Final Upland Remediation (Phase I) Cleanup Action Plan for Interim Action Work Plan Custom Plywood Site Anacortes, Washington

Prepared by Hart Crowser
under Direction and Contract with
Washington State
Department of Ecology
under Agreement with
GBH Investments, LLC

September 2011
17330-27

Washington State Department of Ecology

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ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
BMPs	best management practices
CAP	Cleanup Action Plan
COA	City of Anacortes
COC	constituent of concern
COPC	constituent of potential concern
cPAHs	carcinogenic polycyclic aromatic hydrocarbons
CQAP	Construction Quality Assurance Plan
CSM	conceptual site model
cy	cubic yard
DAHP	Department of Archaeology and Historic Preservation
DCA	disproportionate cost analysis
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
EPA	US Environmental Protection Agency
FRTR	Federal Remediation Technology Roundtable
FS	Feasibility Study
GBH	GBH Investments, LLC
IAWP	Interim Action Work Plan
MHHW	Mean Higher High Water
mg/kg	milligrams per kilogram
MTCA	Model Toxics Control Act
OHW	Ordinary High Water
OMMP	Operations, Monitoring, and Maintenance Plan
PCBs	polychlorinated biphenyls
PCP	pentachlorophenol
PLP	Potentially Liable Party
POC	point of compliance
PSI	Puget Sound Initiative
QA	quality assurance
RI	Remedial Investigation
SEA	Shorelands and Environmental Assistance
SEPA	State Environmental Policy Act
sf	square feet
SMP	Shoreline Master Program
SMS	sediment management standards
SQS	sediment quality standards
SVOCs	semivolatile organic compounds
TCP	(Ecology) Toxics Cleanup Program

TPH	total petroleum hydrocarbon
ug/L	micro-grams per liter
USACE	U S Army Corps of Engineers
VOCs	volatile organic compounds

EXECUTIVE SUMMARY

In accordance with an agreement with GBH Investments, LLC (GBH), this Cleanup Action Plan (CAP) for Phase I Upland Remediation has been prepared under the provisions of the Washington State Model Toxics Control Act (MTCA – Chapter 173-340 WAC) for the Custom Plywood Site (Site) in Anacortes, Washington. The CAP was prepared under the direction of the Washington State Department of Ecology (Ecology) Toxics Cleanup Program (TCP), for selected upland portions of the Site, of which GBH is the current property owner and a Potential Liable Person (PLP) (per WAC Chapter 173-340-200).

This CAP is part of the MTCA Interim Action Work Plan (IAWP) for the Site. The IAWP consists of the September Remedial Investigation (RI) Report for Interim Action Work Plan prepared by AMEC Geomatrix (AMEC 2011) for GBH, the September 2011 Feasibility Study (FS) Report for Interim Action Work Plan and the September 2011 Upland Remediation (Phase I) Engineering Design Report (EDR) for Interim Action Work Plan prepared by Hart Crowser for Ecology, and this CAP for Phase I upland remediation. (Note that these reports are referred to herein as the RI, FS, EDR, and CAP hereafter.) GBH completed the RI in response to Ecology Agreed Order DE 5235, dated March 17, 2008.

As summarized in the RI, the property was originally developed as a saw and planing mill in the early 1900s. Through the years, the property ownership has changed several times, and was rebuilt and added onto until Custom Plywood became an operating entity sometime before 1991. The facility was used as a sawmill and plywood manufacturing plant until most of the wooden structures in the main plant area, many of which were built in the 1940s, were consumed in a fire on November 28, 1992. Except for the parcels on the periphery that have been sold and redeveloped, the main part of the former mill property has been used sporadically since 1992.

The upland area of the Site is characterized as heavily disturbed, containing relict foundations and structures, concrete and wood debris, native and non-native vegetation, and wetlands. The remnants of former structures, including concrete foundations and pilings and abandoned tanks from previous industrial activities, are scattered across the property. More than 1,500 wooden pilings associated with the former Custom Plywood mill structures remain on the property.

The shoreline of the Site contains industrial debris and significant quantities of naturally occurring woody debris, which ranges in size from sawdust to larger mill end remnants and logs. Active erosion is occurring along the northeast and central portion of the property where storm events and long-period waves have locally destabilized the shoreline. Temporary measures have been completed with the intent to stabilize the shoreline to prevent or slow further erosion.

Results of the RI identified constituents of potential concern (COPCs) and key indicator hazardous substances in soil and groundwater at the Site. The COPCs and key indicator hazardous substances that were identified in Site soil include diesel- and oil-range total petroleum hydrocarbons (TPH), metals (arsenic, cadmium, copper, chromium, lead, mercury, nickel, selenium, silver, and zinc), and select semivolatile organic compounds (SVOCs), which primarily include carcinogenic polycyclic aromatic hydrocarbons (cPAHs). Of these, oil-range TPH had the most significant relative exceedance of preliminary MTCA screening levels, identified near the former press pits located in the central upland portion of the property. PCBs, dioxins/furans, and other compounds were identified infrequently and generally at concentrations below screening levels. As such, these compounds were not considered to be key indicator hazardous substances in the RI or FS.

The RI reported limited groundwater data for establishing indicator hazardous substances. Several constituents were detected during sampling and testing of Site groundwater monitoring wells and seeps that were considered indicator hazardous substances, which include diesel- and oil-range TPH, cPAHs, and metals (arsenic, copper, nickel, and zinc).

Previous independent and limited interim remedial actions have been conducted in the upland portion of the Site. These actions include removal of soil impacted by hydraulic oil within the City of Anacortes right-of-way located immediately northwest of the GBH property in 1998, and removal of impacted soils from four areas where petroleum hydrocarbons and other constituents exceeded MTCA Method A cleanup levels in 2007.

The FS that was prepared for the Site assessed several upland cleanup alternatives applicable to remediation of impacted Site soil and groundwater, which were developed based on the findings of the RI and evaluated in accordance with MTCA criteria (WAC 173-340-360), including disproportionate cost analysis (DCA) considerations. The FS alternatives were evaluated to assess compliance with minimum regulatory requirements, including consistency with provisions of MTCA and other ARARs. MTCA places preference on permanent solutions to the maximum extent practicable based on the DCA.

Four upland cleanup alternatives covering several excavation options and surface capping were evaluated in the FS. Other technologies were considered, for example, thermal treatment; but not retained. A range of potential wetland mitigation and stormwater management alternatives were considered.

The benefits of the alternatives considered were balanced against relative costs for implementing each alternative. Preference was also placed on remedies that can be implemented in a shorter time, based on potential environmental risks and effects on current Site use and associated Site and surrounding area resources. The third criterion, public concerns, will be addressed during comment periods for RI and FS.

The selected remedy for the uplands is identified in the FS as Alternative U-3. As described in the FS and this CAP, this remedy combines removal of near-surface debris, concrete foundations and pilings (where necessary to access contaminated soil), with soil excavation as a source control measure, and backfilling to existing contours.

The remedy involves excavation up to a depth of 15 feet in the shoreline protection zone (defined as the area that lies between the Mean Higher High Water [MHHW] line to a distance 75 feet landward of MHHW) and up to 6 feet elsewhere on the property. Portions of the excavation areas that lie seaward of Ordinary High Water (OHW) will be excavated in the later aquatic phase of work (Phase II). Excavation up to a depth of 6 feet represents source removal to the ecological point of compliance, and excavation to 15 feet represents source removal to the human health point of compliance (POC). The final extent of excavation will be determined during construction through field screening, soil sample testing, or by other criteria based on field conditions encountered during construction.

A target volume of approximately 26,000 cubic yards (cy) of debris and contaminated soil material is estimated to be excavated and disposed of off site at a permitted Subtitle D landfill facility. The excavation areas will be backfilled to grade using clean imported fill and crushed concrete debris generated from on-site aboveground structure and foundation demolition. Post-construction site stabilization measures (hydroseeding and other erosion protection technologies) will be implemented in the last phase of construction that occurs outside of the new stormwater management and wetland mitigation and buffer areas that are created.

The selected upland cleanup alternative includes mitigation for nearly 12,000 square feet (sf) of wetlands impacted by the planned soil excavation activities. A consolidated wetland concept in the southern portion of the property is included as part of the overall cleanup action for the Site, which includes an estuarine wetland created landward of OHW with an associated upland buffer approximately 50 to 75 feet in width that will be planted with native vegetation. Public access elements are also planned to be implemented that include beach access at the southern landward tip of the Site.

Installation of a stormwater swale is planned for management and treatment of stormwater currently routed onto the Custom Plywood property through a City of Anacortes conveyance. The swale will provide basic stormwater treatment before it enters a vegetated conveyance corridor that will route the treated stormwater from the swale into the restored wetland area. The conveyance corridor will be designed to meander through the restored buffer area to provide additional treatment and infiltration as well as a more natural channel configuration.

Post-construction stormwater and confirmational monitoring will be conducted to verify the long-term efficacy of the upland interim action after performance standards have been reached. In addition, one or more environmental covenants are planned to be established for the Custom Plywood property.

The Draft Interim Action Work Plan documents, which included the Draft CAP was issued in mid-February 2011 for combined MTCA/SEPA public review. Briefing meetings were held with Site stakeholders and the general public on February 24, 2011 and the final IAWP documents were released in September 2011 following the September 2011 completion of the Summary Response to Comments from the stakeholders and public. The detailed design phase for Phase I upland cleanup began in early February to develop the necessary project plans, specifications, and related quality assurance planning and compliance monitoring documents.

The construction bid solicitation was advertised in May 2011, and the construction contract awarded in June 2011. Phase I upland construction began in the middle of July and is currently scheduled to be completed by the end of October 2011. Field construction for aquatic remediation (Phase II) is scheduled to start in 2013 and will extend through 2015 as a follow-on action to Phase I upland remediation.

UPLAND REMEDIATION (PHASE I)
CLEANUP ACTION PLAN
FOR INTERIM ACTION WORK PLAN
CUSTOM PLYWOOD SITE
ANACORTES, WASHINGTON

1.0 INTRODUCTION

This Phase I upland remediation Cleanup Action Plan (CAP) is prepared under the direction of the Washington State Department of Ecology (Ecology) Toxics Cleanup Program (TCP) in accordance with an agreement with GBH Investments, LLC (GBH) for selected upland portions of the Custom Plywood Site (Site) located in Anacortes, Washington (Figure 1-1). GBH is the current property owner and Potentially Liable Party (PLP) under provisions of the Washington State Model Toxics Control Act (MTCA – Chapter 173-340 WAC).

The Site is one of several Anacortes Area Bay-Wide priority sites for Fidalgo/Padilla Bays being addressed by the TCP under the Puget Sound Initiative (PSI). The Site includes property owned by GBH covering approximately 6.6 acres of upland and 34 acres of intertidal and subtidal areas (Figure 1-2 – extent of aquatic portion of GBH property and Site not shown on figure). Additional state-owned aquatic areas are also included within the Site.

The Site was the location of lumber and plywood milling operations beginning in about 1900. Milling activities produced wood waste and chemical contaminants affecting Site soils and groundwater that are the focus of this CAP.

This CAP covers planned remedial actions for the upland portion of the Site, defined by the GBH property boundary eastward to the Ordinary High Water (OHW) line (Figure 1-2). The work is planned to be conducted in phases with Phase I defined to first complete upland remediation beginning in the summer of 2011, with cleanup of in-water areas completed in 2012 and 2013. A separate CAP is to be completed for Phase II, the in-water remediation component, with permitting and construction completed as separate, follow-on efforts to upland remediation.

1.1 Regulatory Framework

This CAP is intended to further identify and evaluate potential areas of upland aquatic contamination, inform cleanup and habitat restoration decisions, and confirm the priority areas for cleanup as part of a MTCA Interim Action Work Plan (IAWP). The IAWP consists of the September Remedial Investigation (RI) Report for Interim Action Work Plan prepared by AMEC Geomatrix (AMEC

2011) for GBH, the September 2011 Feasibility Study (FS) Report for Interim Action Work Plan prepared by Hart Crowser for Ecology, the September 2011 Engineering Design Report (EDR) for Interim Action Work Plan prepared by Hart Crowser for Ecology, and this September 2011 CAP prepared by Hart Crowser for Ecology. (Note that these reports are referred to herein as the RI, FS, EDR, and CAP hereafter.) GBH completed the RI in response to Ecology Agreed Order DE 5235, dated March 17, 2008. The RI identified the nature and extent of contaminated soil and groundwater in the upland and sediments in the intertidal and subtidal portions of the Site. The RI further identified cleanup screening levels for affected soil, groundwater, and sediment relative to applicable requirements of MTCA, SMS, and other regulatory criteria.

The FS further developed a conceptual site model (CSM) describing contaminant sources, pathways, and receptors for the upland and in-water portions of the Site. Remedial action objectives, including applicable cleanup levels, were identified for upland and aquatic areas planned for remediation as part of the IAWP. In accordance with WAC 173-340-350(8), the FS screened potential remedial technologies and alternatives in accordance with applicable MTCA threshold and sediment management standards (SMS) cleanup action requirements. Remedial action alternatives were evaluated by assessing their compliance with the requirements for cleanup actions specified in WAC 173-340-360. The FS then identified preferred remedial alternatives for the upland and in-water areas of the Site.

This also includes two additional documents in the Appendices:

- The September 2011 Archaeological Monitoring Plan for construction activities associated with upland remediation. Historical Research Associates (HRA) prepared the Archaeological Monitoring Plan for Ecology and Hart Crowser to support the IAWP and guide follow-on design; and

- The September 2011 Conceptual Wetland Mitigation Plan for the project developed and presented as part of the FS, but also included herein in Appendix B for informational purposes.

1.2 Custom Plywood Site CAP (Phase I) Approach and Organization

Elements of this CAP address requirements of WAC 173-340-380 including:

- A description of the planned cleanup action;

- Rationale for selecting the preferred alternative;

- A summary of other cleanup action alternatives evaluated;
- Cleanup standards for hazardous substances and media of concern;
- Schedule for the planned implementation of the Phase I upland cleanup action ;
- Institutional controls;
- Applicable state and federal laws;
- Preliminary determination of compliance with MTCA remedy selection criteria; and
- Types, levels, and amounts of hazardous substances remaining on site, and measures to prevent migration and contact.

Specific discussion points pertinent to these MTCA criteria are presented in subsequent sections organized as follows.

Section 2.0 Summary of Site Conditions

This section summarizes the historical uses of the Site and its current land use. An overview of the results of the RI and other recent investigation work are tabulated in the FS and this CAP, and prior cleanup actions at the Site are summarized. This information is used to develop a CSM for the Site.

Section 3.0 Cleanup Requirements

Remedial action objectives and cleanup standards for the upland area of the Site within the GBH property boundary are identified in Section 3.0. The criteria used to establish upland wetland mitigation are also defined in Section 3.0.

Section 4.0 Selected Upland Cleanup Action Alternative

The cleanup actions planned for upland soils are detailed in Section 4.0. These actions include an array of soil removal and off-site disposal activities, stormwater management, and wetland mitigation measures. Section 4.0 also contains information related to the monitoring that is planned during and after implementation of the cleanup action, identifies contingency actions that are planned to be implemented if the remedial action objectives for the Site are not achieved, identifies the potential future land uses of the Site, and identifies the restrictive covenants anticipated to be established to protect human health and the environment once the cleanup action has been implemented.

Section 5.0 Remedial Action Alternatives Considered and Basis for Selecting the Upland Cleanup Action

The technology screening process used in the FS to identify candidate treatment technologies for the upland area of the Site, and to assemble these technologies into remedial alternatives is summarized in Section 5.0. The process used to assess the relative compliance of each alternative with MTCA criteria is also summarized in Section 5.0.

Section 6.0 Upland Cleanup Action Implementation

The work planned to implement the upland cleanup interim action is outline in Section 6.0. This work includes preparation of the remedial design documentation, construction plans, specifications, and schedule needed to implement the cleanup action at the Site.

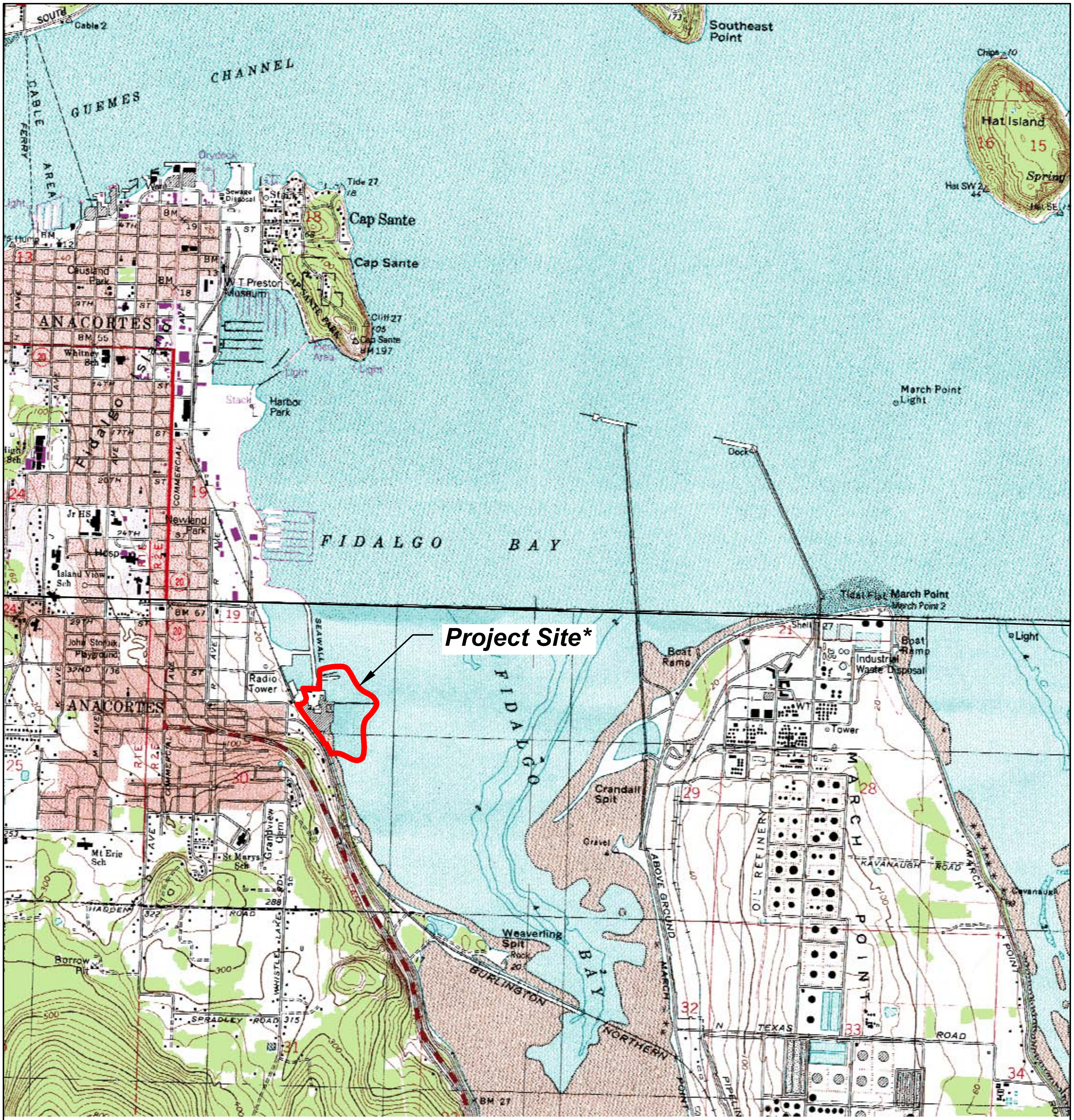
Section 7.0 Compliance Monitoring

The compliance monitoring and potential contingency responses planned to comply with WAC 173-340-410 are outlined in Section 7.0.

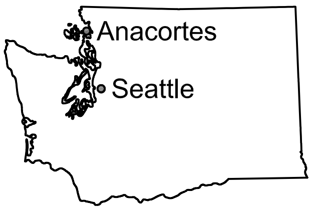
Section 8.0 Ecology Five-Year Review

The interim cleanup action described in this CAP will leave hazardous substances behind at concentrations above cleanup levels and will require restrictive covenants as part of the remedy. Therefore, a 5-year review of the cleanup action will be required. The components of this review are outlined in Section 8.0.

This also serves as a decision document for the selected upland remediation alternative identified as part of the IAWP. Design and construction considerations for this alternative are further developed and evaluated in the EDR and forthcoming project design plans and specifications.



Source: Base map prepared from USGS 7.5-Minute Series Topographic Map, Anacortes North and Anacortes South Quadrangles.



0 0.5 1
Scale in Miles

N

* Represents upland and aquatic portions of the site included with current CAP.

Custom Plywood Site
Anacortes, Washington

Vicinity Map

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Figure
1-1

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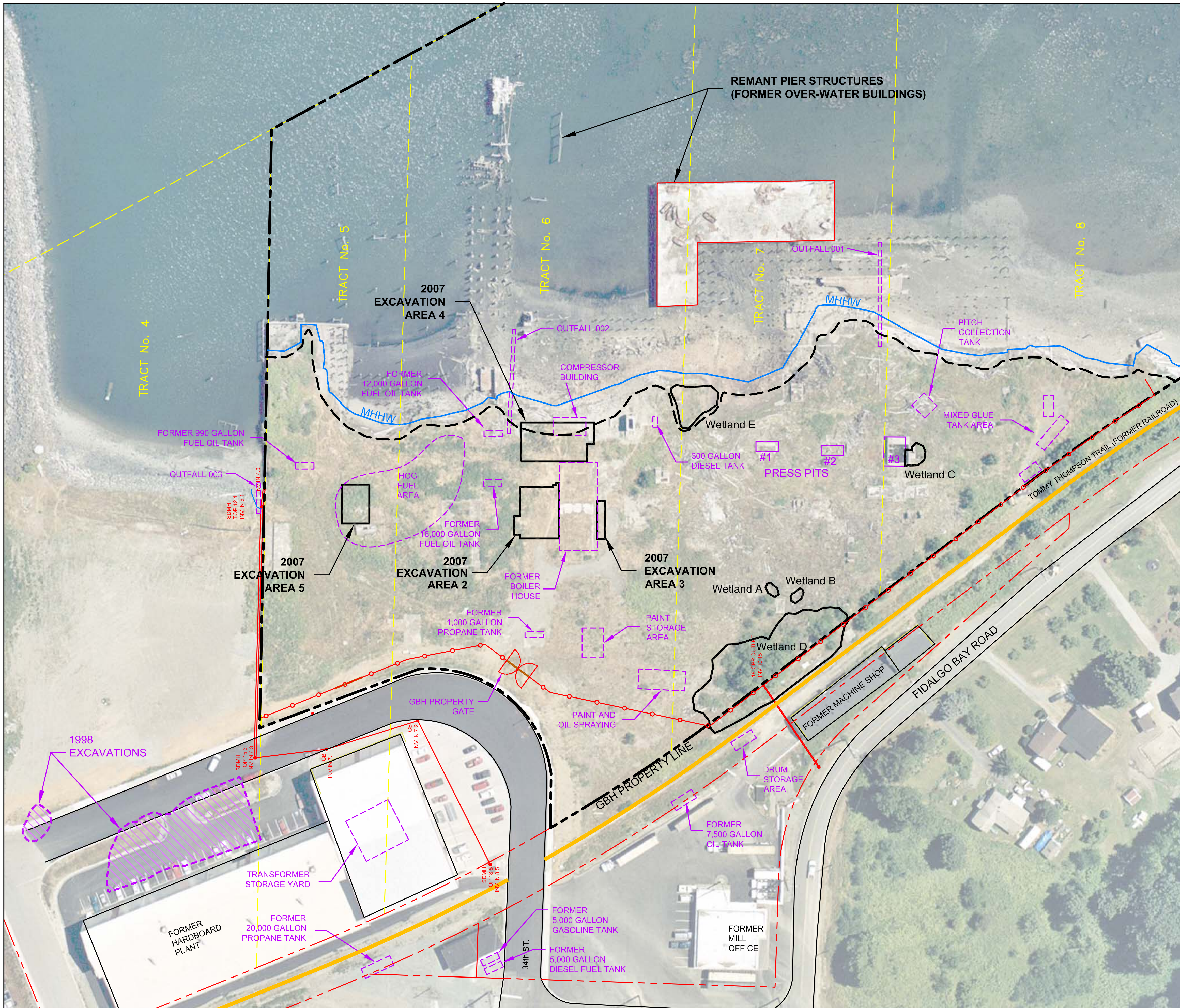

Ordinary High Water

MHHW Mean Higher High Water

Fence

Storm Drain Line

Historical Feature

Note: Adapted from AMEC Geomatrix (2010) First Draft Remedial Investigation (RI) Report Figure 3.

Source: Aerial photo courtesy of City of Anacortes, 2003.

N

0 100 200

Scale in Feet

Custom Plywood Site
Anacortes, Washington

Site Features Map

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Figure **1-2**

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2.0 SUMMARY OF SITE CONDITIONS

For purposes of this CAP, the Site is defined by the extent of contamination on or near the Custom Plywood Mill facility. The Site includes the footprint of the former plywood mill at its maximum extent during operation, including property currently owned by GBH, and property owned by other parties. The Site also encompasses offshore areas extending to the Inner Harbor Line including GBH-owned aquatic parcels and state aquatic lands located farther offshore and affected by dioxin contamination above the Fidalgo Bay background concentration. Ecology determined the aquatic portion of the Site boundary, extending well out into Fidalgo Bay (and not shown on CAP figures for clarity) following the 2010 sediment quality sampling and testing by SAIC (2010). Remediation associated with the aquatic portion of the Site is not considered further in this CAP, but will be addressed in a subsequent CAP for Phase II in-water work.

Property, for purposes of this CAP, is defined as the tracts of land (Tract Nos. 4 through 10) currently owned by GBH, including upland and tideland seaward to the Inner Harbor Line (Figure 2-1, entire GBH aquatic holdings not shown on figure). According to Skagit County Assessor's records, the main part of the Site property is an irregularly shaped parcel that covers approximately 6.6 acres of upland and 34 acres of intertidal and subtidal areas currently owned by GBH (Figure 1-2).

The remaining portions of the Site property consist of roughly 7 upland acres and 1.3 tideland acres that are owned and redeveloped by other parties. These remaining property areas are not part of the current interim action or current CAP.

Subsequent Sections 2.1 and 2.2 summarize the historical and current uses of the Site, respectively. Section 2.2 describes the nearshore, intertidal, and subtidal areas for completeness and to provide context. Interim cleanup actions have been conducted at the Site since 1998. These prior cleanup actions are summarized in Section 2.3 for background context. The investigatory work presented in the RI is summarized in Section 2.4. This prior investigatory and cleanup work is used to create a CSM of the Site in Section 2.5.

2.1 Site History

As summarized in the RI, the property was originally developed as a saw and planing mill from around 1900 until it burned down sometime between 1925 and 1937. Through the years, the property changed hands several times, and was rebuilt and added onto until Custom Plywood became the operating entity sometime before 1991. The facility was used as a sawmill and plywood manufacturing plant until most of the wooden structures in the main plant area, many of which were built in the 1940s, were consumed in a fire on November 28, 1992. The current Site layout is shown on Figure 1-2.

Except for the parcels on the periphery that have been sold and redeveloped, the main part of the former mill property has been used sporadically since 1992. In December 2007, the main part of the former mill property was sold to GBH. For further discussion of the history of Site operation and ownership and the history and characteristics of surrounding properties, refer to RI.

2.2 Current Land Use and Description

The Site has been divided into an upland area, a wetland area, an intertidal area, and a subtidal area. These areas are described in this section.

2.2.1 Upland Area

The upland of the Site is characterized as a heavily disturbed site containing relict foundations and structures, concrete and wood debris, vegetation (native and non-native), and wetlands (Figure 1-2). A mixture of native and non-native vegetation consisting of grasses, Canada thistle, and other weedy species dominates the vegetation. No trees are present on the property.

The northwestern portion of the property is currently used as a temporary boat storage yard. The remnants of former structures, including concrete foundations and pilings and abandoned tanks from previous industrial activities, are scattered across the property. Portions of the above-ground foundations have been removed from the property. Several debris piles containing wood, metal, and other material are located throughout the property.

2.2.2 Wetlands

Five wetland areas (Wetlands A through E) are located within the southern portion of the property (Figure 1-2). These wetlands were delineated and their boundaries accepted by the US Army Corps of Engineers (USACE) and Ecology's Shorelands and Environmental Assistance (SEA) Program. Wetlands A (120 square feet [sf] in area), B (124 sf in area), and D (9,910 sf in area) are freshwater wetlands, and Wetlands C (367 sf in area) and E (1,389 sf in area) are estuarine wetlands. The freshwater wetlands are small, and appear to be created because of unfilled test pits and stormwater collecting on the property. Wetlands A and B are rated as Category IV systems, Wetland D is rated as a Category III system, and Wetlands C and E are rated as Category II systems. Wetland D is located in an area exceeding the preliminary soil screening levels based on the previously delineated extent of contamination (AMEC 2011). Wetlands A, B, C, and E are adjacent or immediately adjacent to areas that have been identified as areas where some contaminants are present at concentrations that exceed screening levels (AMEC 2011). Given this information, the on-site wetlands are currently at risk or have a potential risk of becoming contaminated.

2.2.3 Nearshore and Intertidal Area

The shoreline of the Site property contains industrial debris and significant quantities of naturally occurring woody debris (Figure 1-2). Woody debris ranges in size from sawdust to large mill end remnants and logs. Active erosion is occurring along the northeast and central portion of the property where storm events and long-period waves have locally destabilized the shoreline (refer to Appendix B-2 of the FS). Within the central portion of the shoreline, ecology blocks covered in a geotextile fabric and concrete/debris were placed near the Mean Higher High Water (MHHW) line during an emergency erosion control action following a high wave and storm event in January 2010. The southernmost tip of the property is armored with rip rap, which extends off site to the south.

The intertidal zone contains an L-shaped pier supported by piles, individual pilings, considerable quantities of wood waste embedded in the substrate, and structural debris from previous buildings on the property (Figure 1-2). More than 1,500 pilings associated with the Site are present on the property. Rockweed (*Fucus*) is present on a variety of structures and debris along the central and northern portions of the shoreline.

Surf smelt spawning has been documented in small areas along the property shoreline. Given the shoreline and intertidal conditions and the presence of wood debris, it is questionable whether spawn is viable along the northern and central portions of the intertidal zone. Hydrogen sulfide odor is also prevalent at times along portions of the shoreline.

Site conditions show an actively eroding shoreline upon which ecology blocks and rubble have been placed over time to help stabilize the shoreline to prevent or slow further erosion. The in-water structures provide some protection from wind and wave energy. Coastal wave modeling for the property shows that a majority of the wave energy propagates from the northeast, which is aligned with the longest fetch but differs from the predominant wind pattern (refer to Appendix B-2 of the FS). This strongly suggests that the beach face is subject to acute, episodic erosion events similar to the event during the winter of 2010 causing visible erosion along the shoreline embankment. Although the predominant wave and wind conditions support a smaller stable grain size in the nearshore area, the stronger episodic storm events undermine the beach face and cause significant erosion.

2.2.4 Subtidal Area

The immediate subtidal portion of the property is a low-slope mudflat that contains large amounts of wood debris, sawdust, and is partially covered by overwater structures (Figure 1-2). This heavily impacted zone contains macroalgae (*Ulva* sp.) and an abundance of cyanobacteria and reducing bacteria (likely *Beggiatoa* sp.) that are indicative of sulfide-rich sediments. This apparent reducing layer is present at the surface at several locations on the mudflat.

Deeper in the subtidal zone, extensive eelgrass beds are documented on and adjacent to the Custom Plywood property. These beds are contiguous with the larger Fidalgo Bay eelgrass population. The condition of the shoreward limits of the eelgrass bed appeared good during site reconnaissance efforts supporting the FS in the summer of 2010, but distribution was limited by the presence of wood debris and, possibly, by predominantly dissolved sulfide conditions.

