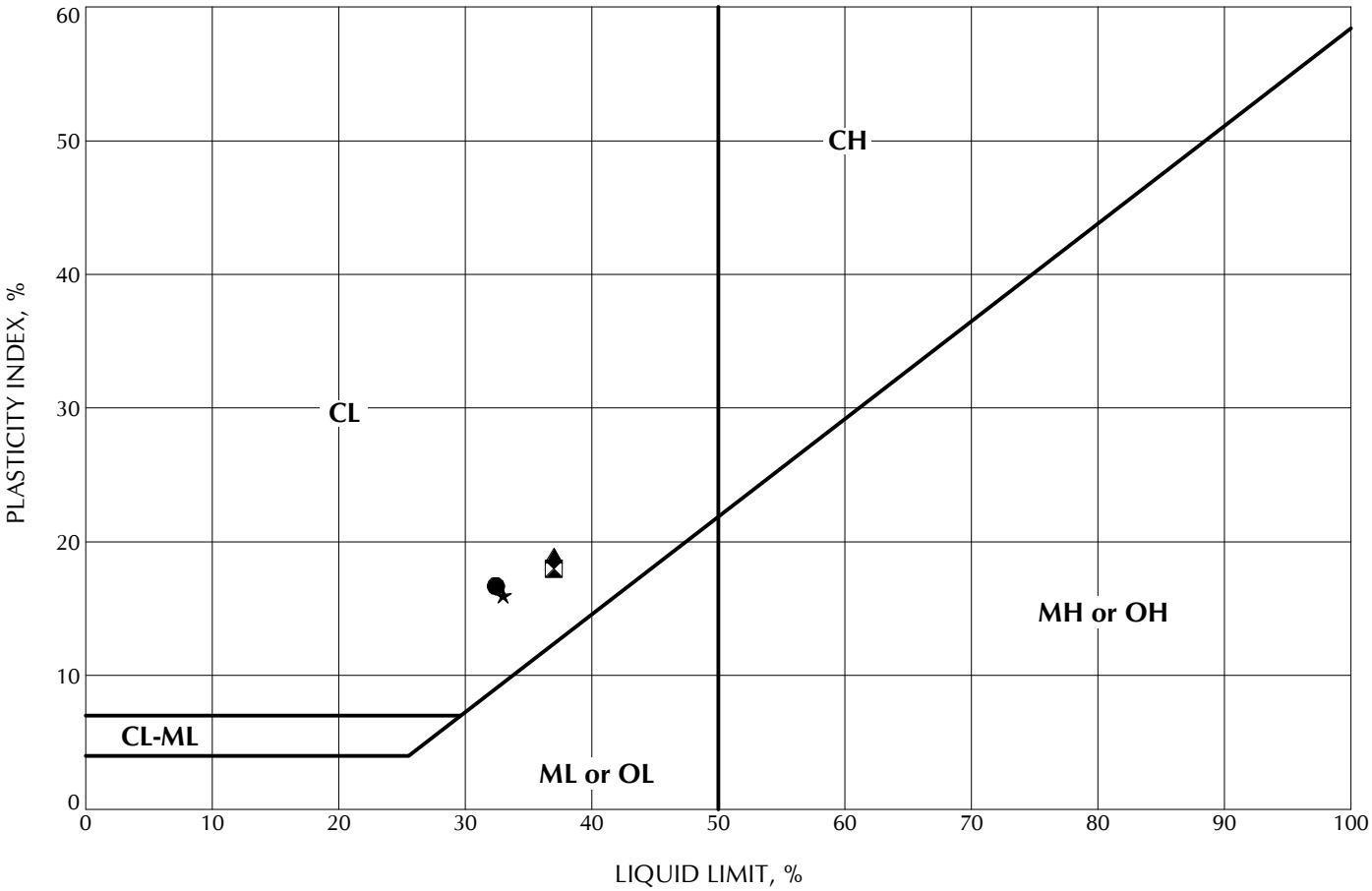
GRI

BORING B-3 (cont.)

AUG. 2013 JOB. NO. W1115 FIG. 3A

GROUP SYMBOL	UNIFIED SOIL CLASSIFICATION FINE-GRAINED SOIL GROUPS
OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
ML	INORGANIC CLAYEY SILTS TO VERY FINE SANDS OF SLIGHT PLASTICITY
CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY

GROUP SYMBOL	UNIFIED SOIL CLASSIFICATION FINE-GRAINED SOIL GROUPS
OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
MH	INORGANIC SILTS AND CLAYEY SILT
CH	INORGANIC CLAYS OF HIGH PLASTICITY



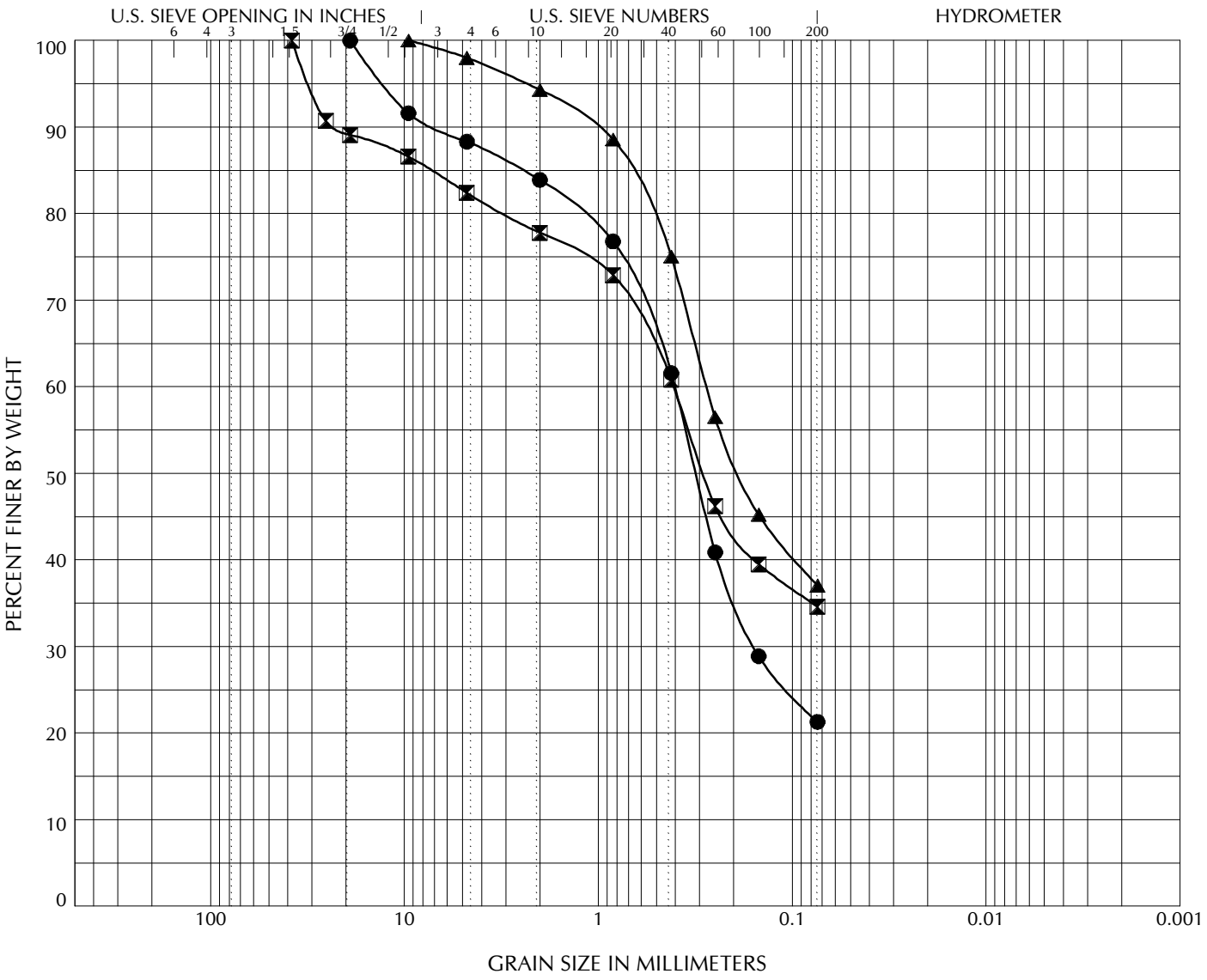
	Location	Sample	Depth, ft	Classification	LL	PL	PI	MC, %
●	B-1	S-8	20.5	Sandy CLAY; fine-grained sand	32	16	16	20
⊠	B-1	S-11	35.5	CLAY; some silt, trace sand	37	19	18	35
▲	B-2	S-10	31.0	CLAY; trace silt and sand	37	18	19	36
★	B-3	S-12	36.0	CLAY; some sand, trace silt	33	17	16	31

GRI

PLASTICITY CHART

AUG. 2013 PROJECT NO. W1115 FIG. 4A

ATTERBERG-PLASTICITY 4 PER PAGE W1115-LAB.GPJ GRI-LAB.GDT 8/27/13



COBBLES	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

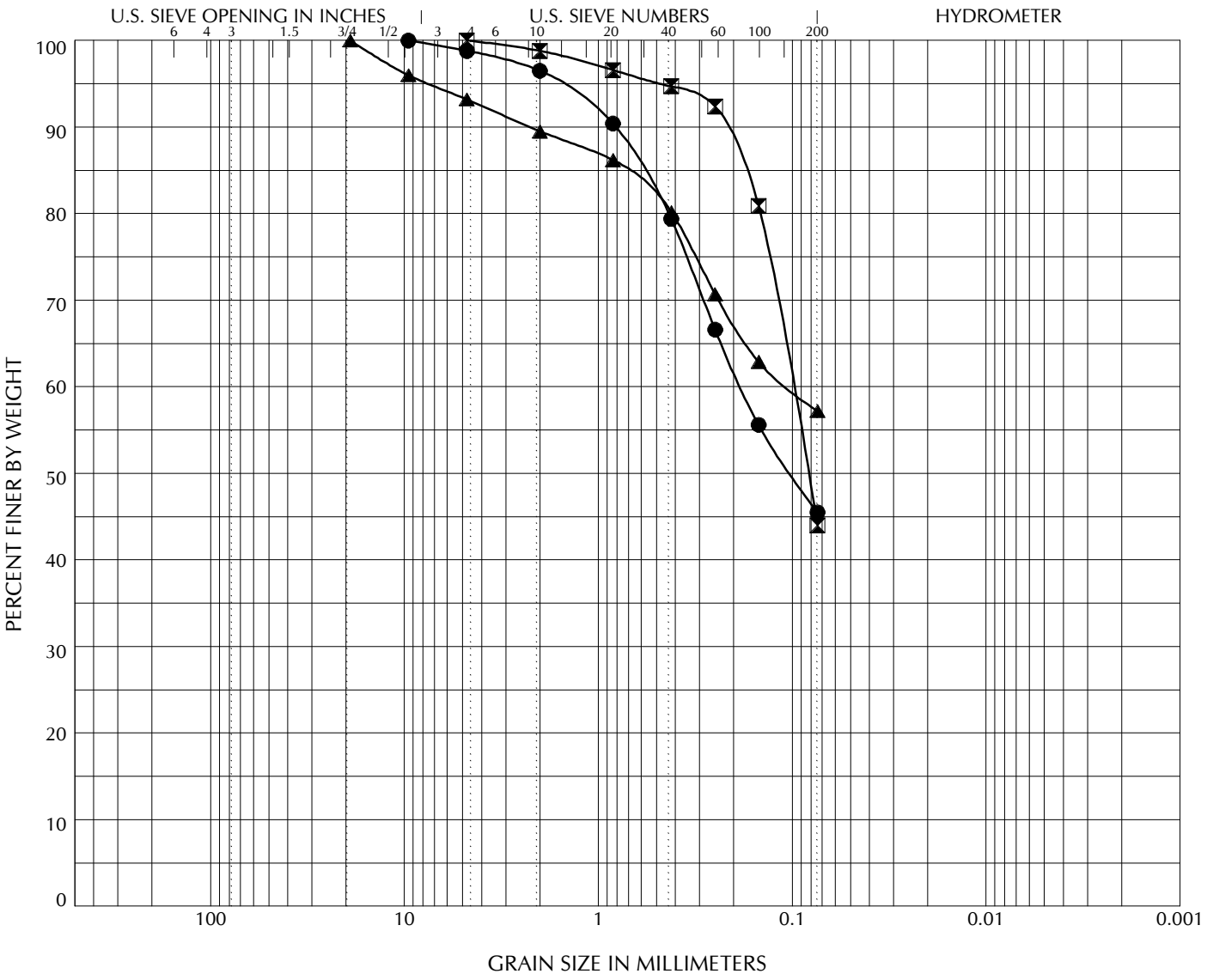
	Location	Sample	Depth, ft	Classification	Gravel, %	Sand, %	Fines, %
●	B-1	S-3	7.5	FILL: SAND; some silt, clay, and gravel	11.7	66.8	21.4
⧓	B-1	S-4	10.5	FILL: Silty SAND; some gravel	17.6	47.7	34.7
▲	B-1	S-5	11.5	Silty SAND; trace gravel	2.0	60.8	37.2

GRAIN SIZE GRI-THREE PER PAGE W1115-LAB.GPJ GRI-LAB.GDT 8/20/13

GRI

GRAIN SIZE DISTRIBUTION

AUG. 2013 PROJECT NO. W1115 FIG. 5A



COBBLES	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

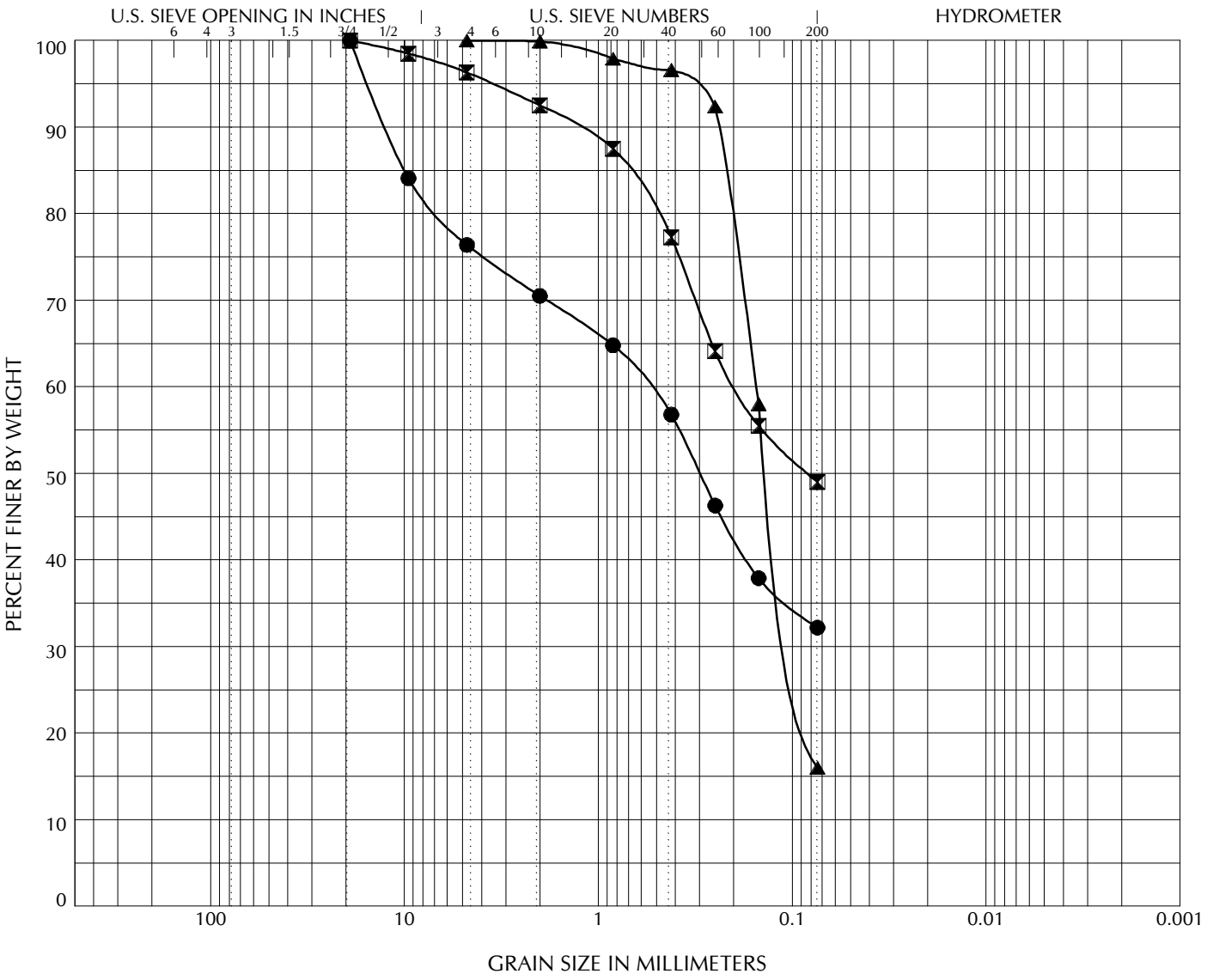
	Location	Sample	Depth, ft	Classification	Gravel, %	Sand, %	Fines, %
●	B-1	S-14	44.5	Silty SAND; scattered gravel	1.2	53.1	45.7
⧓	B-1	S-20	79.5	Silty SAND; trace clay	0.0	55.3	44.7
▲	B-3	S-2	5.0	FILL: Sandy SILT; trace gravel and clay	6.8	35.9	57.3

