CLEANUP ACTION PLAN
CORNWALL AVENUE LANDFILL
BELLINGHAM, WASHINGTON

Prepared by

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LIST OF ABBREVIATIONS AND ACRONYMS

ARARs	applicable or relevant and appropriate requirements
BBP	butylbenzylphthalate
BEP	bis(2-Ethylhexyl)phthalate
BNSF	BNSF Railway Company
BSAF	biota-sediment accumulation factor
CFR	Code of Federal Regulations
City	City of Bellingham
CL	cleanup level
cm	centimeter
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CSL	Cleanup Screening Level
DCA	Disproportionate Cost Analysis
CAP	Draft Cleanup Action Plan
DNR	Washington State Department of Natural Resources
Ecology	Washington State Department of Ecology
ESA	Endangered Species Act
ENR	Enhanced Natural Recovery
IHS	Indicator Hazardous Substance
IPA	interim placement area
ft	foot
FS	Feasibility Study
GP	Georgia Pacific
LFG	landfill gas
MU	Management Unit
µg/kg-dw	micrograms per kilogram dry weight
MFS	Minimum Functional Standards
MNR	Monitored Natural Recovery
MTCA	Model Toxics Control Act
NWCAA	Northwest Clean Air Authority
PAH	polycyclic aromatic hydrocarbon
PBT	persistent bioaccumulative toxin
PCB	polychlorinated biphenyl
PLP	Potentially Liable Party
Port	Port of Bellingham
PQL	practical quantitation limit
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study report
RCW	Revised Code of Washington
SCO	Sediment Cleanup Objectives
SCUM	Sediment Cleanup Users Manual
Site	Cornwall Avenue Landfill Site
SMS	Sediment Management Standards
SVOC	semivolatile organic compound
TEQ	toxicity equivalency
VOC	volatile organic compound
WAC	Washington Administrative Code
yd^3	cubic yard

1.0 INTRODUCTION AND SITE BACKGROUND

This cleanup action plan (CAP) describes the cleanup action selected by the Washington State Department of Ecology (Ecology) for the Cornwall Avenue Landfill site (Site). The CAP is based on a Remedial Investigation/Feasibility Study (RI/FS, Landau Associates 2013) prepared in accordance with an agreed order between Ecology and other parties as follows:

Site Name:	Cornwall Avenue Landfill
Site Location:	South end of Cornwall Avenue, Bellingham, WA
Facility Site Identification No.:	2913
Agreed Order No.:	1778
Effective Date of Order:	February 10, 2005
Parties to the Order:	Ecology, City of Bellingham, Port of Bellingham
Current Property Owner:	City of Bellingham, Washington State

The Site is being cleaned up under the authority of the Model Toxics Control Act (MTCA), Chapter 70.105D of the Revised Code of Washington (RCW), and the MTCA Cleanup Regulation, Chapter 173-340 of the Washington Administrative Code (WAC). The Site cleanup action will be conducted under a consent decree between Ecology, the Port of Bellingham (Port), the City of Bellingham (City), and the Washington State Department of Natural Resources (DNR). The Port, City, and DNR have been identified as potentially liable parties (PLPs) for the Site.

In December 2013, the Port and City completed the RI/FS for the Site in accordance with the referenced Agreed Order. The RI/FS identified a preferred cleanup action, which is the basis for the cleanup action presented in this CAP. As specified in WAC 173-340-380, this CAP:

- Identifies Site cleanup standards
- Describes the selected cleanup action
- Summarizes the rationale for selecting the cleanup alternative for the Site
- Briefly summarizes other cleanup action alternatives evaluated in the RI/FS (Landau Associates 2013)
- Identifies institutional controls required as part of the cleanup action, if applicable
- Identifies applicable state and federal laws
- Provides the schedule for implementation of the cleanup action
- Specifies the types, levels, and amounts of hazardous substances remaining on site, and the measures that will be used to prevent migration and contact with those substances.

The Site has been subdivided into three Management Units (MUs), which are discussed in Section 4.0. This CAP addresses MU-1 and MU-2. MU-3, the outermost MU in the aquatic portion of the Site, will be addressed following the establishment of regional background concentrations for Persistent Bioaccumulative Toxins (PBTs) in marine sediment, and the CAP will be amended at that time to address MU-3.

1.1 SITE LOCATION AND DESCRIPTION

The Site is located south of downtown Bellingham, at the terminus of Cornwall Avenue, adjacent to Bellingham Bay. The Site is bordered to the east by an active rail line owned by BNSF Railway Company (BNSF), and to the north by the R.G. Haley site. The Site's location and current conditions are presented on Figures 1 and 2, respectively.

The Site extends across two separate properties, one owned by the City and the other consisting of Washington state lands administered by DNR, as shown on Figure 2 (Note: project north established as the northeastern Cornwall property line). Property-related references in the CAP use the following conventions:

- DNR property or state land: The upland and in-water area owned by the State of Washington seaward of the Inner Harbor Line.
- Cornwall property: The upland area formerly owned jointly by the Port and the City, and now owned solely by the City landward of the Inner Harbor Line.
- BNSF railway mainline: The upland area owned by BNSF.
- The Cornwall landfill, Cornwall Avenue Landfill, or the landfill: The area containing municipal refuse.

The Site is defined as the area containing refuse, the area containing wood waste within Cornwall property boundaries, the stabilized sediment piles imported as part of the interim action (see Section 1.4), and the adjoining areas impacted by hazardous substance releases from the refuse or wood waste (see Figure 3). The Site's boundaries are described more specifically as follows:

- West and South Site Boundary: These boundaries will be set when MU-3 is defined based on regional background concentrations in sediment, as further described in Section 4.1.
- North Site Boundary: This boundary is set at the northern limit of refuse or impacts from refuse. Where refuse is absent, this boundary is established at the northern Cornwall property line.
- East Site Boundary: This boundary is set at the eastern edge of the wood waste fill, which generally coincides with the eastern Cornwall property line (i.e., where it adjoins the BNSF railway mainline).

The portion of the Site addressed by this CAP (MU-1 and MU-2) is approximately 25.8 acres in size, including about 12.6 acres of aquatic lands (MU-2) and 13.2 acres of uplands (MU-1). The aquatic lands and approximately 8.4 acres of the uplands are owned by Washington State and managed by DNR. The remaining 4.8 acres of the uplands are owned by the City. The inner harbor line represents the boundary

between City-owned land and state-owned land at the Site. Property to the north of the Site is also owned by the City, and is part of the R.G. Haley MTCA cleanup site[1]. BNSF owns the property east of the Site for the railway mainline.

Presently, the only significant features on the Site consist of a stormwater detention basin constructed in 2005 at the south end of the Site, and the interim placement areas (IPAs) located in the western portion of the Site that store stabilized sediment from the interim action conducted in 2011 and 2012 (see Section 1.4 and Figure 2). The Site is largely unpaved, with the exception of a section of asphalt road and discontinuous areas of unmaintained pavement in the northeastern portion of the Site.

1.2 ADJACENT PROPERTIES AND ASSOCIATED CLEANUP PROGRAMS

The R.G. Haley MTCA site is located adjacent and north of the Site. Releases from the R.G. Haley site appear to have impacted soil and ground water conditions in the northern portion of the Site, in an area referred to herein as the overlap area (see Figure 4). Additionally, refuse from the Site is present in the southwestern portion of the R.G. Haley site uplands. Additional overlap also appears to exist between the sites with respect to sediment contamination. The City is currently conducting an RI/FS for the R.G. Haley site to address contamination originating from past wood treating operations. Information from the City's investigation as to the environmental conditions in the overlap area was considered in the Site FS to ensure that the alternatives evaluated did not interfere with or preclude cleanup alternatives for the neighboring R.G. Haley site (Landau Associates 2013).