2.3 Summary of Prior Cleanup Actions

Since 1993, previous property owners, the City of Anacortes (COA), Ecology, and the US Environmental Protection Agency (EPA) have conducted a series of environmental characterization and sampling and analysis investigations near the Site. These investigations were conducted to define the extent of contamination and evaluate the condition of the soil, groundwater, and offshore sediments. Each successive investigation targeted data gaps identified in the previous investigations.

Interim remedial actions were conducted under WAC 173-340-515 (Independent Remedial Actions) on the upland portion of the Site beginning in 1998. In 1998, Woodward-Clyde completed removal of soil impacted by hydraulic oil within the COA right-of-way located immediately northwest of the GBH property. Ecology issued a No Further Action determination for this location following three years of groundwater monitoring. The area in question is not located within the project area covered by this upland CAP.

Investigations conducted between 1995 and 2003 culminated in the development of an Interim Remedial Action Plan for soil removal within the upland excavation areas 2 though 5, as noted on Figure 1-2 (Geomatrix 2007). The Interim Remedial Action Plan was implemented by GBH without Ecology's oversight and included excavation and off-site disposal of the soil in the northern tracts (Tracts 5 and 6) first, followed by planned excavation and disposal of the soil in the southern tracts (Tracts 7 and 8) a year later. The first phase of the interim action work on the northern tracts was conducted in July 2007 to remove impacted soils from four areas where petroleum hydrocarbons and other constituents exceeded MTCA Method A cleanup levels. A more complete description of the northern interim cleanup action is provided in the RI. After the interim action in 2007, Ecology required the subsequent work to be conducted within the Puget Sound Initiative (PSI) program under an Agreed Order to be consistent with the approach at other PSI-led sites in Fidalgo Bay.

2.4 Summary of Environmental Conditions and Previous Investigations

A brief summary of the Site environmental characterization and sampling and analysis investigations that have been conducted is presented in Table 2-2. Further discussion of the individual investigations and findings between 1993 and 2010 are presented in the RI. Sampling locations for historical upland and sediment investigations from 1993 to 2010 are shown on Figure 2-1. A representation of the Site setting in uplands, nearshore, and tideland areas, based on previous and current investigations, is depicted in Cross Sections A-A′ and B-B′ on Figures 2-2 and 2-3 for reference.

2.4.1 Site Soils

The investigation of Site soils was summarized in Section 6.2 of the RI. Former plywood milling operations produced copious amounts of wood waste fill placed in upland and aquatic portions of the site over many years. Site fill soils consist of a heterogeneous mixture of silt, sand, and gravel with abundant near-surface debris and intermixed wood waste over native clay deposits. Upland fill materials exceed 15 feet in thickness in some areas and include to general “upper” and “lower” fill units identified in the RI. Concrete, brick, and other debris are the distinguishing components of the upper unit, while wood waste is more prevalent in the lower unit.

The primary constituents of potential concern (COPCs) and key indicator hazardous substances in soil identified by the RI are diesel- and oil-range total petroleum hydrocarbons (TPH), metals (arsenic, cadmium, copper, chromium, lead, mercury, nickel, selenium, silver, and zinc), and select Semivolatile Organic Compounds (SVOCs) —primarily carcinogenic polycyclic aromatic hydrocarbons (cPAHs). Of these, oil-range TPH had the most significant relative exceedance of preliminary MTCA screening levels with concentrations up to 164,000 milligrams per kilogram (mg/kg) identified near the press pits shown on Figure 1-2. TPH appears to affect both the upper and lower fill units. Polychlorinated biphenyls

(PCBs) and dioxins/furans each exceeded their respective screening levels at only one location. Where the concentrations of petroleum hydrocarbons are highest, some SVOCs were detected (e.g., phenanthrene, fluoranthene, and pyrene). PCBs, dioxin/furans, and other compounds were identified infrequently and nearly always at concentrations below screening levels. These compounds were not considered to be key indicator hazardous substances in the RI or FS. The RI provides additional detail regarding the extent of MTCA screening level exceedances.

2.4.2 Groundwater

The investigation of Site groundwater was summarized in Section 6.3 of the RI. Limited groundwater data were reported in the RI for establishing indicator hazardous substances. Several constituents were detected during 2008 and 2009 sampling and testing of Site groundwater monitoring wells and seeps that were considered indicator hazardous substances. These included:

- Diesel- and oil-range TPH;
- cPAHs; and
- Metals including arsenic, copper, nickel, and zinc.

The RI provides further information on the frequency and locations of MTCA screening level exceedances for these constituents, although monitoring data are somewhat limited. Cadmium, lead, and mercury were COPCs identified for soil and are included as additional COPCs for groundwater based on potential exposure pathways associated with Site construction activities

2.5 Conceptual Site Model

The conceptual site model (CSM) for the Site describes the physical and chemical conditions of the upland portion of the GBH property area and adjacent aquatic area addressed in the FS. The CSM is a representation that identifies the potential or suspected sources of hazardous substances, the types and concentration of hazardous substances, potentially contaminated media, and actual and potential exposure pathways and receptors (WAC 173-34-200) present at the Site.

The CSM is a set of hypotheses derived from existing Site data and knowledge gained from environmental evaluations conducted at other similar sites. This model summarizes our understanding of the environmental processes underway at the Site based on data available as of December 2010.

The following sections summarize:

- The suspected contaminant sources and media present in upland portions of the Site (Section 2.5.1);
- The contaminant release mechanisms, transport, and exposure pathways that can allow contaminants to migrate from upland source areas to potential receptors (Section 2.5.2);
- The potential receptors that could be impacted by contaminants from upland sources (Section 2.5.3); and
- The completed exposure pathways (Section 2.5.4).

The CSM builds on information presented in the RI, and additional Site data presented in the FS. A generalized CSM for the Site is depicted on Figure 2-4.

2.5.1 Contaminant Sources and Affected Media

Lumber milling and plywood operations took place at the Site for over 100 years. Although operational details are lacking, former plant operations produced copious amounts of wood waste fill placed in upland and aquatic portions of the Site over many years. Site operations ceased following the 1992 fire, with no continuing primary sources of contamination.

The primary and secondary sources of contaminants for the upland portion of the Site are identified below. Affected environmental media are also described.

Sources and Contaminants

Historical sources and processes releasing wood waste and hazardous chemical materials to the environment during mill operation are not well known or documented. The RI identified petroleum hydrocarbons (diesel and heavy oil), cPAHs, and metals as COPCs in soil and groundwater, and dioxin/furans as COPCs for sediments. Wood waste was also identified as a potential deleterious substance in aquatic areas of the Site. The process used to further evaluate and identify COPCs is described in Section 4.0 of the FS.

The RI noted that petroleum hydrocarbons were the most widely used and released hazardous material at the Site. TPH contamination and localized free product in site fill appear most prevalent near the press pit area in the south central portion of the upland area of the GBH property (Figure 1-2). Other suspected contaminant sources include burned debris from the 1992 fire, with

PAHs and dioxins expected as typical products of combustion. Creosote-treated pilings are an additional potential source of cPAHs in the aquatic and upland environments.

Other upland contaminants include pentachlorophenol (PCP) detected in a limited number of soil samples. No information was reported in the RI regarding the possible use of wood waste treatment compounds on the Site. PCP was a common ingredient in sap stain formulations historically applied at many plywood mills. The RI further notes that the distribution and relatively low concentrations of metals detected in soil are indicative of typical and limited historical industrial practices associated with building paint and equipment. No widespread or higher concentration sources of metals or metal waste streams were reported.

In the aquatic environment, thick sections of sawdust, mill ends, and other wood waste fill were deposited near former overwater structures associated with former Site operations.

Secondary Sources of Contamination and Affected Media

TPH and other chemical constituents including cPAHs and metals in soil represent a source of residual contamination in the upland portion of the Site. Soil contaminants are present in upland fill materials exceeding 15 feet in thickness in some areas of the Site. As a secondary source of contamination, TPH in soil appears to affect both the “upper” and “lower” fill units (Figures 2-2 and 2-3). Concrete, brick, and other debris are the distinguishing components of the upper unit, while wood waste is more prevalent in the lower unit. Residual soil contaminants have the potential to migrate to groundwater, surface water, and sediments.

Elevated concentrations of metals such as arsenic, copper, and nickel are present in groundwater in some upland areas of the Site. Limited sampling data exist to define the overall extent and prevalence of these constituents or possibly other COPCs in groundwater. The degree to which groundwater represents a secondary source of contamination, therefore, is uncertain. However, remediation of soil as secondary contaminant source is expected to remove groundwater as a contaminated medium.

2.5.2 Release Mechanisms and Transport Processes

The primary release mechanisms and transport processes by which contaminants can migrate from sources to receptors are identified in this section. For the upland environment, contaminants can migrate from source areas to receptors by the routes described below for affected media.

Surface Soil Potential Exposure Route

- Direct ingestion or dermal contact;
- Volatilization and dispersion to the air;
- Wind erosion to the air;
- Uptake into plants;
- Stormwater runoff into surface water and/or sediments; and
- Soil erosion from sloughing, and wave action.

Subsurface Soil Potential Exposure Route

- Direct ingestion or dermal contact; and
- Infiltration, percolation, or dissolution/desorption into groundwater.

Groundwater Potential Exposure Route

- Direct ingestion or dermal contact; and
- Flow into surface water including tidal flushing.

2.5.3 Receptors

Several classes of human and ecological receptors have been identified. For the upland portion of the Site, potential human receptors include current and future Site workers and other incidental users such as visitors who may be exposed to contaminated soil, groundwater, and surface water. Upland ecological receptors include plants and animals exposed to contaminated soil, groundwater, and surface water, as well as secondary food chain consumers such as birds and mammals.

2.5.4 Summary of Completed Exposure Pathways

For a constituent of concern (COC) to present a risk to human health and/or the environment, the pathway from the COC to the receptor must be completed.

The COC to receptor pathways judged to be present at the Site are listed in this section by contaminated media.

Upland Soils

Human Receptors. Direct contact with COCs in upland fill soils within 15 feet below ground surface (bgs) via the dermal contact or ingestion pathways.

Ecological Receptors. Direct contact with COCs in upland soils and within 6 feet bgs, including contact with near-surface soil and burrowing pathways; and direct uptake to plants, other terrestrial species, and secondary biological food chain/consumption pathways.

Groundwater and Upland Surface Water Runoff

The pathways judged to be present that may allow COCs in groundwater and upland runoff to reach receptors include the following.

Human Receptors. Direct contact (dermal contact, or incidental ingestion) with groundwater and surface water pathways.

Ecological Receptors. Direct contact (dermal contact, plant uptake, and possibly food chain consumption) by terrestrial species pathways.

Table 2-1 - Summary of Previous Upland Cleanup Actions at the Custom Plywood Site

Remediation Event	Remediation Description	Remediation Area
1998 Soil Remediation Report for 3205 V Place (Woodward-Clyde, 1998a)	Conducted a limited cleanup action on the City of Anacortes' V Place property in the areas where soil is heavily impacted by hydraulic oil located near the hardboard plant (Woodward-Clyde, 1997 a,b,c,d). Three groundwater monitoring wells (MW-1, MW-2, and MW-3) were installed downgradient of the soil excavation areas. Following three years of groundwater monitoring, the City of Anacortes received a "No Further Action" letter under the VCP through Ecology's NMRO. In 2002, the monitoring wells were decommissioned.	City of Anacortes V Place properties Areas #1, #2, #3
2007 Interim Remedial Action Areas 2 through 5 (Geomartix, 2007)	Conducted a interim remedial action on the Site in the areas where concentrations of COPCs exceeded unrestricted MTCA Method A soil cleanup levels. Four of the five identified areas (Areas 2-5) were excavated and disposed of off-site. Approximately, 1,500 tons of contaminated soil was disposed of at Rabanco's Subtitle D landfill in Klickitat County.	Former Custom Plywood properties

Notes:

For further discussion of the individual remediation activities, refer to the Custom Plywood Remedial Investigation (RI) (AMEC 2010).

Refer to Figure 3 for historical uplands remediation action locations.

Table 2-2 - Summary of Previous Upland Environmental Characterization and Sampling Investigations at the Custom Plywood Site

Investigation Event	Investigation Description	Exploration Type Nomenclature	
1993 Preliminary Environmental Evaluation (John A. Pinner and Associates, 1993)	Collected and analyzed surface water samples and a soil sample as a preliminary environmental evaluation. Samples locations not clearly located in report.	Surface Water:	One from Press Pit #2 and one from a depression north of Press Pit #2.
		Soil:	One northeast of Press Pit #3.
1995 Phase I and Limited Phase II Environmental Site Assessment (Enviros, 1995a)	Collected and analyzed hand-auger (HA) and shallow grab soil samples from areas with the highest likelihood of contamination.	Hand-auger:	HA3, HA4, HA5, HA6, HA7, HA8, HA9, HA11, HA14, HA17, HA18
		Soil:	G15-S
1995 Preliminary Sediment Sampling Report (Enviros, 1995b)	Collected and analyzed sediment samples offshore of the Site as a preliminary characterization study of sediment chemistry.	Sediment:	S1, S2, S3, S4a, S4b, S4c, S4d, S5, S6, S7, S8, S9, S10, S11, S12
1997 Marine Habitat and Resources Survey (URS Greiner, 1997)	Conducted a marine habitat and resources survey offshore of the City of Anacortes and the Site in the area from the shoreline to the outer harbor line.	Survey:	Vegetation and surficial sediment surveys, bathymetric contours, video data noting distribution of eelgrass and macroalgae, sediment grain size, wood content, and fauna present.
1997 Phase I and Limited Phase II Environmental Site Assessment (Woodward-Clyde, 1997a)	Collected and analyzed soil samples from thirteen test pits on the upland portion of the V Place property owned by the City of Anacortes.	Test Pit:	AN1, AN2, AN3, AN4, AN5, AN6, AN7, AN8, AN9, AN10, AN11, AN12, AN13
1997 Survey for Petroleum and Other Chemical Contaminants in the Sediments of Fidalgo Bay (Ecology, 1997b)	Collected and analyzed sediment samples to investigate the extent of oil and chemical contamination within Fidalgo Bay.	Sediment:	Outer_26, Outer_17, Inner_8
1997 Soil Sampling, 3205 V Place Property (Woodward-Clyde, 1997b)	Collected and analyzed soil samples from three test pits from the area described in Woodward-Clyde (1997a) as having the highest concentrations of TPH.	Test Pit:	ANX1, ANX2, ANX4
1997 Custom Plywood Soil Sampling (Woodward-Clyde, 1997c)	Collected and analyzed soil samples from four borings and fifteen hand-auger/shovel sample locations to investigate the presence of PCBs in the upland soils on the Site	Boring:	CP-GP1, CP-GP2, CP-GP3, CP-GP22
		Hand-auger /Shovel:	CP-HA20, CP-HA21, CP-HA23, CP-HA24, CP-HA25, CP-HA26, CP-HA27, CP-HA28, CP-HA29, CP-HA30, CP-HA31, CP-HA32, CP-HA33, CP-HA34, CP-HA??
1997 EMAP Program (Ecology, 1997a)	Collected and analyzed sediment samples for conventional parameters (i.e., total organic carbon), metals, SVOCs, and PCBs within Fidalgo Bay.	Station:	WA000007 and WA000008

Table 2-2 - Summary of Previous Upland Environmental Characterization and Sampling Investigations at the Custom Plywood Site

Investigation Event	Investigation Description	Exploration Type Nomenclature	
1997 Limited Phase II Site Assessment (Woodward-Clyde, 1997d)	Collected and analyzed soil samples from eleven test pits on the northern property boundary of the Site to determine the extent of heavy petroleum hydrocarbon contamination.	Test Pit:	ANA-TP1, ANA-TP2, ANA-TP3, ANA-TP4, ANA-TP5, ANA-TP6, ANA-TP7, ANA-TP8, ANA-TP9, ANA-TP10, ANA-TP11
1998 Site Investigation and Remedial Options Evaluation (Woodward-Clyde, 1998b)	Collected and analyzed soil and grab groundwater samples from seven push probes, five hand augers, and three shallow soil sample locations to: (1) delineate the extent of petroleum-impacted soil and groundwater in the press pit area; (2) identify potentially impacted soil in the vicinity of the resin/caustic storage shed and the former mixed glue tank; and (3) assess the quality of surface water contained in the press pits for disposal purposes. A preliminary evaluation of remedial options was also developed for the Site.	Push-probe:	CP-GP4 through CP-GP10
		Hand-auger:	CP-HA36 through CP-HA40
		Soil:	CP-HARC-A, CP-HARC-B, CP-HAGT
		Grab Groundwater:	CP-GP5, CP-GP7, CP-GP8
2000 START Preliminary Assessment/Site Inspection (EPA, 2000)	Collected and analyzed ten sediment samples, 61 soil samples, six grab groundwater samples, and one shoreline seep sample to document the nature and extent of contamination that may be present at the Site.	Sediment:	FB01 through FB10
		Boring:	BH01 to BH06, PP01 to PP08, CB01 to CB03, CB03b and CB04, RC01 to RC03, GT01 to GT03, UL01 to UL03, BG01, SL01
2003 Draft Engineering Evaluation/Cost Analysis and Cleanup Action Plan (URS, 2003)	Prepared for the City of Anacortes and the Anacortes Public Development Authority (PDA) to evaluate soil and groundwater cleanup alternatives in the upland portion of the Site. Intended to summarize previous investigations, evaluate remedial technologies, and provide a conceptual plan for preferred remedial action. Note: document was not finalized and the work was not performed.	No additional explorations were completed, summarized previous investigations.	
2003 Chemical Contamination, Acute Toxicity in Laboratory Tests, and Benthic Impacts in Sediments of Puget Sound (Ecology and NOAA, 2003)	Collected and analyzed sediment samples as a survey of background conditions within Puget Sound. Three stations were located within Fidalgo Bay and are close enough to provide potential background conditions in the vicinity of the Site.	Station:	17-1-50, 17-2-51, 17-3-52

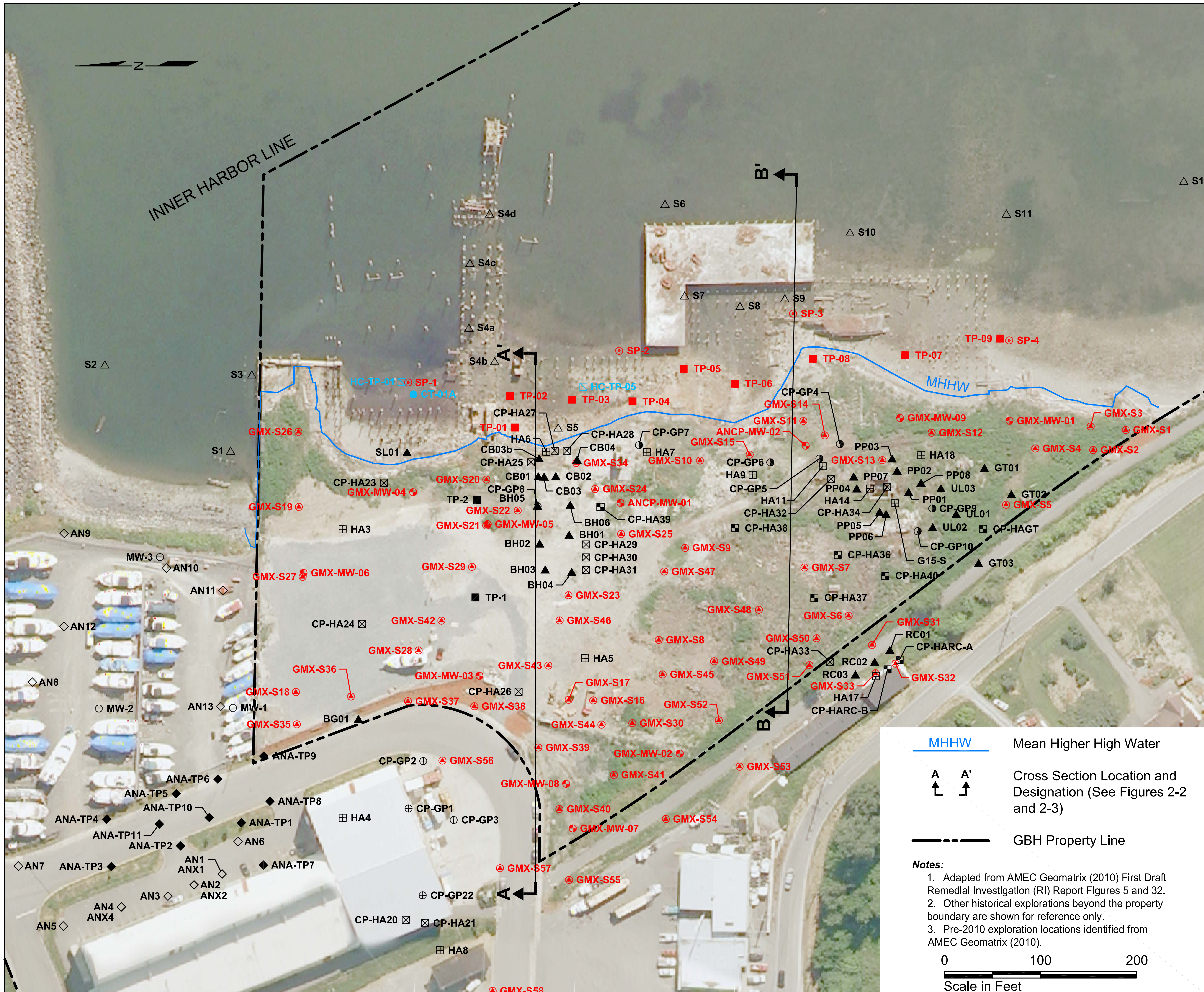
Table 2-2 - Summary of Previous Upland Environmental Characterization and Sampling Investigations at the Custom Plywood Site

Investigation Event	Investigation Description	Exploration Type Nomenclature	
2006 Wetlands Delineation Study (Geomatrix, 2006)	Conducted a study of the Site and several small areas were identified as wetlands that met all three jurisdictional wetland criteria used by the US Army Corps of Engineers and Ecology to define a wetland.	Survey:	Wetland Delineation
2007 Underwater Habitat Survey (Geomatrix, 2007b)	Conducted an underwater survey offshore of the Site in the area from the shoreline to the outer harbor line.	Survey:	Underwater survey of the extent of eelgrass, macroalgae, and debris in the marine areas near the Site.
2007 to 2009 Additional Remedial Investigation and Supplemental investigations (AMEC Geomatrix 2007 to 2010)	Collected and analyzed soil, groundwater, and offshore sediment samples, and conducted a bathymetric and benthic habitat survey for the Site. Samples included; (1) soil samples at 58 push probes and nine monitoring well boreholes, (2) groundwater samples at nine new monitoring wells and two existing monitoring well locations, and (3) sediment samples at nine test pits and four seep locations.	Soil:	GMX-S1 to GMX-S58 Nine monitoring well boreholes
		Groundwater:	GMX-MW-01 to GMX-MW-09, ANCP-MW-01 and ANCP-MW-02
		Sediment:	TP-01 to TP-09 SEEP1 to SEEP4
		Survey:	Bathymetric and benthic habitat survey witin the Site.

Notes:

For further discussion of the individual investigations and findings of previous investigations, see draft Custom Plywood Remedial Investigation (AMEC 2010) and draft Feasibility Study (Hart Crowser 2010) .

Refer to Figure 2-1 for historical uplands exploration locations.



MHHW — Mean Higher High Water

A A' — Cross Section Location and Designation (See Figures 2-2 and 2-3)

GBH Property Line

Notes:

1. Adapted from AMEC Geomatrix (2010) First Draft Remedial Investigation (RI) Report Figures 5 and 32.
2. Other historical explorations beyond the property boundary are shown for reference only.
3. Pre-2010 exploration locations identified from AMEC Geomatrix (2010).

0 100 200

Scale in Feet

2010 Exploration Location and Number

CT-01A ● Sample (SAIC 2010)

HC-TP-05 ⧅ Test Pit (Hart Crowser 2010)

Pre-2010 Exploration Location and Number

HA4 ⊞ Hand Auger or Grab Sample (Enviros 1995a)

S1 △ Sediment Sample (Enviros 1995b)

AN1 ◇ Test Pit Sample (Woodward-Clyde 1997a,b)

CP-GP1 ⊕ Geoprobe Sample (Woodward-Clyde 1997c)

CP-HA26 ⊠ Hand Auger or Grab Sample (Woodward-Clyde 1997c)

ANA-TP3 ◆ Test Pit Sample (Woodward-Clyde 1997d)

CP-GP9 ◑ Geoprobe Sample (Woodward-Clyde 1998b)

CP-HA40 ◩ Hand Auger or Grab Sample (Woodward-Clyde 1998b)

SL01 ▲ Soil Boring (EPA 2000)

AMEC Geomatrix Exploration Location and Number

TP-01 ■ Test Pit (Geomatrix 2007; AMEC 2009)

GMX-MW-02 2008 and 2009 Monitoring Well (AMEC 2009)

GMX-S6 2008 and 2009 Soil Sample (AMEC 2009)

SP-1 August 2008 Seep Sample (AMEC 2009)

MW-1 ○ Decommissioned Monitoring Well

Custom Plywood Site
Anacortes, Washington

Historical Site and Exploration Plan

17330-27 (CAP) 2/11

HARTCROWSER

Figure **2-1**

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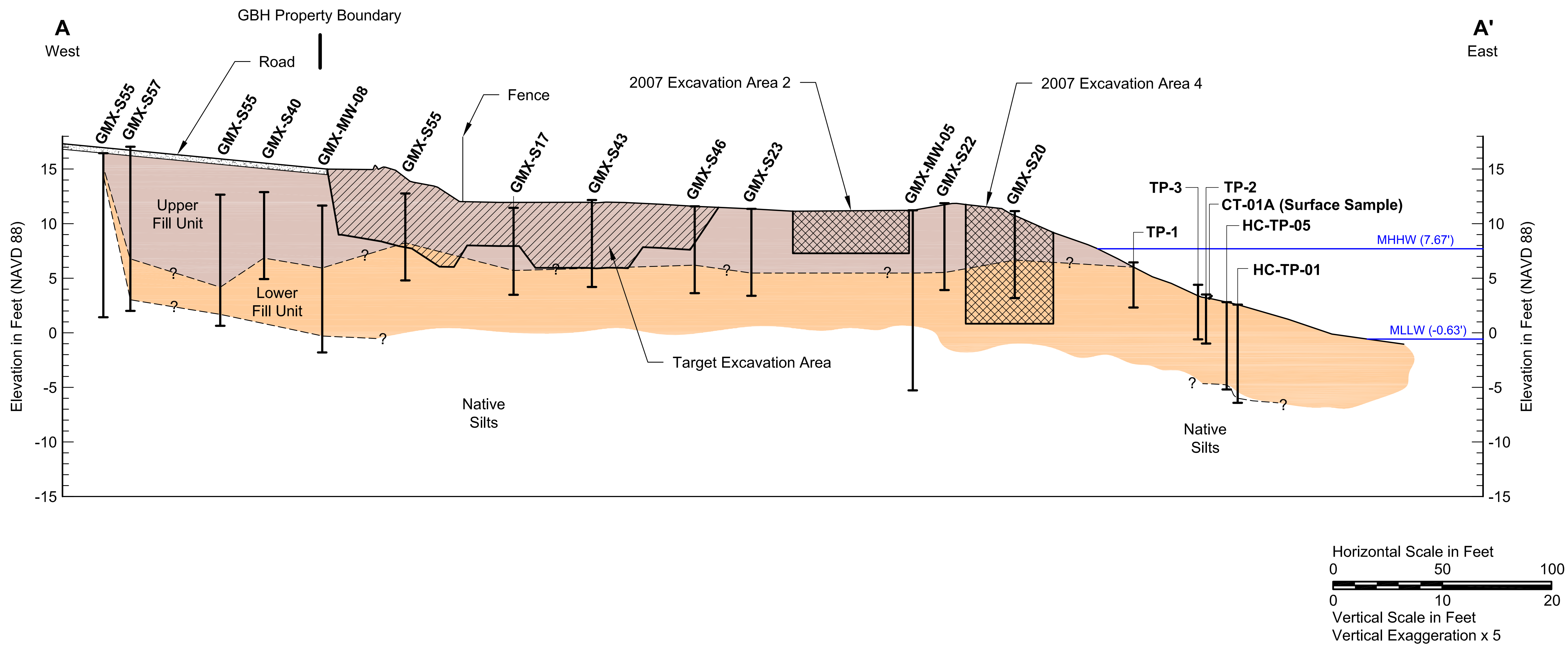

Notes:

1. Adapted from AMEC Geomatrix (2010) First Draft Remedial Investigation (RI) Report Figure 30.

Upper Fill Unit	Silty Sand with Gravel, Brick Fragments, and Buried Building Debris
Lower Fill Unit	Fine-Grained Wood (Sawdust to Bark Chip Sized) with Scattered Logs
GMX-S43	Exploration Name
I	Exploration Location
MHHW	Mean Higher High Water
MLLW	Mean Lower Low Water

Custom Plywood Site
Anacortes, Washington

Cross Section A-A'
(Upland Soil Remedial Alternative U-3)

17330-27 (CAP) 2/11

HARTCROWSER

Figure
2-2

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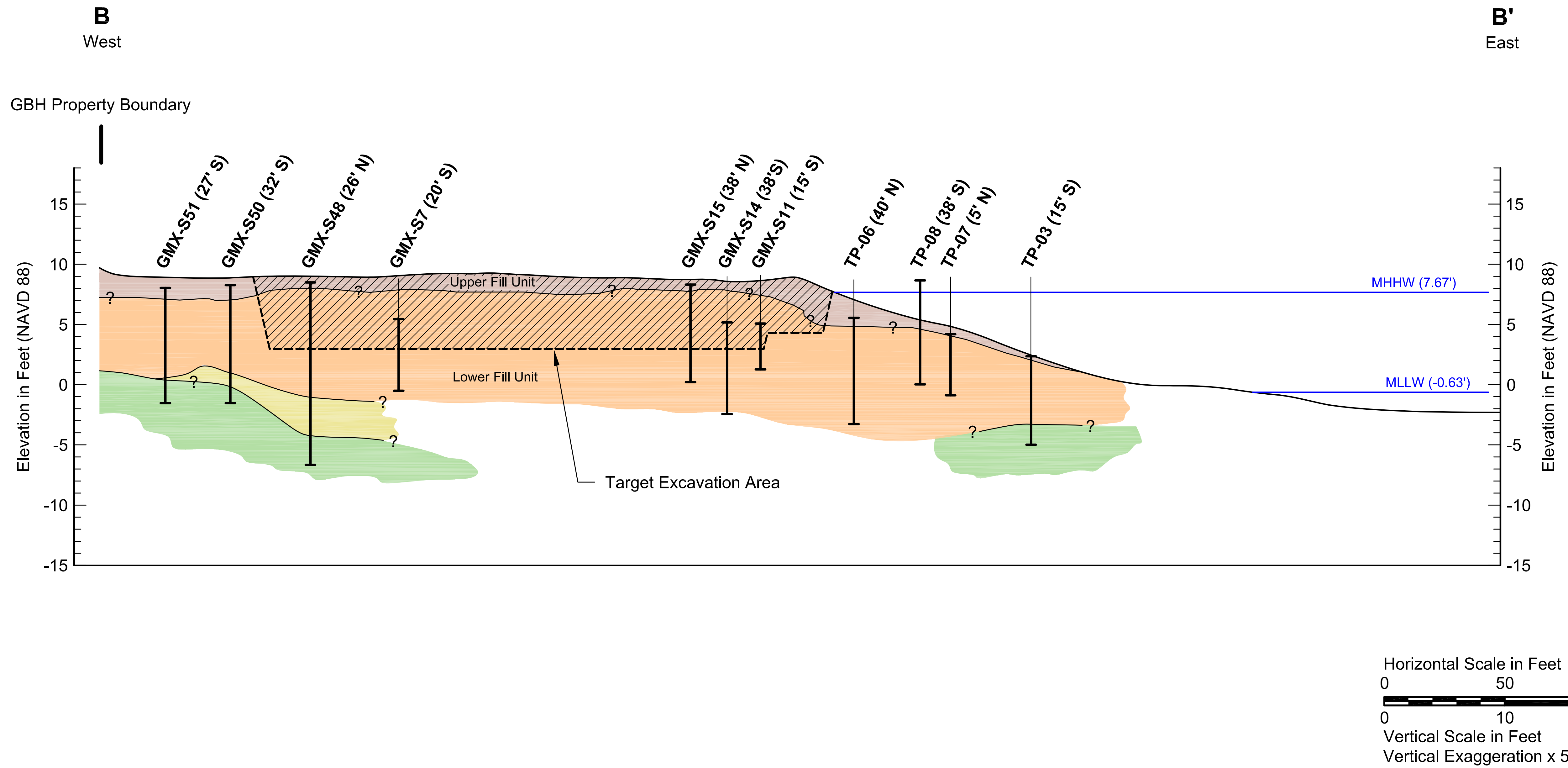

Upper Fill Unit	Sandy and Gravelly Fill
Lower Fill Unit	Fine-Grained Wood (Sawdust to Bark Chip Sized) with Scattered Logs
	Sandy Silt and Silty Sand
	Native Clay

GMX-S51 (27' S) Exploration Name and Offset Distance and Direction

Exploration Location

MHHW Mean Higher High Water

MLLW Mean Lower Low Water

Note: Subsurface units modified slightly from Figures presented in AMEC Geomatrix 2010.