GRAIN SIZE GRI-THREE PER PAGE W1115-LAB.GPJ GRI-LAB.GDT 8/20/13

GRI

GRAIN SIZE DISTRIBUTION

AUG. 2013 PROJECT NO. W1115 FIG. 6A



COBBLES	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

	Location	Sample	Depth, ft	Classification	Gravel, %	Sand, %	Fines, %
●	B-3	S-3	7.5	FILL: Silty SAND; some gravel, trace clay	23.6	44.1	32.3
⧓	B-3	S-4	10.0	FILL: Sandy SILT; trace gravel and clay	3.7	47.2	49.1
▲	B-3	S-15	50.0	SAND; some silt and clay	0.0	83.2	16.8

GRI

GRAIN SIZE DISTRIBUTION

AUG. 2013 PROJECT NO. W1115 FIG. 7A

Appendix B

Cornet Bay Marina Mitigation Plan

CORNET BAY MARINA

CORNET BAY MARINA MITIGATION PLAN
MODEL TOXIC CONTROL ACT (MTCA) CLEANUP

Grette Associates LLC
ENVIRONMENTAL CONSULTANTS

CORNET BAY MARINA

CORNET BAY MARINA MITIGATION PLAN
MODEL TOXIC CONTROL ACT (MTCA) CLEANUP

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JULY 1, 2013

CHAD WALLIN
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ENVIRONMENTAL CONSULTANTS

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1 INTRODUCTION

Grette Associates, LLC was under contract with Kennedy/Jenks Consultants, Inc. to prepare a wetland delineation and analysis report for the Cornet Bay Marina Model Toxic Control Act (MTCA) cleanup. The Cornet Bay Marina is located at 200 Cornet Bay Drive (Island County Parcels R13436-488-2260, R13436-506-2420, and R13436-517-2500) and is located in Section 36, Township 34 North, Range 1 East, W.M. in Oak Harbor, Washington (Figure 1).

Figure 1. Site Vicinity Map

Grette Associates, LLC prepared a Wetland Delineation and Analysis Report for the Cornet Bay Marina MTCA Cleanup (Grette Associates 2013). For a complete description of the wetlands discussed herein, please refer to this report.

This Compensatory Mitigation Plan (Plan) has been prepared in compliance with the requirements of the Island County Code (ICC) Chapter 17.02A.070 – Critical Area Mitigation, the Washington State Department of Ecology's requirements under Chapter 90.48 RCW and Section 401 of the Federal Clean Water Act (CWA), and the U.S. Army

Corps of Engineers (Corps) requirements under Section 404 of the CWA. This Plan was also prepared using the guidance from *Wetland Mitigation in Washington State* (Ecology, Corps, and EPA 2006).

2 PROJECT DESCRIPTION

2.1 Current Use

The Cornet Bay Marina provides moorage and refueling for private and small commercial vessels. In addition, the marina property consists of a gravel and paved parking lot and small general store for marina users. The property to the northeast of the marina is Deception Pass State Park, owned and managed by Washington State.

2.2 Existing Structures

The existing timber bulkhead at the Cornet Bay Marina was constructed with creosote timber pile in 1960. The current condition of the bulkhead is showing signs of decay. Existing structures waterward of the bulkhead consists of two fixed piers that provide access to dock floats.

In addition, there are several above-ground structures and underground structures associated with the Cornet Bay Marina that are landward of the existing bulkhead. The existing above-ground structures consist of a main building functioning as a storefront and reception area and a small storage shed to the west. The underground structures include a concrete vault that contains two fuel tanks.

2.3 Proposed Actions

In 1989, underground fuel tanks in the marina parking lot leaked an unknown quantity of gas and/or diesel products. Because the tanks were isolated from Cornet Bay by a timber bulkhead, the leak was not identified until a sheen was observed on the water. After the leak was discovered, the underground tanks and pipes were replaced with a concrete vault containing a two compartment, 12,000 gallon tank with connecting lines to the marina's fuel dock; however, the contaminated area was not remediated.

In 1992, the Washington State Department of Ecology (Ecology) entered into a Consent Decree with the property owner for MTCA cleanup of the property, as "the actions to be taken pursuant to [the] Decree are necessary to protect the public health, welfare, and the environment." From 1995 through 2011, Ecology performed site investigations to characterize the distribution of soil and groundwater contamination on the property. Proposed remediation activities will remove hydrocarbon-contained soils and groundwater.

Cleanup activities onsite will involve removal of all petroleum affected soils associated with the release. In addition, the shoreward portions of the two timber docks will be demolished to make room for the installation of a new sheet pile bulkhead. The timber dock portions shoreward of the first pile bent will be removed temporarily during construction. Then a new 330 linear foot steel sheet "Z pile" bulkhead will be installed approximately 3 horizontal feet waterward and as close as possible to the existing timber bulkhead. The sheet pile bulkhead will extend 35 to 50 feet below grade. Installation of

the sheet pile will occur using a land-based crane with vibratory hammer attachment. The existing timber bulkhead will be cut off at the mud line or deeper, dependent upon the depth of planned remediation efforts. Timbers extending below the cutoff depth will remain in place. A temporary floating dock will be placed between the existing docks to allow access to the boats during construction.

Once the new bulkhead has been installed and the dock–to-shore access ways replaced in-kind, remediation of the contaminated soils will commence. This portion of the project will involve excavation and disposal of contaminated material, hauling of contaminated material to an approved upland site, import of clean material, back filling, and compacting of the excavation site. During all remediation activities, a silt boom with an oil boom inside its perimeter will be in place waterward of the bulkhead.

Construction dewatering may be necessary during deeper excavations to facilitate excavations and reduce the water content of excavated soils. Construction water or ground water will be collected and discharged to a series of holding tanks for solids settling, filtration, and treatment. Following treatment, water will be discharged directly into Cornet Bay (pending permit requirements). Discharged water will be monitored to assure that it meets water quality standards established by Ecology for the site.

During the excavation of the contaminated material, the existing marina building and ancillary facilities will be moved off their original foundations and placed in an approved area onsite. Once the buildings have been relocated, the old foundation of the building, septic tank, and utilities will be demolished as required for cleanup. Water and electricity will be temporarily re-routed. The fuel line will be temporarily shut down during construction. After remediation is complete, the marina building will be moved back to a new foundation placed on its original location. At this time utilities will be restored, a new guardrail erected, a 6 foot wide concrete cap will be constructed along the bulkhead for safety and stability, and all marina infrastructures will be replaced as appropriate.

2.4 Regulatory Summary

The Critical Area features described in this report and in the Wetland Delineation and Analysis Report (Grette Associates 2013) are regulated by four agencies: Island County, the Washington State Department of Ecology (Ecology), the U.S. Army Corps of Engineers – Seattle District (Corps), and the Washington State Department Fish and Wildlife (WDFW).

3 IMPACT ANALYSIS

The proposed cleanup project will result in unavoidable impacts to critical areas at the Cornet Bay Marina property. These impacts are described in detail below. The impacts addressed in this Plan include those impacts to the aquatic area below the Ordinary High Water Mark (OHWM) and the estuarine intertidal wetlands onsite. Affected Critical Areas by type are summarized below in Table 1.

Table 1. Proposed Critical Area Impact Summary by Type.

Impact Area	Square Feet	Duration
Aquatic	990	Permanent
Wetland Buffer	1750	6-9 months
Total	2740	

3.1 Aquatic Impacts

As discussed above in Section 2.3, the proposed cleanup will extend the new steel sheet pile wall approximately 3 horizontal feet waterward of the existing timber bulkhead. The total length of the sheet pile wall is 330 linear feet and will permanently remove approximately 990 square feet of aquatic habitat.

Pursuant to the Magnuson-Stevenson Fishery Conservation Management Act (MSFCMA) and the 1996 Sustainable Fisheries Act, an evaluation of impacts of the Cornet Bay Marina MTCA cleanup project on Essential Fish Habitat (EFH) is necessary. EFH is defined by MSFCMA as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." (50 CFR 600.905-930). An Essential Fish Habitat Assessment (Grette Associates 2013b) was completed for the Cornet Bay Marina MTCA cleanup and is attached in Appendix B.

3.2 Wetland Buffer Impacts

Activities associated with the cleanup project will occur in a wetland buffer; however, the existing wetland buffer does not currently provide quality buffer function due to the land use and development of the area. Activities proposed within the wetland buffer are temporary impacts associated with the excavation of contaminated soils on site and will occur over a 3-6 month duration.

3.3 Affected Functions and Values

3.3.1 Aquatic Functions and Values

The proposed actions to occur during the project will temporarily alter or remove aquatic area. The function most affected by the proposed project is Essential Fish Habitat (EFH). The Pacific Fisheries Management Council (PEMC) has designated EFH for the Pacific salmon fishery, federally managed ground fishes, and coastal pelagic fishes (NOAA 1999, PFMC 1999). The EFH for these species extend from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the Exclusive Economic Zone (EEZ) off the Washington coast (PFMC 1999). The existing nearshore intertidal habitat to be removed or temporarily altered would occur in an already modified shoreline area with low substrate complexity and habitat value. Based on the EFH Assessment (Grette Associates 2013b), the proposed project will not adversely affect EFH for Pacific salmon, ground fish, or coastal pelagic fishes.

3.3.2 Wetland Buffer Functions and Values

As discussed above in Section 3.2, the wetland buffer impacts proposed are temporary and will not result in a net loss of wetland buffer area. The existing wetland buffer does

not provide much, if any buffer function since vegetation is limited within the buffer and the existing land development.

4 MITIGATION APPROACH

The proposed Cornet Bay Marina cleanup project was designed and configured to avoid and then minimize impacts to the critical areas within the project area. Unavoidable impacts to aquatic habitat will be mitigated through the creation of aquatic habitat from uplands. These actions will be accompanied by the enhancement of wetland and wetland buffer to protect the functions of the mitigation of aquatic habitat and associated wetland.

4.1 Mitigation Sequencing

As required by ICC 17.02A.70, this section describes the efforts to apply mitigation sequencing to the proposed project. Mitigation sequencing is a set of steps designed to prevent unavoidable impacts to the environment, and then to rectify those impacts that cannot be avoided. The steps considered during the planning of this project are discussed below.

1. *Avoidance*
   The Washington State Department of Ecology (Ecology) entered into a Consent Decree with the property owner for MTCA cleanup of the property, as "the actions to be taken pursuant to [the] Decree are necessary to protect the public health, welfare, and the environment;" therefore, the environmental impacts associated with the cleanup are unavoidable.

2. *Reduction*
   In order to completely remove the contaminated soils and materials at the Cornet Bay Marina, the reduction of the project area to avoid environmental impacts is not feasible. The contamination onsite extends to the existing creosote-treated timber pile bulkhead, which is also proposed to be removed; thus a mechanism was needed to contain the contaminants during construction and replace the existing bulkhead. The current design extends the new bulkhead approximately 3 feet waterward of the existing bulkhead, which is the minimum requirements needed to successfully remove the contamination.

3. *Restoration*
   Due to the requirements needed to successfully remove all contaminants within the project area, restoration of the impacted area is not feasible. The construction process will require extending the proposed bulkhead approximately 3 feet waterward, which will permanently remove 990 square feet of aquatic area.

4. *Compensation*
   The functions of the affected aquatic area will be replaced through creation of an aquatic area and enhancing existing wetland. In addition, the associated wetland buffer will be enhanced to protect the functions of the mitigation of aquatic habitat and associated wetland. This site is located onsite between the southwest corner of the existing parking lot and the existing infiltration basin.

4.2 Goals and Objectives

The overall goal of the Mitigation Plan is to compensate for lost aquatic area resulting from project construction. More specific mitigation goals include:

- Provide equivalent aquatic area;
- Provide structurally diverse, native vegetation;
- Provide enhanced wildlife habitat functions;
- Provide enhanced upland vegetation diversity.

Specific Functional objectives of the Plan include:

1. Create 1,300 square feet (0.03 acres) of intertidal aquatic habitat;
2. Enhance 1,720 square feet (0.04 acres) of wetland vegetation;
3. Enhance 1,750 square feet (0.04 acres) of upland vegetation.

4.3 Mitigation Site Selection

Site selection for the mitigation site to be used was conducted by looking at adjacent areas owned by Cornet Bay Marina that would best replace the functions lost due to the proposed project. The chosen location within the site offers the potential to replace the aquatic acreage that will be lost to the project. In addition the site will likely offer the potential to increase the functional value of the created habitat beyond what is present in the impact area.

4.3.1 Functional Potential

The mitigation area is adjacent to the infiltration basin, which is inundated daily by high tides within Cornet Bay, and a saltwater tidal fringe wetland (Wetland W). The vegetation within the lower elevations of the infiltration basin is dominated by pickleweed (*Salicornia virgincia*). Currently, the infiltration basin likely provides foraging and refuge habitat for juvenile salmonids that enter the wetland during high tides. The increased function of the area will offset the functions and area affected by the proposed project.

4.4 Background Information

4.4.1 Wetland W

Wetland W, the wetland to be enhanced, is an Estuarine Intertidal Regularly Flooded Emergent wetland and is hydrogeomorphically classified as a saltwater tidal fringe wetland. The wetland is located along the infiltration basin and extends southwest outside of the project area. The wetland consists of emergent species that are dominated by pickleweed, Pacific silverweed (*Potentilla anserine*), and Baltic rush (*Juncus balticus*). The pickleweed is limited to the lower elevations of the wetland where daily inundation of saltwater occurs. For additional information on this wetland refer to the Cornet Bay Wetland Delineation and Analysis Report for the Cornet Bay Marina Cleanup (Grette Associates 2013) in Appendix A.

5 COMPENSATORY MITIGATION PLAN

Compensatory mitigation will occur on the Cornet Bay Marina property (Figure 2). Actions proposed at the site include creating 1,300 square feet of aquatic area, 1,720 square feet of wetland vegetation enhancement, and 1,750 square feet of wetland buffer enhancement.

Figure 2. Proposed Mitigation Area.