Another MTCA site, the Whatcom Waterway sediment cleanup site, borders the Site on the west in Bellingham Bay; the site overlaps the sediment portion of the Cornwall Site. The primary contaminant of concern at the Whatcom Waterway sediment cleanup site is mercury and the required cleanup remedy (under Consent Decree No. 07-2-02257-7) in the area of the Cornwall Site is monitored natural recovery (MNR). Monitoring is expected to begin following Phase I implementation of active cleanup measures in other areas of the Whatcom Waterway sediment cleanup site.

As discussed in the Site RI/FS (Landau Associates 2013), the proposed remedial action for the Site will be planned and conducted in coordination with both the R.G. Haley site and Whatcom Waterway cleanup activities (see Section 6.0). It is expected that coordination with these other site cleanups could result in changes to the cleanup remedy in the areas where the Cornwall site cleanup is applied. If substantial, these changes will require an amendment to the CD.

[1] The R.G. Haley RI/FS is currently under preparation. Finalization of the documentation is scheduled for late 2014.

1.3 SITE HISTORY AND BACKGROUND

Prior to its original development, the majority of the Site consisted of tide flats and subtidal areas of Bellingham Bay. A summary of Site history, including ownership, development, and use, is provided in Table 1. Municipal landfill operations occurred at the Site from 1954 to 1965. The landfill was covered with a soil layer of variable thickness, and the shoreline was protected by various phases of informal slope armoring consisting of a variety of rock boulders and broken concrete. Since that time, significant shoreline erosion has occurred, resulting in exposure of landfill refuse at the shoreline surface and release and redistribution of landfill refuse onto the adjacent aquatic area. The toe of the refuse fill slope extends out into Bellingham Bay to some distance beyond the shoreline.

1.4 INTERIM ACTION

In 2011 and 2012, an interim action was conducted at the Site. The interim action included the placement of about 47,500 cubic yards (yd^3) of stabilized, fine-grained sediment from a nearby Port dredging project on the landfill surface. The sediment was placed into two piles and covered with a scrim-reinforced liner to prevent stormwater infiltration. Stormwater runoff from the piles was directed to a series of new drainage ditches connected to an existing stormwater detention basin which discharges to the bay. The effect of this action was to significantly reduce the amount of rainwater infiltrating into the solid waste, and thus reduce the flow of contaminated ground water into Bellingham Bay. The interim action also provides low permeability material that can be used as part of a cleanup capping system. This material will be an integral part of the cleanup action for the Site, as described in Section 4.0.

1.5 ENVIRONMENTAL INVESTIGATIONS AND CONCLUSIONS

The Site RI/FS identified the following constituents of potential concern and associated media:

- Refuse and wood waste in upland "soil" and in aquatic portions of the Site
- Metals and semi-volatile organic compounds (SVOCs) in Site soil
- Metals and dioxins/furans in interim action sediment
- Metals, polychlorinated biphenyls (PCBs), fecal coliform, manganese, and ammonia in ground water
- Methane and possibly volatile organic compounds (VOCs) in soil gas
- Metals, PCBs, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), bis(2-ethylhexyl)phthalate (BEP), and butylbenzylphthalate (BBP) in sediment

The extent of the refuse and wood debris and the overlap area discussed previously associated with the R.G. Haley site are shown in Figure 4.

These constituents of potential concern were further evaluated as part of the Site RI/FS process to eliminate those which did not exceed applicable cleanup levels or were not otherwise representative of Site conditions. Those that remained from this elimination process were identified as Indicator Hazardous Substances (IHSs) for the Site. This CAP identifies Site IHSs and their associated media as follows:

- Refuse, wood waste, existing cover soils, and interim action imported dredged sediment in the upland portion of the Site
- Refuse and wood debris in the aquatic portion of the Site
- Manganese and ammonia in Site ground water
- Methane and possibly VOCs in soil gas
- Metals (cadmium, lead, copper, silver, zinc), PCBs, cPAHs, and BEP in sediment

Cleanup standards for these identified IHSs are discussed further in Section 2.0.

Petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), and semivolatile organic compounds (SVOCs) in the overlap area resulting from releases from the R.G. Haley site are not specifically addressed in this CAP. However, the cleanup action for the Site considered coordination of the cleanup activities for the two sites to ensure the selected Site cleanup action will not preclude future cleanup activities related to the R.G. Haley site releases (see Section 6.0).

2.0 CLEANUP STANDARDS

This section discusses Site cleanup standards for IHSs detected in affected Site media at concentrations above screening levels developed through the RI/FS process. These affected media include soil, ground water, and sediment. Cleanup standards consist of: 1) cleanup levels (CLs) defined by regulatory criteria that are adequately protective of human health and the environment and 2) the points of compliance at which the cleanup levels must be met.

2.1 CLEANUP LEVELS

2.1.1 SOIL

Because of its nature as a waste material and inherent heterogeneity, the refuse at the Site is presumed to be contaminated and was not characterized for soil quality for the purposes of the RI/FS. In addition, the existing Site cover soil and interim action sediment brought to the Site are also considered contaminated and were addressed in a similar manner as the refuse and wood waste in the FS. The selected cleanup action addresses the contaminated soil/refuse/wood waste/interim action sediment by isolating it from the environment. Isolation is defined herein as preventing direct contact and keeping surface water out of the fill. As a result, soil CLs protective of direct contact, leaching to ground water, and/or erosion have not been established.

2.1.2 GROUND WATER

Site ground water CLs are based on ground water discharge to surface water (Bellingham Bay). MTCA allows for the application of ground water cleanup criteria based only on the protection of adjacent surface water, if releases of hazardous substances occur to ground water that is determined to be nonpotable [WAC 173-340-720(2)], and if discharge to sediment or chemical volatilization are not pathways of concern. As discussed in the RI, Ecology has determined that Site ground water is non-potable (Landau Associates 2013). Discharge to sediment and chemical volatilization are also not pathways of concern for this Site because the primary contaminants in groundwater have low sediment toxicity (ammonia and manganese), and volatile chemicals, if present, will be captured in a landfill gas system. Therefore, ground water CLs protective of marine surface water are appropriate for the Site.

The ground water CLs for the Site are the most stringent of the following criteria adjusted to the practical quantitation limit (PQL) or background concentration (as appropriate): 1) federal (40 CFR 131.36) and state (i.e., MTCA) surface water criteria based on human consumption of fish, and 2) federal (40 CFR 131.36) and state (Chapter 173-201A WAC) acute and chronic water quality criteria. Based on the screening of detected constituents in ground water, manganese and ammonia were the only hazardous

substances carried forward as IHSs in ground water for the Site. The screening levels for manganese and ammonia were selected as the CLs, and are listed in Table 2.