Custom Plywood Site
Anacortes, Washington

Cross Section B-B'
(Upland Soil Remedial Alternative U-3)

17330-27 (CAP) 2/11

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Figure
2-3

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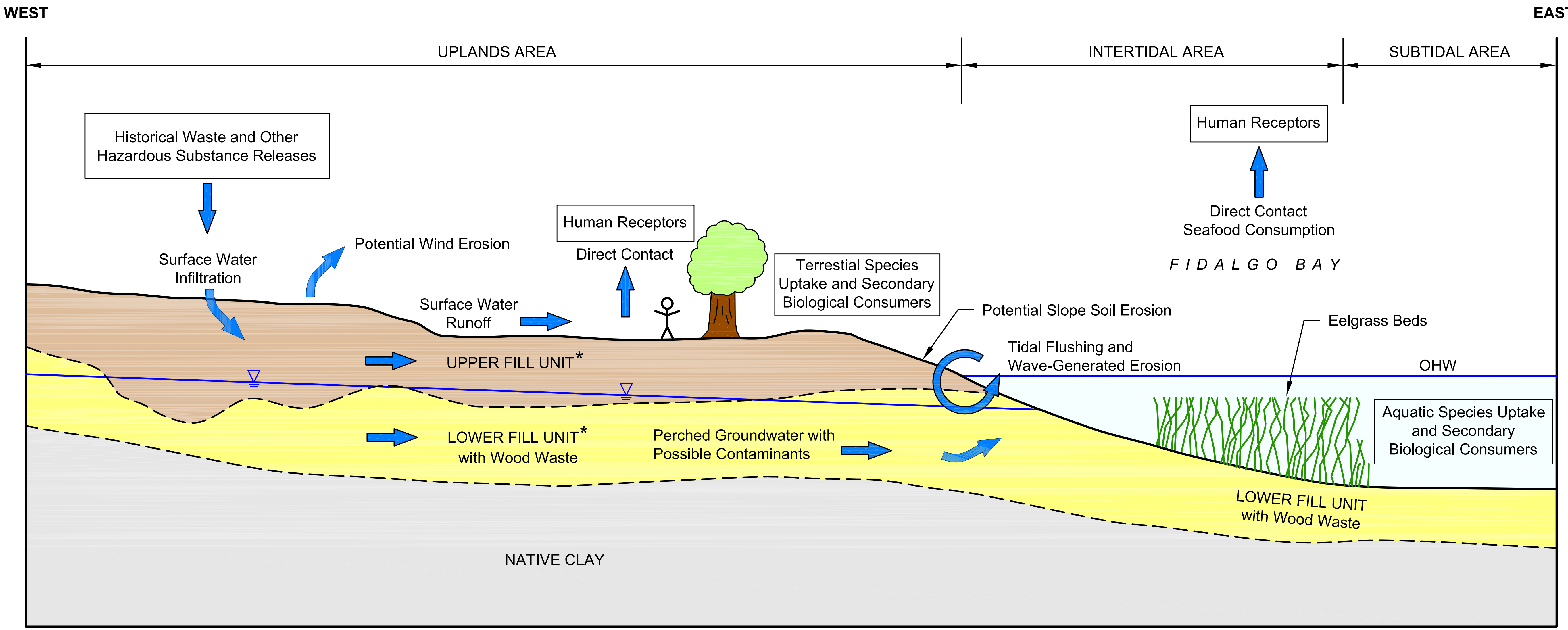

* Secondary Contaminant Sources

Not to Scale

Custom Plywood Site
Anacortes, Washington

Conceptual Site Model
Generalized Site Cross Section
Looking North

17330-27 (CAP) 2/11

HARTCROWSER

Figure
2-4

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3.0 CLEANUP REQUIREMENTS

The following sections identify the remedial action objectives and cleanup standards for the upland portions of the Site addressed in this CAP. Remedial action objectives and cleanup standards were developed to address MTCA and other applicable state and federal regulatory requirements for upland cleanup. These requirements address conditions relative to potential human and ecological receptor impacts. Requirements also consider related habitat, land use, and potential cultural resources issues. Together, project remedial action objectives and cleanup standards provide the framework for selecting a preferred remedial alternative (CAP Section 4.0), as well as evaluating other remedial alternatives (CAP Section 5.0).

3.1 Remedial Action Objectives

The primary objective for the planned upland interim cleanup actions at the Site focuses on substantially eliminating, reducing, and/or controlling unacceptable risks to the environment posed by COPCs to the extent feasible and practicable. Applicable exposure pathways and receptors of interest for human health include current and future Site users including workers and visitors potentially exposed to soil and groundwater associated with direct contact pathways, and consumption of marine biota exposed to upland groundwater or eroded soils. Applicable ecological exposure pathways and receptors include biota potentially exposed to soil and groundwater associated with direct contact pathways and food chain uptake including marine biota exposed to eroding upland soils. These remedial action objectives are presented as target goals to be achieved to the extent feasible and practicable. A key additional objective is the preservation and protection of cultural resources should such objects be encountered during the upland remedial action.

Shoreline Stability Considerations

As discussed in the FS and earlier in this CAP, wave and current action have resulted in significant erosion of the filled shoreline zone and is expected to continue to do so in the future. Results of coastal engineering modeling completed to date are consistent with observed shoreline erosion scarps and high-energy events such as occurred during the winter of 2010. Protective in-water features to prevent further shoreline erosion and migration/dispersion of deleterious sawdust and residual contaminated soil from the Site upland areas will be further addressed in separate CAP and EDR documents for Phase II aquatic cleanup.

3.2 Cleanup Standards

Cleanup standards include cleanup levels and points of compliance (POCs) as described in WAC 173-340-700 through WAC 173-340-760. Cleanup standards must also incorporate other state and federal regulatory requirements applicable to the cleanup action and/or its location. The following sections summarize applicable cleanup standards for the Site.

3.2.1 Cleanup Levels and Points of Compliance

Cleanup levels for upland cleanup consist of applicable MTCA and other protective regulatory concentrations criteria for soil and groundwater. Criteria applicable to the Site are summarized in Tables 3-1 and 3-2 for soil and groundwater, respectively. These cleanup levels are identified as the lowest applicable MTCA, or applicable or relevant and appropriate requirements (ARARs) criteria currently established.

Key indicator hazardous substances and COCs were identified, by media, after a review of the RI. As noted in Section 7.0 and Tables 20 and 21 in the RI, indicator hazardous substances were identified based on their frequency of occurrence, as required by MTCA (WAC 173-340-703). POCs are identified in accordance with standard MTCA protocols for soil and groundwater.

Soil

Soil cleanup levels are determined using MTCA Method B criteria for direct contact and terrestrial, ecological, and groundwater protection (see Table 3-1). Groundwater is not envisioned as a future drinking water source at the Site, and soil cleanup levels for groundwater protection, therefore, are established for the soil to groundwater to surface water pathway. Site-specific cleanup levels for diesel-range TPH are defined based on the results of a terrestrial ecological evaluation with bioassay (reported in Appendix D of the RI). Cleanup levels for some metals including arsenic, chromium, copper, mercury, and nickel are adjusted for regional background concentrations as provided in WAC 173-340-740(5)(c) and WAC 173-340-709.

Key Indicator Hazardous Substances. Key indicator hazardous substances in soil identified by the RI and further evaluated in FS include:

- Diesel- and oil-range TPH;
- cPAHs; and

- Metals including arsenic, cadmium, copper, lead, mercury, nickel, and zinc.

Other compounds including PCBs, PCP, dioxins/furans, chromium, silver, and selenium were identified in Site soils but had a limited number of detections or exceedances of cleanup levels. These compounds will be appropriately addressed through remedial actions focused on indicator hazardous substances. Other compounds including antimony, barium, beryllium, gasoline-range TPH, and volatile organic compounds (VOCs) were excluded as indicator hazardous substances because the concentration of these substances seldom, if ever, exceeded cleanup criteria.

Points of Compliance. The POC for human exposure to soil via direct contact is 15 feet bgs for soil throughout the GBH property (WAC 173-340-740 (6)(d)). The conditional POC for the biologically active soil zone is 6 feet bgs, assuming that an institutional control is established to limit exposure from excavation below this depth (WAC 173-340-7490 (4)).

Groundwater

Groundwater cleanup levels are established based on protection of the groundwater to surface water pathway (Table 3-2). Cleanup levels are derived from the lowest concentration protective of human or ecological health from MTCA Method B, state surface water quality criteria (Chapter 173-201A), Clean Water Act Section 304, or the National Toxics Rule (40 CFR 131) criteria.

Key Indicator Hazardous Substances. Limited groundwater data were reported in the RI for establishing indicator hazardous substances in groundwater. Several constituents were detected during 2008 and 2009 sampling and testing of Site groundwater monitoring wells and seeps and considered indicator hazardous substances. These substances included:

- Diesel- and oil-range TPH;

- cPAHs; and

- Metals including arsenic, copper, nickel, and zinc.

The above constituents are retained for FS evaluation purposes and represent COCs that to be addressed by the remedial alternatives described in Section 5.0 of this FS. Cadmium, lead, and mercury were COPCs identified for soil, and are included as additional COPCs for groundwater based on potential exposure pathways associated with Site construction activities. Accordingly, planned groundwater compliance monitoring to be completed following the upland cleanup action will include this combined metal suite.

Points of Compliance. Although planned soil remediation is expected to prevent the soil to groundwater to surface water pathway, a POC for groundwater throughout the GBH property component of the Site may not be practicable. A conditional POC, therefore, is identified at the groundwater/ surface water interface per provisions of WAC 173-340-720(8)(d)(i), Properties Abutting Surface Water. This conditional POC is located within surface water as close as technically possible to the point where groundwater flows into surface water. Identification of this conditional POC is subject to further conditions of WAC 173-340-720(8)(d)(i), including notice to the Natural Resource Trustees and the USACE, and is subject to long-term monitoring. The ability of each remedial alternative evaluated to meet the criteria specified in WAC 173-340-720(8)(d)(i) is assessed in Section 5.0.

3.2.2 Potentially Applicable Regulatory Requirements

MTCA regulatory provisions form the primary basis for evaluating and implementing upland cleanup alternatives for remediation at the Site. Following selection of a preferred alternative, MTCA requirements guide the process for preparing this CAP. Additional MTCA and other regulatory requirements will be further addressed in the EDR, and project design plans and specifications. Upland and in-water cleanup components are planned to be performed as phased actions, with Phase I upland remediation beginning in 2011, and in-water work planned to begin in 2013.

Although exempt from procedural requirements of certain state and local laws and related permitting requirements, pertinent substantive compliance requirements remain applicable. Formal procedural requirements will remain in effect if Ecology determines that an exemption will result in loss of approval by a federal agency. Applicable exempted state laws include:

- Chapter 70.94 RCW – Washington Clean Air Act;
- Chapter 70.95 RCW – Solid Waste Management – Reduction and Recycling;
- Chapter 70.105 RCW – Hazardous Waste Management;
- Chapter 90.48 RCW – Water Pollution Control Act; and
- Chapter 90.58 RCW – Shoreline Management Act.

The exemption also applies to local government permits and approvals associated with the remedial action. Although the upland and in-water remedial actions are expected to be exempt from these procedural requirements, compliance with substantive provisions of these regulatory programs is required. Construction actions associated with cleanup are further subject to requirements of the State Environmental Policy Act (SEPA – Chapter 43.21C RCW).

MTCA does not provide a procedural exemption from federal permitting, including applicable requirements pertain under Clean Water Act Section 401 (Water Quality Certification), and the Endangered Species Act (agency consultation). In addition, the Fidalgo Bay region is known to be archaeologically sensitive, and USACE involvement in Clean Water Act permitting triggers provisions of Section 106 of the National Historic Preservation Act of 1966, and the Archeological and Historical Preservation Act (16 USCA 469). The project will be coordinated with state and local agencies regarding substantive compliance issues, and USACE and other federal agencies for federal permitting issues. In addition, the Samish Indian Nation, Swinomish Tribal Community, and other tribes with Usual and Accustomed treaty rights within Fidalgo and Padilla Bays, and the Washington State Department of Archaeology and Historic Preservation (DAHP) will be consulted on cultural resource and archaeological matters. An Archaeological Monitoring Plan has also been prepared for upland construction activities and is presented in Appendix A of this CAP.

A wide range of state, federal, and local compliance requirements may be applicable to the upland work that is planned for the Site. These potential compliance requirements and activities that could trigger the requirements are summarized in Table 3-3. Additional detail is provided in the FS.

3.3 Upland Remediation Areas

This section describes upland areas of concern at the Site where the concentration of COPCs exceed the cleanup levels identified in Section 3.0. The areas of concern were identified based on the known or inferred extent of contaminated media following review of historical and analytical data presented in the RI and further summarized in the FS and Section 2.0 of this CAP. Uncertainty remains regarding the overall depth and areal limits of contamination in both the upland and marine areas. This uncertainty is to the result of the limited number of soil samples that have been collected and analyzed to identify the areal boundaries and depth of contamination in the areas of concern. Detailed historical information that could more thoroughly describe contaminant sources and migration mechanisms is not available.

For these reasons, a number of working assumptions were used to provide a practical means of delineated remediation areas for the purposes of evaluating cleanup alternatives and selecting a preferred alternative.

3.3.1 Upland Soils

Figure 3-1 identifies the areas of concern for upland soils at the Site. The concentration of diesel- and oil-range TPH, cPAHs, and metals present in upland soils was compared to the most stringent regulatory screening level available for the protection of human health, ecological receptors, and of marine surface water (via the groundwater migration pathway) to establish these areas of concern. This process was summarized in Section 3.2 of this CAP.

Criteria for Defining Soil Remediation Areas

Uncertainty exists as to the boundaries of soil contamination. This is particularly true in the case of shallow areas within about 2 feet of ground surface and deeper areas below about 8 feet bgs. Much of the existing soil sampling focused on the zone between about 2 and 6 feet below grade that was believed to be the most heavily contaminated based on historical information and previous field observations. Not all COPCs are equally represented in all samples or at all locations and depths. For this reason, the areal extent, depth, and estimated volume of contaminated soil requiring remediation are detailed in the FS. The FS considers nominal ranges of impact between "clean" and "dirty" samples, sampling locations and relative density, sample depth distribution, and proximity to known or potential historical contaminant sources.

Using these FS assumptions and qualifications, estimated soil volumes for remediation throughout the upland area are as follows:

- 0 to 4 feet depth (including debris) 13,000 cubic yards (cy)
- 4 to 6 feet depth 4,200 cy
- 6 to 8 feet depth 1,200 cy
- Potential additional area at 0 to 6 feet depth 6,100 cy

These estimates represent in-place volumes for reference purposes. Note that the combined volume for 0 to 6 feet depth, 23,300 cy, represents the soil volume above the ecological POC, which is 6 feet bgs. The combined volume for 0 to 8 feet depth, 24,500 cy, represents the currently estimated remediation volume for contaminated soil requiring removal. Note this is a target depth and depending on findings during excavation, additional soil may need to be excavated to satisfy the POC for soil for the protection of human health, which is 15 feet bgs. Also, the additional potential areas of soil contamination between 0 and 6 feet depth include locations near the former press pit areas and to the west, as shown on Figure 5-1. These areas were identified on Figure 3-2 of the RI, but limited sample testing data apparently exist to verify the actual nature and extent of soil contamination in this area.

Although the actual soil remediation volumes at the time of the work could vary from the estimated volumes (given current uncertainties on the nature and extent of contamination), the estimated volumes provide useful reference points for evaluating remedial alternatives. Using more conservative assumptions for areal and depth extent of contamination increases the affected volume to well over 40,000 cy, but does not currently appear to be warranted given the available information. Conversely, using less conservative assumptions might significantly underestimate affected volumes given the current sampling density. An adaptive approach to verify the extent of contamination during construction excavation will be implemented. This adaptive approach will be guided by the use of routine field screening indicators and the results of soil sample analyses to guide removal and disposal of additional contaminated soil, as needed, during excavation to the extent practicable.

3.3.2 Groundwater

Limited groundwater data were reported in the RI to establish TPH, cPAHs, and metals (arsenic, copper, nickel, and zinc) as indicator hazardous constituents. However, for the purpose of this CAP, these groundwater constituents are retained as COCs, along with lead, mercury, and zinc as additional COPCs. Remediation of contaminated soils is expected to significantly reduce the soil to groundwater pathway and allow the concentration of these constituents in groundwater to remain and/or return to below cleanup levels within a reasonable restoration time frame, to be further determined during post-construction monitoring.

3.4 Wetland Impacts and Mitigation Plan

Unavoidable impacts to existing wetland resources will occur during upland remediation. Wetlands are spread throughout the upland portion of the GBH property as shown on Figure 1-2. This is primarily because of the property's relatively low elevation, regular tidal inundation, and relatively flat slope with local depressions and pockets that retain stormwater. Together, these wetlands have a combined areal coverage of nearly 12,000 sf. To mitigate for unavoidable loss of these wetlands, a consolidated wetland concept in the southern portion of the GBH property will be constructed, as discussed further in Section 4.3.

Table 3-1 - Soil Cleanup Levels

Concentrations in mg/kg

		Regulatory Criteria				
Soil Constituent **Key Indicator Hazardous Substances Identified in Bold**	**Cleanup Level**	**MTCA Method B Soil-Direct Contact Unrestricted Land Use Carcinogen**	**MTCA Method B Soil-Direct Contact Unrestricted Land Use Noncarcinogen**	**MTCA Method B Protective of Groundwater as Marine Surface Water[a]**	**MTCA Method B Protective of Terrestrial Ecological Receptors [b]**	**Area Background[c]**
Total Metals						
Arsenic	**8.47**	0.67	24	0.08	20	**8.47**
Cadmium	**1.21**	2[d]	80	1.21	25	1.2
Chromium (total)	117	2,000[d]	NE	NE	42	117
Copper	**52.9**	NE	3,000	1.07	100	**52.9**
Lead	**220**	250[d]	NE	1,620	**220**	NE
Mercury	**0.13**	2[d]	24	0.03	9	**0.13**
Nickel	**54.2**	NE	1,600	10.7	100	**54.2**
Zinc	**101**	NE	24,000	**101**	270	85.6
PCBs						
Total PCBs	0.5	NE	0.5	**NE**	2	NE
Dioxins and Furans						
Total ecological TEC dioxin	0.000005	NE	NE	NE	0.000005	
Total ecological TEC furan	0.000003	NE	NE	NE	0.000003	
TPH						
Diesel-range hydrocarbons	**1,700**	2,000[d]	NE	NE	**1,700**	
Oil-range hydrocarbons	**2,000**	**2,000[d]**	NE	NE	**8,500**	
Gasoline-range hydrocarbons (no benzene)	100	100[d]	NE	NE	200	
Gasoline-range hydrocarbons (with benzene)	30	30[d]	NE	NE	200	
SVOCs						
2-Chloronaphthalene	42.56	NE	6,400	42.56	NE	
2-Chlorophenol	1.15	NE	400	1.15	NE	
2-Methyl-4,6-dinitrophenol	NE	NE	NE	NE	NE	
2-Methylnaphthalene	320	NE	320	NE	NE	
2-Methylphenol	4,000	NE	4,000	NE	NE	
2-Nitroaniline	NE	NE	NE	NE	NE	
2-Nitrophenol	NE	NE	NE	NE	NE	
3-Methylphenol	4,000	NE	4,000	NE	NE	
4-Methylphenol	400	NE	400	NE	NE	
3,3'-Dichlorobenzidine	0.001	2.2	NE	0.001	NE	
3-Nitroaniline	NE	NE	NE	NE	NE	
4-Bromophenyl phenyl ether	NE	NE	NE	NE	NE	
4-Chloro-3-methyl phenol	NE	NE	NE	NE	NE	
4-Chloroaniline	320	NE	320	NE	NE	
4-Chlorophenyl phenyl ether	NE	NE	NE	NE	NE	
4-Nitroaniline	NE	NE	NE	NE	NE	
4-Nitrophenol	NE	NE	NE	NE	NE	
Acenaphthene	100.99	NE	4,800	100.99	NE	
Acenaphthylene	NE	NE	NE	NE	NE	
Aniline	180	180	NE	NE	NE	
Anthracene	18,560	NE	24,000	18,560	NE	
Benzidine	0.0007	0.0043	240	0.0007	NE	
Benzo[a]anthracene	**0.13**	NE	NE	**0.13**	NE	
Benzo[a]pyrene	**0.14**	**0.14**	NE	0.35	30	
Benzo[b]fluoranthene	**0.43**	NE	NE	**0.43**	NE	
Benzo(g,h,i)perylene	NE	NE	NE	NE	NE	
Benzo[k]fluoranthene	**0.43**	NE	NE	**0.43**	NE	
Benzyl alcohol	24,000	NE	**24,000**	NE	NE	
bis(2-Chloroethoxy) methane	NE	NE	NE	NE	NE	
bis(2-Chloroethyl) ether	0.003	0.91	NE	**0.003**	NE	
bis(2-Chloroisopropyl) ether	3200	NE	3,200	--	NE	
bis(2-Ethylhexyl) phthalate	4.85	71	1,600	4.85	NE	
bis(2-Ethylhexyl adipate	830	830	48,000	--	NE	
Butyl benzyl phthalate	539.6	NE	16,000	539.6	NE	
Carbazole	50	50	NE	--	NE	
Chrysene	**0.14**	NE	NE	**0.14**	NE	
Dibenzo[a,h]anthracene	**0.65**	NE	NE	**0.65**	NE	
Dibenzofuran	160	NE	160	--	NE	
Diethyl phthalate	248	NE	64,000	248	NE	

Table 3-1 - Soil Cleanup Levels

Soil Constituent Key Indicator Hazardous Substances Identified in Bold	Cleanup Level	Regulatory Criteria MTCA Method B Soil-Direct Contact Unrestricted Land Use Carcinogen	MTCA Method B Soil-Direct Contact Unrestricted Land Use Noncarcinogen	MTCA Method B Protective of Groundwater as Marine Surface Water[a]	MTCA Method B Protective of Terrestrial Ecological Receptors [b]	Area Background[c]
SVOCs (Continued)						
Dimethyl phthalate	5,280	NE	80,000	5,280	NE	
Dibutyl phthalate	162	NE	8,000	162	200	
Di-n-octyl phthalate	1600	NE	1,600	NE	NE	
Fluoranthene	137.8	NE	3,200	137.8	NE	
Fluorene	837.4	NE	3,200	837.4	NE	
Hexachlorobenzene	0.0005	0.63	64	0.0005	31	
Hexachlorobutadiene	13	13	16	19.52	NE	
Hexachlorocyclopentadiene	480	NE	480	4,407	NE	
Hexachloroethane	0.13	71	80	0.13	NE	
Indeno[1,2,3-cd]pyrene	**1.26**	NE	NE	**1.26**	NE	
Isophorone	2.96	1,100	16,000	2.96	NE	
Naphthalene	137.4	NE	1,600	137.4	NE	
Nitrobenzene	4.42	NE	40	4.42	NE	
N-Nitrosodimethylamine	0.02	0.02	NE	NE	NE	
N-Nitroso-di-n-propylamine	0.002	0.14	NE	0.002	NE	
N-Nitrosodiphenylamine	0.48	200	NE	0.48	NE	
Pentachlorophenol	0.05	8.3	2,400	0.05	11	
Phenanthrene	NE	NE	NE	NE	NE	
Phenol	7,786	NE	48,000	7,786	NE	
Pyrene	2,400	NE	2,400	5,456	NE	
Pyridine	80	NE	80	NE	NE	
Total cPAHs - benzo(a)pyrene TEQ	**0.14**	**0.14**	NE	0.35	30	

Notes

[a] Calculated using fixed-parameter three-phase partitioning model WAC 173-340-747(4).
[b.] Based on simplified terrestrial evaluation in WAC 173-340-7492, criteria listed in Table 749-2 for all constituents except TPH. TPH criteria based on bioassay data reported by AMEC (2010).
[c] The screening level adjusted for regional background concentrations within Skagit/Whatcom counties or Western Washington as reported by Ecology (1994).
[d] MTCA Method A value.

mg/kg = milligrams per kilogram
NE = Not established
PCBs = polychlorinated biphenyls
SVOC = semivolatile organic compounds
TEQ = toxicity equivalent concentration
TPH = total petroleum hydrocarbons

Table 3-2 - Groundwater Cleanup Levels

Concentrations in ug/L

Groundwater Constituent Key Indicator Hazardous Substances Identified in Bold	Cleanup Level[a]	Regulatory Criteria Surface Water ARAR - Aquatic Life - Marine/Acute - Ch. 173-201A WAC	Surface Water ARAR - Aquatic Life Marine/Acute - Clean Water Act §304	Surface Water ARAR - Aquatic Life - Marine/Acute - National Toxics Rule, 40 CFR 131	Surface Water ARAR - Aquatic Life - Marine/Chronic - Ch. 173-201A WAC	Surface Water ARAR - Aquatic Life - Marine/Chronic - Clean Water Act §304	Surface Water ARAR - Aquatic Life - Marine/Chronic - National Toxics Rule, 40 CFR 131	Surface Water ARAR - Human Health – Marine – Clean Water Act §304	Surface Water ARAR - Human Health – Marine – National Toxics Rule, 40 CFR 131	Surface Water, Method B, Carcinogen, Standard Formula Value	Surface Water, Method B, Non-Carcinogen, Standard Formula Value
Dissolved Metals											
Arsenic, inorganic	**0.14**	69	69	69	36	36	36	**0.14**	**0.14**	0.098	18
Cadmium	8.8	42	40	42	9.3	**8.8**	9.3	NE	NE	NE	20
Chromium (total)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Copper	**2.4**	4.8	4.8	**2.4**	3.1	3.1	**2.4**	NE	NE	NE	2,700
Lead	8.1	210	210	210	8.1	8.1	8.1	NE	NE	NE	NE
Mercury (Total)	0.025	1.8	1.8	2.1	0.025	0.94	**0.025**	0.3	0.15	NE	NE
Nickel (as soluble salts)	**8.2**	74	74	74	**8.2**	**8.2**	**8.2**	4,600	4,600	NE	1,100
Zinc	**81**	90	90	90	**81**	**81**	**81**	26,000	NE	NE	NE
PCBs											
Total PCBs	**0.000064**	10	NE	NE	0.03	0.03	0.03	**0.000064**	0.00017	0.00011	NE
TPH											
TPH, diesel-range organics	**500[b]**	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
TPH, heavy oil-range organics	**500[b]**	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
TPH, mineral oil-range organics	500[b]	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
SVOCs											
2,3,3,6-Tetrachlorophenol	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2-Chloronaphthalene (beta-chloronaphthalene)	1,600	NE	NE	NE	NE	NE	NE	1,600	NE	NE	1,000
2-Chlorophenol	97	NE	NE	NE	NE	NE	NE	NE	NE	NE	97
2-Methyl-4,6-dinitrophenol	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2-methylnaphthalene	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2-Methylphenol	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2-Nitroaniline	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2-Nitrophenol	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
3,3'-Dichlorobenzidine	0.028	NE	NE	NE	NE	NE	NE	0.028	0.077	0.046	NE
3-Methylphenol	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
3-Nitroaniline	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4-Bromophenyl phenyl ether	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4-Chloro-3-methylphenol	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4-chloroaniline	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4-Chlorophenyl phenyl ether	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4-Methylphenol	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4-Nitroaniline	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4-Nitrophenol	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Acenaphthene	990	NE	NE	NE	NE	NE	NE	990	NE	NE	640

Table 3-2 - Groundwater Cleanup Levels

Groundwater Constituent Key Indicator Hazardous Substances Identified in Bold	Cleanup Level[a]	Surface Water ARAR - Aquatic Life - Marine/Acute - Ch. 173-201A WAC	Surface Water ARAR - Aquatic Life Marine/Acute - Clean Water Act §304	Surface Water ARAR - Aquatic Life - Marine/Acute - National Toxics Rule, 40 CFR 131	Surface Water ARAR - Aquatic Life - Marine/Chronic - Ch. 173-201A WAC	Surface Water ARAR - Aquatic Life - Marine/Chronic - Clean Water Act §304	Surface Water ARAR - Aquatic Life - Marine/Chronic - National Toxics Rule, 40 CFR 131	Surface Water ARAR - Human Health – Marine – Clean Water Act §304	Surface Water ARAR - Human Health – Marine – National Toxics Rule, 40 CFR 131	Surface Water, Method B, Carcinogen, Standard Formula Value	Surface Water, Method B, Non-Carcinogen, Standard Formula Value
SVOCs (Continued)											
Acenaphthylene	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Aniline	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Anthracene	40,000	NE	NE	NE	NE	NE	NE	40,000	110,000	NE	26,000
Benzidine	0.0002	NE	NE	NE	NE	NE	NE	0.0002	0.00054	0.00032	89
Benzo(g,h,i)perylene	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Benzo[a]anthracene	**0.018**	NE	NE	NE	NE	NE	NE	0.018	0.031	NE	NE
Benzo[a]pyrene	**0.018**	NE	NE	NE	NE	NE	NE	0.018	0.031	0.03	NE
Benzo[b]fluoranthene	**0.018**	NE	NE	NE	NE	NE	NE	0.018	0.031	NE	NE
Benzo[k]fluoranthene	**0.018**	NE	NE	NE	NE	NE	NE	0.018	0.031	NE	NE
Benzyl alcohol	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
bis(2-Chloroethoxy) methane	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
bis(2-Chloroethyl) ether	0.53	NE	NE	NE	NE	NE	NE	0.53	1.4	0.85	NE
bis(2-Chloroisopropyl) ether	65,000	NE	NE	NE	NE	NE	NE	65,000	170,000	NE	42,000
bis(2-Ethylhexyl) adipate	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
bis(2-Ethylhexyl) phthalate	2.2	NE	NE	NE	NE	NE	NE	2.2	5.9	3.6	400
Butyl benzyl phthalate	1,900	NE	NE	NE	NE	NE	NE	1,900	NE	NE	1,300
Carbazole	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Chrysene	**0.018**	NE	NE	NE	NE	NE	NE	0.018	0.031	NE	NE
Dibenzo[a,h]anthracene	**0.018**	NE	NE	NE	NE	NE	NE	0.018	0.031	NE	NE
Dibenzofuran	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Dibutyl phthalate	4,500	NE	NE	NE	NE	NE	NE	4,500	12,000	NE	2,900
Diethyl phthalate	44,000	NE	NE	NE	NE	NE	NE	44,000	120,000	NE	28,000
Dimethyl phthalate	1,100,000	NE	NE	NE	NE	NE	NE	1,100,000	2,900,000	NE	72,000
Di-n-octyl phthalate	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Fluoranthene	140	NE	NE	NE	NE	NE	NE	140	370	NE	90
Fluorene	5,300	NE	NE	NE	NE	NE	NE	5,300	14,000	NE	3,500
Hexachlorobenzene	0.00029	NE	NE	NE	NE	NE	NE	0.00029	0.00077	0.00047	0.24
Hexachlorobutadiene	18	NE	NE	NE	NE	NE	NE	18	50	30	190
Hexachlorocyclopentadiene	1,100	NE	NE	NE	NE	NE	NE	1,100	17,000	NE	3,600
Hexachloroethane	3.3	NE	NE	NE	NE	NE	NE	3.3	8.9	5.3	30
Indeno[1,2,3-cd]pyrene	**0.018**	NE	NE	NE	NE	NE	NE	0.018	0.031	NE	NE
Isophorone	600	NE	NE	NE	NE	NE	NE	960	600	1,600	120,000
Nitrobenzene	450	NE	NE	NE	NE	NE	NE	690	1,900	NE	450
N-Nitrosodimethylamine	3	NE	NE	NE	NE	NE	NE	3	8.1	4.9	NE
N-Nitroso-di-n-propylamine	0.51	NE	NE	NE	NE	NE	NE	0.51	NE	0.82	NE
N-Nitrosodiphenylamine	16	NE	NE	NE	NE	NE	NE	NE	16	NE	9.7
Pentachlorophenol	3	13	13	13	7.9	7.9	7.9	3	8.2	4.9	7,100
Phenanthrene	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Phenol	1,700,000	NE	NE	NE	NE	NE	NE	1,700,000	4,600,000	NE	1,100,000
Pyrene	2,600	NE	NE	NE	NE	NE	NE	4,000	11,000	NE	2,600
Pyridine	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

Notes

[a] Cleanup level may be adjusted based on laboratory practical quantitation limit (PQL)
[b] MTCA Method A value.