The proposed mitigation ratios for the Cornet Bay MTCA cleanup were determined based on the existing aquatic habitat functions, the functional lift that is likely at the mitigation site, and conversations with the Department of Ecology's northwest representative. The impact area, approximately 990 square feet in size, consists of an area that is approximately 3 feet waterward of the existing wooden bulkhead. This area is un-vegetated, and the substrate consists of silty sand. The proposed mitigation ratio for the aquatic area lost due to the cleanup project is 1.44:1 (area of mitigation : area of impact).

5.1 Target Functions

5.1.1 Aquatic Functions

The mitigation aquatic area created will possess a greater total functional value than that of the impact area. The geomorphic location of the proposed aquatic area will be in a low wave energy environment compared to the existing impact area. Low energy environments provide greater opportunity for aquatic vegetation to establish within the created area. Based on the existing vegetation along the shoreline, the aquatic area will likely be naturally vegetated by pickleweed, which will provide foraging and refuge habitat for juvenile salmon during high tides.

5.1.2 Wetland Functions

The targeted functional lift proposed in Wetland W will provide greater vegetation complexity to increase habitat value to the wetland. Vegetation within the wetland is dominated by emergent species consisting of Baltic rush, Pacific silverweed, and pickleweed. Establishing a native shrub community within the wetland will outperform existing habitat functions by adding vegetation strata diversity and shading to the wetland and aquatic area. These enhancements will provide greater foraging and refuge opportunities to marine and wildlife.

The enhancement of the wetland buffer will possess a greater functional value than what currently exists in the buffer area. Currently the wetland buffer provides very little protection to the wetland due to the land uses and lack of vegetation complexity in the area. The mitigation wetland buffer area will establish greater vegetation complexity by establishing a native shrub community to the buffer area. The shrub community will provide greater buffer function to Wetland W by providing additional shelter protection to the wetland and habitat value.

5.2 Mitigation Design

The intent of the compensatory mitigation actions at the Cornet Bay Marina is to offset the permanent loss of function of aquatic area within the site. Mitigation actions include removing non-native vegetation along the southwest portion of upland area adjacent to the northeast portion of Wetland W, excavation of the shoreline, and enhancing the existing wetland and wetland buffer areas with native vegetation.

5.2.1 Grading Plan

Initially, the extent of the proposed grading will be clearly marked, and silt fencing will be installed along the outer grading extents. All the vegetation within the areas proposed for excavation and grading will be mechanically removed and disposed of at an approved off-site location.

During excavation and grading, Best Management Practices (BMPs) will be employed to minimize erosion of disturbed surface soils and to prevent sediment-laden runoff from entering Cornet Bay. BMPs to be employed during construction may include (but are not limited to) silt fencing and/or straw bales around the perimeter of the clearing and grading areas, mulching area immediately after completion of grading, and installation of plant material as soon as practical after grading.

Once the vegetation is removed, grading (not including the upland planting areas) will be conducted using bull dozers, excavators, dump trucks and other like equipment as needed to complete the work. The existing shoreline areas will be left intact to prevent the flooding of the excavation areas. Once work within the excavated areas has been completed, the shoreline areas to be graded will be graded down to the design elevation.

The interior of the mitigation aquatic area will be graded down to approximately 7-8 feet (NAVD 88). This elevation will be refined upon topographic surveying and an analysis of the hydrologic conditions along the shoreline. The new mitigation area will be graded such that the new shoreline edges will be wavy and irregular.

Upon completion of excavation, large woody debris (LWD) structures will be installed within the aquatic area. A total of three (3) LWD structures will be installed once the final grade is achieved. A typical LWD structure will include the entire tree, including root wad and branches. LWD can be salvaged onsite only if the LWD is located along the shoreline to be excavated.

It is anticipated that the cleanup project will not need to import amended soils within the aquatic area. If necessary, the topsoil will be amended into surface soils after installation of woody debris but before planting. After grading is complete, the project biologist will determine if topsoil amendments area necessary for volunteer recruitment of intertidal vegetation and survival of the planted and seeded vegetation.

5.2.2 Construction Inspections

Construction monitoring will involve close coordination between the construction contractor, project engineer, landscaping personnel and agency regulators in order to ensure that the proposed mitigation actions are installed in an appropriate manner, as outlined in the approved plan. A pre-construction meeting involving all of the above parties will be held to discuss the mitigation design. The purpose of the meeting will be to discuss the primary intent of the mitigation plan, the requirements in all of the applicable permits, establish communication lines between the involved parties, and address any questions or problems.

During construction, the project engineer will monitor site construction to ensure the approved plan is implemented. This includes proper grading of the site, installation of the various habitat features, appropriate use and maintenance of required BMPs, and installation of the plant materials according to the approved plans. Final acceptance of site grading and hardscape (landscape) work will be at the biologist's discretion.

5.2.3 Planting Plan

Planting installation will be performed in accordance with the specifications outlined in this plan. Any alterations to the planting plan due to site conditions will require approval from the project biologist and appropriate regulatory agencies prior to installation. The Cornet Bay Marina cleanup is only proposing planting within the Wetland W and Wetland W buffer area. It is anticipated that the mitigation aquatic area will naturally

establish a community of pickle weed that is representative to the undisturbed shoreline adjacent to the created aquatic area.

The intent of the wetland enhancement and buffer enhancement planting plan is to create a shrub community intermixed within the existing vegetation community. Shrub species will be planted in clusters among the emergent vegetation at 4 to 6 foot centers and will include Hooker's willow (*Salix hookeriana*) and Pacific wax-myrtle (*Myrica californica*) within the wetland and Nootka rose (*Rosa nutkana*), Scouler's willow (*Salix scouleriana*), and oceanspray (*Holodiscus discolor*) within the wetland buffer area.

5.2.4 Planting Schedule

The proposed planting schedule for the Cornet Bay Marina mitigation areas is presented below in Table 2. The specific quantities of each species will be calculated during final design of the mitigation action. In order to reduce mortality, a late fall planting installation (October – November) schedule is preferred. Plants should not be installed during or immediately before freezing weather.

Table 2. Proposed Planting Schedule

Common Name	*Species Name*	Quantity	Size	Spacing (O.C)
Wetland Enhancement				
Hooker's willow	*Salix hookeriana*	40	2 gallon	4'
Pacific wax-myrtle	*Myrica californica*	25	2 gallon	6'
Wetland Buffer Enhancement				
Nootka rose	*Rosa nutkana*	16	2 gallon	6'
Scouler's willow	*Salix scouleriana*	25	2 gallon	4'
Oceanspray	*Holodiscus discolor*	16	2 gallon	6'

Plant installation will be performed in accordance with the specifications outlined in this Plan. Any alterations to the planting plan due to site conditions will require prior approval from the project biologist and/or land architect.

All plant materials to be used on the site will be native to Western Washington and will consist of nursery grown stock from a reputable, local dealer. Only native species specified in the approved plant schedule are to be used; no hybrids will be allowed. Plant substitutions must be approved by the project biologist if specified species are not commercially available.

Plant material provided will be typical of their species or variety; they will exhibit normal, densely-developed branches and vigorous, fibrous root systems. Plants will be sound, healthy, vigorous plants free from defects and all forms of infestation.

Willow cuttings must be alive with any side branches cleanly removed and bark intact. The butt ends should be cleanly cut at an angle for easy insertion into the soil. The top should be cut square or blunt. The cuttings should be 1/2 inch to 1-1/2 inch in diameter and 24 inches to 42 inches long. Cuttings must be fresh and must be kept moist after they have been cut to the appropriate lengths. They must be prepared and installed within a 48-hour period.

5.2.5 Preparation and Installation of Planting Materials

The landscape contractor shall verify the location of all elements of the landscape plan prior to installation. The project biologist may adjust the locations of landscape elements during the installation period as necessary.

Circular plant pits with vertical sides will be excavated for all container stock. The pits should be at least twice the diameter of the root system, and the depth of the pit should accommodate the entire root system. The bottom of each pit will be scarified to a depth of 4 inches, and the pit should be thoroughly wetted prior to plant insertion to prevent capillary stress. The planting hole shall be amended with a mixture of topsoil and organic material if necessary to provide appropriate rooting media.

Broken roots should be pruned with a sharp instrument and rootballs should be thoroughly soaked prior to installation. Set plant material upright in the planting pit to proper grade and alignment. Water plants thoroughly midway through backfilling and add Agriform tablets. Water pits again upon completion of backfilling. No filling should occur around stems. Do not use frozen or muddy mixtures for backfilling. Form a ring of soil around the edge of each planting pit to retain water, and install a 2-1/2 inch layer of mulch around the base of each container plant.

6 MONITORING PLAN

6.1 Duration and Frequency

The following sections describe the monitoring program for the installation of the Cornet Bay Marina mitigation project. As described below, the monitoring plan extends up to a total of 10 years, with monitoring events occurring in years 1-3, 5, 7, and 10, post – construction. For clarification, the year within which construction of the site is complete (including plant installation) will be considered to be Monitoring Year 0. However, the full monitoring plan may not need to be implemented: if the Performance Standards are met at the end of Year 3, the Corps will be consulted regarding closing out the site monitoring as no additional measures of site success would need to be met. The site will remain protected as a compensatory mitigation site.

6.1.1 Post-Installation Inspection and Monitoring

Compliance monitoring will consist of evaluating the plantings immediately after construction to confirm the plan was followed and plants were installed appropriately. A walk-through survey will be conducted with regulatory staff to verify that installation conforms to the approved plan. Fixed points will be established within the mitigation site, with each point to be used as a transect end point for physical monitoring of site elevations, vegetation monitoring, and photo-point documentation during long-term monitoring.

Compliance monitoring will be conducted by a qualified biologist after completion of the walk – through survey using evaluation standards and criteria discussed below. Coverage and abundance of the vegetation within the wetland and wetland buffer areas will be

recorded along permanent transects, and will constitute baseline conditions for comparison during long – term monitoring.

Following completion of the compliance inspection and baseline monitoring, a monitoring report will be prepared by a qualified biologist presenting the baseline data and verifying that all design features have been correctly implemented. Any changes to the planting plan will also be discussed in the compliance memorandum. The memorandum will be submitted to the appropriate regulatory staff within 60 days following completion of all compensatory mitigation actions.

6.1.2 Long-Term Monitoring

Long-term monitoring will be conducted over a ten (10) year period with observations conducted during years 1, 2, 3, 5, 7 and 10 (Table 3). The purpose of the long-term monitoring program will be to evaluate the establishment and maintenance of the plant communities within the wetland and wetland buffer areas, and to determine if the goals and objectives of the mitigation plan have been met. The transects established during the post-construction inspections will be utilized for monitoring development of the mitigation site over the course of the long-term monitoring period. Photographs will be taken at each transect end-point to document the development of the vegetation communities at the site.

6.2 Performance Standards

Performance standards provide a clear means of evaluating the success of a mitigation action. The following performance standards have been developed to reflect the goals and functional objectives detailed in Section 4.1 of this document. Guidance from *Wetland Mitigation in Washington State – Part 2: Developing Mitigation Plans (Version 1)* was used to develop many of the performance standards used in this document.

Table 3. Cornet Bay Marina Mitigation Area Performance Standards

Mitigation Goal	Functional Objective	Performance Standard	Parameter Measured	Year Inspected[1]	Sampling Method
Provide equivalent aquatic area	1. Create 1,300 square feet (0.03 acres) of intertidal aquatic habitat	1a. A minimum of 1,300 square feet of aquatic area will be created by the end of the Cornet Bay cleanup	Aquatic Habitat Acreage	As-Built	Traditional land survey
Provide enhanced wetland vegetation complexity and wildlife habitat	2. Enhance 1,700 square feet (0.04 acres) of wetland vegetation	2a. A minimum of two (2) species of native shrubs will be present by the end of the monitoring period	Species composition	0, 1, 2, 3, 5, 7, 10	Visual walk through
		2b. A minimum of 80% survival of planted shrubs species each monitoring year[2]	Species health	0, 1, 2, 3, 5, 7, 10	Visual walk through
		2c. . Minimum of 10% aerial coverage of native shrub species[3] in planted areas after year 1, 20% after year 2 and 30% after year 3 through the end of the monitoring period.	Aerial coverage and Species composition	0, 1, 2, 3, 5, 7, 10	Line intercept
Provide enhanced upland buffer	Enhance 1,750 square feet (0.04 acres) of upland vegetation	3a. A minimum of two (2) species of native shrubs will be present by the end of the monitoring period	Species composition	0, 1, 2, 3, 5, 7, 10	Visual walk through

Mitigation Goal	Functional Objective	Performance Standard	Parameter Measured	Year Inspected[1]	Sampling Method
		3b. A minimum of 80% survival of planted shrubs species each monitoring year[2]	Species health	0, 1, 2, 3, 5, 7, 10	Visual walk through
		2c. . Minimum of 10% aerial coverage of native shrub species[3] in planted areas planted after year 1, 20% after year 2 and 30% after year 3 through the end of the monitoring period.	Aerial coverage and Species composition	0, 1, 2, 3, 5, 7, 10	Line intercept

[1] Vegetative monitoring conducted during Year 0 is being done to provide a baseline for comparison during later monitoring years, and will not be compared to performance standards.
[2] Monitoring Year 0 will have 100% survival of planted stock.
[3] Native volunteer species will be an acceptable component of this performance standard.

6.3 Monitoring Methods

6.3.1 Vegetation Monitoring

Vegetation surveys will be conducted in accordance with the monitoring schedule to compare results against the Performance Standards described above. Inspection of the planted material to determine health and vigor of the installation will occur during each monitoring visit.

Vegetation monitoring will include collection of quantitative data during each monitoring visit. Shrubs planted within the mitigation will be assessed using the line – intercept method. The line – intercept method is described in the *Guide for Wetland Mitigation Project Monitoring* (Horner and Raedeke 1989). The line – intercept method is designed for the efficient and consistent collection of information, so that the data can be compared among monitoring years to identify changes through time.

Permanent transects will be established within the mitigation site according to the methods in Horner and Raedeke (1989) to provide consistency of data between monitoring years. These transects will be established during the as-built survey, and will include transects within the graded mitigation area as well as the enhanced riparian/upland zone. The transect end-points, which also will serve as the permanent photo-points, will be permanently marked with capped rebar and surveyed during the as-built survey.

All shrub species planted in Year 0 will be counted each monitoring year to assess mortality. Survival monitoring will include walking the entire site and documenting the health of each species planted in Year 0.

6.3.2 Photographic Documentation

As described above, permanent photo-points will be established during the as-built survey in order to obtain representative photographs of the mitigation site. Photo-points will be established at the ends of each permanent monitoring transect to document wetland and buffer vegetation success and development over time. Photographs will be taken from the same locations (and facing the same direction) yearly to document the project's appearance and progress.

6.4 Monitoring Reports

As part of the monitoring program, regular reports will be prepared to describe the results of the mitigation site monitoring and comparisons to the performance standards.

6.4.1 As-Built Report

Within 60 days of completion of mitigation site construction, an as-built report will be prepared and submitted to the permitting agencies. This report will document the implementation of the mitigation actions and describe any deviations from the original Plan. The report will also describe any potential problems identified during installation and any recommended remedies to be proposed to the permitting agencies. The as-built report must also include a survey drawing prepared by a licensed land surveyor

documenting the physical conditions on the site after implementation. The survey must include all appropriate habitat features and 1-ft contour intervals. Photographs will be taken at the established photo-points to further document the baseline conditions within the mitigation site. The report will also contain the results of the baseline vegetation monitoring (Year 0).

6.4.2 Annual Monitoring Report

An annual monitoring report will be submitted by December 31 to the permitting agencies detailing the results of that year's monitoring activities. The report will document site conditions, provide a summary of the maintenance actions conducted on the site, and describe any deviations from the monitoring protocols prescribed in this plan. The report will also describe any potential problems observed and recommend changes to the maintenance or monitoring protocols.