2.1.3 SEDIMENT

The sediment CLs are based on the chemical criteria and Site-specific physical criteria for refuse and wood debris coverage considered protective of benthic organisms. Sediment CLs based on chemical criteria are established by Ecology's SMS (WAC 173-204, most recent rule update effective as of September 1, 2013). The SMS establishes a two-tiered framework for establishing the Sediment Cleanup Objective (SCO) and the Cleanup Screening Level (CSL). The CSL is used to identify sediment cleanup sites and is the maximum chemical concentration or level of biological effects allowed for a sediment CL (upper tier). The CSL is the higher of the regional background concentration, a risk-based level (10^{-5}), or the PQL. The SCO is the long-term sediment quality goal and is the lower end of the range of chemical concentrations or level of biological effects used to establish a sediment CL (lower tier). The SCO is the higher of the natural background concentration, a risk-based level (10^{-6}), or the PQL. Based on the screening of detected constituents in sediment in accordance with SMS, only certain metals (cadmium, lead, copper silver, zinc), cPAHs, PCBs, and Bis (e-ethylhexyl) phthalate were carried forward as IHSs for at the Site, as described in the following paragraphs. The sediment CLs for these IHSs are listed in Table 2.

The SMS screening criteria used to evaluate sediment data are considered protective of the direct contact pathway for both benthic species and human health. However, these criteria do not consider the bioaccumulative effects on humans and other higher trophic-level species. Based on the current SMS rule, compounds considered as persistent bioaccumulative toxins (PBTs) require the development of CLs that consider bioaccumulative effects if compounds are present at concentrations greater than the natural background concentrations.

Guidance for addressing PBTs in marine sediment is provided in the draft Sediment Cleanup Users Manual (SCUM) II (Ecology 2013). The draft SCUM II guidance is currently out for public review so guidance on developing CLs for PBTs may change in the future. As established under the current draft of SCUM II, CLs for PBTs can be based on the following:

- Natural background concentrations (WAC 173-340-200),
- The PQL for the PBT [WAC 173-204-560(3)(c)],
- Regional background concentrations, or
- A risk-based cleanup level based on the lowest of:
  - marine and freshwater benthic criteria (WAC 173-204-562 through 173-204-563),

- human health risk (10^{-6}) and Hazard Quotient ≤ 1 (for individual contaminants) [WAC 173-204-561(2)(a)],
- Ecological Risk Narrative (WAC 173-204-564), or
- Other state or federal regulations.

Draft values for natural background concentrations and PQLs for PBTs have been developed by Ecology and are included as part of the draft SCUM II guidance. Establishment of a Site-specific risk-based screening level would require determining a Site-specific biota-sediment accumulation factor (BSAF) based on bioaccumulation testing, which has not been conducted. Regional background concentrations for PBTs have not yet been developed by Ecology for the Site vicinity (i.e., Bellingham Bay), and will not be available before the Site CAP is finalized. Once regional background concentrations are established for PBTs, the Site CLs for PBTs in marine sediment will be modified if regional background concentrations are greater than the CLs established in this CAP, or if risk-based values are directly calculated. This modification is not expected to impact the use of a sediment cap as the remedy for MU-2. However, the revised sediment CLs will further inform the remedy selection for MU-3. Any revision of the CL's and the incorporation of the remedy for MU-3 will be addressed through amendments of the CAP and CD, and additional public comment sought pursuant to WAC 173-340-600(10)(e).

PBTs detected in Site sediment consist of lead, cadmium, PCBs, and cPAHs. Mercury is also a PBT detected in Site sediment, but elevated mercury concentrations in the Site vicinity appear to be related to releases from the Whatcom Waterway site, so mercury is not considered a Site IHS.

The PQL established for individual PCB Aroclors [i.e., 6 micrograms per kilogram dry weight (µg/kg-dw)] will be used as the CL for PCBs because the PQL is greater than the PCB natural background concentration. The natural background concentrations for cadmium and lead will be used as the CLs for these constituents because the natural background concentrations are higher than the PQLs. However, these CLs may be adjusted higher to an upper tier value if regional background concentrations for Bellingham Bay are established by Ecology at higher concentrations than natural background, or risk-based CLs are developed.

A natural background concentration of 16 µg/kg-dw has been established for cPAHs in sediment [based on the summation of the toxicity equivalency (TEQ)]. Because the natural background concentration is higher than three of the four median value PQLs available for the benzo(a)pyrene in Appendix F of the SCUM II guidance, the cPAH natural background will be used as the CL. However, the R.G. Haley site is a significant source of cPAHs to marine sediment in the Site vicinity, and appears to affect cPAH concentrations in Site surface sediment. The Site marine sediment CL for cPAHs will be revised to the R.G. Haley CL, once it is established, if the R.G. Haley CL is higher than the cPAH PQL.

CLs for the IHSs identified in Site sediment are presented in Table 2. In summary:

- CLs for the non-bioaccumulative contaminants (copper, silver, zinc, BEP) are based on protection of the benthic direct contact pathway
- CLs for the bioaccumulative contaminants (cadmium, lead, cPAHs, PCBs) are based on either natural background or the PQL. The bioaccumulative CLs may be adjusted in the future as regional background concentrations become available or if mutually agreed upon Site specific risk-based values are directly calculated.

Note that potential future adjustments to the sediment CLs for MU-3 would not change the thin layer cap remedy selected for the sediment portion of MU-2 (see Section 4.2.2.3). The MU-2 capping remedy provides for isolation and containment through thin layer capping and enhanced natural recovery as described below in Section 4.2.2.3. Thin layer capping is intended to attain cleanup levels at the point of compliance as soon as the cap is placed; therefore, the effectiveness of the selected MU-2 sediment remedy is independent of the actual numerical value of the cleanup level because it relies on capping. However, because thin layer capping aims to enhance and accelerate natural recovery, monitoring will be required to ensure cap performance and to document ongoing natural recovery.

The physical criteria for the sediment CLs consist of the following Site-specific criteria for refuse and wood debris in the aquatic environment that Ecology considers adequately protective of benthic organisms:

- No more than a 1 foot (ft) thickness of sediment where wood debris (e.g., sawdust or wood chips) constitutes greater than 50 percent of the sediment by volume
- No detectable refuse
- No less than 1 ft of clean sediment coverage over sediment that exceeds the above criteria for wood debris and refuse.

Additional testing (bioassays) will be conducted during design of the selected cleanup action to confirm the protectiveness of these criteria.

2.1.4 AIR

Air quality standards for the Site will be developed as additional data are gathered during design of the selected cleanup action. As noted in Section 4.2, a landfill gas (LFG) control system will be installed as part of the selected cleanup action. Any VOCs present in Site soil will be addressed by the LFG control system, which will eliminate this potential exposure pathway for the Site. LFG discharge

permitting requirements, as established under the Northwest Clean Air Authority (NWCAA) and MTCA standards for air quality, will have to be met as a compliance requirement for long-term management of the Site post cleanup action. Explosivity guidance, especially in relation to the potential presence and discharge of methane upon completion of the cleanup action, will also have to be considered in the development of LFG compliance monitoring requirements. Air quality cleanup standards for individual constituents in LFG may be incorporated into the long-term cleanup and compliance monitoring process if hazardous substances are detected in soil vapor during the design phase characterization activities at concentrations of concern.

2.2 POINTS OF COMPLIANCE

Points of compliance at which the CLs must be met for the affected media at the Site are discussed in the following sections.

2.2.1 SOIL

The point of compliance for soil, based on WAC 173-340-740(6), is throughout the Site. MTCA recognizes that for those cleanup actions that involve containment of hazardous substances, the soil cleanup levels will typically not be met throughout the Site [WAC 173-340-740(6)(f)]. However, MTCA also recognizes that such cleanup actions may still comply with cleanup standards. The determination of the adequacy of soil cleanup is based on the ability for the remedial action to comply with ground water cleanup standards for the Site, to meet performance standards designed to minimize human or environmental exposure, and to provide practicable treatment of affected soil. Performance standards to minimize human and environmental exposure to effected soil include institutional controls that limit activities that interfere with the protectiveness of the cleanup action, as well as compliance monitoring and periodic reviews to insure the long-term integrity of the containment system [WAC 173-340-740(6)(f)(i-vi)].