NE = Not established.
PCBs = polychlorinated biphenyls
SVOC = semivolatile organic compounds
TPH = total petroleum hydrocarbons

Table 3-3 - Potentially Applicable Federal and State Regulatory Requirements

Federal Regulations	Regulatory Citation	Triggering Activity
Clean Water Act	Sections 303, 311, 312, 401, and 404 US Code (USC) 1252 et seq.	Dredging and placement of sediment capping materials within navigable waters of the United States, protection of surface water quality, and filling or removal of wetlands.
Coastal Zone Management Act	16 USC 1455	Construction activities requiring federal approval must be consistent with the State's Coastal Zone Management Program.
Rivers and Harbors Act	33 USC 403 and CFR Parts 320 and 32	Alteration of waters of Fidalgo Bay as a navigable waterway.
Endangered Species Act	16 USC 1531 et seq.	Presence or suspected presence of threatened or endangered species or critical habitat at or near the site at the time of anticipated work.
National Historic Preservation Act of 1966	Section 106 – 16 USC 470 and 36 CFR Part 800	SEPA regulatory compliance, and federal permitting, assistance, and related involvement.
Archeological and Historical Preservation Act	16 USCA 469	Discovery of archaeological or historical objects during remediation activities.
State Regulations		
Solid and Hazardous Waste Management and Related Federal Resource Conservation and Recovery Act	Chapter 70.105 and 70.105D (MTCA) and Chapter 173-303; and 42 USC 6921-6949a and 40 CFR Part 268, Subtitle D	Potential for generating, handling, and disposing of dredged material containing designated hazardous wastes.
Sediment Management Standards	Chapter 173-204 WAC	Actions which expose or resuspend surface sediments which exceed, or otherwise cause or potentially cause surface sediments to exceed applicable standards of the WAC 173-204-320 through 340.
Water Quality Standards for Surface Waters of the State of Washington	Chapter 90.48 RCW and Chapter 173-201A WAC	Potential for construction activities for the upland and in-water remedial action to adversely affect surface waters of the State.
State Environmental Policy Act	Chapter 43.21C RCW, Chapter 197-11 WAC, and Chapter WAC 173-802	Permit application or proposed regulatory cleanup action under MTCA or SMS, and impacts to critical areas.
Shoreline Management Act	Chapter 90-58 RCW and Chapter 173-27 WAC	Construction work within the shoreline zone.
Wetlands – Water Pollution Control Act	90-48 RCW, WAC 365-190-090, and Chapter 173-201A WAC	Construction work affecting wetlands.
Fish and Wildlife Habitat Conservation	Chapter 77-85 RCW and WAC 365-190-130	Construction work within fish and wildlife habitat conservation areas and within the shoreline zone.
Saltwater Habitats of Special Concern	WAC 220-110-250	Construction work within the shoreline and intertidal zones.
Washington Hydraulics Code	Chapter 70-95 RCW and Chapter 173-304 WAC	Use, diversion, obstruction, or change in the natural flow or bed of Fidalgo Bay from the in-water component of the remedial action.
Indian Graves and Records and Archaeological Sites and Resources	RCW Chapter 27.44 and RCW Chapter 27.53	Construction project involving state funding.

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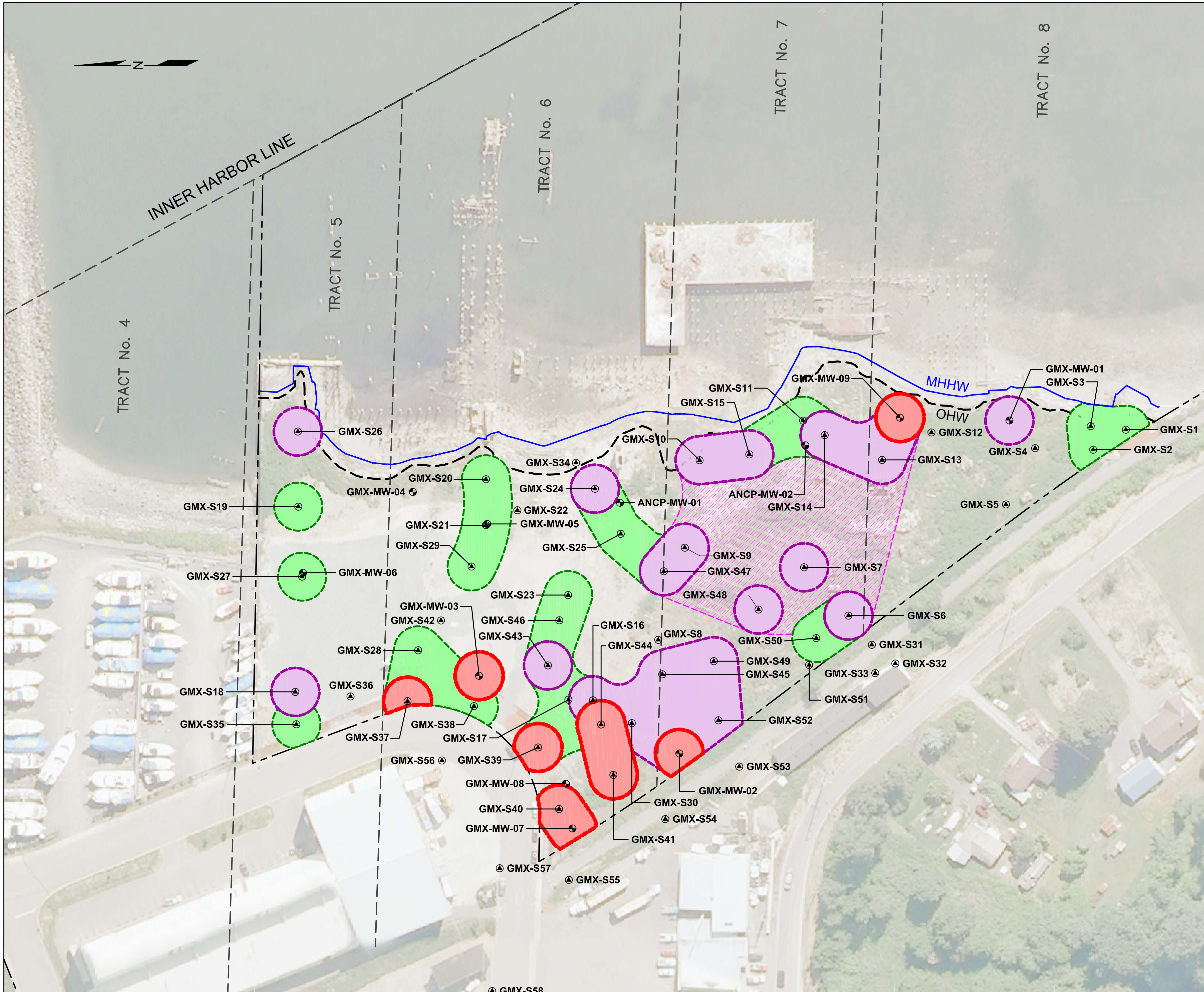

Inferred Areal and Depth Extent of COC Screening Level Exceedances in Soil
Depth Extent in Feet Below Ground Surface

- 0-4 Feet
- 0-6 Feet
- 0-8 Feet
- Potential Exceedance to 6 Feet

Exploration Location and Number

- GMX-MW-02 — 2008 and 2009 Monitoring Well (AMEC 2009)
- GMX-S6 — 2008 and 2009 Soil Sample (AMEC 2009)

Notes:

1. Adapted from AMEC Geomatrix (2010) First Draft Remedial Investigation (RI) Report Figures 5 and 32.
2. Includes exceedance of screening levels for TPH, cPAHs, and metals in soil.
3. Boundary locations estimated based on nominal 25-ft minimum horizontal distance from point of detection. Assumed working scenario for FS evaluation.

0 100 200
Scale in Feet

Custom Plywood Site
Anacortes, Washington

Inferred Extent of COC Screening Level Exceedances in Soil

17330-27 (CAP) 2/11

HARTCROWSER

Figure
3-1

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4.0 SELECTED UPLAND CLEANUP ACTION ALTERNATIVE FOR PHASE I INTERIM ACTION

The cleanup action selected for the Site is described in this section. The cleanup action includes demolition of existing upland structures, debris and piling removal, soil excavation and disposal, backfilling, and associated wetland mitigation, buffer establishment, stormwater management, public access, and site restoration. The selected upland remediation alternative combines components that are applicable to impacted soil and groundwater, as described in Section 4.1. Upland remediation entails demolition and removal of debris and pilings (Section 4.2). Mitigation measures to create a new estuarine wetland complex and buffer are described in Section 4.3. A stormwater swale (Section 4.4) is planned to manage and treat stormwater that is currently routed onto the property through a City of Anacortes conveyance.

Remaining portions of this section summarize contamination that may remain on site at the conclusion of the Phase I interim action (Section 4.5), construction performance monitoring (Section 4.6), and post-construction confirmational monitoring to assure that remedial action objectives are being met (Section 4.7). Contingency actions have been identified to provide additional remedial action if remedial action objectives are not being met (Section 4.8). The selected remedy also will be compatible with potential future land uses of the Site (Section 4.9), and includes restrictive covenants to protect human health and the environment now and into the future (Section 4.10).

4.1 Upland Cleanup Action Description

The selected remedy for the uplands is identified as Alternative U-3 from the FS and is depicted on Figure 4-1. This remedy combines removal of concrete foundations and near-surface debris and pilings (where necessary to access contaminated soil), with source control soils excavation to two different POC depths. Alternative U-3 involves soil excavation up to 15 feet bgs in the shoreline protection zone and press pit area, and up to 6 feet bgs elsewhere on the property. The shoreline protection zone is defined as the area that lies between MHHW to a distance 75 feet landward of MHHW. Portions of the excavation areas that lie seaward of the OHW will be excavated in the later aquatic phase of work.

Excavation up to 6 feet bgs represents source removal to the ecological POC, and excavation to 15 bgs represents source removal to the human health POC. A more comprehensive understanding of the extent of contamination will be determined during construction through field screening and sample testing.

Because the deeper excavations could likely encounter groundwater, provisions for excavating and handling wet material and a contingency for excavation dewatering are included with the soil excavation alternative.

Excavated surface debris and soil will be sent off site for disposal at a permitted Subtitle D landfill facility. Surface debris is intermixed with soil and would be difficult to recycle either on or off site. Regional recycling facilities would not likely accept such material, and significant additional characterization sampling would be needed if on-site reuse was contemplated. Excavated material containing free water will be allowed to dewater directly to the ground before loading and transporting off site; material not requiring dewatering will be directly loaded into trucks for transport.

A target volume of approximately 26,000 cy of debris and contaminated soil material are planned to be excavated and disposed of at an off-site location. The excavation areas will be backfilled to grade using clean imported fill and crushed concrete debris generated from on-site above-ground concrete structure and foundation demolition. Recycling the concrete debris material on site in this manner reduces the quantity of imported fill required and the amount of material sent off site for disposal, thus providing a reduction in cost. Erosion control, site stabilization, and temporary shoreline protection measures (berms) associated with shoreline excavation and wetlands construction would also be implemented.

4.2 Demolition and Removal of Upland Debris and Pilings

The selected cleanup action includes measures to demolish concrete structures that remain on the Site and for the removal of surface debris and wooden pilings where needed to access contaminated soil. It is expected that a nominal 2-foot-thick layer of debris will be removed from the surface of the upland and nearshore excavation areas (approximately 9,300 cy and 4,700 cy, respectively), which will be disposed of off site along with excavated soil.

In the upland remediation area, above-ground concrete and concrete foundation structures will be demolished, crushed, and recycled on site as excavation backfill material. This will contribute approximately 1,750 cy of crushed concrete material to the backfill volume, resulting in a reduction of the quantity of backfill material that will need to be imported to the Site from off-site sources or disposed of off site.

Wood pilings will be removed from the upland excavation areas where needed to facilitate soil removal. Pilings will be left in place elsewhere, where not needed to allow excavation. Alternatively, pilings may be cut off at the excavation floor, particularly in areas where shallower cuts of 4 to 6 feet bgs are anticipated. An estimated 970 pilings will be removed and disposed of from the upland excavation areas.

4.3 Upland Wetland Mitigation

The selected U-3 upland cleanup alternative also includes mitigating for nearly 12,000 sf of wetlands impacted by planned soil excavation activities. These areas, excluding Wetland E, are identified on Figure 1-2. Wetland E is more directly connected to surface waters of Fidalgo Bay, and is planned to be addressed during the subsequent aquatic-phase cleanup.

To mitigate for the loss of wetland areas, a consolidated wetland concept in the southern portion of the GBH property is included as part of the overall cleanup action for the Site. This area and associated buffer are identified on Figure 4-1. The consolidated wetland mitigation area includes a 12,000-square-foot estuarine wetland bench created landward of OHW with an associated upland buffer that will be planted with native vegetation. The planned buffer ranges from 50 to 75 feet in width and is to be fenced to limit access until vegetation can fully mature and establish. Inclusion of the wetland mitigation area and buffer is described later in this document, for the selected remediation alternative. Additional detail is also provided in the Conceptual Wetland Mitigation Plan memorandum (Appendix B). Discussion of mitigation details and related permitting issues is on-going with the SEA program, resource agencies, COA, the Tribes, and other stakeholders.

4.4 Stormwater Management

A stormwater swale is planned to manage and treat stormwater currently routed onto the property through an 18-inch-diameter COA conveyance to Wetland D (Figure 1-2 and Figure 4-1). The swale is designed and sized per Ecology's 2005 Stormwater Management Manual (SWMM) for Western Washington (Ecology 2005) to provide water quality treatment. No infiltration is assumed as a conservative assumption based on subsurface soil and groundwater conditions. Infiltration that does occur provides additional stormwater management control.

Figure 4-1 identifies the general proposed swale location. Stormwater from the existing COA conveyance will be routed to the swale through a control box structure, catch basin, and inlet pipe. These structures will be established at appropriate elevations and gradients to manage flows through the swale.

The swale and conveyance corridor will be vegetated with a standard grass seed mix to filter and remove sediment and particulates from the stormwater. The swale will provide basic stormwater treatment before it enters a vegetated conveyance corridor that will route the treated stormwater from the swale into the restored wetland area. The conveyance corridor will be designed to meander through the restored buffer area to provide additional treatment and infiltration as well as a more natural channel configuration. The swale also will be protected with a low berm and backflow preventer at the outlet to avoid inundation during high tides. Appendix B provides additional information on proposed stormwater management and conceptual swale design.

4.5 Contamination Remaining on Site after the Upland Cleanup Action

The selected upland cleanup action at the Site may leave subsurface soil and groundwater containing COCs with concentrations exceeding applicable MTCA cleanup levels listed in Tables 3-1 (soil) and 3-2 (groundwater). As described in Section 4.1 and on Figure 4-1, the excavation approach for selected Alternative U-3 removes near-surface debris and subsurface foundations, excavates soil up to 15 feet bgs in the shoreline protection zone and press pit area, and to 6 feet bgs elsewhere on the property. This excavation approach is designed to protect the human and ecological receptors and is intended to control the soil to surface water contaminant exposure pathway.

Residual soil contamination could remain in areas targeted for excavation below the ecological POC of 6 feet bgs. These areas will be backfilled with clean import soil following excavation, thus providing separation from the deeper contaminated soil. The areas of residual contaminated soil will be documented following the completion of the upland cleanup actions and will continue to be addressed using confirmational groundwater monitoring, and environmental covenants implemented at the Site, as described below in Sections 4.9 and 4.10, respectively.

The remediation of contaminated soil is also expected to significantly reduce, if not eliminate, the soil to groundwater pathway and allow the concentration of these and other COCs in groundwater to return to levels below the MTCA l criteria within a reasonable restoration time frame. Groundwater samples are anticipated to be collected and analyzed on a quarterly basis for the first two years following completion of Phase II in-water construction scheduled to start in 2013, and then annually for at least five years to monitor the concentration of COCs as a function of time and further evaluate the restoration time frame.

4.6 Construction Performance Monitoring

Performance monitoring (WAC 173-340-410 (1)(b)) is intended to assure that a remedial action has attained cleanup standards (including MTCA criteria), or other performance standards such as construction quality control measurements, permit conditions, or substantive requirements of other laws.

Performance monitoring following soil excavation will begin with topographic surveys or similar grade control measures to verify that the excavation has achieved the desired cut elevation. Soil samples will be collected and analyzed from the base and sidewalls of excavations to confirm that target cleanup levels have been achieved, or to document the concentration of COCs that remain on the Site. Related monitoring and documentation will include verifying the chemical quality of imported soils used for backfilling, placement to match pre-existing grade, and nominal compaction requirements to be established during the design phase.

Performance monitoring will also be required to document construction of the wetlands mitigation complex, associated buffer area, and stormwater swale and conveyance features. Monitoring will include demonstrating that the required areal coverage has been met, appropriate excavation and materials placement have occurred to the planned lines and grades, and that required revegetation and habitat functions have been established. The stormwater conveyance system must also be constructed to comply with state and City design requirements, including appropriate design storm criteria.

Remedy performance criteria, quality assurance (QA) activities, documentation requirements, and potential corrective actions will be developed during the design phase preparation of project plans and specifications. This will further include health and safety protection monitoring as required under WAC 173-340-410(a) in the form of a health and safety plan. A health and safety plan will also be developed for long-term operation, maintenance, and monitoring of the remedy, which will include a monitoring plan for dust and odors.

4.7 Post-Construction Confirmation Monitoring

Confirmation monitoring (WAC 173-340-410(1)(c) is a component of compliance monitoring intended to demonstrate the long-term effectiveness of the cleanup action once cleanup levels or other performance standards have been attained. Specific details for post-construction monitoring will be developed in an Operation, Maintenance, and Monitoring Plan (OMMP) following design phase preparation of project plans and specifications. Anticipated groundwater monitoring and other elements of the OMMP are summarized in Section 7.0 below.

4.8 City of Anacortes Public Access to Shoreline Areas

Public shoreline access provision pursuant to the City of Anacortes (COA) Shoreline Master Program (SMP) will be addressed by making provisions for beach access at the southern landward tip of the Site. The general location of the beach access is identified on Figure 2 in Appendix B. The configuration of these features has not yet been determined, but detailed design is planned concurrently with the design for the Phase II in-water remediation. Aquatic permitting required for the beach access component will also be included with Phase II. Final design and field construction are currently planned to be completed in coordination with the City of Anacortes and the property owner. Access to the public beach areas will require, at a minimum, completion of the Phase II aquatic cleanup.

4.9 Contingency Actions

Post-construction monitoring will be conducted to evaluate whether contaminated soils that are left in-place by the cleanup action poses an unacceptable risk to groundwater or possible marine receptors via contaminant migration from groundwater to surface water and sediment. Similar long-term monitoring programs will be established as part of the wetlands mitigation, buffer, and stormwater swale/conveyance components of the OMMP. Potential contingency actions are described further in the Section 7.0.

4.9.1 Contingency Beach and Shellfish Bed Closure

Although not expected to be needed, the Skagit County Public Health Department would be alerted and consulted relative to the potential need for closure of nearby shellfish beds during the upland remediation. The EDR identifies the need for development of a contingency beach and shellfish bed closure plan.

4.10 Future Land Use

The selected upland remedial Alternative U-3 addresses MTCA and other regulatory requirements to provide a suitable cleanup action that adequately protects human health and the environment as a long-term solution. The remedial action also provides for required wetland mitigation and post-construction stormwater management.

The upland portion of the GBH property is zoned for commercial development. Planned excavation and backfilling for Alternative U-3 is compatible with this future Site use, including potential development of vessel storage and related boat manufacturing support activities envisioned by the current property owner. The selected remedial alternative also provides for potential public access near the south end of the GBH property, as anticipated by the City of Anacortes and described above.

Considerations for potential future Site commercial use include the following:

- The buffer associated with the wetland mitigation complex is designed to provide protection from adjacent commercial activities and separate and preserve the mitigation area. In turn, the presence of the mitigation area and buffer should have little, if any, impact on commercial development other than excluding Site development on the southern end of the GBH property.

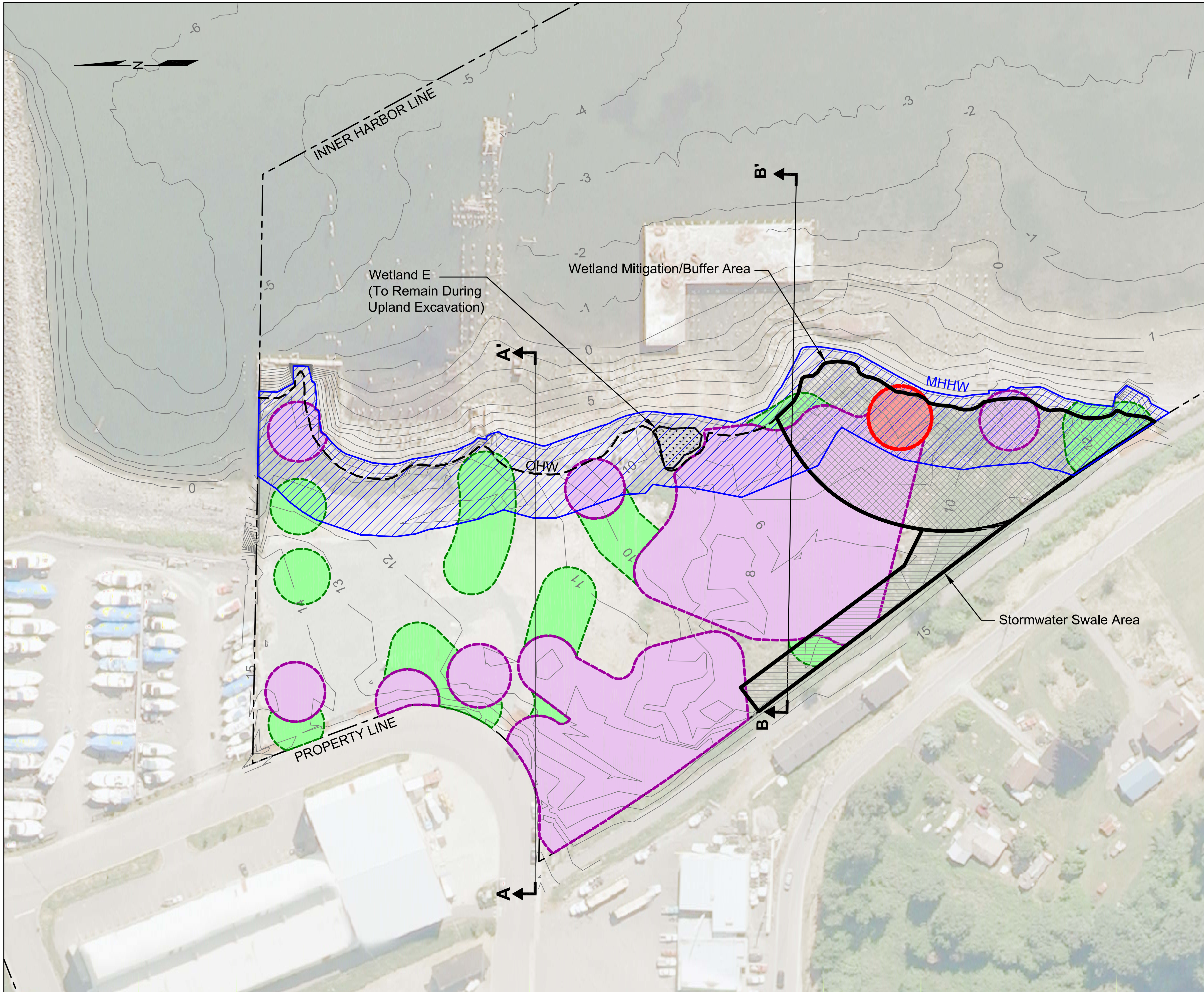
- The stormwater swale and conveyance system will require maintenance and protection but should otherwise not interfere with commercial activities.

- Deeper excavation into soils with potential residual contaminants are planned to be limited through a restrictive covenant or similar control. Deeper excavation will not necessarily preclude installation of deeper foundations or utilities, if appropriate health and safety precautions and material management measures were implemented.

- Backfilling for upland excavations does not anticipate more than nominal, machine-compaction during fill placement. However, this will not preclude more robust subgrade preparation, or placing lifts of structural cover material or a pavement, if desired, as part of future Site development.

4.11 Environmental Covenants

One or more environmental covenants (WAC 173-340-440 (9)) or similar institutional controls will be required for upland areas where contaminants at concentrations above cleanup levels are left behind at the conclusion of the cleanup action (refer to Section 4.5). The covenants will identify soil locations and depths that will require special management if disturbed, unless the soil is removed later. Soil management plans will be required that instruct property owners on Ecology's requirements for performing invasive work in areas of remaining contamination. The environmental covenants will be recorded following completion of Phase I excavation activities described in this CAP.



Target Excavation Area and Depth in Feet Below Grade

- 4 Feet
- 6 Feet
- 8 Feet

Shoreline Protection Zone (75 Feet Landward of MHHW)

MHHW Mean Higher High Water

OHW Ordinary High Water

5 Ground Surface Elevation Contour in Feet (NAVD 88)

A A' Cross Section Location and Designation

Notes:

1. Excavate up to 15 feet depth (Human Health Point of Compliance) in shoreline protection zone and up to 6-feet depth (Ecological POC) elsewhere.
2. Excavations include nominal 1H:1V side walls from base of contaminated area and property boundaries.
3. Target excavation areas located seaward of OHW to be excavated as part of aquatic remediation alternatives.
4. See Figure 5-1 for exploration locations and inferred extent of contamination.
5. Extent of contamination below 8 feet depth is generally uncertain and not included with excavation areas.
6. See Appendix B for stormwater swale and wetland mitigation/buffer element details.

0 100 200

Scale in Feet

Custom Plywood Site
Anacortes, Washington

Selected Upland Remedial Action Alternative U-3

17330-27 (CAP) 2/11

HARTCROWSER

Figure **4-1**

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5.0 REMEDIAL ACTION ALTERNATIVES CONSIDERED AND BASIS FOR UPLAND REMEDY SELECTION

Four upland cleanup alternatives covering several excavation options and surface capping were evaluated in the FS. A range of potential wetland mitigation and stormwater management alternatives were considered, as described in the supporting FS appendices. This section summarizes the process used to identify candidate cleanup technologies (Section 5.1), describes the remedial alternatives developed at a generalized level (Section 5.2), and identifies the MTCA criteria used to evaluate each potential cleanup alternative (Section 5.3).

5.1 Remedial Technology Screening Process

Candidate remedial technologies were identified and screened in Sections 6.1 through 6.3 of the FS to develop potential cleanup alternatives for further evaluation. The remedial technologies considered include methodologies capable of achieving the remedial action objectives, including MTCA cleanup levels and other regulatory requirements.

Candidate technologies applicable to impacted groundwater and soil were identified in many sources, including compilations such those discussed in the web-based Federal Remediation Technology Roundtable (FRTR). The screening of technologies applicable to impacted groundwater, soil, and groundwater remediation included consideration of available methodologies to address contaminants in soil and groundwater, based on their expected implementability, reliability, and relative cost. The FS provides additional background on these evaluation factors along with the rationale for retaining or discarding particular technologies.

Technology screening also considered physical conditions at the Site that limit or support particular technologies, as well as contaminant characteristics that limit the effectiveness or feasibility of a technology. Screening was consistent with MTCA evaluation criteria described further in Section 5.3 for the remedial alternatives evaluation. Screening also considered modifying criteria associated with upland land uses, considered potential historic and archaeological resources, and avoided impacts to habitat resources.

5.2 FS Alternatives Evaluated

Remediation alternatives applicable to impacted upland media at the Site were developed from the technologies retained through the screening process summarized in Section 5.1. Four upland remediation alternatives (U-1 through U-4) were developed from the retained technologies. These remedial technologies include methodologies capable of achieving remedial action objectives, including MTCA cleanup levels and other regulatory requirements applicable to the upland portions of the Site addressed in this CAP.

5.2.1 Upland Remedial Alternatives Summary

The upland remediation alternatives combined components applicable to impacted soil and groundwater media. Remediation alternatives for soil and groundwater were not developed separately because the remediation technologies retained for soil and groundwater remediation through the technology screening process were similar. Excavation with off-site disposal of impacted soil was retained as an effective, well-established remediation methodology applicable to Site soil contaminants. Soil excavation and disposal have the additional benefit of reducing or eliminating potential sources of groundwater contamination. Capping technology was retained as a measure that can minimize direct-contact risk for human and ecological receptors, in addition to minimizing the potential migration of contaminants from impacted soil to groundwater that can be caused by water infiltrating from the ground surface. Natural attenuation processes are likely to reduce the concentration and/or mobility of residual contaminants that may remain in groundwater after implementation of the selected remediation alternative.

Alternatives U-1 through U-3 differed in the depths of contaminated soil excavation within the shoreline protection zone and elsewhere. Alternative U-1 was the most comprehensive, with excavation up to the human health POC of 15 feet bgs. Alternative U-2 was the least conservative, with excavation to the ecological POC of 6 feet bgs. Alternative U-3 was a hybrid approach to excavate to 15 feet bgs in the shoreline protection zone and to 6 feet bgs elsewhere. Alternative U-4 included partial excavation for the wetland mitigation area and a nominal 2-inch-thick asphalt cap cover across the remaining upland portion of the GBH property. Table 5-1 summarizes and compares specific components for each upland alternative.