6.4.3 Monitoring Schedule

Baseline monitoring will be conducted after completion of construction (Year 0). Long-term monitoring of the mitigation site will be conducted in years 1, 2, 3, 5, 7 and 10, post-construction. Unless otherwise noted in Table 3, monitoring activities are to be conducted in late summer (July through August). Monitoring reports will be submitted to the regulatory agency no later than December 31 in the year monitoring activities were conducted.

7 MAINTENANCE AND CONTINGENCY PLANS

The sections below describe the maintenance activities to be conducted within the mitigation areas, as well as the contingency planning process to be followed for the duration of the mitigation monitoring.

7.1 Maintenance Plan

Maintenance of the mitigation action area will be performed for the duration of the monitoring period. During each site visit, all litter including paper, plastic, bottles, construction debris, yard debris, etc., will be documented, as will all non-native, invasive and noxious[1] vegetation. Any litter or invasive vegetation that is observed during site visits will be removed for the duration of the 10 – year monitoring period. Work to be completed during the monitoring period in the planted mitigation areas includes replacement of dead or failed plant materials with plantings of the same species, size and location as original plantings. While the native species selected for mitigation are hardy and typically thrive in the on-site conditions, some individuals within the planted areas might perish due to dry conditions. Replacement plantings, if required, are to be installed during the dormant period.

7.2 Contingency Plan

The contingency plan provides a framework for taking action if the mitigation actions fail to meet the performance standards described above. The contingency actions will vary

[1] Class A, B and C-listed species in the most current Washington State Noxious Weed List (as issued by the Washington State Noxious Weed Control Board.

depending on whether physical or biological processes are responsible for non-attainment of performance standards, and the degree of shortfall. If the Project fails one or more performance standards, but the permitting agencies agree the shortfall is minor, then additional monitoring prior to undertaking more intense corrective actions may be proposed.

7.2.1 Contingency Actions

This contingency plan identifies a planning process for selecting appropriate actions to address failure of specific performance standards. In order to maintain the flexibility needed to respond effectively and appropriately to biological and/or physical conditions, this plan does not present a specific list of actions that will be taken to remedy all specific types of failures at the mitigation area.

Site-specific contingency options do exist for the mitigation area, and sample options are outlined below. The list of sample corrective actions is not exclusive, nor is it a commitment to undertake a specific action. It is expected that any shortfall in mitigation performance can be remedied within the confines of the mitigation area through adaptive management techniques.

Failure of biological components of the mitigation actions are more difficult to predict and specific responses are impossible to present in detail. However, the following general approaches are anticipated:

- If the vegetation planted in the mitigation areas fails to meet the performance standards, additional planting may occur.

- If a specific species that was originally planted continues to have a high mortality rate over time then an approved substitute may be planted.

7.2.2 Contingency Planning Procedures

The problem recognition process is an integral part of the monitoring program. As monitoring data are collected, they will be examined and interpreted relative to the performance standards. The purpose of the process is to determine if there is a problem and if so, the nature and extent of the problem. Good faith will be met and best efforts will be used to reach consensus regarding an appropriate response. In the event that consensus cannot be reached, the permitting agencies will determine if modified or continued monitoring is adequate.

Contingency Planning and Response Process

The purpose of the contingency planning process is to develop contingency actions that may be appropriate, depending on the results of the monitoring program and problem recognition step. If modified or continued monitoring is not an adequate response, a contingency proposal will be submitted for permitting agency review.

The contingency planning process could result in the implementation of an approved response action. Alternatively, it could result in agreement on an approach or set of criteria for taking further action, depending on the results of future monitoring. The

permitting agencies will make a final determination on an appropriate response, based on available information and scientifically and economically feasible recommendations. Resource agencies might be invited into contingency planning and response discussions. No contingency action will be undertaken until the permitting agencies give approval in writing. Potential responses include, but are not limited to, one or more of the following:

- Concluding that the situation does not require further action.
- Expanding or modifying the monitoring program.
- Developing more specific criteria to evaluate the data during future monitoring.
- Initiating a corrective action.

8 BIOLOGIST QUALIFICATIONS

8.1 Chad Wallin

Chad Wallin is a Biologist with extensive training in wetland science and ecology restoration. Chad also has professional experience in stream and fish restoration, marine monitoring, mitigation monitoring, and fish and wildlife assessments.

Chad has earned a Bachelor's of Arts degree in Environmental Studies from the University of Washington along with certificates in ecology restoration and wetland science.

For a list of representative projects, please contact him at Grette Associates.

8.2 Scott Maharry

Scott Maharry is a Biologist with over 13 years of professional experience and extensive training in wetland science as well as fisheries and wildlife ecology. Scott also has extensive experience in wetland and marine aquatic permitting, mitigation planning and implementation, and fish and wildlife assessments.

Scott earned a Bachelor's of Science degree in Biology from Central Washington University. In addition, he has attended numerous State and Federal wetland delineation protocol trainings and workshops throughout his career. He has also attended several wetland trainings offered through the Washington Department of Ecology's Coastal Training Program.

Scott is a certified wetlands delineator, and he is also a Pierce, Kitsap, and Thurston County Qualified Wetland Specialist. He holds similar qualifications from other jurisdictions as well.

For a list of representative projects, please contact him at Grette Associates.

9 REFERENCES

Washington State Department of Ecology, U.S. Army Corps of Engineers Seattle District, and U.S. Environmental Protection Agency Region 10. March 2006. Wetland Mitigation in Washington State – Part 2: Developing Mitigation Plans (Version 1). Washington State Department of Ecology Publication #06-06-011b. Olympia, WA.

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Pacific Fishery Management Council (PFMC). 1999. Apendix A. Indentification and Description of Essential Fish Habitat, Adverse Impacts, and Recommended Conservation Measures for Salmon. Pacific Fishery Management Council, Portland, Oregon.

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CORNET BAY MARINA MITIGATION PLAN
APPENDIX A: WETLAND DELINEATION AND ANALYSIS REPORT

KENNEDY/JENKS CONSULTANTS, INC.

CORNET BAY MARINA REMEDIAL ACTION
WETLAND DELINEATION AND ANALYSIS REPORT

Grette Associates LLC
ENVIRONMENTAL CONSULTANTS

KENNEDY/JENKS CONSULTANTS, INC.

CORNET BAY MARINA REMEDIAL ACTION WETLAND DELINEATION AND ANALYSIS REPORT

PREPARED FOR:

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DATE

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JULY 1, 2013
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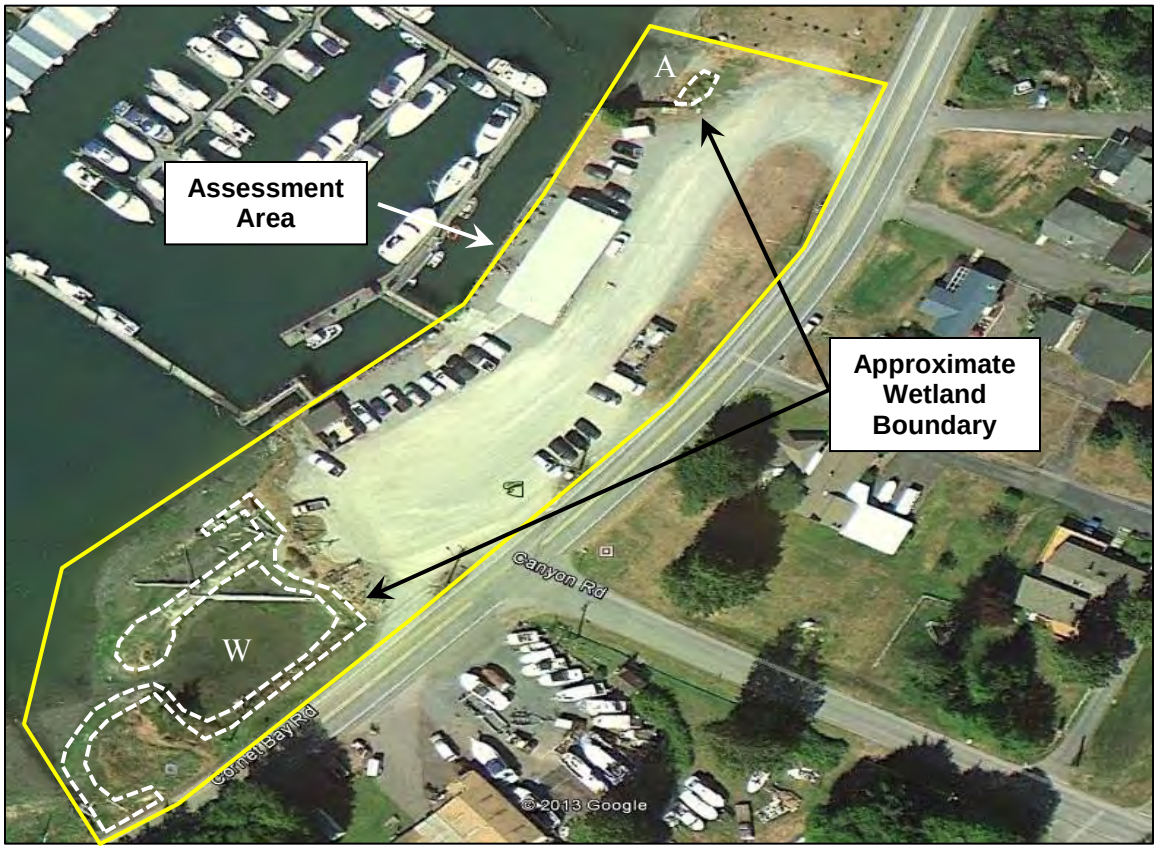
1 INTRODUCTION

Grette Associates, LLC is under contract with Kennedy/Jenks Consultants, Inc. to prepare a wetland delineation and analysis report for the Cornet Bay Marina Model Toxic Control Act (MTCA) cleanup. The Cornet Bay Marina is located at 200 Cornet Bay Drive (Island County Parcels R13436-488-2260, R13436-506-2420, and R13436-517-2500) and is located in Section 36, Township 34 North, Range 1 East, W.M. in Oak Harbor, Washington (Figure 1).

Figure 1. Site Vicinity Map

A Grette Associates wetland specialist visited Cornet Bay Marina (Project Site) on June 5, 2013. During the site visit, two wetlands were identified within the study area that contained indicators of all three wetland criteria. Both of the wetlands are within the tidally influenced portion of the shoreline. The portions of the wetlands within the study area were delineated. Field datasheets are attached for reference in Appendix A. Data plots and wetland boundary flags were recorded using a differential global positioning system (dGPS) and the wetland delineation map is presented in Appendix B.

Figure 2. Cornet Bay Marina study area and approximate wetland boundary



2 FEATURE SUMMARY

Grette Associates collected data and delineated two (2) separate wetlands at the Cornet Bay Marina site on June 5, 2013. Six data plots were sampled to determine the location of upland and wetland areas. Boundary flags and sample plot locations were marked with survey flagging or pin flags, except for areas regularly exposed to wave action, and recorded using a differential global positioning system (dGPS).

During the site assessment, two estuarine wetlands were identified. According to Island County's wetland inventory, the southwest portion of the study area is mapped as estuarine wetland (corresponding with a portion of Wetland W). Further, there is one additional wetland area mapped within 300 feet of the study area, which is located south of Wetland W and across Cornet Bay Rd (Island County 2013).

Wetland W is classified as an Estuarine Intertidal Emergent Regularly Flooded wetland by the U.S. Fish and Wildlife Service's (USFWS) National Wetland Inventory (NWI). Wetland A is not mapped by NWI or Island County. Island County does not use the Washington State Department of Ecology's (Ecology) *Washington State Wetland Rating System for Western WA - Revised* (Hruby 2006) to rate wetlands; therefore, Island County's *Wetland Classification System* was used (ICC 17.02A.090E). Based on this system, both estuarine wetlands are considered high priority wetlands and categorized as

C Wetlands. However, Island County does not regulate C wetlands that are less than 1,000 square feet in size unless the wetland meets specific criteria (ICC 17.02A.090A2). Therefore, Wetland A, approximately 170 square feet in size, is not regulated by Island County. Having a high intensity land use, Wetland W requires a 90 foot buffer width (ICC 17.02A.090F Table 1). In addition to Island County's categorization, the Washington Department of Fish and Wildlife considers Puget Sound nearshore as priority habitat due to the likely use of the habitat by listed salmonid species and other species of high importance.

A summary of the wetlands are provided below in Table 1. A delineation map is provided in Appendix B.

Table 1. Cornet Bay Marina wetland delineation summary

Feature	Size[1] (Approximate)	Cowardin Class	Hydrology Modifier	HGM Class	Wetland Category	Buffer Width
W	5,048 sq. ft.	EIEM	Regularly Flooded	Salt Water Tidal Fringe	C	90 ft.
A[2]	170 sq. ft.	EIEM	Regularly Flooded	Salt Water Tidal Fringe	C	N/A

[1] Size only includes acreage within the Assessment Area.

[2] Wetland A is not regulated by Island County based on its size (ICC 17.02A.090A2)

3 Existing Site Conditions

Wetland W is the larger of the two wetlands identified within the study area. Wetland W is approximately 5,048 square feet (0.12 ac) in size. The wetland is located along the shoreline of Cornet Bay within the southwest portion of the study area and is regularly flooded by the daily tide cycles (Figure 2). Wetland W is dominated by pickleweed (*Salicornia viginica*), Baltic rush (*Juncus balticus*), and Pacific silverweed (*Potentilla anserine*). Hydrologic support to the wetland is primarily provided by tide levels and high groundwater.

Wetland A is approximately 170 square feet in size and is located along the shoreline of Cornet Bay within the northern portion of the study area (Figure 2). The wetland is dominated by Baltic rush and Pacific silverweed. Hydrologic support to the wetland is primarily provided by tide levels. Although Wetland A is not regulated by Island County, Wetland A may be defined as "Waters of the United States" and/or "Waters of State" and may be regulated at the federal and state levels.

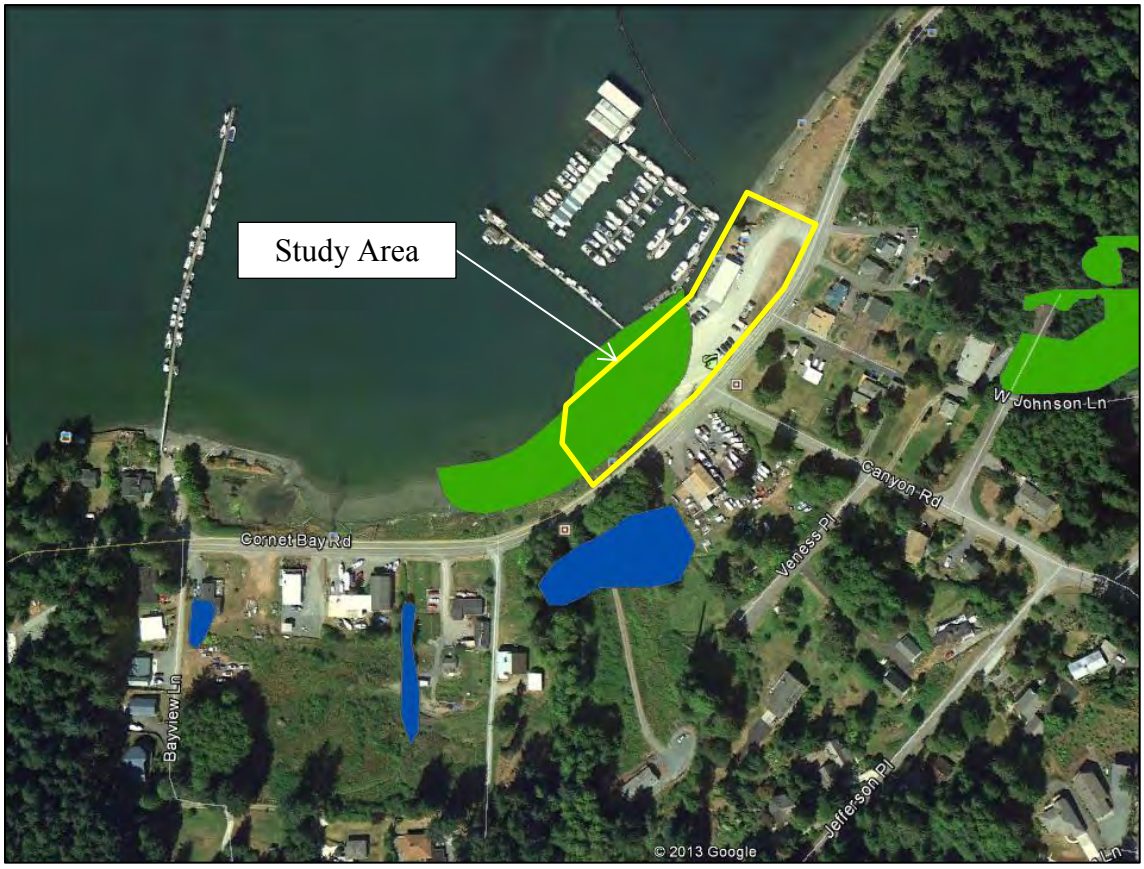
3.1 Local Critical Areas Inventory

A review of Island County's Wetland inventory data (Island County 2013) revealed one wetland within the assessment area. The mapped area incorporates all of Wetland W and extends into the developed portions of Cornet Bay Marina (Figure 3).