2.2.2 GROUND WATER

The point of compliance for ground water is typically throughout the Site when ground water is considered a potential source of potable drinking water. If ground water discharge to surface water represents the highest beneficial use, MTCA provides for a conditional point of compliance at the location of discharge of ground water to the surface water receiving body (i.e., the shoreline). The conditional point of compliance is acceptable under MTCA for properties abutting surface water if the conditions established under WAC 173-340-720(8)(d)(i) are satisfied. The Site meets the required MTCA conditions; therefore the downgradient edge of the Site, as close as technically possible to the point-of-

entry of ground water to Bellingham Bay, will be established as the point of compliance for Site ground water. The achievement of ground water CLs will be measured at the shoreline using a network of angled ground water monitoring wells screened within the vertical range of the intertidal zone, as described further in Section 4.0.

2.2.3 SEDIMENT

The point of compliance for sediment chemical criteria is the predominantly biologically active zone, which is considered the upper 12 centimeters (cm) of sediment in Bellingham Bay. The point of compliance for the physical criteria, as discussed in Section 2.1.3, is the upper 1 ft (30.5 cm).

2.2.4 AIR

The point of compliance for concentrations of contaminants in air (i.e., LFG) is ambient air throughout the Site.

3.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

In accordance with MTCA, cleanup actions conducted under MTCA must comply with applicable state and federal laws [WAC 173-340-710(1)]. MTCA defines applicable state and federal laws to include legally applicable requirements and those requirements that are relevant and appropriate (collectively referred to as the ARARs).

The primary ARARs for the Site are cleanup standards under the SMS and MTCA along with the CLs and procedures for implementation of a cleanup under MTCA. Other potential ARARs identified to date include those in the bulleted list below. During the cleanup design and permitting process, additional ARARs may be identified.

- Washington Chemical Contaminants and Water Quality Act and Washington Water Pollution Control Act and the following implementing regulations: Water Quality for Surface Waters (Chapter 173-201A WAC) and SMS (Chapter 173-204 WAC).
- Minimum Functional Standards (MFS) for Solid Waste Handling (Chapter 173-304 WAC): these regulations contain typical closure requirements that are relevant based on the waste disposal history of the Site.
- Resource Conservation and Recovery Act (RCRA) and Subtitle C regulations, to the extent that any hazardous wastes are discovered during the cleanup action. RCRA regulations may be applied in the overlap area with the R.G. Haley cleanup site for any listed wastes that are present related to R.G. Haley operations.
- Washington Hazardous Waste Management Act and Dangerous Waste Regulations, to the extent that any dangerous wastes are discovered during implementation of the cleanup action.
- Clean Water Act, with respect to water quality criteria for surface water (Bellingham Bay) and in-water work associated with dredging or sediment capping.
- Shoreline Management Act, with respect to construction activities during the cleanup action.
- Dredge and fill requirements under Code of Federal Regulations (CFR) 320-330 and Hydraulic Code Rules under Chapter 220-110 WAC.
- Endangered Species Act (ESA), due to listing of Puget Sound Chinook and the potential listing of Coastal/Puget Sound bull trout.
- Critical Areas Ordinance of the City of Bellingham (Bellingham Municipal Code Chapter 16.55 Critical Areas).
- NWCAA Regulation 300 for point source emissions.

The current refuse regulations, Criteria for Municipal Solid Waste Landfills (Chapter 173-351 WAC), were determined to not be an ARAR for the Site because the current solid waste regulations specifically reference the MFS as the applicable regulations for landfills that did not accept waste after October 9, 1991 [WAC 173-351-010(2)(b)].

MTCA, Water Quality Standards for Surface Waters, SMS, and the Clean Water Act were considered in the development of cleanup standards (see Section 2.0). RCRA Subtitle C and Dangerous

Waste Regulations are not expected to apply unless dangerous wastes are discovered or generated during implementation of the cleanup action; dangerous wastes are not known to be present at the Site. The Shoreline Management Act, dredge and fill requirements, and Hydraulic Code Rules may apply during the implementation of the selected cleanup action but did not directly influence the evaluation of the cleanup alternatives conducted in the RI/FS.

The MFS landfill closure requirements (Chapter 173-304 WAC) were considered during evaluation of the cleanup alternatives; WAC 173-304-407 identifies closure and post-closure requirements for landfills. These requirements include the following:

- The facility shall be closed in a manner that minimizes the need for further maintenance, and controls, minimizes, or eliminates threats to human health and the environment from post-closure escape of solid waste constituents, leachate, landfill gases, contaminated rainfall, or waste decomposition products to the ground, ground water, surface water, and the atmosphere.
- Post-closure activities include ground water monitoring; surface water monitoring; gas monitoring; and maintenance of the facility, facility structures, and monitoring systems for their intended use for a period of 20 years or as long as necessary for the facility to stabilize (i.e., little or no settlement, gas production, or leachate generation) and to protect human health and the environment; and until monitoring of ground water, surface water, and gases can be safely discontinued.

In accordance with MTCA, the cleanup action will be exempt from the procedural requirements of Chapters 70.94, 70.95, 70.105, 77.55, 90.48, and 90.58 RCW, and of any laws requiring or authorizing local government permits or approvals. However, the substantive requirements of such permits or approvals (WAC 173-340-520) must be met.

4.0 SELECTED CLEANUP ACTION

4.1 INTRODUCTION

This section discusses the cleanup action alternatives evaluated in the FS and the preferred alternative identified in the FS, and provides an overview of the selected cleanup action. The FS subdivided the Site into the Upland Unit and the Marine Unit. However, because the CLs for PBTs in marine sediment are subject to change depending on regional background studies, the Site boundary in the Marine Unit cannot be definitively established at this time. As a result, the Site cleanup action has been subdivided into three MUs consisting of the upland area (MU-1), the marine portion of the Site where active remediation is planned (MU-2), and the marine area where monitored natural recovery (MNR) was proposed in the FS (MU-3). The Site MUs are shown on Figure 3.

As previously stated, MU-1 and MU-2 are addressed by this CAP, but the cleanup action will not be selected for MU-3 until regional background concentrations for PBTs in marine sediment are established. MU-3 is presented in the description of the FS cleanup alternatives to provide a complete description of the FS alternatives, but only MU-1 and MU-2 are addressed in the selected cleanup action.

4.1.1 PREFERRED ALTERNATIVE SELECTION

Four cleanup action alternatives were evaluated in the Site FS. The cleanup alternatives evaluated included three containment remedies and one removal remedy. Alternative 1 included containment through installation of an upland low-permeability soil cap (MU-1), shoreline stabilization (MU-2), and subtidal MNR (MU-3). Alternative 2 included containment with an upland two-layer cap (MU-1), shoreline stabilization with a sand filter and a thin-layer sediment cap (MU-2), and MNR (MU-3). Alternative 3 included containment with an upland two-layer cap and upgradient ground water interception system (MU-1), shoreline stabilization with a sand filter and an engineered sediment cap (MU-2), and MNR (MU-3). Alternative 4 consisted of complete removal of impacted media associated with the Site. Each of the alternatives included long-term compliance monitoring, except Alternative 4 (complete removal). Compliance monitoring is used to confirm that the Site meets cleanup standards within the identified restoration time frame and to confirm that the Site continues to meet cleanup standards over time.