5.2.2 Additional Technologies Considered

The FS considered a number of additional candidate technologies for upland remediation. These technologies were not carried forward as components of potential remedial action alternatives based on lack demonstrable effectiveness, implementability issues, or relative cost in relation to other technologies. As an example, on-site or off-site thermal treatment was not retained as a technology expected to be viable for upland remediation. Thermal treatment poses several limitations because of the reliability of the method in heterogeneous soil containing abundant debris and wood waste that tend to make treatment inefficient and costly. Thermal treatment requires relatively high energy inputs to breakdown fine-grain soil fractions and heavy-end TPH fractions characteristic of expected conditions in contaminated upland areas of the Site. Thermal treatment is also less effective for remediating PAH constituents with low volatility in soil and is not effective for treating metals.

5.3 MTCA Evaluation Process

This section summarizes the process that was used to evaluate upland remediation Alternatives U-1 through U-4, and to select Alternative U-3 as providing the most appropriate combination of remedial components for implementation The MTCA criteria used to evaluate each alternative are summarized in Section 5.3.1. Upland cleanup alternatives are then compared to these criteria in Section 5.3.2, with the conclusion of this evaluation process summarized in Section 5.3.3.

5.3.1 MTCA Evaluation Criteria

Key guiding requirements for evaluating cleanup alternatives and cleanup action selection for Site are listed in the MTCA regulations and detailed in the FS. MTCA criteria consist of threshold requirements and other criteria listed in WAC 173-340-360(2) Minimum Requirements for Cleanup Actions, as listed in Table 5-2 and detailed in the FS.

MTCA Disproportionate Cost Analysis – WAC 173-340-360(3)(e) and (f)

MTCA places preference on permanent solutions to the maximum extent practicable based on a disproportionate cost analysis (DCA). The benefits of the alternatives considered are balanced against relative costs for implementing each alternative. Preference is also placed on remedies that can be implemented in a shorter time, based on potential environmental risks and effects on current Site use and associated Site and surrounding area resources. The third criterion, public concerns, is addressed during comment periods for RI/FS documents, remedy selection decision, and subsequent CAP for remedy implementation.

The DCA represents a test to determine whether incremental costs of a given alternative over a lower-cost option exceed the incremental degree of benefit achieved by the higher cost alternative. The most practicable permanent solution is identified as the baseline cleanup action alternative for FS evaluation. The referenced section of MTCA further specifies that where alternatives are equal in benefits, the least costly alternative will be selected provided the MTCA threshold and other requirements are met. Relative costs and benefits of the remedial alternatives are evaluated in the DCA based on specific criteria listed in WAC 173-340-360(3)(f) and summarized in Table 5-2.

5.3.2 Alternatives Comparison by MTCA Criteria

Remediation alternatives for the upland and aquatic areas were evaluated based on MTCA regulatory criteria and DCA considerations. The FS alternatives were evaluated to assess compliance with minimum regulatory requirements, including consistency with provisions of MTCA and other ARARs. DCA criteria were evaluated based on a relative numeric ranking system from 1 to 5, with 1 as the lowest (least favorable) ranking, and 5 as the highest (most favorable) ranking. The DCA criteria were further weighted on a proportional basis to emphasize protectiveness (30 percent), permanence, (20 percent), long-term effectiveness (20 percent),management of short-term risks (10 percent), technical and administrative implementability (10 percent), and consideration of public concerns (10 percent) as the drivers for the ranking.

This DCA ranking approach is consistent with the relative numeric ranking system used for other Puget Sound aquatic cleanup sites. The DCA scores were then totaled and compared to determine the overall ranking and cost benefit. Results of the alternatives evaluation and DCA are presented in Table 5-2, with estimated project costs for the upland remedial alternatives presented in Table 5-3. Appendix C of the FS presents a further breakdown of the estimated costs for the upland alternatives.

5.3.3 Upland Cleanup Action Alternatives Comparison

The ability of each upland cleanup alternative to meet applicable MTCA criteria is assessed in this section.

MTCA Threshold Criteria – Protectiveness, Compliance with Standards and ARARs, and Provisions for Compliance Monitoring

Varying degrees of protectiveness are attained in the three alternatives because of the different maximum quantities of soil removed and the POC that each alternative is designed to reach. Alternative U-1 is most protective, while Alternative U-2 is somewhat less protective but meets the terrestrial ecological POC. Alternative U-3 provides human health and ecological protectiveness in the shoreline protection zone, but is somewhat less protective of human health elsewhere on the property, where it meets only the ecological POC. Alternative U-4 contains impacted soil in-place via surface capping, and impacted soil removal in the wetland mitigation and stormwater management areas. This alternative generally provides less protectiveness than the soil removal alternatives. Additionally, Alternative U-4 does not achieve compliance with standards for soil throughout the Site, but could achieve standards at the property boundary pending confirmation determined through long-term cap (physical containment) and groundwater monitoring.

Other MTCA Criteria – Permanence, Restoration Time Frame, and Public Concerns

Alternatives U-1 through U-3 involve removal of impacted soil and represent permanent remedial actions that can be achieved in short restoration time frames. Alternatives U-2 and U-3 were scored as slightly less permanent than U-1, should deeper contaminated soils left in place with Alternatives U-2 and U-3 persist as a potential source of groundwater contamination. Alternative U-4 includes limited soil removal but contains remaining impacted material on site beneath a surface asphalt cap and, therefore, is considered less permanent.

The installation of the surface cap for Alternative U-4 could be completed in a relatively short period, which will eliminate the human health direct-contact exposure pathway, but the reduction of the soil to groundwater exposure pathway will depend on the slow process of natural attenuation to reduce groundwater concentrations below cleanup levels, resulting in a longer restoration time frame.

While excavation and capping are intended to address public concerns responsibly, it is acknowledged that potential concerns may be raised that Site contaminants will not be completely removed from the environment. Alternatives U-2 and U-4 leave a greater volume of potentially contaminated soil in the shoreline protection zone and, therefore, were ranked slightly lower. A comparable concern is that capping or excavation is invasive technology that could result in more detrimental impacts that are not commensurate with their potential benefits. Aesthetic concerns could also conceivably be raised regarding the installation of an asphalt cap over the majority of the property, although capping is compatible with future commercial use of the property. Conversely, excavation and backfilling alternatives will allow for surface restoration to a more natural-looking state.

Permanence, restoration time frame, and public concerns are further addressed as part of the DCA ranking below.

DCA Evaluation and Alternatives Ranking

As summarized in Table 5-2, excavation Alternative U-1 was ranked highest based on scores for protectiveness, permanence, and long-term effectiveness. Alternative U-2 ranked as the lowest based on lower scores in these categories because of less aggressive removal of contaminated soil within the shoreline protection zone, in comparison with Alternatives U-1 and U-3.

Total estimated costs for the upland alternatives ranged from a low of about $4.6 million for the capping alternative (Alternative U-4) to a high of $7.3 million for the excavation alternative (Alternative U-1). None of the upland alternatives is disproportional relative to the lowest ranking Alternative U-2 base case. Of these alternatives, the capping Alternative U-4 nominally represents the best cost-benefit based on substantially lower cost, but provides only 1 percent additional benefit over the Alternative U-2 base case. Excavation Alternative U-1 provides the next best benefit, quantified as a relative difference of 22 percent between the increased benefit (131 percent) and cost (9 percent) over the Alternative U-2 base case. The comparative cost-benefit percentages for excavation Alternative U-3 calculated in this manner was 18 percent or 4 percentage points lower than Alternative U-1 (refer to Table 5-2).

Although Alternative U-1 is the least expensive of these excavation alternatives, actual construction costs could increase substantially should additional contaminated soils be encountered at depth. Excavation of additional deeper soils for Alternative U-1 will provide limited additional risk reduction or other benefit. For this reason, Alternative U-3 represents the most cost-effective alternative given current uncertainty about the depth extent of contaminated soil. Alternative U-3 also provides greater value by limiting excavation of deeper and lower-risk soils to the shoreline protection zone.

Overall costs for Alternative U-3 as a representative excavation case are estimated at about $6.8 million. This includes projected construction costs of approximately $4.8 million (incorporating 30 percent contingency), and estimated non-construction, mitigation, and long-term monitoring and maintenance costs of about approximately $2 million. Excluding contingencies and long-term monitoring, estimated capital costs for construction, related engineering support, and mitigation are in the $5.5 million range (-30 to +50 percent) for Alternative U-3.

Table 5-1 Upland Remediation Alternatives Summary

Upland Remediation Components	Upland Remediation Alternative			
	U-1	U-2	U-3	U-4
	Excavate Soil To Human Health (HH) POC Long-Term Monitoring	**Excavate Soil to Ecological POC Long-Term Monitoring and Institutional Controls**	**Excavate Soil to HH POC in Shoreline Protection Zone[b] and to Ecological POC Elsewhere on Property Long-Term Monitoring and Institutional Controls**	**Asphalt Pavement Cap Long-Term Monitoring and Institutional Controls**
Remove Near-Surface Debris and Subsurface Foundations[a]	Yes	Yes	Yes	Yes
Excavate Soil with COCs Exceeding Cleanup/Remediation Screening Criteria				
Excavate Up To 15 Feet BGS - All Affected Property Areas (Human Health Direct Contact POC)	Yes	No	No	No
Excavate Up To 6 Feet BGS - All Affected Property Areas (Ecological POC)	Included	Yes	Included	No
Excavate Up To 6 Feet BGS in Shoreline Protection Zone[b] and Press Pits Area, and 4 Feet BGS Elsewhere on Property	Included	Included	Included	No
Excavate Up To 15 Feet BGS in Shoreline Protection Zone[b] and Press Pits Area, and 6 Feet BGS Elsewhere on Property	Included	No	Yes	No
In Wetland Mitigation/Buffer Area and Stormwater Swale Area Only: Excavate Up To 15 Feet BGS in Shoreline Protection Zone[b] and Press Pits Area, and 6 Feet BGS Elsewhere	Included	No	Included	Yes
Containment Capping				
2-Inch-Thick Asphalt Surface Pavement and Stormwater Drainage Control[c]	Not Needed	Contingency[d]	Contingency[d]	Yes
Points of Compliance				
Soil - Upland Locations Within Property Boundary	Achieves Compliance	Achieves Compliance to Ecological POC but Not Attained Below Ecological POC	May Achieve Compliance/Contingency	Not Attained
Groundwater - Freshwater/Saltwater Interface at Shoreward Edge of Property	Yes	Yes	Yes	To Be Determined During Long-Term Monitoring
Monitoring				
Post-Construction Soil Confirmation Monitoring	Yes	Yes[e]	Yes	Yes[e]
Long-Term Cap Performance/Protection Monitoring (Physical Integrity)	Not Needed	Yes	Contingency	Yes
Long-Term Groundwater Performance/Protection Monitoring	Yes	Yes	Yes	Yes
Institutional Controls				
MTCA Administrative Order Conditions	Yes	Yes	Yes	Yes
MTCA Site Listing	Yes	Yes	Yes	Yes
Potential City Administrative/Land Use Restrictions	To Be Determined	To Be Determined	To Be Determined	To Be Determined
Long-Term Monitoring Requirements	Groundwater	Groundwater and Potential Cap Integrity	Groundwater	Groundwater and Cap Integrity
Access and Deed Restrictions	May Not Be Needed	Yes Includes Physical Indicator at Ecological POC	May Not Be Needed	Yes

Notes:
(a) Includes near-surface debris removal to approximately 2 feet bgs, and piling and subsurface foundation removal where needed to facilitate soil excavation.
(b) Includes 75-foot-wide zone landward of MHHW.
(c) Includes nominal 2-foot-thick soil subgrade.
(d) Cap to be placed if warranted based on long-term groundwater monitoring results following excavation.
(e) Surface samples collected from final excavation surface to document residual chemical concentrations in soil

Table 5-2 - Estimated Costs of Upland Remediation Alternatives

Description	Upland Remediation Alternative			
	U-1	**U-2**	**U-3**	**U-4**
	Excavate Soil To Human Health (HH) POC Long-Term Monitoring	Excavate Soil to Ecological POC Long-Term Monitoring and Institutional Controls	Excavate Soil to HH POC in Shoreline Protection Zone and to Ecological POC Elsewhere on Property Long-Term Monitoring and Institutional Controls	Asphalt Pavement Cap Long-Term Monitoring and Institutional Controls
Appendix C Cost Table Reference	C-U1	C-U2	C-U3	C-U4
Construction Subtotal (Including 30% Contingency)	$5,261,000	$4,761,000	$4,794,000	$2,541,500
Non-Construction Costs	$1,100,000	$1,005,000	$1,012,000	$582,000
Mitigation	$704,000	$704,000	$704,000	$704,000
Long-Term Monitoring and Maintenance (Annual and Periodic Costs)	$261,000	$261,000	$261,000	$819,000
Estimated Total	**$7,326,000**	**$6,731,000**	**$6,771,000**	**$4,647,000**

Notes:

Estimated cost assumes an accuracy range of -30 to +50 percent.

See draft Feasibility Study (Hart Crowser 2010) for additional cost discussion and breakdown.

Table 5-3 - Summary of MTCA Evaluation Criteria and DCA for Upland Remediation Alternatives

Criteria	Alternative			
	U-1	U-2	U-3	U-4
Criteria	Excavate Soil To Human Health (HH) POC Long-Term Monitoring	Excavate Soil to Ecological POC Long-Term Monitoring and Institutional Controls	Excavate Soil to HH POC in Shoreline Protection Zone and to Ecological POC Elsewhere on Property Long-Term Monitoring and Institutional Controls	Asphalt Pavement Cap Long-Term Monitoring and Institutional Controls
MTCA Threshold Criteria WAC 173-340-360(2)(a)				
Protection of Human Health and the Environment	Yes	Yes (HH addressed to 6 feet depth)	Yes (HH addressed 6 feet depth landward of Shoreline Protection Zone)	Yes
Compliance with Cleanup Standards	Yes	Yes (Relative to conditional property boundary POC)	Yes (Relative to conditional property boundary POC)	Yes (Relative to conditional property boundary POC)
Compliance with ARARs	Yes	Yes	Yes	Yes
Provision for Compliance Monitoring	Yes	Yes	Yes	Yes
Other MTCA Evaluation Criteria WAC 173-340-360(2)(b)				
Permanence	Yes	Yes	Yes	Yes
Restoration Time Frame	<1 Year[b]	<1 Year[b]	<1 Year[b]	> 1 Year[c]
Consideration of Public Concerns	Yes	Yes	Yes	Yes
MTCA Disproportionate Cost Analysis DCA - WAC 173-340-360(3)(f)[d]				
Protectiveness (30%)	1.5	1.1	1.4	1.1
Permanence (20%)	0.9	0.7	0.8	0.7
Long-Term Effectiveness (20%)	1	0.7	0.9	0.7
Management of Short-Term Risks (10%)	0.45	0.4	0.4	0.5
Technical and Administrative Implementability (10%)	0.5	0.5	0.5	0.4
Consideration of Public Concerns (10%)	0.5	0.35	0.5	0.4
Total Scores	4.9	3.7	4.4	3.8
Estimated Cost (+50% -30%)	**$7,326,000**	**$6,731,000**	**$6,771,000**	**$4,647,000**
Overall Alternative Ranking	1	4	2	3
% Benefit Compared with Lowest Ranking Alternative U-4	131%	100%	119%	1%
% Cost Difference Compared with Lowest Ranking Alternative	109%	100%	101%	-31%
Overall Cost Benefit (% Benefit - % Cost Difference from Base Case)	22%	0%	18%	32%
Cost Disproportionate?	No	Not Applicable	No	No

Notes:

(a) Includes 75-foot-wide zone landward of MHHW.
(b) Assumes no exceedances of groundwater cleanup levels during post-construction groundwater monitoring.
(c) Longer restoration time frame dependent on natural attenuation of potential groundwater contaminants.
(d) Ranked on a 1 to 5 scale with 5 being highest.

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for double-sided printing.

6.0 UPLAND CLEANUP ACTION SELECTION, IMPLEMENTATION, AND SCHEDULE

Following the above MTCA analysis and DCA, Alternative U-3 is identified as the selected alternative for remedial action, pending public review of the Interim Action Work Plan, including this CAP. As a robust source-control action, implementing Alternative U-3 will remove soil in the shoreline protection zone where concentrations exceed cleanup levels to a depth of up to 15 feet bgs. This alternative not only addresses protection of the human health direct contact exposure pathway, but removes impacted upland soils as a secondary source of contamination via the groundwater to surface water and soil erosion pathways.

Consistent with Chapter 70.105D, as implemented by Chapter 173-340 WAC, Ecology has determined that the selected upland cleanup action is protective of human health and the environment, will attain federal and state requirements that are applicable or relevant and appropriate, complies with cleanup standards, and provides for compliance monitoring.

Alternative U-3 is planned to be implemented along with the wetland mitigation and stormwater management components described above, and includes appropriate institutional controls and post-construction monitoring to evaluate long-term remedy performance. Remedy implementation and estimated costs will be further evaluated and presented in the EDR and project design documents.

6.1.1 Preliminary Schedule for Upland Remediation (Phase I)

The draft IAWP documents including this CAP and the FS and EDR for Phase I upland remediation were issued in mid-February 2011 for combined MTCA/SEPA public review. Briefing meetings with the resource agencies, Tribes, and public were held on February 24, 2011. The final IAWP documents were released in September 2011 following issuance of the September 2011 Response to Comments from stakeholders and the public. The detailed design phase was begun in early February to develop project plans and specifications, and was completed by mid-April. Related construction management and planning documents were also completed during this time frame.

Bid solicitation and contracting for Phase I interim action (upland remediation work) were conducted between mid-April and late May 2011. The notice to proceed was issued to the selected contractor in June 2011. The field Phase I upland construction activities started in early July 2011 with a planned duration of 16 weeks, ending in the late fall of 2011. Post-construction sampling and analysis will then commence and continue in accordance with the OMMP schedule to be developed. The groundwater monitoring component of the OMMP will begin following completion of Phase II in-water remediation. Shoreline excavation for Phase II must be completed to facilitate installation of groundwater wells for upland compliance monitoring. Field construction for the aquatic remediation phase is scheduled in 2013 as a follow-on action to upland remediation.

7.0 COMPLIANCE MONITORING

Compliance monitoring is planned to be implemented in accordance with WAC 173-340-410 and includes:

- **Protection Monitoring** to confirm that human health and the environment are adequately protected during the construction period of the cleanup action;

- **Performance Monitoring** to confirm that the cleanup action has attained cleanup standards and other performance standards; and

- **Confirmational Monitoring** to confirm the long-term effectiveness of the cleanup action once performance standards have been obtained.

Protection and performance monitoring during construction are discussed above in Section 4.6. The objective of compliance monitoring is to confirm that cleanup standards have been achieved, and to confirm the long-term effectiveness of cleanup actions at the Site. As discussed in Section 4.7, an OMMP is currently planned to be developed during the project design phase to describe planned monitoring and discuss the duration and frequency of monitoring activities, the trigger for contingency response actions, and the rationale for terminating monitoring. The OMMP may be prepared in conjunction with Construction Management to establish the following:

- Monitoring and inspection elements including activities, sampling and testing parameters and protocols, and frequency;

- Appropriate acceptance criteria including MTCA numerical standards, physical parameters, and functional criteria;

- Threshold triggering criteria/levels and early warning levels;

- Potential corrective and contingency response actions; and

- Reporting requirements.

A key part of post-construction conformational monitoring planned to be implemented after the completion of the Phase II shoreline cleanup is collection and testing of groundwater samples from a network of monitoring wells to be installed near the groundwater-surface water transition zone and elsewhere on the Site. The OMMP will further describe details of this well network; including number of wells, locations, and installation and screening within the shallow, unconfined groundwater system. This shallow system is tidally affected toward the shoreline. At a minimum, groundwater will be monitored quarterly for at least 2 years following Phase II construction, and annually for 5 years following construction. Monitoring results and frequency will be closely evaluated to determine the adequacy of this approach. Longer term monitoring requirements will be evaluated as part of planned 5-year reviews (Section 8.0).

Related post-construction monitoring activities will include annual visual inspections of the upland areas to verify that erosion, rutting, or other potentially adverse conditions are not detrimentally affecting the remedy. Inspection and monitoring will also be required for the wetland mitigation area for a period of 10 years. Routine inspection and maintenance of the stormwater swale and conveyance system will be a further component of the long-term maintenance and monitoring program.

Elements of post-construction monitoring is expected to commence in late 2011 or early 2012 to assess the efficacy of remediation. Groundwater monitoring will likely occur in late 2013 or early 2014 following completion of the nearshore component of Phase II in-water remediation. Although exceedances of groundwater cleanup levels are not anticipated after construction on a persistent long-term basis, other actions as necessary will be considered, including potential Site capping as described for Alternative U-4, should monitoring identify such exceedances.

8.0 ECOLOGY PERIODIC REVIEWS

Periodic reviews will be conducted by Ecology to assess post-cleanup Site conditions and monitoring data in accordance with requirements of WAC 173-340-420 to assure that human health and the environment are adequately protected. Results of groundwater monitoring and other inspection and monitoring data obtained pursuant to the OMMP and other activities will be reviewed at a minimum of every 5 years. The overall efficacy and progress of remediation may be assessed at more frequent intervals, such as following annual monitoring. Notice of periodic reviews for public comment will be provided as deemed necessary.

Several review criteria are listed under WAC 173-340-420 to evaluate overall remedy effectiveness including engineered and institutional controls, new scientific information regarding hazardous substances, and new legal and regulatory requirements. These review criteria further consider Site and resource use, availability and practicability of more permanent remedies, and new and improved analytical techniques.

These review findings will be used to assess the OMMP strategies, determine whether modifications are appropriate, and/or identify potential corrective actions. The scope and breadth of revisions to the OMMP, and potentially to this CAP, will be determined based on results of the 5-year reviews.

9.0 REFERENCES

AMEC, 2011. Remedial Investigation Report for Interim Action Work Plan, Custom Plywood Site, Anacortes, Washington. Prepared by AMEC Geomatrix, Inc. for GBH Investments and Washington State Department of Ecology, September 2011.

SMP, 2010. City of Anacortes Shoreline Master Plan http://www.cityofanacortes.org/Planning/Documents/ShorelineMasterPlan/SMP 2010/SMP_Final.pdf

Hart Crowser, 2011a. Feasibility Study Report for Interim Action Work Plan, Custom Plywood Site, Anacortes, Washington. Prepared by Hart Crowser Inc. for the Washington State Department of Ecology, September, 2011.

Hart Crowser, 2011b. Upland Remediation (Phase I) Engineering Design Report for Interim Action Work Plan, Custom Plywood Site, Anacortes, Washington. Prepared by Hart Crowser Inc. for the Washington State Department of Ecology, September, 2011.

Geomatrix, 2007. Upland Area 1 Interim Remedial Action Plan, Former Custom Plywood Site, Anacortes, Washington. Prepared by Geomatrix Inc. for Concorde Inc., September 2007.

Ecology, 2005. Stormwater Management Manual for Western Washington. Publication Numbers 05-10-029 through 05-10-033, February 2005.

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APPENDIX A
ARCHAEOLOGICAL MONITORING PLAN FOR THE CUSTOM PLYWOOD INTERIM ACTION WORK PLAN, PHASE I UPLAND COMPONENT

Archaeological Monitoring Plan for the Custom Plywood Interim Remedial Action, Phase I Upland Component Skagit County, Washington

Prepared for

Hart Crowser, Inc. and

The Washington State Department of Ecology

Submitted by

HRA
HISTORICAL RESEARCH ASSOCIATES, INC.

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Seattle, Washington

September 2011

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1.0 Introduction and Project Description

The Washington State Department of Ecology (Ecology) Toxics Cleanup Program (TCP) is conducting upland remediation activities associated with the former Custom Plywood Mill facility located in Anacortes, Washington (Figure 1). The Area of Potential Effects (APE) includes locations of planned or potential ground disturbance within upland portions of the property that are currently owned by GBH Investments, LLC (GBH). This upland area is part of a larger Washington State Model Toxics Control Act (Chapter 173-340 WAC) cleanup site that includes aquatic areas to be remediated in the future. Ecology is completing upland and aquatic cleanup in two phases as part of a MTCA interim remedial action.

This Archaeological Monitoring Plan (Monitoring Plan) addresses activities associated with the Phase I upland remediation component planned for the summer of 2011. The Monitoring Plan will be revised to address future Phase II aquatic cleanup. This Monitoring Plan supports an Interim Action Work Plan that also includes Remediation Investigation (RI), Feasibility Study (FS), and Cleanup Action Plan (CAP) documents for the project. The RI, FS, and CAP provide further detail on the site description, history, extent of contamination, planned remedial activities, and schedule.

1.1 Background

Ground disturbance within the APE will be confined to the upland portion of the GBH property eastward to the Fidalgo Bay shoreline, as defined by the Ordinary High Water line (Figure 2). The upland portion of the GBH property comprises approximately 6.6 acres located at the southern extremity of filled land in the town of Anacortes, Washington. The former Custom Plywood Mill (Archaeological Site 45SK436) is no longer in operation. The APE is located along the western shore of Fidalgo Bay and bounded by commercial properties to the north, a City of Anacortes street right of way to the northwest, and the Tommy Thompson Trail to the west and south (Figure 2). The upland portion of the GBH property is located in the northeast quarter of Section 30 of T35N, Range 2E, and shown on the 1980 U.S.G.S. Anacortes South 7.5-minute quadrangle map.

Dr. James Chatters previously conducted a cultural resources assessment of remediation activities in the APE and filed a report with the State Department of Archaeology and Historic Preservation (DAHP), dated June 18, 2010. He noted an archaeological shell midden that appeared to have been moved out of context and redeposited to the west of the property (Chatters 2010:15). Dr. Chatters also recorded and evaluated the remains of the Custom Plywood Mill (45SK436) and recommended it as not eligible for listing in the National Register of Historic Places. The official determination of eligibility from DAHP is pending. The intertidal area of the property is sensitive for the occurrence of archaeological materials, due to continuity of prehistoric and historic-period use of the area, as well as variations in past sea level. Ground disturbance for planned upland remediation activities have prompted the development of this Monitoring Plan for the APE.

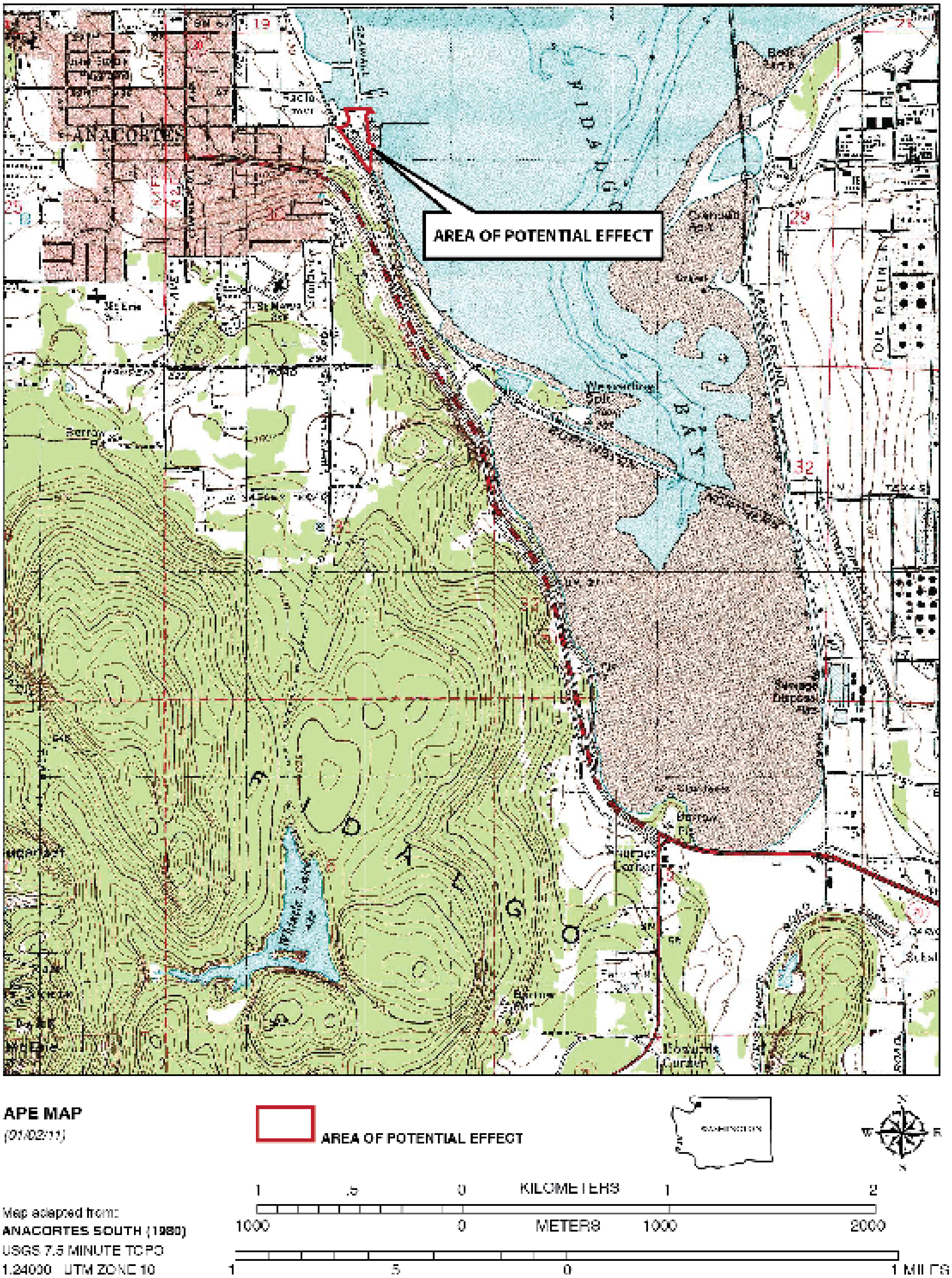

Figure 1. Project Location and Area ofPotential Effect.

Figure 2. Project Limits Map and Area of Potential Effects.

1.2 Monitoring Plan Organization and Intent

This Monitoring Plan provides information on the environmental and cultural context as well as the archaeological potential of the APE (Sections 3.0-5.0). The Monitoring Plan then describes procedures for archaeological monitoring (Section 6.0) and those for treating unanticipated discoveries of archaeological remains (Section 7.0) and human remains (Section 8.0) during ground disturbance. A list of references cited (Section 9), an Archaeological Monitoring Supervisory Plan (Appendix A), and a list of contacts (Appendix B) complete the Monitoring Plan.

This document is intended to:

- Describe planned monitoring and other activities consistent with anticipated forthcoming permit and approval conditions, and other substantive requirements.
- Comply with applicable laws and regulations, particularly 36CFR Part 800 "Protection of Historic Properties," which implements Section 106 of the National Historic Preservation Act of 1966, as amended, and Title 27 Revised Code of Washington, Chapter 27.44 Indian Graves and Records, and Chapter 27.53, Archaeological Sites and Resources.
- Describe to the Samish Indian Tribe, Swinomish Tribal Community, DAHP, and other affected parties and stakeholders planned procedures for archaeological monitoring, and addressing unanticipated discoveries of archaeological resources or human remains.
- Provide direction and guidance to project personnel about the procedures to be followed should the discovery of archaeological resources or human remains occur.

2.0 Area of Impact and Native American Consultation

2.1 APE Description

The APE consists of the area within which ground disturbance could affect human remains or archaeological remains that are eligible for listing in the National Register of Historic Places, if such remains are present. The APE for the purposes of this plan consists of the upland area of the GBH property identified on Figure 2, eastward to Fidalgo Bay as defined by the Ordinary High Water line. Ground disturbance is expected to include soil excavation up to 15 feet below ground surface. Much of the soil disturbance is currently targeted between about 0 and 8 feet below ground surface (0 to 2.4 meters). The actual lateral and depth extent of soil disturbance will be determined at the time of the work based on the presence of contamination and other factors.

2.2 Native American Consultation

Ecology is sending consultation letters to the Samish Indian Nation and the Swinomish Indian Tribal Community describing the project and requesting information on potential cultural resources and concerns of the tribes. This draft of the Monitoring Plan will be presented to both Tribes for comment. Their response will be added to this section before finalization of the Monitoring Plan.