One additional wetland feature is mapped within 300 feet of the study and is located immediately south of Wetland W and across Cornet Bay Road. This wetland is separated

from the project area by Cornet Bay Road, and the functions of this wetland and its buffer will not be affected by the project.

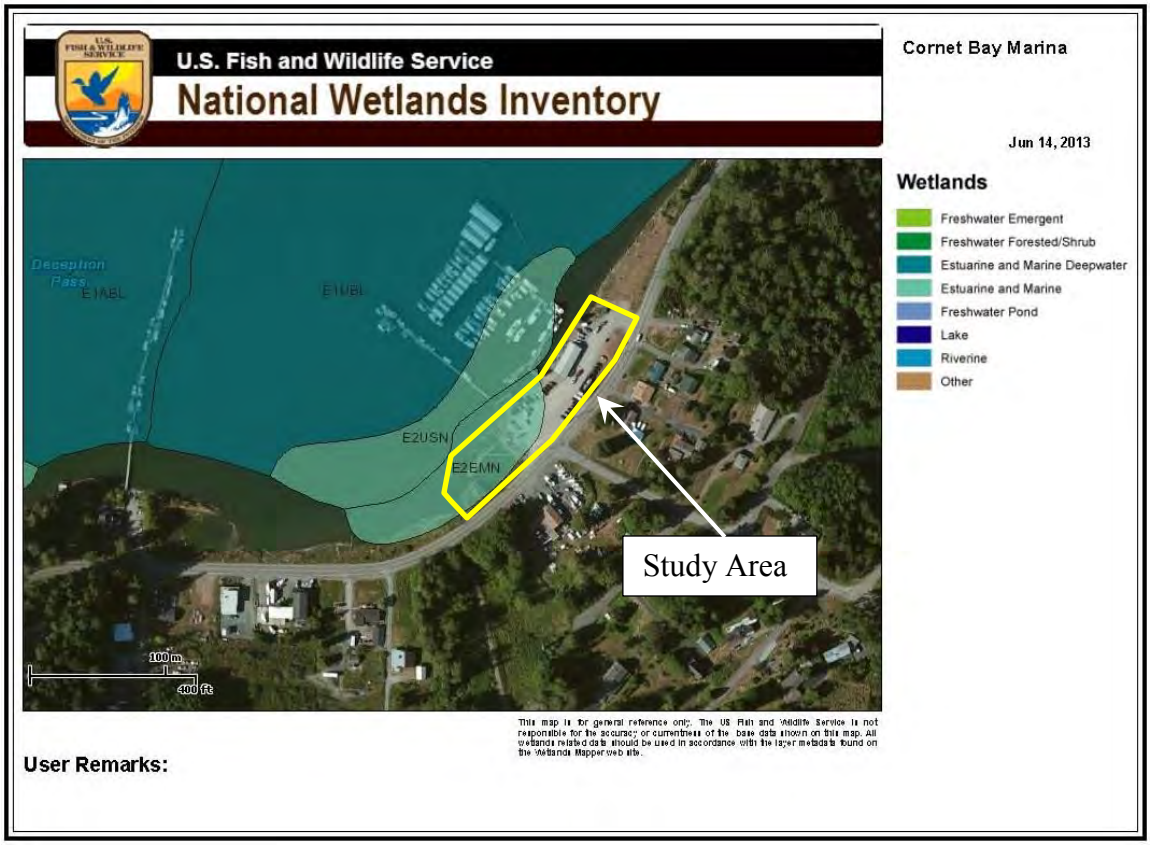
Figure 3. Island County Wetland Inventory - wetland map



3.2 National Wetlands Inventory

The U.S. Fish and Wildlife Service's National Wetlands Inventory (NWI) was queried to determine if previously-identified wetlands are present on or near the study area (USFWS 2013). According to the NWI Interactive Online Mapper, there are two wetlands mapped in or adjacent to the study area (Figure 4). These two features are mapped as Estuarine Intertidal wetlands. Based on conditions observed during the site visit, the mapped wetland waterward of the study area is not regularly exposed during low tides and no emergent or aquatic vegetation was observed.

Figure 4. National Wetland Inventory Map



3.3 Sensitive Wildlife and Plants

The Washington Department of Fish and Wildlife's (WDFW) Priority Habitats and Species (PHS) database on-line mapper was queried to determine if state or federally listed fish or wildlife species occur on or near the study area (WDFW 2013). According to the PHS database, the study area is mapped as providing habitat for Pinto abalone (*Haliotis kamtschatkana*).

The Washington Department of Natural Resources' (WDNR) Natural Heritage Information System was queried to determine if the subject properties occur in a location reported to contain high quality natural heritage wetland occurrences or occurrences of natural heritage features commonly associated with wetlands. According to WDNR data dated March 1, 2013, there are no records of rare plants or high quality native ecosystems occurring on or in the vicinity of the subject properties.

3.4 Soil Information

Based on the NRCS Web Soil Survey (NRCS 2013), the study area consists of Sholander, cool-Limepoint complex (1020) and Beaches – Endoaquents, tidal – Xerorthents association (1025) (Figure 5). Sholander soils are typically a gravelly sandy loam that is somewhat poorly drained located at elevations between 0 to 500 feet. Endoaquents soils typically consist of a stratified sand and gravel that is very poorly drained and located at

elevations between 0 to 20 feet. Both mapped soils are listed as partially hydric (NRCS 2013).

Figure 5. NRCS soil map

Table 2. NRCS hydric soil rating

Hydric Rating by Map Unit— Summary by Map Unit — Island County, Washington (WA029)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
1020	Sholander, cool-Limepoint complex, 0 to 8 percent slopes	Partially Hydric	1.9	82.8%
1025	Beaches-Endoaquents, tidal-Xerorthents association, 0 to 5 percent slopes	Partially Hydric	0.2	10.5%
Subtotals for Soil Survey Area			**2.2**	**93.3%**
Totals for Area of Interest			**2.3**	**100.0%**

3.5 Hydrology

Generally, the hydrologic support for the two wetlands is primarily provided by daily inundation of salt water and a high groundwater table. During rain events, Wetland W likely receives stormwater runoff from the adjacent parking area associated with the

Cornet Bay Marina and Cornet Bay Road. However, Wetland A likely does not receive this additional hydrologic support due to being located adjacent to the Cornet Bay Marina's existing bulkhead and the topography of the parking area. Further, there is a culvert beneath Cornet Bay Road that discharges surface water to Cornet Bay which likely provides some hydrology to Wetland W during low tides when the wetland is not inundated by saltwater.

4 METHODS

The study area was traversed and data was collected to confirm critical area/wetland boundaries. Wetland W and Wetland A were delineated according to the procedures described in the U.S. Army Corps of Engineers (Corps') *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0)* (2010) and Island County Code. (ICC 17.02A.090C). Paired data plots and soil test pits were excavated to evaluate wetland and upland conditions. Guidance from the Corps' *Regional Supplement* was used to evaluate the data at each data point.

The boundary of the wetlands were established based on changes in vegetation, field indicators of hydric soils, water levels at or above 12 inches from the soil surface, topographic changes, and best professional judgment. Data plots were established in and adjacent to the wetland. The location of the wetland boundaries were defined by placement of florescent orange pin flags. The location of each data plot was defined by the placement of orange pin flags. The wetland boundary flagging was labeled alpha-numerically (i.e. A-2), where the letter designates the wetland and the number designates the specific flag angle point. The wetland boundaries were recorded using a differential global positioning system (dGPS). No pin flags were placed along the waterward boundary of the wetlands due to the likelihood of them being removed by wave action.

Plants were determined to be more or less associated with wetlands based on their wetland indicator (FAC) status. The percent dominance for each plant strata was determined using the 50-20 Rule.

4.1 Hydrophytic Vegetation

The U.S. Fish and Wildlife Service (USFWS) and the NWI have established a rating system that has been applied to commonly occurring plant species on the basis of their frequency of occurrence in wetlands (Table 7). Species indicator status expresses the range in which plants may occur in wetlands and non-wetlands (uplands). Under this system, vegetation is considered hydrophytic when there is an indicator status of facultative (FAC), facultative wetland (FACW) or obligate wetland (OBL) (Table 3). The hydrophytic vegetation criterion for wetland determination is met when ***more than*** 50 percent of the dominant species in the plant community are FAC or wetter. The Corps' *National Wetland Plant List* (Lichvar 2012) was used to determine vegetation indicator status.

Table 3. Definitions for USFWS plant indicator status

Plant Indicator Status Category	Indicator Status Abbreviation	Definition (Estimated Probability of Occurrence)
Obligate Upland	UPL	Occur rarely (<1 percent) in wetlands, and almost always (>99 percent) in uplands
Facultative Upland	FACU	Occur sometimes (1 percent to <33 percent) in wetlands, but occur more often (>67 percent to 99 percent) in uplands
Facultative	FAC	Similar likelihood (33 percent to 67 percent) of occurring in both wetlands and uplands
Facultative Wetland	FACW	Occur usually in wetlands (>67 percent to 99 percent), but also occur in uplands (1 percent to 33 percent)
Obligate Wetland	OBL	Occur almost always (>99 percent) in wetlands, but rarely occur in uplands (<1 percent)
Not Listed	NL	Not listed due to insufficient information to determine status

4.2 Wetland Hydrology

Evidence of permanent or periodic inundation (water marks, drift lines, drainage patterns), or soil saturation to the surface for 12 consecutive days or more during the growing season meets the hydrology criterion. Oxidized root channels in the top 12 inches, high water table, and water marks are primary indicators and local soil survey data are secondary indicators of wetland hydrology.

4.3 Hydric Soils

Soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper soil horizons are considered hydric soils. Field indicators include histosols, the presence of a histic epipedon, a sulfidic odor, depleted matrix, and gleying (in sandy soils). Soil conditions were compared to the Field Indicators of Hydric Soils detailed in the Corps' *Regional Supplement* (Corps 2010).

5 RESULTS

The site assessment identified two wetlands (Wetland W and Wetland A) within the study area. Indicators of wetland hydrology, hydric soil characteristics, and dominant hydrophytic vegetation observed within the wetland are summarized in Table 3 below.

Table 4. Wetland indicator summary

Feature ID	Hydric Soil Indicators	Wetland Hydrology Indicators	Hydrophytic Vegetation	Dominant Plant Communities
W	depleted matrix, loamy mucky mineral	high groundwater table, regular inundation, saturation to the surface, oxidized rhizospheres, FAC Neutral test	pickleweed (OBL) Pacific silverweed (OBL) soft rush (FACW) *Agrostis spp.* (FAC) dunegrass (FACU)	Emergent

Feature ID	Hydric Soil Indicators	Wetland Hydrology Indicators	Hydrophytic Vegetation	Dominant Plant Communities
A	Problematic hydric soil[1]	geomorphic position, saturation visible on aerial imagery, FAC Neutral test	soft rush (FACW) Pacific silverweed (OBL)	Emergent

[1] Soils within Wetland A do not exhibit hydric soil indicators due to the low of iron and manganese content.

5.1 Wetland W

Wetland W is an Estuarine Intertidal Regularly Flooded Emergent wetland approximately 5,048 square feet in size (Appendix B). Wetland W is hydrogeomorphically classified as a saltwater tidal fringe wetland.

5.1.1 Vegetation

Vegetation within Wetland W consists of emergent species that are dominated by pickleweed (*Salicornia virgincia*), Pacific silverweed (*Potentilla anserine*), and Baltic rush (*Juncus balticus*). The pickleweed is limited to the lower elevations of the wetland where daily inundation of saltwater occurs.

5.1.2 Hydrology

Hydrologic support of Wetland W is provided primarily by daily inundation of saltwater from Cornet Bay. These daily tides flood a large portion of the wetland which also elevates the groundwater table and soil saturation. Additional hydrologic support to Wetland W likely consists of stormwater runoff during rain events. This wetland is adjacent to Cornet Bay Road and the Cornet Bay Marina which likely direct surface water towards the wetland. No stormwater ditch along the north end Cornet Bay Road was observed that would intercept stormwater from entering the wetland. Primary indicators of wetland hydrology observed within Wetland W include a high water table and saturation to the surface. Secondary indicators include inundation visible on aerial imagery, geomorphic position, and passing the FAC Neutral test.

5.1.3 Hydric Soils

Soils within the study area are mapped by the NRCS as Sholander, cool-Limepoint complex and Beaches – Endoaquents, tidal – Xerorthents association. Soil test pits were examined to a depth of up to 22 inches. During the soil investigation two distinct soils were observed. In the southwest corner of the wetland there is an area that consists of a loamy mucky mineral soil. In a typical soil profile, the upper soil layer (0-18 inches) consists of a black (10YR2/1) (Munsell 2000) mucky clay loam. Within this layer, partially decomposed organic material was observed. Below this layer (18-22 inches) is a layer of very dark greyish brown (10YR3/2) sand with no redox features. The other soil profile documented within the wetland consisted of an upper soil layer (0-4 inches) of a very dark greyish brown (10YR3/2) silt. Beneath this upper layer (4-20 inches) is grey (7.5YR 5/1) clayey silty sand with prominent strong brown (7.5YR4/6) redox features.

Hydric soil indicators observed within Wetland W include a loamy mucky mineral and a depleted matrix.

5.2 Wetland A

Wetland A is an Estuarine Intertidal Regularly Flooded wetland. Within this wetland, hydric soil indicators are absent due to the landscape position of the wetland and the coarse textured soils. Wetland A is approximately 170 square feet in size and is hydrogeomorphically classified as a saltwater tidal fringe wetland.

5.2.1 Vegetation

Vegetation within Wetland A consists of emergent vegetation that is dominated by Pacific silverweed and Baltic rush. These two species are very dense and likely do not allow for other species to establish. No other rooted vegetation was observed within the wetland.

5.2.2 Hydrology

Hydrologic support of Wetland A is provided primarily by daily inundation of saltwater from Cornet Bay. These daily tides likely flood portions of the wetland which also elevates the groundwater table and soil saturation. During the site assessment, no primary wetland hydrology indicators were observed, however, based on the wetland's geomorphic position, saturation visible on aerial imagery, and passing the FAC Neutral test the wetland meets the hydrology criteria defined in the Corps *Regional Supplement* (2010).

5.2.3 Hydric Soils

Soils within Wetland A are mapped by the NRCS as Sholander, cool-Limepoint complex and Beaches – Endoaquents, tidal – Xerorthents association. Soil test pit depths in both upland and wetland were limited due to restrictive layers. In a typical wetland soil pit, the upper layer (0-10 inches) is a dark greyish brown (10YR4/2) sand with no redox features. Below this layer is a layer of a very compact dark greyish brown (10YR4/2) sandy hardpan.