Alternative 2 was identified as the preferred alternative in the FS and is the selected cleanup action for the Site MU-1 and MU-2 (see Section 5.0 for the selection rationale).

4.1.2 AREAS SUBJECT TO CLEANUP

The selected cleanup action consists primarily of an upland cap with stormwater controls for MU-1, and shoreline protection/stabilization and in-water enhanced natural recover (ENR) with a thin layer sediment cap to accelerate natural recovery for MU-2. Figure 5 shows where these various features are expected to be applied, and Figure 6 shows them in cross section.

The area of the MU-1 subject to the cleanup action is well defined, and includes all of the area shown in green on Figure 3. The area of the MU-2 subject to the cleanup action is equally well defined for purposes of the CAP, and includes the shoreline protection/stabilization system and the sediment thin layer cap that extends to the outer extent of the refuse and wood debris related to Site releases.

4.1.3 CLEANUP ACTION OVERVIEW

For MU-1, the primary purposes of the upland cap with stormwater controls are to prevent direct contact with existing contaminated fill, and to keep surface water out of the contaminated fill. Standard construction methods and materials will be used to create this upper surface. Design details will be established in an Engineering Design Report (EDR), and construction plans and specifications will be developed on the basis of the EDR. The primary engineering criteria will be to achieve containment and isolation of affected soil, refuse and wood waste in perpetuity. Ecology has determined that the cleanup action in MU-1 complies with cleanup standards through containment, consistent with WAC 173-340-740(6)(f). Because the Cornwall Avenue Landfill and R.G. Haley sites partially overlap each other, it is expected that the construction plans for the overlap area will reflect the needs of both cleanups. For MU-2, the primary purpose of the shoreline protection/stabilization system is to prevent direct contact with contaminated fill (refuse, wood waste), and protect the existing shoreline from erosion. Oceanographic engineering will be needed to design a system capable of meeting these needs. Primary engineering criteria to be met for this aspect of the cleanup include isolation of the contaminated fill, and design of a system capable of resisting waves and currents.

Also for MU-2, the primary purposes of the thin layer sediment cap and associated ENR are to cover the underlying refuse/wood waste and provide an upper 12 centimeters of sediment protective of benthic species, aquatic species, and human health. The general plan, as depicted on Figures 5 and 6, is to place a cap of clean material from the edge of the shoreline stabilization system out to the edge of refuse/wood waste fill.

Habitat benefit and function will result from the cleanup action itself. Specific habitat related actions will be developed in coordination with permitting agencies.

4.2 DESCRIPTION OF THE SELECTED CLEANUP ACTION

4.2.1 MANAGEMENT UNIT 1

4.2.1.1 Low Permeability Capping System and Stormwater Control

A low-permeability capping system, comprised of the interim action sediment overlain by a scrim-reinforced polyethylene liner or equivalent material, will be installed throughout MU-1 as part of the cleanup action. The low-permeability capping system will provide containment of refuse and wood debris and reduce ground water recharge from stormwater at the Site, while the inclusion of the scrim-reinforced polyethylene or equivalent liner will further reduce infiltration and provide a more durable physical separation layer. Figures 5 and 6 present the area of coverage and a conceptual site profile of the capping system, respectively.

The actual details of the capping system, including layer thicknesses and materials, will be developed during the remedial design process. In general, the low-permeability containment capping system will include the following elements from ground surface to the depth of refuse and wood debris (see Figure 6):

- **Surface cover**: The surface of the MU-1 will consist of a layer of topsoil at least 1 ft thick, asphaltic pavement, or buildings, depending on Site use in a particular area. It is likely, under the current redevelopment plans, that the majority of the Site uplands surface cover would be topsoil vegetated to support property use as an open park (see Section 6.3). Paved areas will be limited and may include surface parking or paved sidewalks. Buildings will also be limited and may include small structures located at the Site to support potential park functions such as facilities maintenance or public restrooms.
- **Granular fill soil**: Clean fill soil will be imported and placed as needed to create adequate grades for stormwater surface drainage and future Site use. The amount of soil required to establish Site grades will be reduced through the use of the interim action sediment discussed in the previous bullet and Section 1.4.
- **Drainage layer:** A drainage layer will be located beneath the surface cover to provide drainage for water that infiltrates through topsoil or pavement. The drainage layer could be constructed from geocomposite materials or granular fill, as determined during the remedial design.
- **Scrim-reinforced polyethylene liner:** A scrim-reinforced polyethylene liner or equivalent liner material will be placed between the drainage layer and the underlying low-permeability soil layer to reduce infiltration and provide an additional layer of physical separation. The inclusion of the scrim-reinforced polyethylene (or equivalent) liner with the underlying low permeability soil (see next bullet) will result in a capping system that effectively eliminates infiltration.
- **Low permeability soil layer**: In areas not covered with buildings or pavement, an approximately two-foot thick layer of low-permeability soil will be installed beneath the scrim-reinforced liner to minimize stormwater infiltration into the underlying refuse and wood debris. The fine-grained interim action sediment stored at the Site as part of the

2011/2012 interim action will be used for this purpose. Additional low permeability soil may be imported for this purpose to achieve Site coverage, if necessary (see Section 1.4).

- **Gas control layer:** A gas control layer will be placed just below the low-permeability soil layer to provide a ventilation pathway for LFG and/or VOCs rising from the subsurface refuse and wood debris. This layer will be constructed from geocomposite materials or granular fill, as determined during the remedial design.

4.2.1.2 Stormwater Management System

The existing soil cover, low-permeability layer, and imported fill will be graded to provide adequate drainage and prevent stormwater ponding, and the surface cover will be re-vegetated where a soil capping system is used. These actions will significantly reduce surface water infiltration through improved stormwater interception and increased evapotranspiration from the vegetative cover. Stormwater management will consist of stormwater interception, treatment (as applicable), and conveyance to a surface water discharge to Bellingham Bay. Stormwater actions such as re-grading, lining of ditches and tight-line conveyance of stormwater will be made to intercept, convey, and discharge surface water that currently accumulates in ponds and ditches near the BNSF railroad tracks. The existing Site stormwater system will be decommissioned or rehabilitated as part of the redevelopment activities.

4.2.1.3 LFG Control

Based on the duration since the landfill's closure, it is expected that current LFG generation rates are minimal. However, placement of the low-permeability cap could result in the accumulation and possible migration of LFG. As a result, a LFG management system will be installed throughout the Site which provides for the collection of and passive ventilation of LFG and potentially other VOCs that may be in the soil gas. It is anticipated that LFG monitoring and generation-potential modeling will be conducted during the remedial design phase to evaluate LFG quality and whether active or passive gas control is needed to meet NWCAA guidelines and MTCA air quality standards. [WAC 173-340-350]

4.2.2 MANAGEMENT UNIT 2

4.2.2.1 Shoreline Stabilization

The cleanup action will include shoreline stabilization in the intertidal and shallow subtidal zone, as shown on Figures 5 and 6. Portions of the areas to be addressed by the cleanup action overlap with the R.G. Haley property. The manner in which cleanup for the two sites will be coordinated is discussed further in Section 6.0.