3.0 Environmental Setting

The potential for the APE to contain archaeological remains depends on its geological setting, its prehistory, and the ethnographic and historic use of the area. This information can reveal the potential types and locations of archaeological remains in the APE. The following sections summarize information that HRA reviewed or developed about the geological setting, prehistory, ethnographic land use, and history of the Custom Plywood site vicinity.

3.1 Geological Setting

The APE is located on the western shore of Fidalgo Bay near the Skagit River Delta in Puget Sound. Late Pleistocene glacial and Holocene processes have been the primary influences on the geological setting of the APE. The Pleistocene glacial retreat freed the area from ice by about 16,000 years Before Present (BP), depositing glacial till and outwash (Boswell et al. 2000, based on Bucknam et al. 1992, Porter and Swanson 1998, and Waitt and Thorson 1982).

As the weight of the ice was removed, the land rebounded rapidly, relative to sea level, across the northern Puget Sound area. Various factors caused submergence and re-emergence of the land until 11,000 BP. Sea level then rose more slowly, until it reached its near modern elevation at about 5,000 BP. Tectonic activity has affected local shorelines in recent times, lifting some and lowering others. The APE is on a narrow shoreline that slopes gently upward towards the west and steeply southward. Archaeological materials are likely along the natural shoreline near the APE. These are most likely to be found at the surface, or just below it in the gently sloping areas, and may have been covered by sediments in the steeper areas.

The saline environment of the Fidalgo Bay inlet formerly contained a diverse population of invertebrates, fish and fowl. Mussels, chitons, clams, crabs and gastropods, as well as surfperch, flatfish and sculpin, are common in the shallower areas. Off shore, salmon, herring and dog fish seasonally inhabit the area. Diving birds are present year round and their population increases during the migration season.

The nearest source of fresh water, prior to Euroamerican settlement, was a small creek located in the northern half of the northwest quarter of Township 35 North, Range 2 East, Section 30 (US Surveyor General 1884). It entered bay approximately 200 feet north of the property. The stream was covered in the late 1960's (Chatters 2010:5). Shell midden sites are common in such areas.

3.1 Site Fill Soils

Soils within the APE generally consist of fill to approximately 8 to greater than 15 feet below ground surface. Fill soils contain abundant wood waste from historical plywood milling operations along with concrete, brick, and other debris. Wooden pilings and concrete building foundations remain in-place. Native clay materials underlie fill soils.

4.0 Cultural Setting

The following sections provide a brief overview of the cultural background for the Custom Plywood remediation project vicinity. This information is drawn from HRA's Archaeological Monitoring Report for the Custom Plywood Remediation Project (Compas and Schau 2010).

4.1 Prehistory

Most archaeologists agree that human occupation and use of western Washington has been continuous from approximately 11,500 years ago. The earliest sites consist of lithic scatters, possibly including leaf-shaped projectile points (called Cascade points within Old Cordilleran or Olcott occupations), which may be the remains of broad-spectrum foraging camps or hunting and gathering activity areas. Over time, changing aboriginal technology and site locations suggest increased sedentism and specialization in the use of particular environments and resources (Ames and Maschner 1999; Blukis Onat 1987).

Researchers have created several chronological sequences that describe the timing and nature of cultural change in the Pacific Northwest. Kenneth Ames and Herbert Maschner (1999:66) divide their chronology of prehistoric occupation into five developmental periods: Paleo-Indian, Archaic, Early Pacific, Middle Pacific, and Late Pacific. They suggest a gradual shift from small nomadic groups relying on generalized hunting and gathering to larger sedentary groups with increasing social complexity and specialized reliance on marine and riverine resources.

In the Anacortes region, Late Prehistoric people focused on salmon, which they trolled for in spring, reef-netted in summer, and trapped at river weirs in fall. They also used other finfish; shellfish; plants, such as camas and berries; waterfowl; and land and sea mammals. Large midden sites represent winter villages and smaller sites resulted from camping and resource processing. Several archaeological midden sites have been recorded within an approximate 2 mile (3.2 kilometer) radius of the APE, including shell midden sites 45SK13 at the Guemes Island ferry dock (Bryan 1953); 45SK42, located just over 2 miles (3.2 kilometers) southeast (Blukis Onat 1981; Bryan 1954a); 45SK43, located approximately 1.5 to 2 miles (2.4 to 3.2 kilometers) southeast (Bryan 1954b; Moura 2003; Schalk 2004; Trost 2005); 45SK44, located just over 2 miles (3.2 kilometers) southeast (Bryan 1954c; Conca 1985); and 45SK294, located around 0.75 mile (1.2 kilometers) southwest (Barsh 2003). Midden site 45SK299 was recorded in the vicinity of the Anacortes Ferry terminal on the western side of Anacortes, approximately 3.1 miles (5 kilometers) from the former Custom Plywood facility (Robinson 1996). Dates from some of these sites indicate that this specialized native subsistence economy had been established for about 1,500 years by the time of initial Euro-American contact in the 18th and 19th centuries.

4.2 Ethnographic Land Use

The APE is located within the traditional territory of the Samish Indians, which included the northern part of Fidalgo Island, Samish Island, and the eastern San Juan Islands (Suttles 1974:97; Suttles and Lane 1990). Swinomish territory is located to the south and east of the Samish, and the two groups have close economic, social, and historical ties.

The Samish ranged widely in canoes to fish, gather, and hunt for a variety of resources. Their subsistence activities included fishing for sockeye, spring, silver, and dog salmon, as well as herring and halibut; collecting horse and other clams and oysters; digging camas; and hunting deer, ducks, and seal.

Suttles (1974:97) shows the location of a Samish winter village to the west of the APE. The original village was located on Guemes Island, on the northern shore of Guemes Channel, west of the ferry landing. In 1792, Spanish explorers reported two large houses standing on the northwest point of the channel. Conditions became crowded there, and some of the people moved across the channel to a village called "ironwoods," or *Ke-LEH-tsilch* in the Straits Salish language, on the northern shore of Fidalgo Island. Another village, called "camas", or *Quh-hwulh-AWÉk-awl*, was located at the eastern end of the railroad bridge across Fidalgo Bay, at the place that later became the town of Fidalgo. Although the Samish abandoned that village in the 19th century, they continued camping there when gathering camas on the prairie around the head of the bay (Suttles 1974:99). Swanton (1984:437) lists a Samish village named *Hwaibathl* at Anacortes, but this location does not match the far more detailed information that Suttles reported.

The Samish used seasonal camps in various areas, including the eastern shore of Fidalgo Bay and southeast of Fidalgo Head (Suttles 1974:97). In spring and early summer, they trolled for salmon in San Juan Channel, located between San Juan Island and Shaw/Orcas Islands, and around Cattle Point, located at the southern end of San Juan Island (Suttles 1974:190-191).

The geographer T. T. Waterman noted several ethnographic place-names in the vicinity of the APE, including *K!aix* for "a promontory at the town of Anacortes" (Cap Sante) and *dəgʷalč*, "enclosed water," for Fidalgo Bay (Hilbert et al. 2001:349, 354; Waterman circa 1920).

4.3 Historic Period

4.3.1 Anacortes Area Development

This section summarizes historical development of the Anacortes area as general background for Monitoring Plan. A group of local residents and speculators, including Hazard Stevens, son of the former Territorial Governor, and other members of the Stevens family, bought or claimed land between Ship Harbor and the present day Anacortes in 1870. At this time, the Northern Pacific Railroad was still considering the location for their Puget Sound terminus. After the economic downturn of the 1870s and the choice of Tacoma as the railroad terminus, these investors sold their land (Boswell et al. 2000). The 1872 General Land Office mapped the Project area shoreline as part of Township 35N Range 2E.

In 1876, Amos and Annie Bowman bought waterfront land from a member of the Stevens family and built a cabin near the modern intersection of 3rd Avenue and Q Avenue (Bowman 1890). Amos named the fledgling settlement that grew there after his wife Annie, or Anna, Curtis Bowman, in 1879, when he opened the first post office and store on the wharf he completed that same year (Bourasaw 2006). Amos was a civil and mining engineer and, with his wife and sons, ran their store in Anacortes. The sale of timber to Tacoma mills was one of the first sources of income for the settlement (Bowman 1890). On the 1880 census, most of the residents listed occupations, such as farmer, miner, and carpenter. The two census precincts enumerated that year on Fidalgo included 290 people (U.S. Census 1880).

The Oregon Improvement Company (OIC) began construction of the Seattle & Western Railroad in 1888, laying tracks between Anacortes and Sedro by the end of 1890 (Armbruster 1999:190; Bowman 1890). This stimulated the growth of Anacortes, leading to the platting of the town in 1889. According to the Sanborn maps (1892-1950) the northern end of Anacortes was platted and developed first. The OIC constructed what became known as Ocean Dock at the end of P Avenue, now Commercial Avenue (Sanborn 1890). By 1892, the Union Wharf Company Dock replaced an old wharf, probably Bowman's wharf, at the end of Q Avenue. The Anacortes Saw Mill dock, at the foot of T Avenue, first appears by this time as well (Sanborn 1892).

Despite succeeding in laying track as far as Sedro, the OIC was unable to secure enough business for the Seattle & Western to operate profitably. Economic difficulties forced them to lease the line to the Northern Pacific, beginning in 1890 (Armbruster 1999:148). Regardless of the railroad's difficulties, the town of Anacortes grew. The 1897 Sanborn map is the first one to show the railroad connecting to Ocean Dock. The map also indicates an enlarged and expanded Ocean Dock, with a coal platform and railroad office providing connections to the mainland (Sanborn 1897). Grain warehouses were located on both Ocean Dock and Union Wharf. The land in the vicinity of the former Custom Plywood facility had not been platted in 1897, although the Skagit saw mill was on the shore of Fidalgo Bay, west of the end of 15th Street, about 1 mile to the north of the APE.

Gradually the town expanded, and the Skagit Saw Mill had changed hands by 1905. It was renamed the Rodgers Saw Mill and Box Factory. The Baty Shingle Mill and Burpy Brothers Shingle Mill were located near the foot of 17th Street. A spur of the Northern Pacific was constructed from 22nd Street northward along R Avenue (Sanborn 1905).

By 1907, the Sanborn maps show the town as being platted southward to 30th Street. Four more shingle mills had developed along Fidalgo Bay. The Vincent Owens and Burke Shingle Mills were at the foot of 25th Street, while the J.H. Cavanaugh Shingle Mill was located on the shore between 27th and 28th Street. The Bernard Shingle Mills was on the shore between 28th and 29th Street.

4.3.2 Custom Plywood Mill Facility

Research for the Custom Plywood Factory, conducted by Chatters (2010), indicated that the site of the facility was "originally a saw and planing mill operated by Fidalgo Mill Company after 1907 until it burned down sometime after 1925 and prior to 1937" (Chatters 2010:PG 10). The land was acquired by Bill Morrison in 1913, who sold it to the Anacortes Plywood Company circa 1937. The company reorganized in 1939 as the Anacortes Veneer Company and was sold to Publisher's Forest Products in 1969. The company eventually failed, as the local timber supplies decreased. In 1984, Anacortes Plywood assumed control. In 1991, Custom Plywood took over after bankruptcy proceedings and was in operation until 1992. A fire consumed many of the wooden structures on the property that same year.

The main portion of the property has remained unused since 1992; however, Anacortes Joint Venture gained ownership of the mill in 1999 and sold it to Concorde, Inc in 2006. The plant was sold again to GBH, who owns parcels P33196, P33198, P33199, P33208, P33209, and P33210.

Other portions of the property were sold to various owners after the 1992 fire, including Northern Marine and Cimarron Trucking. For further information about the plant, see Chatters' 2010 report.

5.0 Reported and Anticipated Archaeological Remains

The following sections discuss the background research and its findings, including previous cultural resources within the vicinity of the APE, recorded archaeological sites, and historical buildings and structures. The section ends with a description of the types of archaeological resources that could be expected during ground disturbance for upland component of remediation for the Custom Plywood site.

5.1 Previous Cultural Resources Studies

Two cultural resources surveys have been conducted in the vicinity of the APE (Table 1). During these previous studies, two historic sites were recorded – one adjacent to the APE, and one within the APE. One Pre-Contact site was also noted, but is located outside of the APE.

Table 1. Previous Cultural Resources Studies Within the APE (GBH Upland Property) Vicinity.

Author(s)	Date	Title	Cultural Resource Identified	Eligibility Status*
Hodges, Charles M.	2003	*A Cultural Resources Reconnaissance for the Thompson Trail Project, Phase 2, City of Anacortes*	45SK43 – shell midden, not located within APE vicinity; 45SK296 – railroad grade located adjacent to APE	Not Yet Evaluated
Chatters, James	2010	*Archaeological Monitoring of Remedial Investigation Activities at Former Custom Plywood Mill*	45SK436 – historic Custom Plywood Mill, within APE Out of Context Shell Midden	Evaluated, Formal determination of eligibility is pending DAHP review. Noted, not recorded because it was out of context

*National Register of Historic Places and Washington Heritage Register

Site 45SK296 is a BNSF railroad grade that runs along the Tommy Thompson Trail, along the west edge of the APR. The majority of the ties and rail that ran along the APE area were previously removed, but a short section of railway spur and the manual spur switch remain just south of the APE area (Hodges 2003).

Site 45SK436 is the Custom Plywood Mill site. Recorded features located within the APE area include 4 unidentified concrete foundations, 3 press pits, and historic debris. The site was inventoried and evaluated in 2010 by Chatters, who recommended the site as ineligible for listing on the National Register of Historic Places (Chatters 2010). Concurrence with this finding from DAHP is pending.

Chatters (2010:15) noted shell midden soils in a bore west of the current APE. According to Chatters (2010:15), midden appeared to have been moved from another area and had been redeposited, so he did not record it as an archaeological site.

5.2 Expectations for Archaeological Deposits in the APE

Although intensive development and filling of the historical shoreline since the 1890s (see Section 4.3) could have destroyed or disturbed prehistoric, historical Native American, and Euro-American archaeological resources, it is possible that the APE could contain archaeological deposits. The APE location near the shallow tidelands near the shoreline of Fidalgo Bay suggests that prehistoric archaeological materials associated with occupation, shellfish gathering, fishing, and other activities could be present beneath historical fill. Artifacts could include remains that had been dumped onto the site as fill, such as lithic, bone, and shell artifacts, as well as the food and technological materials from plants and animals. Remains also could contain preserved wood and plant fiber artifacts. Human remains and burials, which were typically placed in upland areas, may be expected within the APE. Soil borings just west of the APE, conducted west of the Tommy Thompson Trail during monitoring in 2009, indicate the possibility of a shell midden nearby, but outside of the western APE boundary (Chatters 2009).

Artifacts and features also could result from historical activities, which largely would consist of filling the APE as well as building and use of the saw, lumber, and pulp mill complexes, circa 1892-1990s (see Section 4.3). Artifacts or features related to railroad lines associated with the mill may also be encountered. The mill complex is well represented in documentary sources and the activities carried out there were common to the region. Unless remains related to Native American, Asian American, or female workers are located, the historic-period archaeological deposits are not anticipated to be historically significant.

6.0 Procedures for Archaeological Monitoring and the Treatment of Archaeological Resources

1. Archaeological monitoring will take place in the APE during ground disturbing activities.
2. Ecology will arrange for a professional Archaeologist who meets the Secretary of the Interior's qualifications (36 CFR Part 61; required by the State of Washington in RCW 27.53.030.8). If an archaeologist meeting the qualifications is not available but an experienced archaeologist (e.g., one with 5 or more years of experience in a variety of archaeological field situations) is available to monitor construction activities, they will be allowed to do so given that a "Supervisory Plan for Archaeological Monitoring" has been filed with DAHP prior to their work at the site. The form is located in Appendix A. The Archaeologist will be on-site to observe soil disturbing activities, or will be available on an on-call basis.
3. For those areas requiring monitoring and associated with contaminated soils, all field personnel including the Archaeologist shall be 40-hour Hazardous Work Operations and Emergency Responses (HAZWOPER) certified in accordance with Occupation Health and Safety Administration standards (OSHA 29 CFR, 1910.120).

4. Ecology will invite representatives from the Samish Indian Nation and Swinomish Tribal Community to visit the project site and/or witness the excavations with the Archaeologist and other field personnel.
5. Ecology's on-site representative will brief the Archaeologist on the Health and Safety Plan elements under which the Archaeologist will perform the monitoring, when present. The Archaeologist will provide the proper Personal Protective Equipment (e.g., hard hat, steel-toed shoes, safety glasses) as required by the Project Health and Safety Plan.
6. Ecology will inform affected Tribes about the schedule for ground-disturbing activities that will receive archaeological monitoring and will invite them to send a representative to view the monitoring.
7. Ecology will arrange for the Archaeologist to train site personnel including Ecology's on-site representative and construction staff on the appropriate procedures to follow in the event of encountering archaeological deposits and human remains. Prior to conducting onsite training, the Archaeologist will contact the Tribes to ask if they have concerns or information they would like to have included in the training. The Archaeologist will arrange for Tribes to take part in the training upon their request. The training will be held before ground-disturbance activities in APE commences. In each week's Construction Safety Meeting during these ground-disturbance activities, Ecology's on-site representative and the Construction Supervisor will emphasize the need for vigilance regarding the unanticipated discovery of archaeological deposits and human remains, and the procedures for treating unanticipated discoveries.
8. Ecology will inform the construction contractor(s) about the Archaeologist's monitoring work. Ecology will also authorize the Archaeologist to stop construction periodically, as needed, for a closer examination of exposed soils.

   During construction excavation of appropriate areas, the Archaeologist will examine representative soils, including excavations and back-dirt piles. Archaeological equipment will include, as appropriate, a shovel, trowel, and screen of 1/4-inch mesh. The Archaeologist will watch for human remains and for prehistoric or historic-period artifacts or features, or for layers/lenses of shell and organically enriched/midden soils that might indicate past human use.

   Ecology's on-site representative and the Archaeologist (when present) will record the monitoring work as follows: daily activities will be recorded on a Daily Record Form and in a field notebook, and overview photographs of the site, along with detailed photographs of particular construction areas, work in progress, and any cultural materials, will be promptly logged in a field notebook. In addition, the Archaeologist will log in sketches/drawings of particular areas, features, and soil profiles; and construction work that has been monitored will be noted on construction plans.

   At the completion of monitoring, the Archaeologist will prepare a report on the methods and results of the work, illustrated with maps, drawings, and photographs, as appropriate. The Archaeologist will submit the report to Ecology for distribution to the affected Tribes, DAHP, and other affected parties for review and comment. Based on the comments, the Archaeologist will provide a final report to Ecology for filing and distribution.

7.0 Procedures in the Event of Discovery of Archaeological Remains

If the Archaeologist or a member of the construction work force believes that they have encountered prehistoric or important historic-period archaeological materials (including, but not limited to, remains that had been dumped into the shallow intertidal waters of the bay, which may include lithic, bone, and shell artifacts, as well as the food and technological materials from plants and animals; the remains of stone or wood fish weir structures; or historic-period materials that appear to be associated with Chinese, Japanese, Philippine, Native American, and/or female workers), the Archaeologist or Ecology's on-site representative will direct the Construction Supervisor to stop excavation work in the immediate area. If the Archaeologist is not present at the time of discovery, Ecology's on-site representative will be responsible for stopping excavation work and immediately contacting the Archaeologist.

If the Archaeologist believes that the discovery is a significant archaeological resource (i.e., intact enough to warrant further investigation and potential testing for NRHP eligibility), Ecology's on-site representative will direct the contractor to take appropriate steps to protect the discovery site by installing a physical barrier (i.e., exclusionary fencing) and prohibiting machinery, other vehicles, and unauthorized individuals from crossing the barrier. If the discovery appears to be potentially eligible for listing in the NRHP, the Archaeologist will inform Ecology, who will then immediately contact the affected Tribes, DAHP, and other affected parties. Treatment measures may include mapping, photography, limited probing and sample collection, or other activities as determined by the Ecology in consultation with the affected Tribes, DAHP, and other affected parties. Ecology will then authorize excavation in the area of the discovery after it has been evaluated and treated.

If the monitoring of ground-disturbing activities results in the collection of any artifacts or samples, such as an isolated find not associated with a larger archaeological site, the Archaeologist will be responsible for temporary curation of the artifacts (including appropriate, secure storage). In the case of an isolated find, construction excavation will likely not halt for more than the several minutes that the Archaeologist will require for photography and recording details of the location (e.g., depth below the ground surface, sedimentary context) and other pertinent information about the object. Construction excavation may resume in the area when the Archaeologist has notified Ecology's on-site representative.

When monitoring work has been completed, the Archaeologist will prepare a report discussing the methods and results of the work. The report will be provided to Ecology for review. Ecology may provide review comments and HRA will complete a final version of the report responding to any comments. Ecology will file and distribute the report to the affected Tribes, DAHP, and other affected parties.

After monitoring has been completed, consultation among the interested and involved parties will determine the disposition of any artifacts or other cultural material collected. If monitoring reveals human remains, the procedures listed in Section 8 will be followed.

8.0 Procedures in the Event of Discovery of Human Remains

Any human remains that are discovered during construction will be treated with dignity and respect. The affected Native American Tribes are the Samish and Swinomish Tribes with regard to this issue.

If ground disturbing activities encounter human skeletal remains during the course of construction, then all activity that may cause further disturbance to those remains **must** cease, and the area of the find must be secured and protected from further disturbance. In addition, the finding of human skeletal remains **must** be reported to the county coroner **and** local law enforcement in the most expeditious manner possible. The remains should not be touched, moved, or further disturbed.

The county 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 coroner determines the remains are non-forensic, they will report that finding to the DAHP, who will then take jurisdiction over those remains and report them to the appropriate cemeteries and affected tribes. 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. The DAHP will then handle all consultation with the affected parties as to the future preservation, excavation, and disposition of the remains.

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Appendix A

Example Supervisory Plan for Archaeological Monitoring

Supervisory Plan for Archaeological Monitoring

Project: Custom Plywood Interim Remedial Action, Phase I Upland Component

Location: Anacortes, Skagit County, Washington

Monitoring Plan: Attachment A (not included herein)

Name of Archaeological Monitor: Name

Monitor's Resume Attachment B (not included herein)

Summary of Monitor's Qualifications:

- At least 5 years of archaeological field experience: ☒ Yes ☐ No
- Experience in archaeological excavation: ☒ Yes ☐ No
- Experience with historical and prehistoric archaeological artifacts and deposits that could be found at the monitoring location: ☒ Yes ☐ No
- Experience in archaeological monitoring: (or an HRA onsite supervisor will be present during first monitoring project) ☒ Yes ☐ No

Professional Archaeologist(s) who will serve as Monitoring Supervisor(s):

Name, Degree	Position
Gail Thompson, Ph.D.	HRA Senior Associate Archaeologist
Jennifer Gilpin, M.A.	HRA Research Archaeologist
Derek Shaw, M.A.	HRA Research Archaeologist
Shari Silverman, M.A.	HRA Project Archaeologist

Supervisory Requirements:

- Monitor will have a cell phone and a digital camera.
- Supervisor will visit the project site at the beginning of the work, if the monitor has not worked at the location previously. Supervisor will visit the project site periodically if the monitoring work continues longer than two full-time weeks. Supervisor will visit the project site if a find is made that needs immediate attention.
- Monitor will record daily notes on HRA's standard monitoring form (Attachment C). Monitor will take at least one photograph daily to record the work progress.
- Monitor will telephone Monitoring Supervisor daily to describe construction work, monitoring methods, and findings, and to discuss any questions.
- Monitor will send electronic photographs of any finds of artifacts or deposits to supervisor for discussion of treatment measures and decisions. The Supervisor will be available to visit site on short notice to view finds that are questionable and/or need immediate attention.
- Monitor will submit written notes weekly for Supervisor's review.
- Supervisor will review written notes at least weekly and during site visits, and will sign each monitoring record form.

Appendix B
List of Contacts

List of Contacts

Washington State Department of Ecology (Ecology)

Hun Seak Park, Project Manager
360-407-7189 office
360-584-5045 cell
hpar461@ecy.wa.gov

Sandra Caldwell, Bay-Wide Coordinator
360-401-7209 office
saca461@ecy.wa.gov

City of Anacortes Police Department (APD)

Bonnie Bowers, Chief of Police
360-293-4684

Skagit County Coroner

Daniel Dempsey
360-336-9431

Archaeological Consultant

Historical Research Associates, Inc. (HRA).
Gail Thompson
206-343-0226 (Ext. 15)
206-898-5692 cell

Samish Indian Nation

P.O. Box 217
2918 Commercial Avenue
Anacortes, WA 98221
Phone (360) 293-6404
samishtribe@samishtribe.nsn.us

Tom Wooten, Tribal Chairman
(360) 293-6404

Diana Barg, Cultural Resources Program Manager
(360) 293-6404 ext. 210 (leaving at end of August)

Christine Woodward, Director, Samish Indian Nation Department of Natural Resources
(360) 293-6404, ext. 205

Swinomish Indian Tribal Community

PO Box 817
11404 Moorage Way
Laconner, WA 98257
(360) 466-3163

Brian Cladoosby, Tribal Senate Chairman
(360) 466-3163

Kevin Hall, Cultural Committee Chairman
(360) 540-3906

Charlie O'Hara, Director of Planning
(360) 466-7280

Washington State Department of Archaeology and Historic Preservation (DAHP)

State Archaeologist
Dr. Rob Whitlam
PO Box 48343
Olympia, WA 98501
360-586-3080 office
Rob.whitlam@dahp.wa.gov

State Physical Anthropologist
Dr. Guy Tasa
PO Box 48343
Olympia, WA 98501
360-586-3534 office
Guy.tasa@dahp.wa.gov

HRA HISTORICAL RESEARCH ASSOCIATES, INC.

Appendix C

Resume for Dan Schau

Daniel J. Schau

915 Queen Anne Ave N.
Seattle, WA 98109

Phone (206) 718-3796 (msg)
danielschau@yahoo.com

Employment Objective

Energetic, capable, team-oriented and responsible; likes hands-on field work; interested in site survey and data collection; seeking an opportunity in North American archaeology.

Education

Central Washington University, Ellensburg, WA * — 2001 – 2006
Bachelor of Science, Anthropology

- Honors in Foreign Study
- Studies at University of Salzburg, Salzburg, Austria — 2004 – 2005

Field Experience

Central Washington University, Ellensburg, WA — 2005
Saddle Mountain Field School, Saddle Mt.

Experience in archaeological field methods – pedestrian survey, site mapping, site survey, excavation, GPS, lithic lab analysis, shovel probe testing

Field Archaeology Seminar, Yakima Training Center

Luton Museum, Luton, England — 2007
volunteer and assistant to head archaeologist

Work Experience

Historical Research Associates — 2009 -- Present
Archaeological Field Technician, Duties include: Field survey and excavation of test probes, post-field data processing, artifact sorting and culling, summary reporting; archaeological monitoring for utility and redevelopment projects, including for HazMat applications.

Northwest Archaeology Associates — 2009 -- Present
Archaeological Field Technician/Monitor. Duties include: observe and track operators; as well as assist in archaeological excavations

Northwest Archaeology Associates — 2007
Lead Archaeologist Field Monitor. Duties include: observe and track excavation operators; investigate and note disturbances and removal of "native soil"

Languages

German – Intermediate Level

Skills/Certification

HazWoper Certification, OSHA / NIOSH Approved Institute — 2010

GPS, GIS, site mapping, site survey, lithic analysis, excavation, monitoring, most MS applications, team work

References

Steven Hackenberger, PhD; Professor of Anthropology, Central Washington University; (509) 963-3224; hackenbe@cwu.edu

Patrick McCutcheon, PhD; Assistant Professor of Anthropology, Central Washington University; (509) 963-2075; mccutchp@cwu.edu

Northwest Archaeological Assoc.
5418 20th Ave NW, Suite 200
Seattle, Washingtonp: 206.781.1909 f: 206.781.0154 e. inquiries@northwestarch.com

*Additional information available upon request.

Appendix D

HRA Standard Monitoring Form

Recorder's Name and Signature of Primary Monitor	
Date and Hours on Site/ Travel Time	
Safety Meeting Yes / No – issues discussed	
Site Location/ Weather Conditions Area Description	
Site Description Describe environment, subdivision, road grade and also archaeological and/or historical context	
Nature of Construction Activity, Skidding, grubbing, scraping, excavating	
Remedial Activities Nature of removals and where taken to, if any	
Equipment working on Site Types and number of machines	
Workers Present Names and Companies	
Visitors On Site Names and Companies	
Arch Monitoring Activities Describe in full if equipment was stopped or asked to move	
Distance and Direction of nearby Recorded Archaeological Sites	
Archaeological Findings Include significant findings, soil descriptions, level of disturbance, description of debris not considered significant	
Notes on Discussions with others HRA, other contractors, Tribes	

APPENDIX B
CONCEPTUAL WETLAND MITIGATION PLAN
FOR THE CUSTOM PLYWOOD INTERIM REMEDIAL ACTION

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for double-sided printing.

MEMORANDUM

DATE: September 9, 2011

TO: Hun Seak Park, PE

FROM: Celina Abercrombie
Jason Stutes, PhD
Rick Moore, LHG

RE: **Appendix B - Conceptual Wetland Mitigation Plan for the Custom Plywood Interim Remedial Action**
17330-27

The Custom Plywood Site (Figure 1) contains five freshwater and estuarine wetlands totaling 11,910 square feet (sf) that would be impacted by proposed remediation activities on the property. Wetlands A, B, C, and D are isolated wetlands that will be impacted during the Phase I upland remediation. Wetland E is connected to state and navigable waters, and the U.S. Army Corps of Engineers (USACE) has determined that Wetland E is federally regulated. Wetland E will be impacted during the Phase II in-water remediation. These five wetlands will be consolidated into one large estuarine wetland and restored on site as agreed upon by applicable regulatory agencies. The restored wetland will: (1) replace the impacted wetland areas; and (2) improve the functions provided by the existing wetlands.

Off-site mitigation options, such as the Ship Harbor site in Anacortes, were given consideration as compensatory mitigation for on-site wetland impacts resulting from the cleanup. Based on the timing and feasibility of an off-site mitigation option, on-site wetland mitigation was determined to be to a preferable alternative that provides adequate compensation for impacts to existing wetlands and serves as an integrated habitat improvement piece within the larger project.

A summary of the key elements associated with proposed on-site mitigation activities for the Custom Plywood Site is provided below.

1700 Westlake Avenue North, Suite 200
Seattle, Washington 98109-3056
Fax 206.328.5581
Tel 206.324.9530

WETLAND MITIGATION AREA

The restored estuarine wetland would be a minimum of 12,000 sf in area (Figure 2). The wetland mitigation area would be constructed landward of the Ordinary High Water (OHW) line. During Phase I upland remediation activities, a bench would be excavated and graded at suitable elevations for the establishment of estuarine wetland vegetation. The wetland edge would be constructed to provide sinuosity between the wetland and the transition to the upland buffer. A protective berm would be created at and landward of the OHW line to prevent contaminant migration into the restored wetland during in-water construction as part of Phase II. The width of the berm would be approximately 10 feet, and the height of the berm would be approximately 10.5 feet Mean Lower Low Water (MLLW) or at the height of the existing shoreline berm. Near the completion of the in-water work, the protective berm would be removed and the area covered by the berm would be graded to appropriate elevations that allow for tidal connection of the wetland to Fidalgo Bay and for installation of native plantings.

Colonization of wetland vegetation would occur between elevations of 7 feet MLLW and Mean Higher High Water (MHHW), which is 8.6 feet for the Custom Plywood Site. It is anticipated that a larger area between MHHW and OHW (about 9.2 feet MLLW) would colonize with a variety of saltmarsh vegetation. The wetland would be planted and naturally colonize with native saltmarsh vegetation, including, but not limited to pickleweed (*Salicornia virginica*), saltgrass (*Distichlis spicata*), and seacoast bulrush (*Scirpus maritimus*). The restored wetland area would provide a moderate to high level of function, and support other aquatic habitats and species such as juvenile salmon rearing and migration.