Although the soils within Wetland A did not meet any hydric soil field indicators defined in the Corps *Regional Supplement* (2010), the soils meet the definition of a hydric soil. Having indicators of hydrophytic vegetation and wetland hydrology, the procedures described in Chapter 5 of the Corps *Regional Supplement* (2010) were used. Based on the course soil texture and geomorphic position, the soils meet the criteria of a problematic soil situation. Further, the daily inundation by saltwater has likely leached the iron and manganese out of soils. Therefore, the accumulation of iron or manganese cannot form in these soil conditions and exhibit a typical hydric soil indicator (i.e. redoximorphic features).

In such situations where hydric soil indicators are lacking due to the physical properties of the soil, the relative strength of the hydrophytic vegetation and hydrology indicators must be taken into consideration. As the dominant vegetation in the wetland is very hydrophytic (FACW and OBL) and the wetland is inundated by tidal waters at least twice

per day, it is reasonable to conclude (based on the guidance in the *Regional Supplement*) that the soils within the wetland meet the definition of a hydric soil.

5.3 Wetland Determination

At the time of the site assessment, the area identified as wetland exhibited sufficient indicators of the required parameters for the presence of wetland conditions. These parameters include a predominance of hydrophytic vegetation, presence of wetland hydrology, and indicators of hydric soils. Soils within Wetland A are problem hydric soils that lack typical hydric soils indicators, however, this area was determined to be a wetland based on the guidance in the Corps *Regional Supplement* (2010) and best professional judgment. The wetland boundary location was determined based on these indicators, the general topographic relief at the site, and best professional judgment. Prior to any formal site planning, this document should be reviewed and the wetland boundary verified by the appropriate regulatory agencies.

6 DISCUSSION

6.1 Wetland Categorization

To determine the categorization of the wetland within the study area based on function, the Island County *Wetland Classification System* was used. Based on ICC 17.02A.090E, estuarine wetlands are considered high priority wetlands and categorized as C Wetlands (Table 5). Having a high intensity land use, the wetlands within the study area receive a 90 foot buffer width (ICC 17.02A.090F Table 1).

Although Island County does not incorporate the Washington State Department of Ecology's (Ecology) *Washington State Wetland Rating System for Western WA - Revised* (Hruby 2006) to rate wetlands, Ecology's system was used to evaluate the wetlands within the study area for the purposes of federal and state permitting requirements. Based on Ecology's rating system, all saltwater tidal fringe wetlands are categorized based on special characteristics because no rapid methods have been developed to characterize the water quality, hydrology, and habitat functions of estuarine wetlands. Ecology's rating system rates Wetland W and Wetland A as a Category II wetlands based on the relative quality of their buffers (Hurby 2006).

Table 5. Wetland categorization summary

Feature	Size[1] (Approximate)	Cowardin Class	Hydrology Modifier	HGM Class	ICC Category	Ecology's Category	Buffer Width[2]
W	5,048 sq. ft.	EIEM	Regularly Flooded	Salt Water Tidal Fringe	C	II	90 ft.
A[3]	170 sq. ft.	EIEM	Regularly Flooded	Salt Water Tidal Fringe	C	II	N/A.

[1] Size only includes wetland within the Assessment Area.
[2] ICC 17.02A.090F Table 1
[3] Wetland A is not regulated by Island County (ICC 17.02A.090A2) due to its small size.

6.2 Functions and Values

Wetland W provides several functions, such a water quality enhancement, stormwater collection, and aquatic habitat. The wetland likely filters out sediments and toxins from stormwater runoff, preventing it from entering Cornet Bay. The wetland likely provides limited wildlife functions which include small mammal foraging and passerine and waterfowl foraging and nesting. Wetland W also likely provides foraging and refuge habitat for juvenile salmonids that enter the wetland during high tides.

Wetland A likely provides very limited wetland functions due to its geomorphic position and adjacent landscape. The wetland is located next to an existing wood bulkhead and at the base of a small shoreline ledge; therefore, the wetland has minimal opportunity to provide water quality and hydrologic enhancement. Limited wildlife functions include small mammal foraging and passerine and waterfowl foraging. Wetland A likely does not provide any habitat for aquatic species due to the vegetation and elevation within the wetland.

6.3 Regulatory Considerations

As mentioned above, wetlands are regulated by agencies at the local, state and federal levels. At the local level, wetlands above the OHWM are regulated under Island County's Critical Areas Ordinance (Chapter 17.02A ICC), or if within 200 feet of the marine shoreline, Island County's Shoreline Master Program (Chapter 17.05). The County does not, however, regulate "Category A, B, C, and D wetlands that are less than 1,000 square feet in size and Category E wetlands less than 5,000 square feet in size" (ICC 17.02A.090) Therefore, Wetland A should be exempt from local regulation.

At the state level, wetlands are regulated by the Washington State Department of Ecology through the State Clean Water Act (Section 401). The requirement for a Water Quality Certification from Ecology for wetland impacts is triggered by an applicant's applying for a federal Clean Water Act Section 404 permit from the Corps. In addition, in counties bordering the Puget Sound or Pacific Ocean, Ecology manages activities within wetlands through the Coastal Zone Management program. Ecology may also issue an Administrative Order, allowing them wetland regulatory authority without a federal nexus.

At the federal level, impacts (specifically dredging or filling) to aquatic features are regulated by the Environmental Protection Agency through the US Army Corps of Engineers. The Corps administers the federal Clean Water Act (Section 404) for projects involving dredging or filling in Waters of the US (lakes, streams, marine waters, and most non-isolated wetlands). The Corps also regulates activities in tributaries to Waters of the US, including ditches, swales and canals with an established hydrologic connection.

While it is the regulatory agencies that make the final determination regarding jurisdictional status, project proponents can infer jurisdiction using the guidance provided by each agency or local government. This inference can be used to design a project based on the anticipated regulatory constraints within the project area. However, it is the

project proponent's responsibility to contact each potential regulating agency and confirm their regulatory status and requirements.

6.4 Disclaimer

The findings and conclusions documented in this report have been prepared for specific application to this proposed project site. They 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 the area. Our work was also performed in accordance with the terms and conditions set forth in our proposal. The conclusions and recommendations presented in this report are professional opinions based on an interpretation of information currently available to us and are made within the operation scope, budget, and schedule of this project. No warranty, expressed or implied, is made. In addition, changes in government codes, regulations, or laws may occur. Because of such changes, our observations and conclusions applicable to this site may need to be revised wholly or in part.

Wetland boundaries are based on conditions present at the time of the site visit and are considered preliminary until the flagged wetland and/or drainage boundaries are validated by the appropriate jurisdictional agencies. Validation of the boundaries by the regulating agencies provide a certification, typically in writing, that the wetland boundaries verified are the boundaries that will be regulated by the agencies until a specific date or until the regulations are modified. Only the regulating agencies can provide this certification.

Since wetlands are dynamic communities affected by both natural and human activities, changes in wetland boundaries may be expected. Because of such changes, our observations and conclusions applicable to this site may need to be revised wholly or in part.

7 BIOLOGIST QUALIFICATIONS

7.1 Chad Wallin

Chad Wallin is a Biologist with extensive training in wetland science and ecology restoration. Chad also has professional experience in stream and fish restoration, marine monitoring, mitigation monitoring, and fish and wildlife assessments.

Chad has earned a Bachelor's of Arts degree in Environmental Studies from the University of Washington along with certificates in ecology restoration and wetland science.

For a list of representative projects, please contact him at Grette Associates.

7.2 Scott Maharry

Scott Maharry is a Biologist with over 13 years of professional experience and extensive training in wetland science as well as fisheries and wildlife ecology. Scott also has

extensive experience in wetland and marine aquatic permitting, mitigation planning and implementation, and fish and wildlife assessments.

Scott earned a Bachelor's of Science degree in Biology from Central Washington University. In addition, he has attended numerous State and Federal wetland delineation protocol trainings and workshops throughout his career. He has also attended several wetland trainings offered through the Washington Department of Ecology's Coastal Training Program.

Scott is a certified wetlands delineator, and he is also a Pierce, Kitsap, and Thurston County Qualified Wetland Specialist. He holds similar qualifications from other jurisdictions as well.

For a list of representative projects, please contact him at Grette Associates.

8 REFERENCES

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CORNET BAY MARINA REMEDIAL ACTION

WETLAND DELINEATION AND ANALYSIS REPORT
APPENDIX A: WETLAND DELINEATION DATA SHEETS

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

Project Site: Cornet Bay Marina City/County: Island Sampling Date: 6/6/13
Applicant/Owner: State: WA Sampling Point: SP1W
Investigator(s): Section, Township, Range:
Landform (hillslope, terrace, etc.): Local relief (concave, convex, none): Slope (%):
Subregion (LRR): Lat: Long: Datum:
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐, significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐, naturally problematic? (If needed, explain any answers in Remarks.)

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

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

Remarks: Low tide approx. @ 10:20am

VEGETATION – Use scientific names of plants

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50% = ____, 20% = ____		= Total Cover	
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
50% = ____, 20% = ____		= Total Cover	
Herb Stratum (Plot size: ____)			
1. Potentilla anserina	20%	Y	OBL
2. Juncus balticus	5%	N	FACW
3. Elymus mollis	5%	N	FACW
4. Agoseris sp.	70%	Y	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
50% = 50%, 20% = 70%		= Total Cover	
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
50% = ____, 20% = ____		= Total Cover	
% Bare Ground in Herb Stratum ____			

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

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

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ☐ 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:

Project Site: ____

SOIL

Sampling Point: ____

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
0-18"	10YR2/1	100%	____	____	____	____	Mucky clay silt	
18-22"	10YR3/2	100%	____	____	____	____	sand	mixed w/ upper layer material
____	____	____	____	____	____	____	____	____
____	____	____	____	____	____	____	____	____
____	____	____	____	____	____	____	____	____
____	____	____	____	____	____	____	____	____
____	____	____	____	____	____	____	____	____
____	____	____	____	____	____	____	____	____

[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:

Between 16"-18" larger size of organic debris

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:

area is highly influenced by tides. Elevation slant in reference to the active beach

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

Project Site: Carnet Bay City/County: / Sampling Date: 6/5/13
Applicant/Owner: State: ___ Sampling Point: SP2U
Investigator(s): Section, Township, Range:
Landform (hillslope, terrace, etc.): Local relief (concave, convex, none): ___ Slope (%): ___
Subregion (LRR): Lat: Long: Datum:
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐, significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐, naturally problematic? (If needed, explain any answers in Remarks.)

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

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

Remarks:

VEGETATION – Use scientific names of plants

Tree Stratum (Plot size: ___)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50% = ___, 20% = ___		= Total Cover	
Sapling/Shrub Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
5.			
50% = ___, 20% = ___		= Total Cover	
Herb Stratum (Plot size: ___)			
1. Elymus mollis	5%	N	FACU
2. Agrostis sp.	85%	Y	FAC
3. Holcus lanatus	2%	N	FAC
4. Heracleum lanatum	2%	N	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
50% = ___, 20% = ___		= Total Cover	
Woody Vine Stratum (Plot size: ___)			
1. Rubus ursinus	5%		
2.			
50% = ___, 20% = ___		= Total Cover	
% Bare Ground in Herb Stratum ___			

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

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

Prevalence Index = B/A = ___

Hydrophytic Vegetation Indicators:

- ☐ 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:

Project Site: ____

Sampling Point: ____

SOIL

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 %	Type[1]	Loc[2]	Texture	Remarks
0-20"	10YR3/2	100%					gravelly 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:

soils dry

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:

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

Project Site: Carnation Bay City/County: Island Sampling Date: 6/5/13
Applicant/Owner: State: WA Sampling Point: SP3W
Investigator(s): Section, Township, Range:
Landform (hillslope, terrace, etc.): Local relief (concave, convex, none): Slope (%):
Subregion (LRR): Lat: Long: Datum:
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐, significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐, naturally problematic? (If needed, explain any answers in Remarks.)

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

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

Remarks:

VEGETATION – Use scientific names of plants

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50% = ____, 20% = ____		= Total Cover	
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
50% = ____, 20% = ____		= Total Cover	
Herb Stratum (Plot size: ____)			
1. Salicornia virginica	100%	Y	OBL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
50% = ____, 20% = ____		= Total Cover	
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
50% = ____, 20% = ____		= Total Cover	
% Bare Ground in Herb Stratum ____			

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

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

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ☐ 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:

Project Site: ____

SOIL

Sampling Point: ____

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4"	7.5YR3/2	100%					Silt	
4-20"	7.5YR5/1	90%	7.5YR4/6	10%	C	M	silty Sand	a little clay

[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:

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): 12"

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: Inundated daily due to tides

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

Project Site: _____ City/County: ____/____ Sampling Date: 6/5/13

Applicant/Owner: _____ State: ____ Sampling Point: SP4U

Investigator(s): _____ Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): ____ Slope (%): ____

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

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

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

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

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

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

Remarks:

VEGETATION – Use scientific names of plants

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50% = ____, 20% = ____		= Total Cover	
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
50% = ____, 20% = ____		= Total Cover	
Herb Stratum (Plot size: ____)			
1. gumweed	5%		FACW
2. Scotts broom	10%	Y	FACU
3. Quackgrass	40%	Y	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
50% = 25% 20% = 10		= Total Cover	
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
50% = ____, 20% = ____		= Total Cover	

% Bare Ground in Herb Stratum ____

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

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

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ☐ 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:

Project Site: _____

SOIL

Sampling Point: _____

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
0-12"	10YR6/2	100%					gravelly 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: sand

Depth (inches): below approx. 12" soil pit caves in

Hydric Soils Present? Yes ☐ No ☒

Remarks:

Soils very dry

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:

A aven

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

Project Site: Comet Bay City/County: / Sampling Date: 6/5/13
Applicant/Owner: State: ___ Sampling Point: SP1W
Investigator(s): Section, Township, Range:
Landform (hillslope, terrace, etc.): Local relief (concave, convex, none): ___ Slope (%): ___
Subregion (LRR): Lat: Long: Datum:
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐, significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐, naturally problematic? (If needed, explain any answers in Remarks.)

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

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

Remarks: Area located NE corner of property

VEGETATION – Use scientific names of plants

Tree Stratum (Plot size: ___)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50% = ___, 20% = ___		= Total Cover	
Sapling/Shrub Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
5.			
50% = ___, 20% = ___		= Total Cover	
Herb Stratum (Plot size: ___)			
1. arctic rush	50%	Y	FACW
2. Pac. silverweed	50%	Y	OBL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
50% = ___, 20% = ___		= Total Cover	
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
50% = ___, 20% = ___		= Total Cover	

% Bare Ground in Herb Stratum ___

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 1 (A/B)

Prevalence Index worksheet:

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

Prevalence Index = B/A = ___

Hydrophytic Vegetation Indicators:

- ☐ 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:

Project Site: ____

Sampling Point: ____

SOIL

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 %	Type[1]	Loc[2]	Texture	Remarks
0-10"	10YR4/2	100%					sand	
10"+	very compacted 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: compacted sand/hardpan

Depth (inches): 10"

Hydric Soils Present? Yes ☒ No ☐

Remarks:

Soils moist

other: area is inundated or saturated daily due to tides.

A-typical

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 area is inundated or saturated daily due to tides.

A area

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

Project Site: Cornet Bay City/County: / Sampling Date: 6/5/13
Applicant/Owner: State: Sampling Point: SP2U
Investigator(s): Section, Township, Range:
Landform (hillslope, terrace, etc.): Local relief (concave, convex, none): Slope (%):
Subregion (LRR): Lat: Long: Datum:
Soil Map Unit Name: NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☐ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐, significantly disturbed? Are "Normal Circumstances" present? Yes ☐ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐, naturally problematic? (If needed, explain any answers in Remarks.)