The shoreline stabilization system will be placed over the sand filter layer element described in Section 4.2.2.2 below. The shoreline stabilization system will prevent shoreline erosion, which could

cause exposure to, or possibly the migration of, refuse and wood debris at the shoreline. The system will be constructed throughout the intertidal zone and into the shallow subtidal zone to ensure that the stabilization system will remain stable under high-wave action during extreme low tides. In addition to the sand filter layer, the stabilization system will also serve as a cap and biotic barrier over the sediment that is most impacted by Site releases due to shoreline erosion resulting from wave action.

It is assumed for conceptual design purposes that the shoreline stabilization system will consist of gravel and riprap approximately 3 ft thick, with a nominal 6-inch layer of gravel placed over the revetment rock to fill the rock interstices and enhance the habitat value of the stabilization system. However, additional engineering analysis of the stabilization system thickness, gradation, and elevation limits will be required during remedial design to ensure that the system will provide adequate protection from significant wave action during winter storms to effectively contain the sand filter layer and the underlying refuse and wood debris.

The stabilization system will be designed to balance the need for the rock size to be large enough to resist detachment from wave action while also meeting federal in-water permitting requirements. The use of soft bank technologies to enhance aquatic habitat will be considered during remedial design, particularly at the southern end of the Site where the shoreline is partially protected from winter storms. The use of soft bank technologies in this area could minimize the loss of eelgrass habitat and better support its re-establishment following construction.

4.2.2.2 Sand Filter Treatment Layer

A sand filter treatment layer will be installed along the shoreline and beneath the shoreline stabilization layer to provide filtration for ground water discharging to Bellingham Bay. The actual thickness, composition and gradation of the filter layer will be determined during remedial design, however for conceptual design purposes, the sand filter layer is assumed to consist of approximately 1 ft of clean, well-graded sand placed on the intertidal slope as a filtration layer beneath the shoreline stabilization system (discussed in Section 4.2.2). A non-woven geotextile layer will be placed atop the sand filter layer to provide separation between the sand filter and the overlying stabilization material to ensure that the filter media is not eroded through the large stabilization media pore spaces (see Figure 6).

The sand filter treatment layer will provide:

- Filtering of the ground water prior to entering Bellingham Bay to reduce suspended particles
- Increased hydrodynamic dispersion near the ground water/surface water interface by providing a higher permeability and more heterogeneous media for mixing of ground water and surface water
- Enhanced aeration of ground water prior to entry into surface water by increasing the intermixing of oxygen-rich surface water with the ground water.

Based on the ground water quality data and the anticipated effectiveness of the MU-1 low-permeability cap, a relatively thin and highly-permeable granular filter layer should be adequate to achieve cleanup standards (Section 2.0). Additionally, the ground water compliance monitoring system will be integrated into the sand filter treatment layer to provide more representative samples of ground water at the ground water/surface water interface (see Figure 6). A detailed compliance monitoring plan will be developed as part of remedial design. The compliance monitoring plan will present the locations of monitoring wells, and establish monitoring frequency, location-specific analytes, and analytical methods.

4.2.2.3 Thin Layer Cap

To meet the chemical cleanup standards and sediment physical criteria in the subtidal zone, the cleanup action will include constructing a thin layer sand cap over the area shown on Figures 5 and 6. The thin layer sand cap will extend from the boundary of the shoreline stabilization system to the outer limit of the extent of refuse and wood debris.

The purpose of a thin layer cap is primarily to accelerate and enhance natural recovery rather than to provide a stable, engineered cap that will isolate contaminated sediment from overlying biological activity and other natural or anthropogenic activities that could expose contaminated sediment to the predominantly biologically active zone (top 12 cm). The thin layer cap will consist of a nominal thickness of 6 inches of clean sand. In combination with the shoreline stabilization system, the thin layer cap will cap about 11.6 acres of intertidal and subtidal aquatic lands.

Similar to shoreline stabilization, subtidal capping will need to be coordinated with implementation of the R.G. Haley cleanup. Sediment dredging, if selected as a component of the RG Haley cleanup, will need to be implemented in advance of Site subtidal capping (see Section 6.0 for further discussion of the required coordination).

4.2.2.4 Enhanced Natural Recovery

The cleanup action for the MU-2 includes ENR in the area of the thin layer cap. Natural recovery in marine sediment primarily occurs through the natural deposition of clean sediment over contaminated sediment. Natural recovery in conjunction with the thin layer cap is expected to create a thick layer of clean sediment over MU-2. Sediment deposition meeting the sediment physical criteria (1 ft accumulation of clean sediment) has already occurred over approximately 5.8 acres of the deep subtidal portion of the Site), and sediment accumulation at other locations in Bellingham Bay support the conclusion that natural recovery is occurring throughout Bellingham Bay (Landau Associates 2013).

4.3 INSTITUTIONAL CONTROLS

Institutional controls will apply to MU-1 and MU-2. These controls will include a detailed Institutional Control Plan (i.e., operations and maintenance plan) and an environmental covenant(s). The environmental covenant(s) will be filed as a deed restriction(s) with Whatcom County, will be binding on the owner's successors and assignees, and will impose limits on property conveyance. The Institutional Control Plan will be part of the Environmental Covenant(s) [WAC 173-340-440(9) and RCW 64.70].

Environmental covenant provisions applicable to MU-1 prevent activities that could compromise the integrity of the cleanup action (i.e., containment system) or otherwise result in unacceptable risks to human health or the environment. The restrictive covenant will prevent the use of ground water for potable purposes and will place restrictions and management requirements on intrusive activities that could result in releases of hazardous substances or exposure of construction workers to contaminated media.

Environmental covenant provisions applicable to MU-2 will prevent damage to the shoreline stabilization system and the thin layer cap. Institutional controls will include prohibitions on activities that could damage or breach the shoreline stabilization system. Additionally, vessel activity within MU-2 will likely need to be managed to prevent damage by boat prop wash, anchoring, or similar activities to the shoreline stabilization system and the thin layer cap.

The Institutional Controls Plan will outline long-term care and maintenance of the elements comprising the cleanup action, establish protocols for disruptions to the cleanup action system, provide for record keeping and reporting, develop contingency measures for addressing extraordinary events (e.g., flooding due to extreme storm events), and describe any other activities necessary to maintain protection of human health and the environment.

4.4 TYPES, LEVELS, AND AMOUNTS OF HAZARDOUS SUBSTANCES TO REMAIN-IN-PLACE

The extent of exposed refuse in the MU-1 was evaluated during the investigations conducted to support the RI/FS. The extent of *in situ* landfill refuse and wood waste in MU-1 was estimated from the interpretation of boring logs and test pits (Landau Associates 2013). Based on the estimated areal extent and thickness of refuse, the total volume of refuse in MU-1 is estimated to be about 215,000 yd^3. Approximately 80,000 yd^3 of refuse is estimated to be present within MU-2. The total volume of wood waste in MU-1 is estimated to be about 94,000 yd^3. The volume of wood waste within MU-2 was not estimated because data regarding wood waste thickness in this area are limited and the difficulty in

differentiating between wood waste originating from Site releases and other sources in the marine environment.

Based on these estimates, the total volume of waste at the Site is estimated to be about 390,000 yd^3 of combined refuse and wood waste, plus whatever volume of wood waste is present in MU-2. Because the cleanup action relies on containment, this volume of refuse and wood waste will remain in-place following implementation of the cleanup action.