A vegetated buffer would be provided around the restored wetland totaling approximately 26,000 sf. The buffer along the Tommy Thompson Trail would measure 50 feet in width and the remainder of the buffer would measure 75 feet in width as agreed upon by applicable regulatory agencies. Installation of a variety of native tree and shrub plantings may include, but is not limited to big-leaf maple (*Acer macrophyllum*), shore pine (*Pinus contorta*), black cottonwood (*Populus balsamifera*), Sitka spruce (*Picea sitchensis*), Douglas fir (*Pseudotsuga menziesii*), paper birch (*Betula paperifera*), Pacific crabapple (*Malus fusca*), salmonberry (*Rubus spectabilis*), salal (*Gaultheria shallon*), oceanspray (*Holodiscus discolor*), snowberry (*Symphoricarpos albus*), red elderberry (*Sambucus racemosa*), Indian plum (*Oemleria cerasiformis*), serviceberry (*Amelanchier alnifolia*), Nootka rose (*Rosa nutkana*), thimbleberry (*Rubus parviflorus*), red-flowering currant (*Ribes sanguineum*), dunegrass (*Leymus mollis*), coastal strawberry (*Fragaria chiloensis*), and kinnikinnick (*Arctostaphylos uva-ursi*). Following removal of the protective shoreline berm, dunegrass would be planted within the buffer along the shoreline and as a transition species between the wetland and the upland buffer. Trees would be planted 10 to 12 feet on center and shrubs would be planted 5 to 7 feet on center throughout the upland buffer. Emergent and groundcover vegetation would be planted 1 to

3 feet and 3 to 5 feet on center throughout the wetland and buffer, depending on the species designated for installation in each area. Tables 1 and 2 show the plant schedule for the wetland and buffer planting areas. In addition to native plantings, large woody debris and other habitat structures would be installed in the dunegrass and upland buffer planting areas.

A temporary fence fitted with light reduction slats would be installed along the upland extent of the wetland buffer to deter human access and protect against light and noise pollution. In addition, barrier plantings of rose (*Rosa* sp.) and Douglas hawthorne (*Crataegus douglasii*) would be densely planted along the outer perimeter of the wetland buffer and would develop into a thicket replacing the function of the temporary fence over time. The barrier planting area would measure approximately 6 to 8 feet in width. The temporary fence would be removed once the barrier plantings become established. Critical/sensitive area signs may also be installed along the edge of the buffer.

Additionally, a public access easement would be provided along the beach and possibly within the upland buffer of the mitigation area as well as a beach access area at the southern landward tip of the site. The general locations of a beach access and the buffer trail are shown on Figure 2. The final configuration of these features has not yet been determined and is ultimately subject to an agreement between the City of Anacortes and the property owner. A conceptual design is planned concurrent with the design for the Phase II in-water remediation. The final aquatic permitting required for the beach access component will also be included with Phase ii. Final design and field construction are currently planned to be completed in coordination with the City of Anacortes and the property owner. Public access to a wetland buffer trail would occur following a required 10-year wetland/buffer monitoring period after construction. Access to the public beach area may require, at a minimum, completion of the Phase II aquatic cleanup.

A plan view of the wetland mitigation area is provided on Figure 2 and a cross section is provided on Figure 3.

SITE GRADING AND CONSTRUCTION

Current site elevations over much of the area of the planned wetland mitigation area vary from about 10 to 11 feet MLLW. Although these elevations are slightly above the estuarine wetlands zone, it is desirable to further elevate the adjacent buffer area to protect buffer vegetation from damage during high tides. Typical high tides near Anacortes range between about elevation 9.2 to 10 feet MLLW. Therefore, it is desirable to raise site grades in the mitigation buffer area to about 12 feet to provide a suitable level of protection and a factor of safety. This bench would also provide sufficient elevation for constructing a stormwater conveyance system and treatment swale, as described in the Stormwater section below.

Construction of the mitigation area is planned for the southern property corner landward of the OHW line and extending to the north and west. Following excavation related to site cleanup in the wetland and buffer areas, the buffer adjacent to the southern property line along the Tommy Thompson Trail would be backfilled and the grade raised to an appropriate elevation for the establishment of the buffer plantings. Construction would then extend north into the restored wetland area.

The wetland area would be excavated an additional 3 feet beyond the proposed bottom elevation of approximately 7 feet MLLW and a layer of sand would be placed within this additional excavation area to serve as a planting medium for emergent wetland plantings (to be installed during Phase II following tidal connection to Fidalgo Bay) and to prevent vertical migration of remaining clean wood waste located on the Site. This sand layer would cover the 12,000 sf wetland mitigation area and extend landward into the buffer where dunegrass plantings are proposed. A low-gradient transition between the wetland and tree and shrub planting area would be provided. Large woody debris and dunegrass would be installed throughout this zone to mimic a more natural shoreline. Woody debris placement and dunegrass plantings would coincide with planting activities in the tree and shrub planting area.

During excavation and grading activities in the restored wetland, a temporary berm would be placed along the opening of the wetland at and landward of the OHW line. This berm is intended to protect the mitigation area from migrating contaminated sediment until in-water construction is underway and the area waterward of the mitigation area is remediated. The berm would be constructed from a combination of quarry spalls and sand. A geotextile fabric may be placed between the existing substrate along the OHW line and the quarry spalls to provide additional stability and filtration of sediments that may be present in the water column. Additional design details would be developed during the construction design process. This feature is intended to be temporary and would be removed from the existing beach during Phase II to protect the previously installed wetland area. Potential damage to this temporary berm may occur from winter storm surges but are not anticipated given the existing in-water structures will remain in-place until Phase II construction. In the event of a large storm event, a site visit would be conducted to evaluate potential damage and develop a remedy for re-stabilizing this feature. Possible remedies include, but are not limited to, repositioning of the geotextile fabric and installation of additional quarry spalls or similar material. During or following removal of the temporary berm, the wetland area would be planted as described in the Wetland Mitigation Area section.

Following excavation and backfilling of sand in the wetland area, the remaining upland buffer to the west and north of the wetland would be backfilled with a clean fill material. The upland planting area would be graded and lightly compacted for structural stability. In addition, the buffer would be graded to provide microtopography and a somewhat undulating surface. Compost would be applied and tilled into the soil throughout the tree and shrub planting area. Then a layer of mulch would be placed throughout this area for weed control and water retention. Following mulch placement, large woody debris would also be placed throughout the buffer for habitat value. Trees, shrubs, and groundcover species would be installed per the planting details previously described. A 5- to 6-foot-wide area would be retained for future public access. A geotextile fabric would be placed over the ground surface and mulch placed over the top until designs and construction details for this area are developed. Care would be taken to avoid disturbing the existing buffer during installation of the public access features. A fence would be constructed around the mitigation area during or immediately following plant installation to prevent human access during the plant establishment and monitoring period.

STORMWATER

Swale Concept

A stormwater swale located outside of the wetland buffer has been designed to treat stormwater currently routed onto the property through a City of Anacortes conveyance (Figure 2). The swale is designed and sized per the Washington State Department of Ecology's 2005 Stormwater Management Manual (SWMM) for Western Washington to provide water quality treatment. No infiltration is assumed as a conservative assumption based on subsurface soil and groundwater conditions. Infiltration that does occur provides additional stormwater management control.

The swale includes the following elements and target design dimensions:

- Size: Approximately 788 sf at the base
- Flow path length: Minimum 175 linear feet
- Side slopes: 5H:1V
- Depth: Minimum of 10 inches
- Slope: Approximately 2 percent

A combination of native trees, shrubs, and groundcover species would be planted around the perimeter of the swale.

Stormwater Routing

Stormwater from the existing 18-inch City of Anacortes conveyance pipe to Wetland D would be routed through a control box structure to control flow and provide settling in a 48-inch catch basin (Figure 4). Flow from the control box would discharge through a higher elevation outlet in the box to provide necessary elevation and gradient for downstream flow management. Specific components of the routing system downstream of the control box include:

- An approximately 50-foot-long, 18-inch-diameter conveyance pipe sloped at 2 percent grade between the control box outlet and the swale inlet;
- An in-line settling/treatment structure between the control box and the swale;
- A possible gravel pad or other energy dissipation feature at the swale inlet to accommodate a 0.5-foot drop from the upstream conveyance pipe as a required design feature;
- An approximately 175-foot-long, vegetation-lined treatment swale to manage SWMM design flow as described above;
- An approximately 45-foot swale discharge conveyance channel sloped at 0.5 percent grade between the swale outlet and the estuarine wetland complex; and
- A level spreader or energy dissipater, such as quarry spalls or a similar material, to connect the swale discharge channel to the estuarine wetland complex.

The swale and conveyance corridor would be vegetated with a standard grass seed mix to filter and remove sediment and particulates from the stormwater. The swale would provide basic treatment prior to entering a vegetated conveyance corridor that would route the treated stormwater from the swale into the restored wetland area. The conveyance corridor would be designed to meander through the restored buffer area to provide additional treatment and infiltration as well as a more natural channel configuration. The swale would also be protected with a low berm and backflow preventer at the outlet to avoid inundation during high tides.

Target design elevations at various points in the stormwater routing system are as follows, subject to continuing design analysis.

- Discharge Elevation at Estuarine Wetland: 8.6 feet
- Swale Outlet Elevation: 9.5 feet
- Swale Inlet Elevation: 13.0 feet
- Control Box Outlet Elevation: 14.5 feet
- Control Box Inlet Elevation: 10.7 feet (surveyed elevation)

To optimize the grades and locations of the stormwater and bioswale features, several factors were considered to balance the elevation of the control box outlet with the discharge point at the edge of the estuarine wetland. The discharge point at the wetland edge was set at 8.6 feet (approximately MHHW) as an optimal design target. A lower elevation for discharge to the wetland would require deeper incising of the conveyance channel from the swale outlet (approximately 9.5 feet) into the new topographic bench to be established at approximately 12 feet. A higher discharge elevation would result in progressively higher upstream elevations for the swale and control box outlet, which would be undesirable.

MONITORING ACTIVITIES

Monitoring Schedule

Monitoring of the mitigation areas would be conducted for 10 years following construction. Following upland remediation and debris removal (summer 2012), a report would be prepared to summarize the constructed conditions of the restored wetland and buffer, including, but not limited to site grading, and berm location, prior to tidal connection. Formal monitoring of the wetland and buffer areas would not begin until the completion of the Phase II in-water work and connection of the wetland to Fidalgo Bay. At this time, a formal as-built report would be prepared and monitoring would begin.

Site inspections and reporting would occur on an annual basis. The following schedule would be used for project monitoring reports:

- At time of construction/As-built (Year 0);
- Year 1: detailed annual report;
- Year 2: detailed annual report;
- Year 3: detailed annual report;
- Year 4: reconnaissance level report;
- Year 5: detailed annual report;
- Year 6: reconnaissance level report;
- Year 7: detailed annual report;

- Year 8: reconnaissance level report;
- Year 9: reconnaissance level report; and
- Year 10/Final: detailed annual report

Following construction, an as-built report would be submitted by the project applicant to the applicable federal, state, and local government agencies within approximately 30 days after completion of plant installation in both the wetland and buffer areas. The report would document mitigation site conditions at completion of plant installation and would be used as a baseline for future monitoring events. Annual detailed monitoring reports would be submitted to the appropriate regulatory agencies by December 31 of each calendar year.

GOALS AND PERFORMANCE STANDARDS

Project goals include restoring wetland areas through the creation of appropriate elevations and installation of native vegetation, restoring buffer areas through the installation of native vegetation, and maintaining invasive vegetation at low levels within the wetland and buffer areas. Performance requirements for the mitigation area would include:

Goal 1: Restore Wetland Areas through Installation of Native Vegetation

Performance Standards:

a) Survival of planted native vegetation would be monitored for two years.

- Year 1: 90 percent survival of installed plants visually estimated
- Year 2: 80 percent survival of installed plants visually estimated

b) Areal coverage of native shrubs and emergent vegetation would be a minimum of 80 percent after 10 years.

- Year 1: 20 percent cover
- Year 2: 30 percent cover
- Year 3: 40 percent cover
- Year 5: 50 percent cover
- Year 7: 60 percent cover
- Year 10: 80 percent cover

Goal 2: Restore Buffer Areas through Installation of Native Vegetation

Performance Standards:

a) Survival of planted native vegetation would be monitored for two years.

- Year 1: 90 percent survival of installed plants
- Year 2: 80 percent survival of installed plants

b) Areal coverage of native tree, shrub, and groundcover species would be a minimum of 80 percent after 10 years.

- Year 1: 20 percent cover
- Year 2: 30 percent cover
- Year 3: 40 percent cover
- Year 5: 50 percent cover
- Year 7: 60 percent cover
- Year 10: 80 percent cover

Goal 3: Control Invasive Plant Species within the Wetland and Buffer Areas

a) Invasive plant areal coverage would be less than 10 percent after 10 years.

- Years 1 through 10: 10 percent or less coverage of invasive plants

Goal 4: Provide Adequate Hydrologic Connection for Restored Wetland

a) Visual observation of tidal inundation during a normal tidal cycle each year.

- Years 1 through 10: 100 percent coverage of marsh mitigation area by tidal waters at tidal elevation of approximately MHHW

b) Documented coverage (in square feet) of emergent estuarine plant species using a global positioning system during Years 1, 5, and 10.

- Years 1, 5, and 10: 12,000 sf or greater cover of native estuarine plant species

A total of 12,000 sf or more of wetland would be maintained throughout the 10-year monitoring period. Monitoring would include qualitative observations on vegetation (cover, density, survival, and natural colonization) and wildlife, and quantitative data collection (species composition and percentage cover, total percentage plant cover, percentage cover of volunteer plants, and percentage cover of invasive species) using a sample plot method. In addition, permanent photo points would be established within the wetland and buffer mitigation areas to supplement the qualitative data.

Vegetation

The project biologist or mitigation specialist conducting monitoring activities would make a number of qualitative observations on vegetation and wildlife during quantitative data collection. Qualitative data on plant cover, density, survival and naturally colonizing plants would be collected. In addition, observations of wildlife use, including birds, amphibians, reptiles, and small mammals would be recorded during each monitoring visit.

Wetland and buffer plant communities would be sampled along permanent vegetation transects using a circular quadrat (1-meter radius). A minimum of two transects would be established in the wetland and buffer restoration areas for minimum total of four transects throughout the mitigation area. Transect lengths would range between 100 and 200 feet, depending on the as-built conditions at the site. A minimum of five permanent quadrats would be established along each transect. To ensure the same locations are monitored each year, permanent markers would be established at the ends of each transect and at each quadrat sampling point (either PVC, wood lathe, or a combination of PVC and rebar). A map of the transect and sample plot locations would be created for use during monitoring events.

Wetland and buffer plantings would be visually evaluated along each transect to determine the rate of survival, health, and vigor. Plants would be recorded as live, stressed, or dead/dying. For the first year of monitoring, plant survival would be calculated by dividing the number of installed plants still living by the number of initially installed plants.

The percent cover of individual plant species present within each quadrat would be visually estimated. Data collection would consist of species composition and percent cover, total percent plant cover, percent cover of volunteer plants, and percent cover of invasive species, including, but not limited to, Himalayan blackberry (*Rubus armeniacus*), English ivy (*Hedera helix*), Scot's broom (*Cytisus scoparius*), nightshade (*Solanum* sp.), Canada thistle (*Cirsium arvense*), and reed canarygrass (*Phalaris arundinacea*). Species coverage values would be summed to determine the total areal coverage in each quadrat.

Photo Points

Permanent photo points would be established within the wetland and buffer mitigation areas to supplement the qualitative data. Photo points would be established at topographic vantage points that provide complete views of the mitigation area, if possible. Photos would document relative changes in plant cover, density, and height. Permanent markers would be established at each photo point (either PVC, wood lathe, or a combination of PVC and rebar) or the photo points would correspond with permanent site features meeting the above requirements.

MAINTENANCE AND CONTINGENCY ACTIONS

Maintenance and contingency actions would include, but are not limited to, irrigation, pruning, replacement of dead/dying or undesirable transplants with the appropriate vegetation, substitution of plant species, regular weeding and removal of noxious and invasive weeds, and installation of plant protective devices. No post-planting applications of fertilizer are anticipated. Irrigation would be provided for the first two years following construction to aid in establishing native plantings within the buffer area.

If the mitigation area is not providing the required cover of native estuarine wetland area by the end of Year 3, adaptive management approaches and additional contingency measures would be evaluated to determine whether waiting a longer period for the desired vegetation establishment is warranted, regrading or deepening of the wetland area is needed, replanting of vegetation or other measures are necessary to meet the project's performance requirements. In addition, contingency measures would be evaluated during each monitoring event to help ensure that the proposed mitigation is successful.

Attachments:
Table 1 – Plant Schedule for Wetland Mitigation Planting Area
Table 2 – Plant Schedule for Buffer Planting Area
Figure 1 – Vicinity Map
Figure 2 – Wetland Mitigation Plan
Figure 3 – Wetland Mitigation Cross Section
Figure 4 – Conceptual Stormwater Drainage Conveyance and Swale Profile
Isolated Wetlands Information Sheet
Wetland Rating Form - Western Washington

TABLES

Table 1 - Plant Schedule for Wetland Mitigation Planting Area

Common Name	Scientific Name	Condition	Minimum Spacing (on center in feet)	Planting Notes	Quantity
Emergents					
Pickleweed	*Salicornia virginica*	Division or plug	1 to 3	Plant in groups of 10 to 15	880
Saltgrass	*Distichlis spicata*	Division or plug	1 to 3	Plant in groups of 10 to 15	880
Seacoast bulrush	*Scirpus maritimus*	Division or plug	1 to 3	Plant in groups of 10 to 15	880
Total Emergents					**2,640**

Note: Plant species and quantities are subject to change.

Table 2 - Plant Schedule for Buffer Planting Area

Common Name	Scientific Name	Condition	Minimum Spacing (on center in feet)	Planting Notes	Quantity
Trees					
Douglas fir	*Pseudotsuga menziesii*	1 gallon	10 to 12	Plant individually	55
Shore pine	*Pinus contorta*	1 gallon	10 to 12	Plant individually	55
Black cottonwood	*Populus balsamifera*	1 gallon	10 to 12	Plant individually	55
Big-leaf maple	*Acer macrophyllum*	1 gallon	10 to 12	Plant individually	55
Total Trees					**220**
Shrubs					
Oceanspray	*Holodiscus discolor*	1 gallon	5 to 7	Plant in groups of 4 to 8	110
Vine maple	*Acer circinatum*	1 gallon	5 to 7	Plant in groups of 4 to 8	110
Red elderberry	*Sambucus racemosa*	1 gallon	5 to 7	Plant in groups of 4 to 8	110

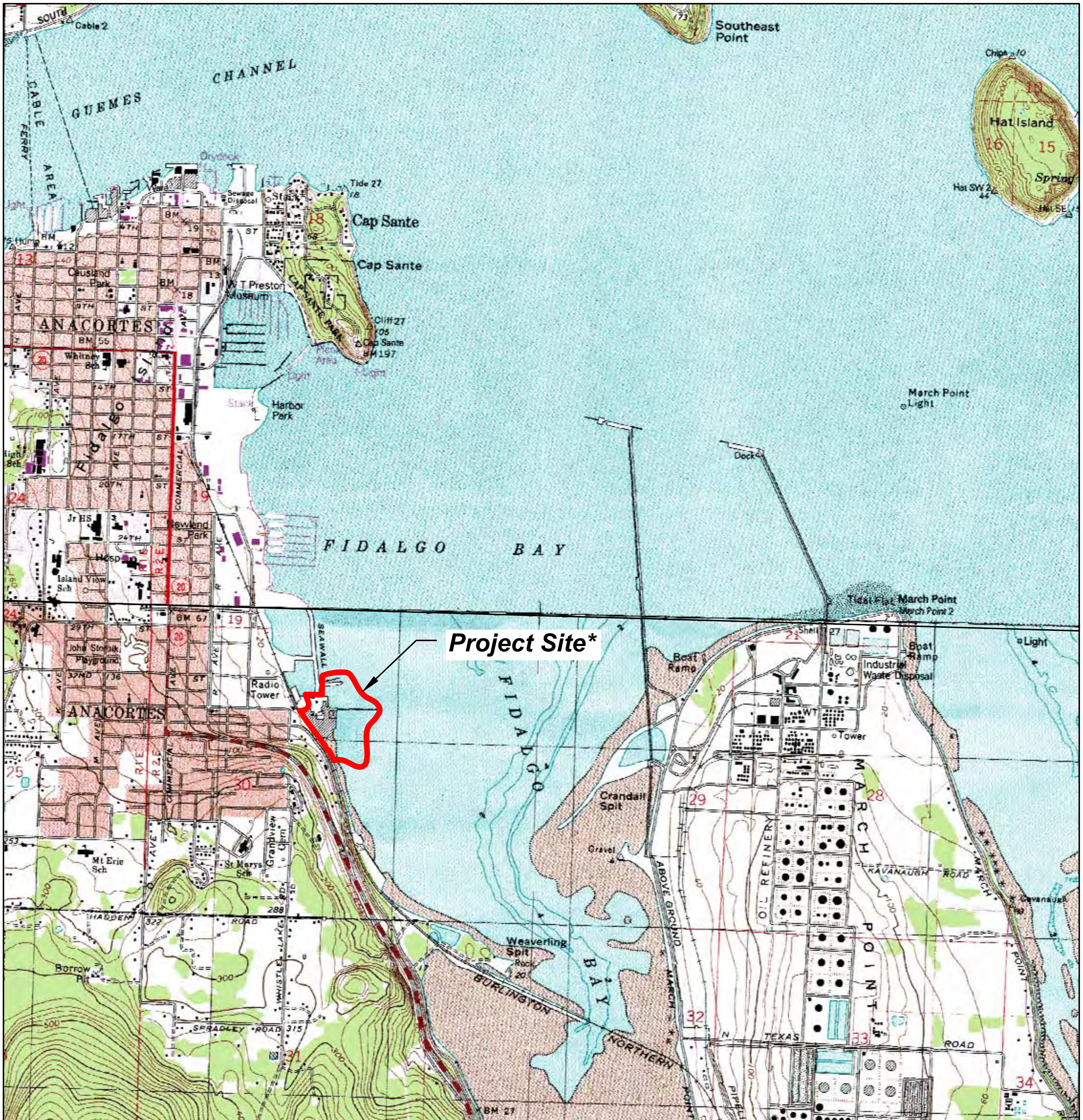
Common Name	Scientific Name	Condition	Minimum Spacing (on center in feet)	Planting Notes	Quantity
Nootka rose	*Rosa nutkana*	1 gallon	5 to 7	Plant in groups of 4 to 8	110
Red-flowering currant	*Ribes sanguineum*	1 gallon	5 to 7	Plant in groups of 4 to 8	110
Snowberry	*Symphoricarpos albus*	1 gallon	5 to 7	Plant in groups of 4 to 8	110
Thimbleberry	*Rubus parviflorus*	1 gallon	5 to 7	Plant in groups of 4 to 8	110
Salal	*Gaultheria shallon*	1 gallon	5 to 7	Plant in groups of 4 to 8	110
Douglas hawthorne [a]	*Crataegus douglasii*	1 gallon	3 to 5	Plant individually in alternating rows	110
Rose (to be determined) [a]	*Rosa* sp.	1 gallon	3 to 5	Plant individually in alternating rows	110
Total Shrubs					**1,100**
Herbs					
Dunegrass [b]	*Leymus mollis*	Division or plug	1 to 3	Plant in groups of 10 to 15	660
Coastal strawberry	*Fragaria chiloensis*	4-inch	3 to 5	Plant in groups of 4 to 8	605
Kinnikinnick	*Arctorstaphylos uva-ursi*	4-inch	3 to 5	Plant in groups of 4 to 8	605
Total Herbs					**1,870**

Note: Plant species and quantities are subject to change.

[a] For installation as a barrier planting along the perimeter of the buffer only.

[b] For installation along the shoreline and slope between wetland and buffer only.

FIGURES



Source: Base map prepared from USGS 7.5-Minute Series Topographic Map, Anacortes North and Anacortes South Quadrangles.

0 0.5 1

Scale in Miles

N

* Represents upland and aquatic portions of the site included with current Feasibility Study.

Custom Plywood Site

Anacortes, Washington

Vicinity Map

17330-27 (B-1) 2/11

HARTCROWSER

Figure

1

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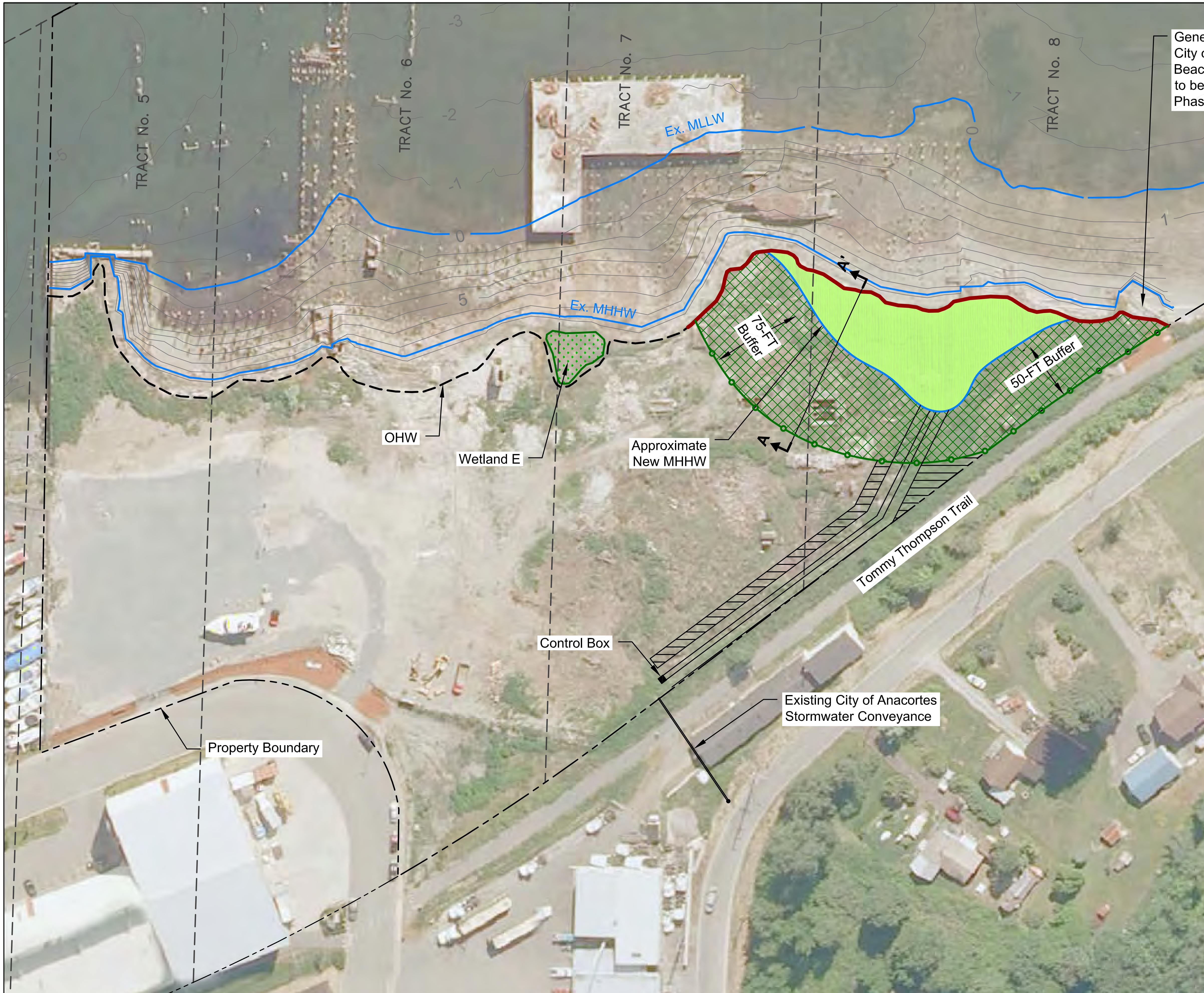

Estuarine Wetland (12,050 sf)

Buffer (26840 sf)

Swale and Conveyance

Temporary Fencing and Barrier Plantings

Temporary Shoreline Berm

Stormwater Plantings

A A' Cross Section Location and Designation

Note: See Figure 4 for stormwater conveyance and swale details.

N

0 80 160

Scale in Feet

Source: Aerial photo courtesy of City of Anacortes, 2003.