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

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

Remarks:

VEGETATION – Use scientific names of plants

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
50% = ____, 20% = ____		= Total Cover	
Sapling/Shrub Stratum (Plot size: ____)			
1. Rubus discolor	60%	Y	FACU
2.			
3.			
4.			
5.			
50% = ____, 20% = ____		= Total Cover	
Herb Stratum (Plot size: ____)			
1. Plantago lanceolata	5%		FACU
2. UN-grass (mowed)	95%	Y	FAC?
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
50% = ____, 20% = ____		= Total Cover	
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
50% = ____, 20% = ____		= Total Cover	

% Bare Ground in Herb Stratum ____

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

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

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ☐ 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:

Project Site: ____

SOIL

Sampling Point: ____

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

[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: compact gravel/sand

Depth (inches): surface

Hydric Soils Present? Yes ☐ No ☒

Remarks:

soils are compacted gravelly sand

area of pit is approx. 4' higher than SPW due to manmade increase in topo. Possibly an area where a bulkhead used to exist.

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:

CORNET BAY MARINA REMEDIAL ACTION

WETLAND DELINEATION AND ANALYSIS REPORT
APPENDIX B: WETLAND DELINEATION MAP

LEGEND

WETLAND W
5,048 SQ SF (APPROX.)

—MHHW— MEAN HIGHER HIGH WATER
11.02 FT. (APPROX.)

C. NO. 91001920.

CORNET BAY MARINA FACILITIES

BULKHEAD
TIMBERS
METAL SHED
WOOD
WOOD DECK
GATE
SUBMERGED AT HIGH TIDE
ALL VEH. MUST PEG
EDGE OF GRAVEL AND PAVEMENT
PARCELS D, E, &
CT12
TELR
GP
STREET
DUCT
CORNET BAY RD

Grette Associates LLC
ENVIRONMENTAL CONSULTANTS
2102 North 30th Street, Suite A
TACOMA, WA 98403
(253) 573-9300
grettеassociates.com

PROJECT #:304.003 | DATE:05.14.13
DESIGNED BY:CW | DATE:05.14.13
CHECKED BY: MB | DATE:05.14.13

CLIENT:
Cornet Bay Marina

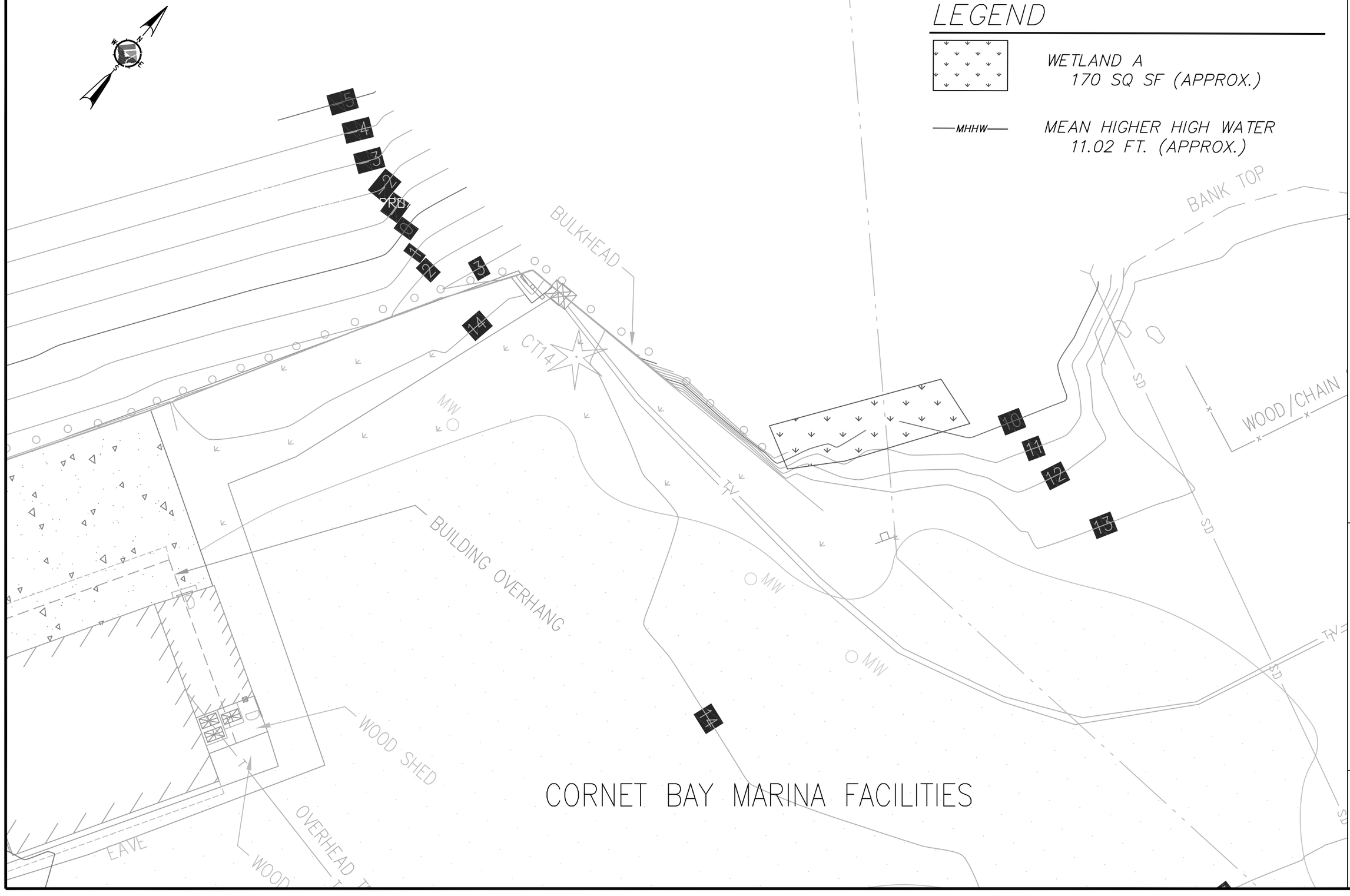
CORNET BAY
WETLAND DELINEATION AND ANALYSIS REPORT

SITE ADDRESS: Island County, WA

DRAWING SCALE: 1/2"=1'0"

WETLAND W AREA MAP

SHEET 1 OF 2



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CLIENT: Cornet Bay Marina

PROJECT #:304.003 DATE:07.02.13
DESIGNED BY:CW DATE:07.02.13
CHECKED BY: MB DATE:07.02.13

CORNET BAY WETLAND DELINEATION AND ANALYSIS REPORT

SITE ADDRESS: Island County, WA

DRAWING SCALE: 1"=1'0"

WETLAND A AREA MAP

SHEET 2 OF 2

CORNET BAY MARINA MITIGATION PLAN
APPENDIX B: ESSENTIAL FISH HABITAT ASSESSMENT

1 Background

Pursuant to the Magnuson-Stevenson Fishery Conservation Management Act (MSFCMA) and the 1996 Sustainable Fishery Act, an evaluation of impacts of the Cornet Bay Marina MTCA Cleanup project on Essential Fish Habitat (EFH) is necessary. EFH is defined by the MSFCMA in 50 CFR 600.905-930 as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The Pacific Fisheries Management Council (PFMC) has designated EFH for the Pacific salmon fishery, federally managed ground fishes, and coastal pelagic fishes (NOAA Fisheries 1999, PFMC 1999).

In Washington, EFH for the Pacific salmon fishery includes all those streams, lakes, ponds, wetlands and other water bodies currently or historically accessible to Chinook (*Oncorhynchus tshawytscha*), coho (*Oncorhynchus kisutch*), and pink salmon (*Oncorhynchus gorbuscha*), except above impassible barriers (PFMC 1999). In estuarine and marine areas, designated EFH for Chinook, coho and pink salmon extends from nearshore and tidal submerged environments within state territorial waters out to the full extent of the Exclusive Economic Zone (EEZ) off the Washington coast (PFMC 1999).

The EFH designation for groundfishes and coastal pelagics includes those waters and substrates necessary to ensure the production needed to support a long-term sustainable fishery. Ground fish and coastal pelagic EFH within marine waters of Washington also extends from the nearshore and tidal submerged environment out to the EEZ.

The west coast ground fish management unit includes 83 species that typically live on or near the bottom of the ocean. Species groups include skates and sharks, rockfishes, flatfishes and ground fishes. Coastal pelagics are schooling fishes that migrate in coastal waters. West coast pelagics include the pacific sardine (*Sardinops sagax*), Pacific chub (*Scomber japonicus*), northern anchoy (*Engraulis mordax*), jack mackerel (*Trachurus symmertircus*) and market squid (*Loligo opalescens*).

The objective of this EFH assessment is to determine whether or not the Cornet Bay Marina MTCA Cleanup project "may adversely affect" designated EFH for relevant commercially, federally-managed fisheries species within the proposed Action Area. It also described conservation measures proposed to avoid, minimize or otherwise offset potential adverse effects to designated EFH associated with the Action Area.

2 Essential Fish Habitat Analysis

2.1 Essential Fish Habitat within the Action Area

Salmon, groundfish, and pelagic species and life-stages with designated EFH in Puget Sound estuaries that may be present in the Action Area are listed in Table 1, below.

Table 1. Fish species and life-stages with designated essential fish habitat in Puget Sound

Guild / Common Name	Species Name	Adults	Eggs	Juveniles	Larvae
Groundfish[1]					
Big skate	*Raja binoculata*	x	x	x	
Black rockfish	*Sebastes melanops*	x		x	
Blue rockfish	*Sebastes mystinus*	x		x	x
Bocaccio	*Sebastes paucispinis*	x		x	x
Brown rockfish	*Sebastes auriculatus*	x		x	
Butter sole	*Isopsetta isolepis*	x	x	x	x
Cabezon	*Scorpaenichthys marmoratus*	x	x	x	x
China rockfish	*Sebastes nebulosus*	x		x	
Copper rockfish	*Sebastes caurinus*	x		x	
Dover sole	*Microstomus pacificus*	x	x	x	x
English sole	*Parophrys vetulus*	x	x	x	
Flathead sole	*Hippoglossoides elassodon*	x		x	
Greenstriped rockfish	*Sebastes elongatus*	x		x	x
Kelp greenling	*Hexagrammos decagrammus*	x	x	x	x
Lingcod	*Ophiodon elongatus*			x	x
Longnose skate	*Raja rhina*	x	x	x	
Pacific cod	*Gadus macrocephalus*	x			
Pacific hake	*Merluccius productus*	x		x	
Pacific sanddab	*Citharichthys sordidus*	x	x	x	x
Petrale sole	*Eopsetta jordani*	x		x	
Quillback rockfish	*Sebastes maliger*	x		x	x
Redstripe rockfish	*Sebastes proriger*	x		x	x
Rex sole	*Glyptocephalus zachirus*	x		x	
Rock sole	*Lepidopsetta bilineata*	x	x	x	x
Sablefish	*Anoplopoma fimbria*	x	x	x	x
Sand sole	*Psettichthys melanostictus*	x	x	x	x
Spiny dogfish	*Squalus acanthias*	x		x	
Splitnose rockfish	*Sebastes diploproa*	x		x	x
Spotted ratfish	*Hydrolagus colliei*	x	x	x	
Starry flounder	*Platichthys stellatus*	x	x	x	x
Tiger rockfish	*Sebastes nigrocinctus*	x		x	x
Widow rockfish	*Sebastes entomelas*	x		x	x
Yelloweye rockfish	*Sebastes ruberrimus*	x			x
Yellowtail rockfish	*Sebastes flavidus*	x		x	

Guild / Common Name	Species Name	Adults	Eggs	Juveniles	Larvae
Pacific Salmon[2]					
Chinook	*Oncorhynchus tshawytscha*	x		x	
Coho	*Oncorhynchus kisutch*	x		x	
Puget Sound pink	*Oncorhynchus gorbuscha*	x		x	
Coastal Pelagics[2]					
Northern anchovy	*Engraulis mordax*	x	x	x	x
Pacific sardine	*Sardinops sagax caerulea*	x			
Pacific mackerel	*Scomber japonicus*	x			
Market squid	*Loligo opalescens*	x			

[1] Based on information from EFH database provided by J. Stadler (NFMS) dated January 16, 2007.
[2] Based on previously published Puget Sound EFH lists from NFMS used in EFH Assessments through 2012.

All three of the Pacific salmon management unit species (chinook, coho and pink salmon) may be present within the Project Action Area (WDFW 2013). The nearest streams with salmon spawning and rearing are approximately 8 miles away (WDFW 2013), and some seasonal rearing, particularly for Chinook salmon, may occur in the Action Area. All three salmon species may use the Action Area for adult migration and juvenile out-migration.

Many of the ground fish species that occur in Puget Sound may also occur within the Action Area. West coast pelagic fishes are primarily associated with open ocean and coastal areas (PFMC 1998), and are therefore not likely to occur within the Action Area.

2.2 Description of the Proposed Action

Detailed descriptions of proposed Project activities may be found in Section 2.3 of the Biological Evaluation (BE), to which this document is attached. Although this Project is primarily an upland cleanup of contaminated soils, there are associated in-water construction activities required. There are no impacts to EFH associated with upland cleanup activities. The potential for impacts to designated EFH within the Action Area is primarily associated with minor habitat loss due to proposed sheet pile driving. Additionally, there is potential for impacts to water quality through minor turbidity and potential for spills into the water from construction activities.

2.3 Potential Effects of the Project

This assessment of whether proposed Project activities may adversely affect designated EFH within the Action Area is based on information in the documents referenced above (NMFS 1998; PFMC 1998a, 1998b, 1999).

The primary elements of the Project that could potentially impact designated EFH, and Conservation Measures that would avoid and minimize impacts, are summarized in Table 2, below. Detail about all potential Project impacts on species of concern may be found in Section 5 of the BE.

Table 2. Affected EFH by Project element and proposed conservation measures

Project Element	Affected EFH	Impact Mechanism	Conservation Measures
Sheet wall installation	Salmon, groundfish, coastal-pelagic substrate EFH	Vibratory installation of replacement steel sheet pile bulkhead would occur 2-3 ft waterward of existing timber bulkhead for the entire shoreline within the Project Area (340 ft). This would result in a net loss of 680-1020 sf of nearshore intertidal marine habitat. The elimination of 680-1020 sf of nearshore intertidal habitat would occur in an already modified shoreline area with low substrate complexity and habitat value. In the long term, the loss of 680-1020 sf of low quality intertidal habitat would represent an insignificant change to EFH in Cornet Bay.	**1, 2, 3 (for salmon EFH), 4, 5.**
Sheet wall installation	Salmon, groundfish, coastal-pelagic water column EFH	Installation of the sheet pile bulkhead will allow the complete isolation and subsequent removal of 340 lineal feet of creosote-treated vertical creosote-treated timber bulkhead from the aquatic environment. This will benefit water quality in water column EFH in the long term.	
Construction activities	Salmon, groundfish, coastal-pelagic water column EFH	Minor turbidity could result from sheet pile driving. Any turbidity generated would be localized and temporary.	**1, 2, 3 (for salmon EFH), 5 and 6.**
		Operation of construction machinery, including pile driving equipment, would have the potential for accidental releases of hazardous substances into the water.	**1, 2, 3 (for salmon EFH), 5, 6and 7.**

List of Applicable Conservation Measures

1. Compliance with the State's standards will ensure that fish and aquatic life will be protected to the extent feasible and practicable.
2. Compliance with the substantive requirements of the Hydraulic Code.
3. Timing restrictions specifying that in-water work must occur when juvenile salmon are absent or present in very low numbers.
4. Sheet pile will be installed with a vibratory hammer.
5. Sheet pile wall will completely isolate the timber bulkhead and adjacent upland areas from the aquatic environment during demolition and clean up activities.
6. Compliance with applicable State water quality standards (WAC 173-201A).
7. Care will be taken to prevent any petroleum products, chemicals, or other toxic or deleterious materials from entering the water. If a spill were to occur, work would be stopped immediately, steps would be taken to contain the material, and appropriate agency notifications would be made. Spill response and hazardous material control plans will be produced and used by project contractors.