4.5 RESTORATION TIME FRAME

The restoration time frame for the cleanup action following finalization of the CAP is expected to be as follows:

- 2-3 years: Complete upland soil isolation, landfill gas protection, storm water drainage improvements
- 2-3 years: Complete shoreline protection system
- 2-3 years: Achieve sediment cleanup standards in MU-2
- 3-4 years: Achieve ground water cleanup standards

5.0 RATIONALE FOR SELECTING THE CLEANUP ACTION

The four cleanup alternatives presented in the FS were evaluated with respect to their ability to adequately achieve compliance with MTCA threshold criteria [WAC 173-340-360(2)(a)], including each alternative's ability to protect human health and the environment, comply with cleanup standards, comply with state and federal laws, and provide for compliance monitoring. Compliance with these requirements under MTCA (and SMS) is presumed by definition to be protective of human health and the environment and in compliance with applicable state and federal laws once cleanup standards have been met. The alternatives were further evaluated for their ability to satisfy these threshold criteria within a reasonable time frame [WAC 173-340-360(2)(b)(ii) and WAC 173-340-360(4)] and achieve the remedial action objectives (RAOs) identified for the Site. All four alternatives were determined to meet these requirements.

MTCA provides for the costs and benefits associated with alternatives to be evaluated through a disproportionate cost analysis (DCA), which compares the relative environmental benefits of each alternative against the most permanent alternative. Costs are disproportionate to benefits if the incremental cost of the most permanent alternative exceeds the incremental degree of benefits achieved over the lower cost alternative [WAC 173-340-360(3)(e)(i)]. Alternatives that exhibit disproportionate costs are considered "impracticable", and that alternative is eliminated from further consideration. The six evaluation criteria for the DCA are:

- Protectiveness
- Permanence
- Long-term effectiveness
- Short-term risk management
- Implementability
- Considerations of public concerns

Based on the results of the DCA, Alternative 2 was determined to be permanent to the maximum extent practicable. More detailed information on the alternative evaluation and the DCA process is included in the Site RI/FS (Landau Associates 2013).

The selected cleanup action complies with the provisions of WAC 173-340-360. It will be protective of human health and the environment, comply with cleanup standards and applicable state and federal laws, and provide for compliance monitoring. Refuse, wood waste, soil, and sediment with hazardous substance concentrations that exceed CLs will be contained. Institutional controls will provide notification regarding the presence of residual contaminated soils, regulate the disturbance/management of those soils/sediment and the cleanup action components, and provide for long-term monitoring and

stewardship of the cleanup action. As discussed above, the selected cleanup action is also considered to use permanent solutions to the maximum extent practicable, and to provide for a reasonable restoration time frame.

6.0 COMPATIBILITY WITH ADJACENT CLEANUP ACTIONS AND SITE REDEVELOPMENT

Effective implementation and compliance of the cleanup action for the Site will be coordinated with ongoing and planned cleanup actions at neighboring sites and with the longer-term redevelopment strategy the Site's vicinity. An overview of the elements involved in this coordination is provided in the following sections. Should coordination substantially change the cleanup action at this Site, the CAP and CD will be amended.

6.1 WHATCOM WATERWAY

The cleanup action for the Site has some overlap with the Whatcom Waterway site within MU-2. Because the selected remedy for the Whatcom Waterway cleanup site is MNR in the Site vicinity (under Consent Decree No. 07-2-02257-7), the select cleanup action for the area of overlap (MU-2) is compatible. Cleanup in MU-2 will include a thin layer sand cap and ENR, and as such, will not interfere with the Whatcom Waterway site and will result in a shorter restoration timeframe in the area where capping will be conducted.

6.2 R.G. HALEY CLEANUP ACTION

As mentioned previously, the R.G. Haley site is located at the northern end of the Site and some overlap exists between the two sites. Because of this overlap the cleanup actions implemented at the two sites will be coordinated to ensure successful remediation and long-term performance/compliance for both sites.

Although a final cleanup action has not yet been selected for the R.G. Haley site, it is anticipated that each site could utilize similar remedial technologies within much of the overlap area, including upland containment, stormwater management, shoreline erosion protection, and other engineering and institutional controls. Other cleanup actions such as ground water extraction, soil excavation/consolidation, and/or sediment dredging will require proactive coordination and the potential phasing of the separate cleanup actions. Site remedial design will identify specific cleanup components that will require coordination, however examples of possible cleanup elements in the overlap area that will likely require coordination and/or sequencing include:

- Source control measures at the R.G. Haley site (including surface water management) will need to be completed before or in conjunction with the installation of the sand filter, shoreline erosion controls, and the thin layer sediment cap associated with the Site's cleanup action.
- Potential sediment dredging/removal linked to the final cleanup action for the R.G. Haley site will also need to be coordinated with placement of the sand filter, shoreline stabilization

system, and the thin layer sediment cap (especially with respect to how it may affect impacted sediment at the northern end of the Site's MU-2).

- Potential sediment capping methods (i.e., use of cap amendments for contaminant attenuation) that may be part of the final cleanup action for the R.G. Haley site will need to be coordinated with Site cleanup actions in MU-2. In particular, the remedies in the overlap area may differ between the two sites and will require design coordination and integration.
- The R.G. Haley site's ground water remediation strategy may need to be implemented in the overlap area at the north end of the Site prior to final construction of the Site's MU-1 containment system in this area.

6.3 SITE REDEVELOPMENT

The property associated with the Site is located at the southern boundary of the Waterfront District redevelopment area and the Site is included in the planning for redevelopment as a public park and open space. Development of the park could include construction of buildings where indoor air quality will need to be considered. Redevelopment may also include roadways, parking lots, and areas of vegetation whose design and construction will need to be integrated with the containment element (i.e., capping) of the selected cleanup action.

Redevelopment is still in the planning stages, and detailed design and construction of the selected Site cleanup action may or may not be performed concurrently with the design and construction of redevelopment components.