Custom Plywood Site
Anacortes, Washington

Wetland Mitigation Plan

17330-27 (B-1) 9/11

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Figure

2

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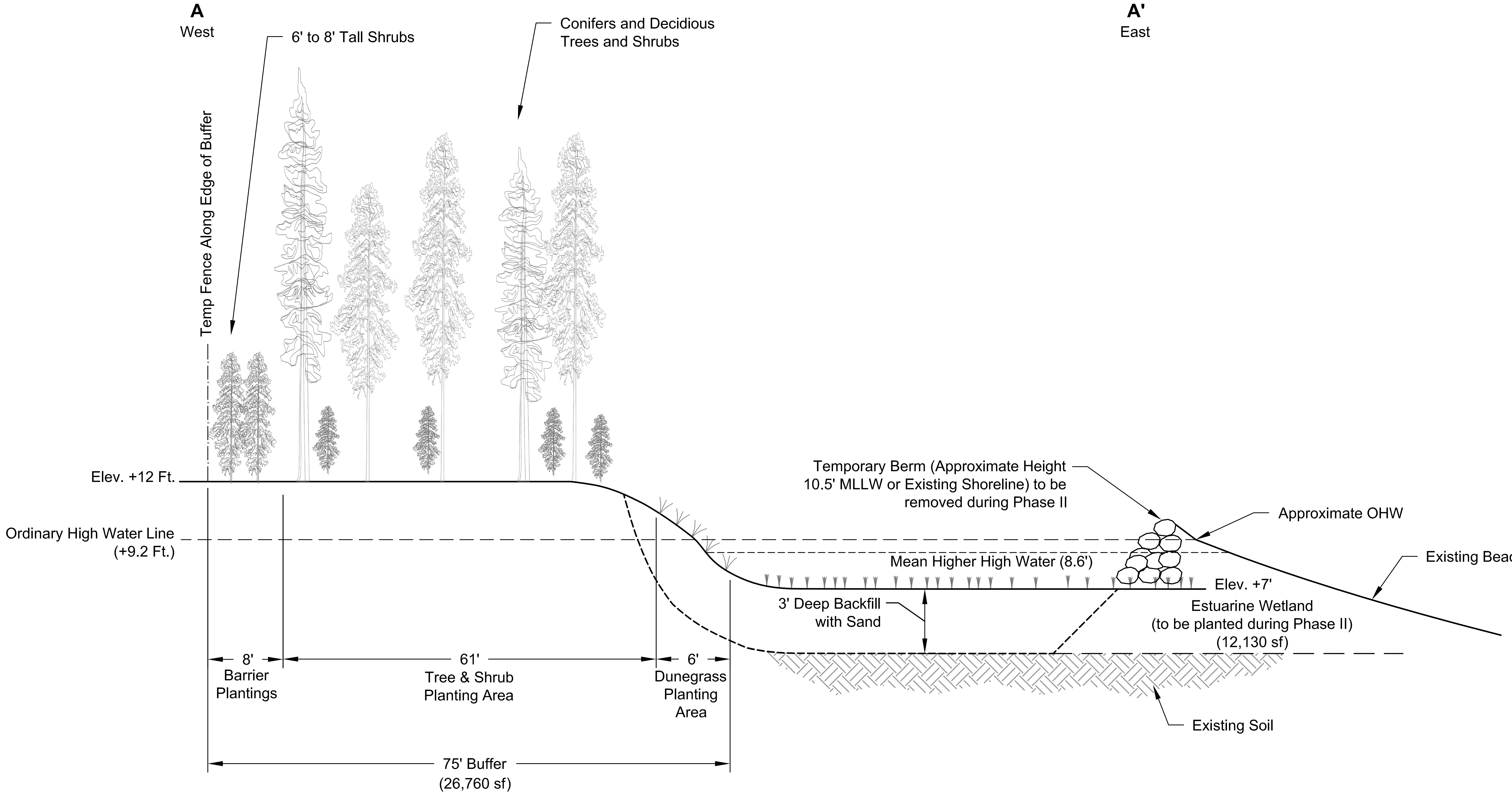

Elevation Datum: Mean Lower Low Water

Horizontal Scale in Feet
0 15 30
0 5 10
Vertical Scale in Feet
Vertical Exaggeration x 3

Custom Plywood Site
Anacortes, Washington

Wetland Mitigation Cross Section

17330-27 (B-1) 9/11

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Figure
3

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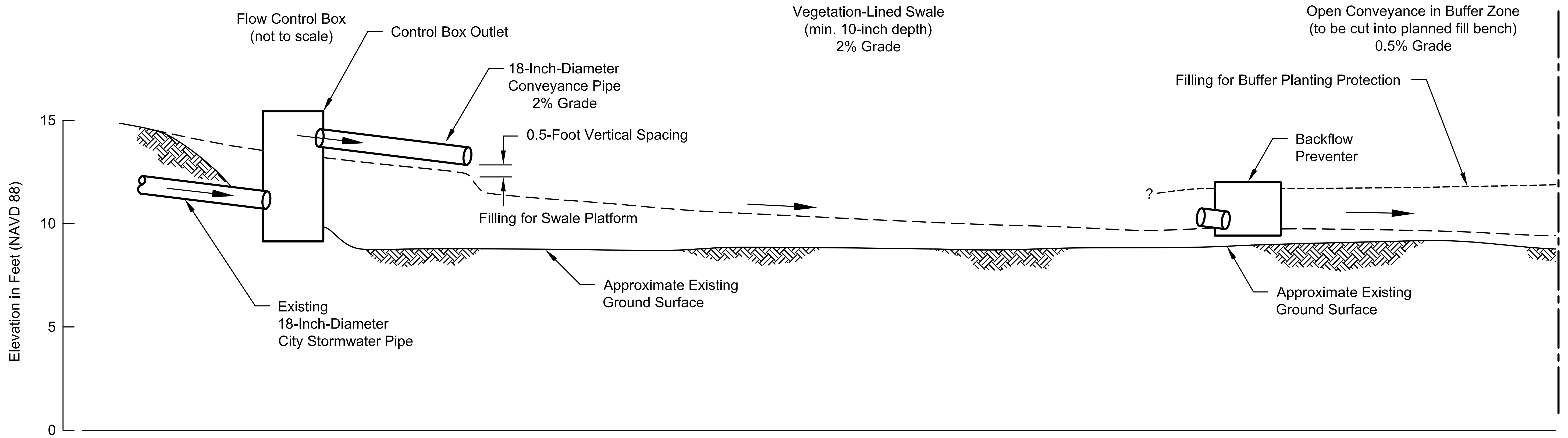
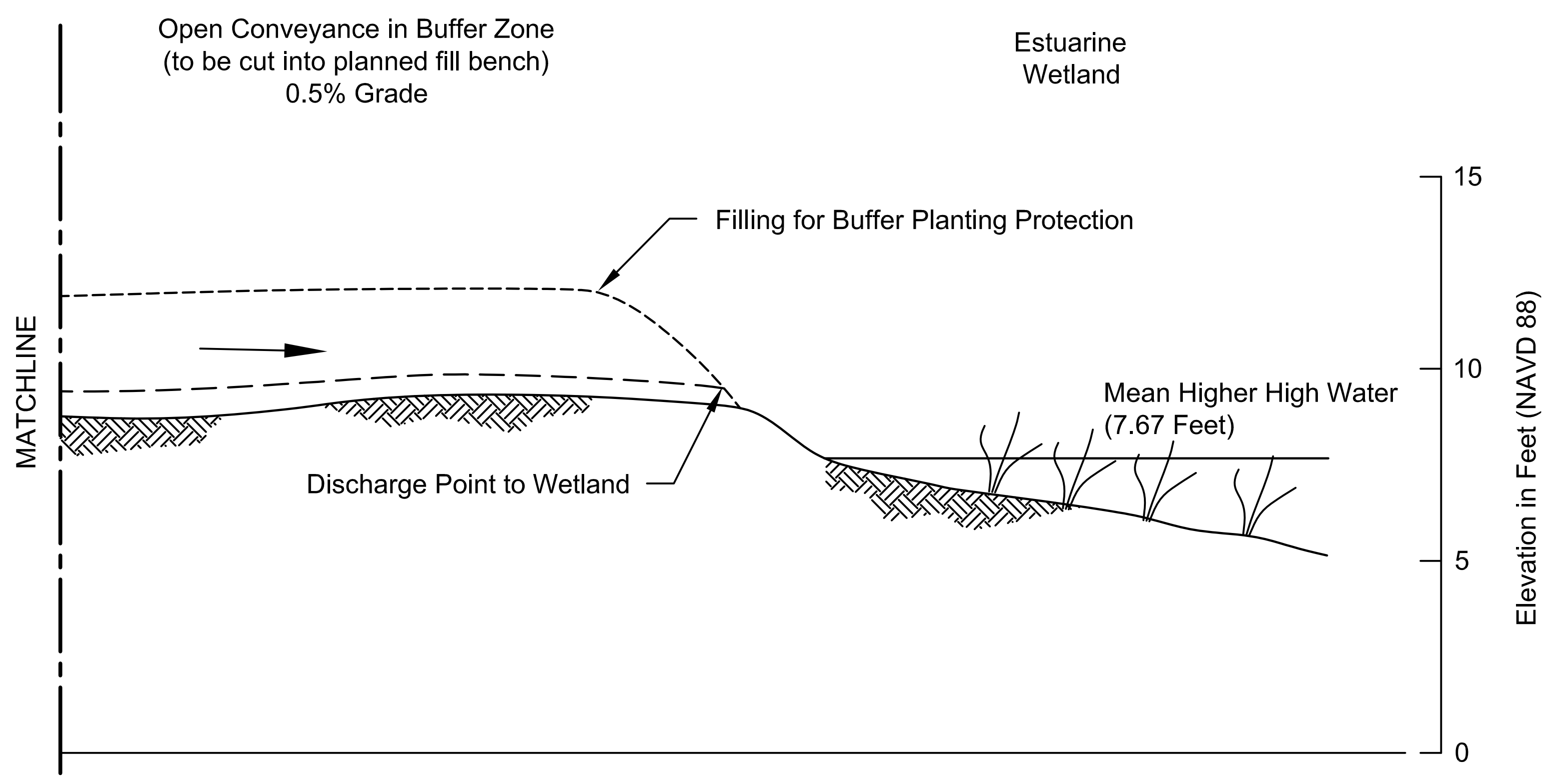




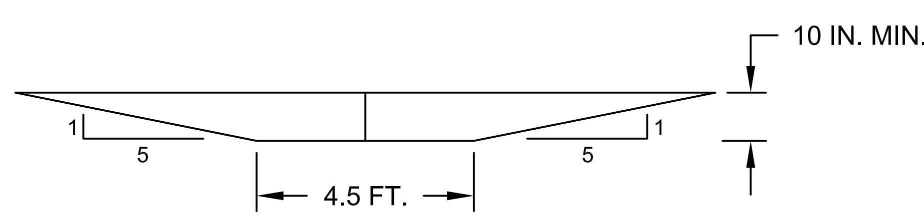
Target Design Elevations

City Stormwater Pipe Invert Elevation at Control Box: 10.14 Feet (Surveyed)
Control Box Outlet Elevation: 13.9 Feet
Swale Inlet Elevation: 12.4 Feet
Swale Outlet Elevation: 8.9 Feet
Discharge Elevation at Estuarine Wetland: 8.0 Feet

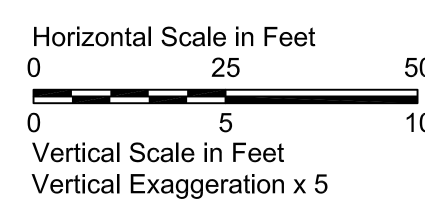
Notes:

→ Stormwater Flow Direction

Not Shown for Clarity:
- In-line treatment/settling structure between control box and swale inlet
- Energy dissipation structure at swale inlet
- Level spreader at wetland discharge point



CONCEPTUAL SWALE CROSS SECTION



Custom Plywood Site
Anacortes, Washington

Conceptual Stormwater Drainage Conveyance and Swale Profile

17330-27 (B-1) 2/11

HARTCROWSER

Figure **4**

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ISOLATED WETLANDS INFORMATION SHEET

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DEPARTMENT OF ECOLOGY
State of Washington

Isolated Wetlands Information Sheet

If you are proposing to fill or otherwise alter an isolated wetland, you will need to obtain authorization from Ecology through an administrative order. To help expedite review of your project, you can provide the information requested below. Answer the following questions to the best of your ability and attach any reports or documents that provide supporting information. This information can also augment information provided in a Joint Aquatic Resources Permit Application[1]. You may need to hire a qualified wetland professional[2] to assist you. Failure to provide this information may result in delays in review of your project.

1.	**Wetland Area and Location (provide a delineation report, including data sheets--see 5a below)**
	a. How large (in acres or square feet) is the wetland or wetlands (including contiguous portions offsite)? Wetland A = 120 sf Wetland B = 124 sf Wetland C = 367 sf Wetland D = 9,910 sf Total (Wetlands A, B, C and D) = 10,521 sf
	b. How far is the wetland(s) from the nearest surface water body (lake, river, wetland, etc.)? All wetlands are located within approximately 250 feet of the shoreline of Fidalgo Bay and within approximately 150 feet of one another.
	c. Is the wetland(s) within a FEMA-mapped 100-year floodplain? No.
2.	**Wetland Rating** (http://www.ecy.wa.gov/programs/sea/wetlands/ratingsystems/)
	What is the category(ies) of the wetland(s) according to the Washington State Wetland Rating System (eastern or western Washington version as appropriate)? Wetland A = Category 4 Wetland B = Category 4 Wetland C = Category 2 Wetland D = Category 3

[1] The Joint Aquatic Resource Application (JARPA) is available on the web at: http://www.epermitting.wa.gov/.
[2] For more information on how to hire a qualified wetland professional go to: http://www.ecy.wa.gov/programs/sea/wetlands/professional.html.

3.	Cowardin Classification	
	Describe the Cowardin[3] vegetation class(es) in the wetland (for example, emergent, scrub/shrub, forested, open water, etc.), and list the dominant plant species in each class.	
	Cowardin Class	**Dominant Plant Species**
	Wetland A = PEM Wetland B = PEM Wetland C = EEM Wetland D = PEM	Wetland A = Typha latifolia Wetland B = Typha latifolia Wetland C = Scirpus maritimus and Distichlis spicata Wetland D = Festuca sp., Chenopodium album, Rumex occidentalis, Equisetum arvense, and Rubus armeniacus
4.	**Wetland Impacts**	
	How much wetland area (in acres or square feet) is proposed to be:	
	a. Filled? 10,521 sf	
	b. Excavated? 10,521 sf	
	c. Drained?	
	d. Flooded?	
	e. Cleared, vegetation altered? 10,521 sf	
	f. Other? (list)	
5.	**Please provide copies of the following information if available:**	
	a. Wetland delineation report, including data sheets (http://www.ecy.wa.gov/programs/sea/wetlands/delineation.html)	
	b. Photographs of wetland	
	c. Wetland rating form (http://www.ecy.wa.gov/programs/sea/wetlands/ratingsystems/)	
	d. Wetland function assessment report	
	e. Project plans, including grading plan	
	f. Erosion control and stormwater control plans, and reports	
	g. Wetland mitigation plan (http://www.ecy.wa.gov/programs/sea/wetlands/mitigation/guidance/)	

[3] Refers to the U.S. Fish and Wildlife Service's classification system (Cowardin et al, *Classification of Wetlands and Deepwater Habitats of the United States*, 1979).

WETLAND RATING FORM - WESTERN WASHINGTON

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for double-sided printing.

Wetland name or number D

WETLAND RATING FORM – WESTERN WASHINGTON
Version 2 - Updated July 2006 to increase accuracy and reproducibility among users
Updated Oct 2008 with the new WDFW definitions for priority habitats

Name of wetland (if known): D - Custom Plywood Date of site visit: 8/9/10

Rated by C. Abercrombie Trained by Ecology? Yes X No___ Date of training 4/05

SEC: 30 TWNSHP: 35N RNGE: 2E Is S/T/R in Appendix D? Yes___ No X

Map of wetland unit: Figure —— Estimated size 1,900 sf.

SUMMARY OF RATING

Category based on FUNCTIONS provided by wetland

I___ II___ III X IV___

Category I = Score >=70
Category II = Score 51-69
Category III = Score 30-50
Category IV = Score < 30

Score for Water Quality Functions	16
Score for Hydrologic Functions	20
Score for Habitat Functions	10
TOTAL score for Functions	46

Category based on SPECIAL CHARACTERISTICS of wetland

I___ II___ **Does not Apply** X

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

Summary of basic information about the wetland unit

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

Wetland name or number D

Does the wetland unit being rated meet any of the criteria below?

If you answer YES to any of the questions below you will need to protect the wetland according to the regulations regarding the special characteristics found in the wetland.

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

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

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

Wetland name or number D

Classification of Wetland Units in Western Washington

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

1. Are the water levels in the entire unit usually controlled by tides (i.e. except during floods)?
NO – go to 2 **YES** – the wetland class is **Tidal Fringe**

If yes, is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)? **YES – Freshwater Tidal Fringe** **NO – Saltwater Tidal Fringe (Estuarine)**

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

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.
NO – go to 3 **YES** – The wetland class is **Flats**

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

3. Does the entire wetland unit **meet both** of the following criteria?
___The vegetated part of the wetland is on the shores of a body of permanent open water (without any vegetation on the surface) at least 20 acres (8 ha) in size;
___At least 30% of the open water area is deeper than 6.6 ft (2 m)?
NO – go to 4 **YES** – The wetland class is **Lake-fringe (Lacustrine Fringe)**

4. Does the entire wetland unit **meet all** of the following criteria?
____The wetland is on a slope (*slope can be very gradual*),
____The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks.
____The water leaves the wetland **without being impounded**?
NOTE: *Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3ft diameter and less than 1 foot deep).*
NO - go to 5 **YES** – The wetland class is **Slope**

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

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

____ The overbank flooding occurs at least once every two years.

NOTE: The riverine unit can contain depressions that are filled with water when the river is not flooding.

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

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

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

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

NO – go to 8 **YES** – The wetland class is **Depressional**

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

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

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

Wetland name or number D

D	**Depressional and Flats Wetlands** HYDROLOGIC FUNCTIONS - Indicators that the wetland unit functions to reduce flooding and stream degradation	**Points** (only 1 score per box)
	D 3. Does the wetland unit have the potential to reduce flooding and erosion?	*(see p.46)*
D	D 3.1 Characteristics of surface water flows out of the wetland unit Unit is a depression with no surface water leaving it (no outlet) points = 4 Unit has an intermittently flowing, OR highly constricted permanently flowing outlet points = 2 Unit is a "flat" depression (Q. 7 on key), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch points = 1 *(If ditch is not permanently flowing treat unit as "intermittently flowing")* Unit has an unconstricted, or slightly constricted, surface outlet *(permanently flowing)* points = 0	4
D	D 3.2 Depth of storage during wet periods *Estimate the height of ponding above the bottom of the outlet. For units with no outlet measure from the surface of permanent water or deepest part (if dry).* Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7 The wetland is a "headwater" wetland" points = 5 Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet points = 5 Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet points = 3 Unit is flat (yes to Q. 2 or Q. 7 on key) but has small depressions on the surface that trap water points = 1 Marks of ponding less than 0.5 ft points = 0	3
D	D 3.3 Contribution of wetland unit to storage in the watershed *Estimate the ratio of the area of upstream basin contributing surface water to the wetland to the area of the wetland unit itself.* The area of the basin is less than 10 times the area of unit points = 5 The area of the basin is 10 to 100 times the area of the unit points = 3 The area of the basin is more than 100 times the area of the unit points = 0 Entire unit is in the FLATS class points = 5	3 (Possibly 100 times area of unit)
D	**Total for D 3** *Add the points in the boxes above*	10
D	**D 4. Does the wetland unit have the opportunity to reduce flooding and erosion?** Answer YES if the unit is in a location in the watershed where the flood storage, or reduction in water velocity, it provides helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows. Answer NO if the water coming into the wetland is controlled by a structure such as flood gate, tide gate, flap valve, reservoir etc. OR you estimate that more than 90% of the water in the wetland is from groundwater in areas where damaging groundwater flooding does not occur. *Note which of the following indicators of opportunity apply.* — Wetland is in a headwater of a river or stream that has flooding problems — Wetland drains to a river or stream that has flooding problems — Wetland has no outlet and impounds surface runoff water that might otherwise flow into a river or stream that has flooding problems — Other Limited downslope resources **YES** multiplier is **2** **NO** multiplier is **1**	*(see p. 49)* multiplier 2?
D	**TOTAL - Hydrologic Functions** Multiply the score from D 3 by D 4 ***Add score to table on p. 1***	20

Wetland development is a result of stormwater routed onto the property.

Wetland name or number D

D	Depressional and Flats Wetlands WATER QUALITY FUNCTIONS - Indicators that the wetland unit functions to improve water quality	Points (only 1 score per box)
D	**D 1. Does the wetland unit have the potential to improve water quality?**	*(see p.38)*
D	D 1.1 Characteristics of surface water flows out of the wetland: Unit is a depression with no surface water leaving it (no outlet) points = 3 Unit has an intermittently flowing, OR highly constricted permanently flowing outlet points = 2 Unit has an unconstricted, or slightly constricted, surface outlet *(permanently flowing)* points = 1 Unit is a "flat" depression (Q. 7 on key), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch points = 1 *(If ditch is not permanently flowing treat unit as "intermittently flowing")* Provide photo or drawing	Figure ___ 3
D	S 1.2 The soil 2 inches below the surface (or duff layer) is clay or organic *(use NRCS definitions)* YES points = 4 NO points = 0	0
D	D 1.3 Characteristics of persistent vegetation (emergent, shrub, and/or forest Cowardin class) Wetland has persistent, ungrazed, vegetation > = 95% of area points = 5 Wetland has persistent, ungrazed, vegetation > = 1/2 of area points = 3 Wetland has persistent, ungrazed vegetation > = 1/10 of area points = 1 Wetland has persistent, ungrazed vegetation <1/10 of area points = 0 Map of Cowardin vegetation classes	Figure ___ 3
D	D1.4 Characteristics of seasonal ponding or inundation. *This is the area of the wetland unit that is ponded for at least 2 months, but dries out sometime during the year. Do not count the area that is permanently ponded. Estimate area as the average condition 5 out of 10 yrs.* Area seasonally ponded is > ½ total area of wetland points = 4 Area seasonally ponded is > ¼ total area of wetland points = 2 Area seasonally ponded is < ¼ total area of wetland points = 0 Map of Hydroperiods	Figure ___ 2
D	**Total for D 1** *Add the points in the boxes above*	8
D	**D 2. Does the wetland unit have the opportunity to improve water quality?** Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland. *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* — Grazing in the wetland or within 150 ft X Untreated stormwater discharges to wetland — Tilled fields or orchards within 150 ft of wetland — A stream or culvert discharges into wetland that drains developed areas, residential areas, farmed fields, roads, or clear-cut logging X Residential, urban areas, golf courses are within 150 ft of wetland — Wetland is fed by groundwater high in phosphorus or nitrogen — Other___ **YES** multiplier is 2 **NO** multiplier is **1**	*(see p. 44)* multiplier 2
D	**TOTAL - Water Quality Functions** Multiply the score from D1 by D2 ***Add score to table on p. 1***	16

Grasses Weedy

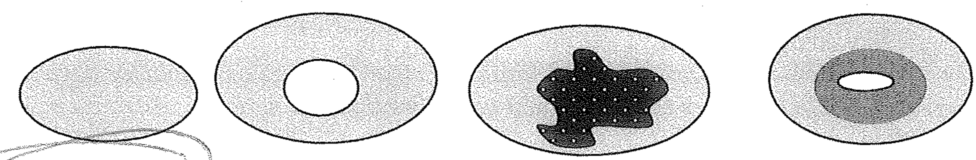
These questions apply to wetlands of all HGM classes. HABITAT FUNCTIONS - Indicators that unit functions to provide important habitat	**Points** (only 1 score per box)
H 1. Does the wetland unit have the potential to provide habitat for many species?	
H 1.1 Vegetation structure ***(see p. 72)*** *Check the types of vegetation classes present (as defined by Cowardin)- Size threshold for each class is ¼ acre or more than 10% of the area if unit is smaller than 2.5 acres.* ____Aquatic bed X Emergent plants ____Scrub/shrub (areas where shrubs have >30% cover) ____Forested (areas where trees have >30% cover) *If the unit has a forested class check if:* ____The forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the forested polygon *Add the number of vegetation structures that qualify. If you have:* 4 structures or more — points = 4 Map of Cowardin vegetation classes — 3 structures — points = 2 2 structures — points = 1 1 structure — (points = 0)	Figure ___ Ø
H 1.2. Hydroperiods ***(see p. 73)*** *Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ acre to count. (see text for descriptions of hydroperiods)* ____Permanently flooded or inundated — 4 or more types present — points = 3 X Seasonally flooded or inundated — 3 types present — points = 2 ____Occasionally flooded or inundated — 2 types present — point = 1 ____Saturated only — 1 type present — (points = 0) ____ Permanently flowing stream or river in, or adjacent to, the wetland ____ Seasonally flowing stream in, or adjacent to, the wetland ____***Lake-fringe wetland*** **= 2 points** ____***Freshwater tidal wetland*** **= 2 points** Map of hydroperiods	Figure ___ Ø
H 1.3. Richness of Plant Species ***(see p. 75)*** Count the number of plant species in the wetland that cover at least 10 ft^2. (*different patches of the same species can be combined to meet the size threshold)* *You do not have to name the species.* *Do not include Eurasian Milfoil, reed canarygrass, purple loosestrife, Canadian Thistle* If you counted: > 19 species — points = 2 *List species below if you want to:* 5 - 19 species — (points = 1) < 5 species — points = 0 Rumex Typha Epilobium Festuca Equisetum Chenopodium	1

Total for page 1

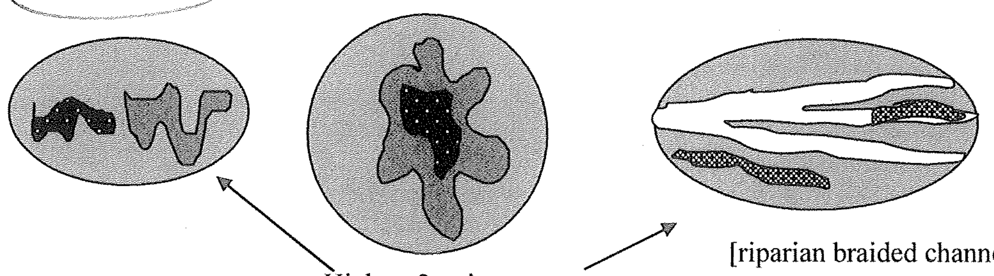
Wetland name or number D

H 1.4. Interspersion of habitats *(see p. 76)* — **Figure ___**

Decide from the diagrams below whether interspersion between Cowardin vegetation classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, medium, low, or none.



None = 0 points Low = 1 point Moderate = 2 points



[riparian braided channels]

High = 3 points

NOTE: If you have four or more classes or three vegetation classes and open water the rating is always "high". **Use map of Cowardin vegetation classes**

Score: Ø

H 1.5. Special Habitat Features: *(see p. 77)*

Check the habitat features that are present in the wetland. The number of checks is the number of points you put into the next column.

____Large, downed, woody debris within the wetland (>4in. diameter and 6 ft long).

____Standing snags (diameter at the bottom > 4 inches) in the wetland

____Undercut banks are present for at least 6.6 ft (2m) and/or overhanging vegetation extends at least 3.3 ft (1m) over a stream (or ditch) in, or contiguous with the unit, for at least 33 ft (10m)

____Stable steep banks of fine material that might be used by beaver or muskrat for denning (>30degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet turned grey/brown)*

____At least ¼ acre of thin-stemmed persistent vegetation or woody branches are present in areas that are permanently or seasonally inundated. *(structures for egg-laying by amphibians)*

____ Invasive plants cover less than 25% of the wetland area in each stratum of plants

NOTE: The 20% stated in early printings of the manual on page 78 is an error.

Score: Ø

H 1. TOTAL Score - potential for providing habitat
Add the scores from H1.1, H1.2, H1.3, H1.4, H1.5 — 1

Comments

Wetland name or number D

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

Disturbed buffers

Total for page 3

Wetland name or number D

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

Wetland name or number D

H 2.4 Wetland Landscape *(choose the **one** description of the landscape around the wetland that best fits)* ***(see p. 84)*** There are at least 3 other wetlands within ½ mile, and the connections between them are relatively undisturbed (light grazing between wetlands OK, as is lake shore with some boating, but connections should NOT be bisected by paved roads, fill, fields, or other development. points = 5 The wetland is Lake-fringe on a lake with little disturbance and there are 3 other lake-fringe wetlands within ½ mile points = 5 There are at least 3 other wetlands within ½ mile, BUT the connections between them are disturbed points = 3 The wetland is Lake-fringe on a lake **with** disturbance and there are 3 other lake-fringe wetland within ½ mile points = 3 There is at least 1 wetland within ½ mile. points = 2 There are no wetlands within ½ mile. points = 0	3
H 2. TOTAL Score - opportunity for providing habitat *Add the scores from H2.1,H2.2, H2.3, H2.4*	9
TOTAL for H 1 from page 14	1
Total Score for Habitat Functions – add the points for H 1, H 2 and record the result on p. 1	10

Wetland name or number D

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

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

Wetland Type *Check off any criteria that apply to the wetland. Circle the Category when the appropriate criteria are met.*	**Category**
SC 1.0 Estuarine wetlands *(see p. 86)* Does the wetland unit meet the following criteria for Estuarine wetlands? — The dominant water regime is tidal, — Vegetated, and — With a salinity greater than 0.5 ppt. YES = Go to SC 1.1 NO ✓	
SC 1.1 Is the wetland unit within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? YES = Category I NO go to SC 1.2	**Cat. I**
SC 1.2 Is the wetland unit at least 1 acre in size and meets at least two of the following three conditions? YES = Category I NO = Category II — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. If the non-native *Spartina* spp. are the only species that cover more than 10% of the wetland, then the wetland should be given a dual rating (I/II). The area of Spartina would be rated a Category II while the relatively undisturbed upper marsh with native species would be a Category I. Do not, however, exclude the area of Spartina in determining the size threshold of 1 acre. — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland has at least 2 of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands.	**Cat. I** **Cat. II** **Dual rating I/II**

Wetland name or number D

SC 2.0 Natural Heritage Wetlands *(see p. 87)*	
Natural Heritage wetlands have been identified by the Washington Natural Heritage Program/DNR as either high quality undisturbed wetlands or wetlands that support state Threatened, Endangered, or Sensitive plant species. SC 2.1 Is the wetland unit being rated in a Section/Township/Range that contains a Natural Heritage wetland? *(this question is used to screen out most sites before you need to contact WNHP/DNR)* S/T/R information from Appendix D X or accessed from WNHP/DNR web site X YES____ – contact WNHP/DNR (see p. 79) and go to SC 2.2 NO X SC 2.2 Has DNR identified the wetland as a high quality undisturbed wetland or as or as a site with state threatened or endangered plant species? YES = Category I NO X not a Heritage Wetland	**Cat. I**
SC 3.0 Bogs *(see p. 87)* Does the wetland unit (**or any part of the unit**) meet both the criteria for soils and vegetation in bogs? *Use the key below to identify if the wetland is a bog.* ***If you answer yes you will still need to rate the wetland based on its functions.*** 1. Does the unit have organic soil horizons (i.e. layers of organic soil), either peats or mucks, that compose 16 inches or more of the first 32 inches of the soil profile? (See Appendix B for a field key to identify organic soils)? Yes - go to Q. 3 No - go to Q. 2 2. Does the unit have organic soils, either peats or mucks that are less than 16 inches deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on a lake or pond? Yes - go to Q. 3 No - Is not a bog for purpose of rating 3. Does the unit have more than 70% cover of mosses at ground level, AND other plants, if present, consist of the "bog" species listed in Table 3 as a significant component of the vegetation (more than 30% of the total shrub and herbaceous cover consists of species in Table 3)? Yes – Is a bog for purpose of rating No - go to Q. 4 NOTE: If you are uncertain about the extent of mosses in the understory you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16" deep. If the pH is less than 5.0 and the "bog" plant species in Table 3 are present, the wetland is a bog. *1.* Is the unit forested (> 30% cover) with sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Englemann's spruce, or western white pine, WITH any of the species (or combination of species) on the bog species plant list in Table 3 as a significant component of the ground cover *(> 30% coverage of the total shrub/herbaceous cover)?* 2. YES = Category I No X Is not a bog for purpose of rating	**Cat. I**

Wetland name or number D

SC 4.0 Forested Wetlands ***(see p. 90)*** Does the wetland unit have at least 1 acre of forest that meet one of these criteria for the Department of Fish and Wildlife's forests as priority habitats? *If you answer yes you will still need to rate the wetland based on its functions.* — **Old-growth forests**: (west of Cascade crest) Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/acre (20 trees/hectare) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 inches (81 cm) or more. NOTE: The criterion for dbh is based on measurements for upland forests. Two-hundred year old trees in wetlands will often have a smaller dbh because their growth rates are often slower. The DFW criterion is and "OR" so old-growth forests do not necessarily have to have trees of this diameter. — **Mature forests**: (west of the Cascade Crest) Stands where the largest trees are 80 – 200 years old OR have average diameters (dbh) exceeding 21 inches (53cm); crown cover may be less that 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth. YES = Category I NO X not a forested wetland with special characteristics	**Cat. I**
SC 5.0 Wetlands in Coastal Lagoons ***(see p. 91)*** Does the wetland meet all of the following criteria of a wetland in a coastal lagoon? — The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks — The lagoon in which the wetland is located contains surface water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom)* YES = Go to SC 5.1 NO X not a wetland in a coastal lagoon SC 5.1 Does the wetland meets all of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of invasive plant species (see list of invasive species on p. 74). — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland is larger than 1/10 acre (4350 square feet) YES = Category I NO = Category II	**Cat. I** **Cat. II**

SC 6.0 Interdunal Wetlands *(see p. 93)*	
Is the wetland unit west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? YES - go to SC 6.1 NO X not an interdunal wetland for rating ***If you answer yes you will still need to rate the wetland based on its functions.*** In practical terms that means the following geographic areas: • Long Beach Peninsula- lands west of SR 103 • Grayland-Westport- lands west of SR 105 • Ocean Shores-Copalis- lands west of SR 115 and SR 109 SC 6.1 Is the wetland one acre or larger, or is it in a mosaic of wetlands that is once acre or larger? YES = Category II NO – go to SC 6.2 SC 6.2 Is the unit between 0.1 and 1 acre, or is it in a mosaic of wetlands that is between 0.1 and 1 acre? YES = Category III	**Cat. II** **Cat. III**
Category of wetland based on Special Characteristics *Choose the "highest" rating if wetland falls into several categories, and record on p. 1.* If you answered NO for all types enter "Not Applicable" on p.1	N/A