3 Conclusions and Determination of Effects

3.1.1 Salmon EFH

The impacts of the Project on salmon EFH are shown in Table 2. During construction, bulkhead installation will isolate 680-1020 sf of low quality nearshore intertidal habitat. This is a relatively small area of low quality substrate EFH. Further, because construction will be timed to avoid juvenile salmon outmigration, the isolation of this area is unlikely to significantly affect substrate EFH function. Increased turbidity and risk of unintentional releases from construction equipment may temporarily impact water column EFH during project activities, but these impacts would be localized, minimal, and temporary in nature. All temporary effects would be further reduced by project timing, which will reduce the likelihood for juvenile salmon presence during project activities.

In the long term, the project will permanently remove the 680-1020 sf area isolated behind the sheet pile wall during construction. Although this is permanent loss of EFH, the biological significance of this loss for salmon EFH function within the Action Area is expected to be insignificant based on its relatively small area and low habitat quality. Further, the project will benefit water column EFH through the permanent removal of 340 lf of creosote-treated timber bulkhead and cleanup of adjacent areas.

Overall, the Project ***will not adversely affect salmon EFH***.

3.1.2 Groundfish EFH

The impacts of the Project on groundfish EFH are shown in Table 2. During construction, bulkhead installation will isolate 680-1020 sf of low quality nearshore intertidal habitat. This is a relatively small area of low quality substrate EFH. Increased turbidity and risk of unintentional releases from construction equipment may temporarily impact water column EFH during project activities, but these impacts would be localized, minimal, and temporary in nature.

In the long term, the project will permanently remove the 680-1020 sf area isolated behind the sheet pile wall during construction. Although this is permanent loss of EFH, the biological significance of this loss for groundfish EFH function within the Action Area is expected to be insignificant based on its relatively small area and low habitat quality. Further, the project will benefit water column EFH through the permanent removal of 340 lf of creosote-treated timber bulkhead and cleanup of adjacent areas.

Overall, the Project ***will not adversely affect groundfish EFH***.

3.1.3 Coastal Pelagic EFH

The impacts of the Project on coastal pelagic habitat are shown in Table 2. Increased turbidity and risk of unintentional releases from construction equipment may temporarily impact water column EFH during project activities, but these impacts would be localized, minimal, and temporary in nature.

In the long term, the project will benefit water column EFH through the permanent removal of 340 lf of creosote-treated timber bulkhead and cleanup of adjacent areas.

Overall, the Project ***will not adversely affect coastal pelagic EFH***.

4 References

National Marine Fisheries Service (NMFS). 1998. Essential Fish Habitat West Coast Groundfish Appendix. NMFS, Seattle, Washington.

Pacific Fishery Management Council (PFMC). 1998a. The Pacific Coast Groundfish Fishery Management Plan. Pacific Fishery Management Council, Portland, Oregon.

Pacific Fishery Management Council (PFMC). 1998b. Coastal Pelagics Fishery Management Plan. Pacific Fishery Management Council, Portland, Oregon.

Pacific Fishery Management Council (PFMC). 1999. Appendix A. Identification and Description of Essential Fish Habitat, Adverse Impacts, and Recommended Conservation Measures for Salmon. Pacific Fishery Management Council, Portland, Oregon.

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CORNET BAY MARINA MITIGATION PLAN
APPENDIX C: MITIGATION DESIGN SHEETS

LEGEND

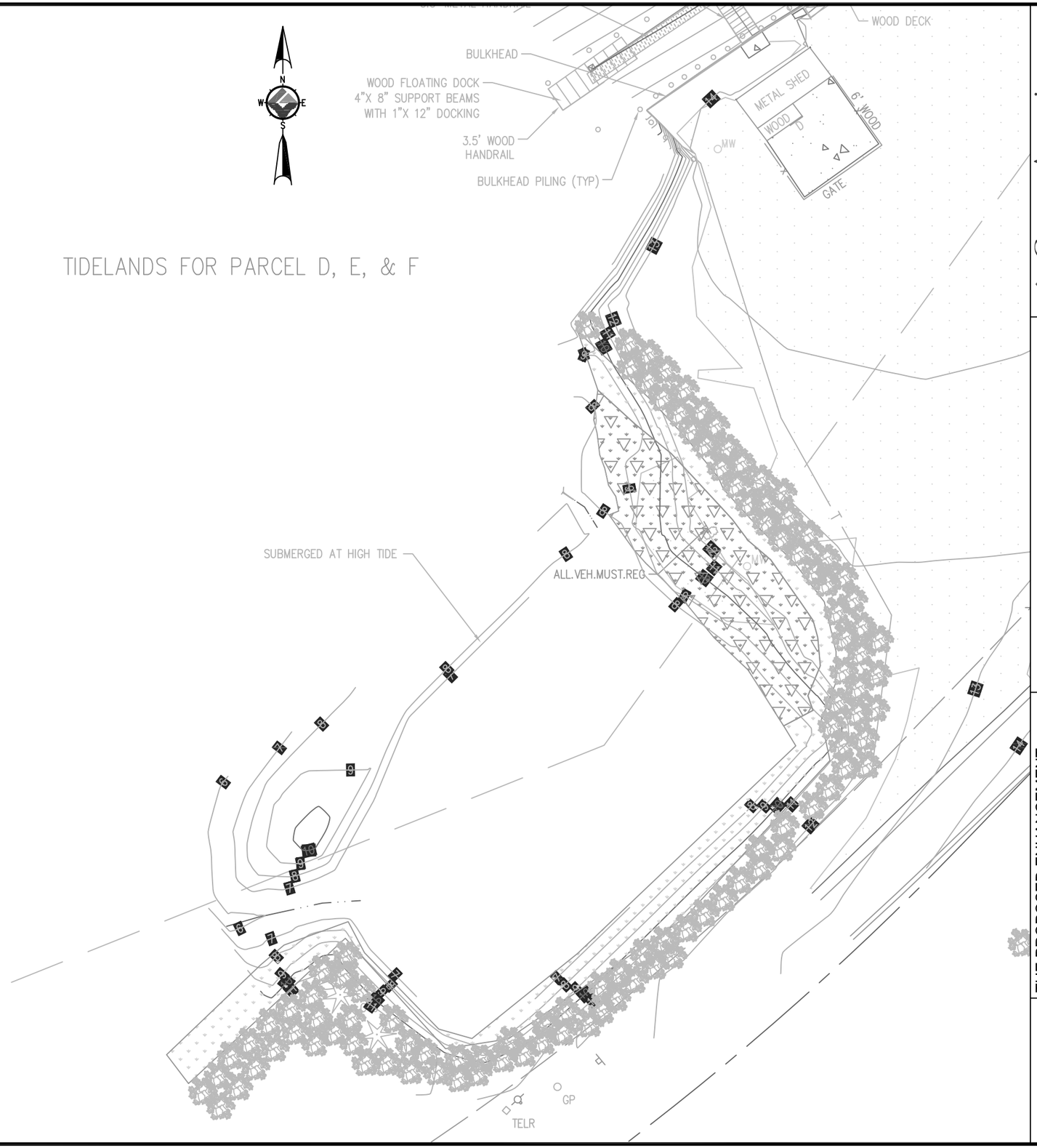
AQUATIC HABITAT CREATION
1300 SF (APPROX.)

WETLAND ENHANCEMENT
1720 SF (APPROX.)

WETLAND BUFFER ENHANCEMENT
1750 SF (APPROX.)

—MHHW— MEAN HIGHER HIGH WATER
11.02 (APPROX.)

TIDELANDS FOR PARCEL D, E, & F



Grette Associates LLC
ENVIRONMENTAL CONSULTANTS
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TACOMA, WA 98403
(253) 573-9300
gretteassociates.com

PROJECT #:304.003	DATE:05.14.13
DESIGNED BY:CW	DATE:05.14.13
CHECKED BY: MB	

CLIENT:
Cornet Bay Marina

SITE ADDRESS: Island County, WA

DRAWING SCALE: 1/2"=1'0"

CORNET BAY
REMEDIATION PROJECT
PROPOSED ONSITE MITIGATION

THE PROPOSED ENHANCEMENT AREAS WILL BE PLANTED WITH NATIVE SHRUB SPECIES

SHEET
1
OF
1

Appendix C

Proposed Plan for Archaeological Monitoring and Inadvertent Discovery Protocol

PROPOSED PLAN FOR ARCHAEOLOGICAL MONITORING AND INADVERTENT DISCOVERY PROTOCOL, FOR THE CORNET BAY MARINA MTCA CLEANUP PROJECT, ISLAND COUNTY, WASHINGTON

On-Site Monitoring

Grette Associates, on behalf of Cornet Bay Marina, is requesting archaeological monitoring during excavation and other below-fill ground-disturbing project actions for the Cornet Bay Marina Clean-up project in Cornet Bay, Whidbey Island, Island County, Washington to minimize potential effects to any as-yet unknown human remains and/or intact archaeological deposits. The project is a bulkhead replacement, demolition of a building constructed in the late 1970s, and site cleaning from a diesel fuel leak in underground tanks located at Cornet Bay Marina. The project will include drilling holes and trenches and removing soil behind the existing timber bulkhead, removing a building and its concrete foundation, and installing a new steel bulkhead. The maximum depth of soil disturbing activities will be 15 feet.

CRC will provide archaeological monitoring during excavation of the existing bulkhead and other excavations of below-fill ground-disturbing activities for the Cornet Bay Marina MTCA Cleanup Project.

CRC will provide on-site archaeological monitoring orientation for construction crew.

Archaeological monitoring would entail having an archaeologist present during construction excavation to observe subsurface conditions and identify any buried archaeological materials that may be encountered. Monitoring will be performed either by a "professional archaeologist" (RCW 27.53.030 (8)) or under the supervision of a professional archaeologist.

The monitoring archaeologist would stand in close proximity to construction equipment in order to view subsurface deposits as they are exposed, and would be in close communication with equipment operators to ensure adequate opportunity for observation and documentation. Archaeological monitoring will seek to identify potential buried surfaces, anthropogenic sediments, and archaeological features such as shell middens, hearths, or artifact-bearing strata. The monitoring archaeologist will inspect project excavations and the recovered sediments for indications of such archaeological resources. The archaeologist will be provided the opportunity to screen excavated sediments and matrix samples when this is judged useful to the identification process. It is not expected that modern fill (e.g., imported culturally-sterile construction fill) or glacial till sediments would be included in screening procedures. Excavated spoils may be examined in the course of monitoring. If cultural materials are observed in spoils piles, it is expected that these would be removed for examination and that the opportunity to screen spoil sediments would be available.

Archaeological monitoring of construction excavation will proceed until it can be determined with a greater level of confidence that human remains or other cultural resources are not likely to be impacted by construction excavation of the project. The archaeologist will conduct monitoring until native and fill deposits can be confidently isolated and identified based on

observed sedimentary exposures. Upon completion of the monitoring, the archaeologist will prepare a report on the methods and results of the work, and recommendations for any necessary additional archaeological investigations, illustrated with maps, drawings, and photographs as appropriate.

Protocols for Discovery of Archaeological Resources
In the event that archaeological resources are encountered during project implementation, the following actions will be taken:

In work areas, all ground disturbing activity at the location will stop, and the work supervisor will be notified immediately. The work site will be secured from any additional impacts and the supervisor will be informed.

The project proponent will immediately contact the agencies with jurisdiction over the lands where the discovery is located, if appropriate. The appropriate agency archaeologist or the proponent's contracting archaeologist will determine the size of the work stoppage zone or discovery location in order to sufficiently protect the resource until further decisions can be made regarding the work site.

The project proponent will consult with DAHP regarding the evaluation of the discovery and the appropriate protection measures, if applicable. Once the consultation has been completed, and if the site is determined to be NRHP-eligible, the project proponent will request written concurrence the agency or tribe(s) concurs that the protection and mitigation measures have been fulfilled. Upon notification of concurrence from the appropriate parties, the project proponent will proceed with the project.

Within six months after completion of the above steps, the project proponent will prepare a final written report of the discovery. The report will include a description of the contents of the discovery, a summary of consultation, and a description of the treatment or mitigation measures.

Protocols for Discovery of Human Remains
If human remains are found within the project area, the project proponent, its contractors or permit-holders, the following actions will be taken, consistent with Washington State RCWs 68.50.645, 27.44.055, and 68.60.055:

If ground-disturbing activities encounter human skeletal remains during the course of construction, or if they are exposed by reservoir operations then all activity will cease that may cause further disturbance to those remains. The area of the find will be secured and protected from further disturbance. The project proponent will prepare a plan for securing and protecting exposed human remains and retain consultants to perform these services. The finding of human skeletal remains will be reported to the county medical examiner/coroner and local law enforcement in the most expeditious manner possible. The remains will not be touched, moved, or further disturbed. The county medical examiner/coroner will assume jurisdiction over the human skeletal remains and make a determination of whether those remains are forensic or non-forensic. If the county medical examiner/coroner determines the remains are non-forensic, then they will report that finding to DAHP, which will then take jurisdiction over the remains. DAHP

will notify any appropriate cemeteries and all affected tribes of the find. The State Physical Anthropologist will make a determination of whether the remains are Indian or Non-Indian and report that finding to any appropriate cemeteries and the affected tribes. DAHP will then handle all consultation with the affected parties as to the future preservation, excavation, and disposition of the remains.

Lead Representative and Primary Contact

Grette Associates
2102 North 30th Street, Tacoma, WA 98403
Primary Contact: Matthew Boyle, Senior Biologist/Principal, 253-573-9300

Washington State Department of Ecology
3190 – 160th Avenue SE, Bellevue, WA 98005-5452
Primary Contact: Jing Liu, Toxics Cleanup Program, Northwest Regional Office, 425-649-4310

U. S. Army Corps of Engineers, Seattle District
PO Box 3755, Seattle, WA 98124-3755
Primary Contact: Olivia H. Romano, Biologist/Project Manager/ WRDA-214, 206-764-6960

Samish Tribe
PO Box 217, Anacortes, WA 98221
Primary Contact: Jackie Ferry, Cultural Resources, 360-293-6404 ext. 215

Stillaguamish Tribe
3310 Smokey Point Drive, PO Box 277, Arlington, WA 98223-0277
Primary Contact: Kerry Lyste, Cultural Resources, 360-652-7362 ext. 226

Swinomish Indian Tribal Community
11430 Moorage Way, La Conner, WA 98257-8707
Primary Contact: Larry Campbell, THPO, Cultural Resource, 360-466-7352

Tulalip Tribes
6410 23rd Avenue NE, Tulalip, WA 98271
Primary Contact: Richard Young, Cultural Resources, 360-716-2652

Upper Skagit Tribe
25944 Community Plaza, Sedro Woolley, WA 98284
Primary Contact: Scott Schuyler, Cultural Resources, 360-854-7009

Washington Department of Archaeology and Historic Preservation
PO Box 48343, Olympia, WA 98504-8343
Lead Representative: Allyson Brooks, State Historic Preservation Officer, 360-586-3066
Primary Contact: Rob Whitlam, State Archaeologist, 360-586-3080
Primary Contact for Human Remains: Guy Tasa, State Physical Anthropologist, 360-586-3534

Island County Coroner's Office
PO Box 5000, Coupeville, WA 98239-5000
Lead Representative: Robert W. Bishop, Coroner, 360-679-7358

Island County Sheriff's Office
PO Box 5000, Coupeville, WA 98239
Lead Representative: Mark C. Brown, Sheriff, 360-678-4422