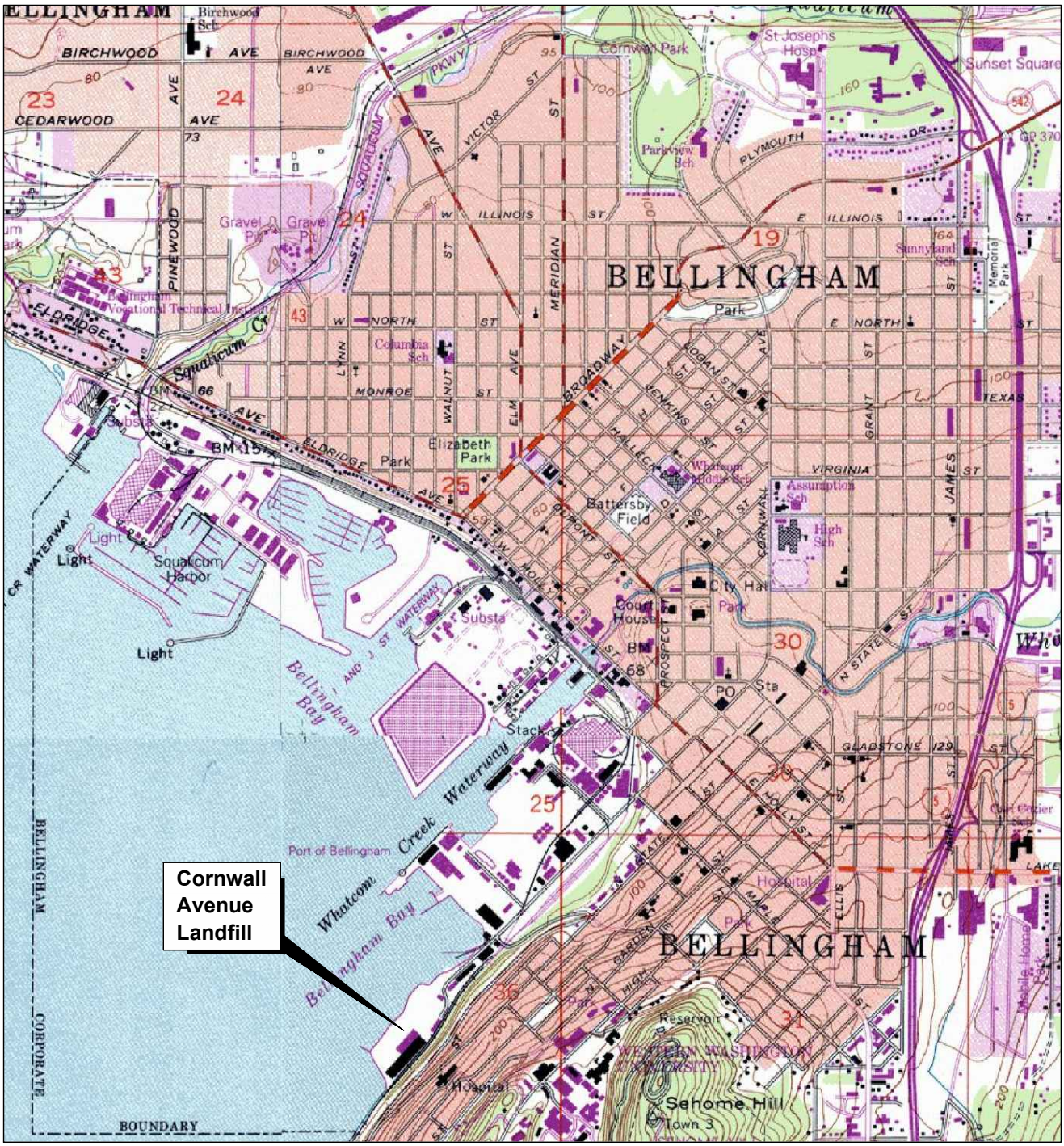
7.0 CLEANUP ACTION SCHEDULE

The CD, Exhibit C, provides a Schedule of Work and Deliverables, which identifies the schedule for submitting design and construction documents to Ecology for review and approval. One of the first deliverables following entry of the CD with the court will be a detailed project schedule that identifies project deliverables and other major project elements through the design and construction of the cleanup action. Because many of the project deliverables and other project milestones are contingent on the completion, review, and approval of preceding project tasks, the project schedule will be a living document that will require periodic updating throughout the project.

8.0 REFERENCES

Ecology. 2013. *Draft Sediment Cleanup Users Manual II, Guidance for Implementing the Sediment Management Standards, Chapter 173-204 WAC.* Washington State Department of Ecology Publication No. 12-09-057. December.

Landau Associates. 2013. *FINAL Remedial Investigation/Feasibility Study, Cornwall Avenue Landfill, Bellingham, Washington.* Prepared for the Port of Bellingham. December 17.

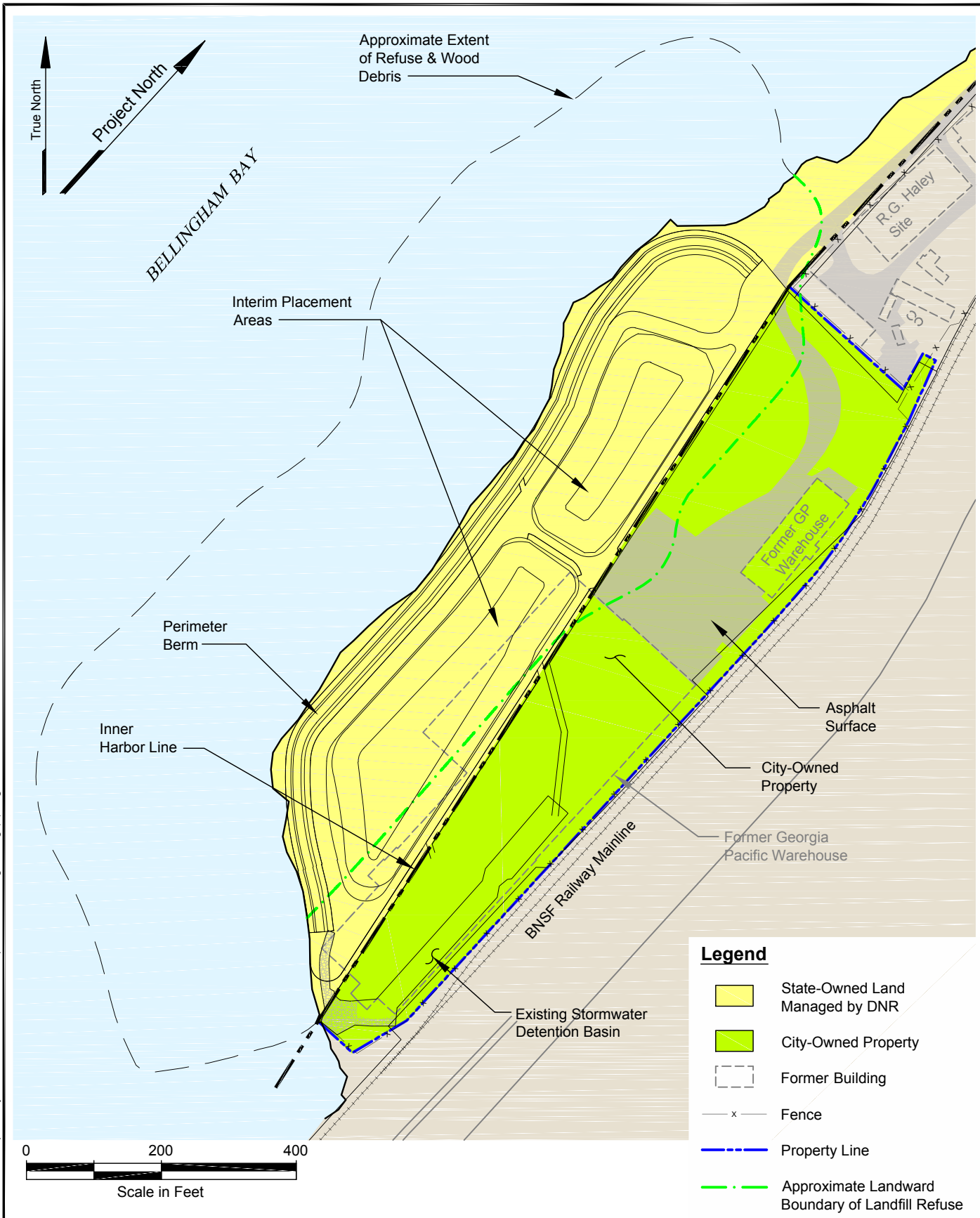


Map from DeLorme Street Atlas USA 2002

Port of Bellingham \ Cornwall Avenue Landfill \ RI/FS | G:\Projects\001\020\400\530\Cleanup Action Plan\Fig 01.dwg (A) "Figure 1" 5/12/2014

LANDAU ASSOCIATES

Cornwall Avenue Landfill Bellingham, Washington	**Vicinity Map**	Figure 1



Basemap source: Port of Bellingham 1996, Anchor Environmental 2008

Landau Associates, Inc. | G:\Projects\001\020\400\530\Cleanup Action Plan\Fig 02.dwg (A) "Figure 2" 5/20/2014

LANDAU ASSOCIATES

Cornwall Avenue Landfill
Bellingham, Washington

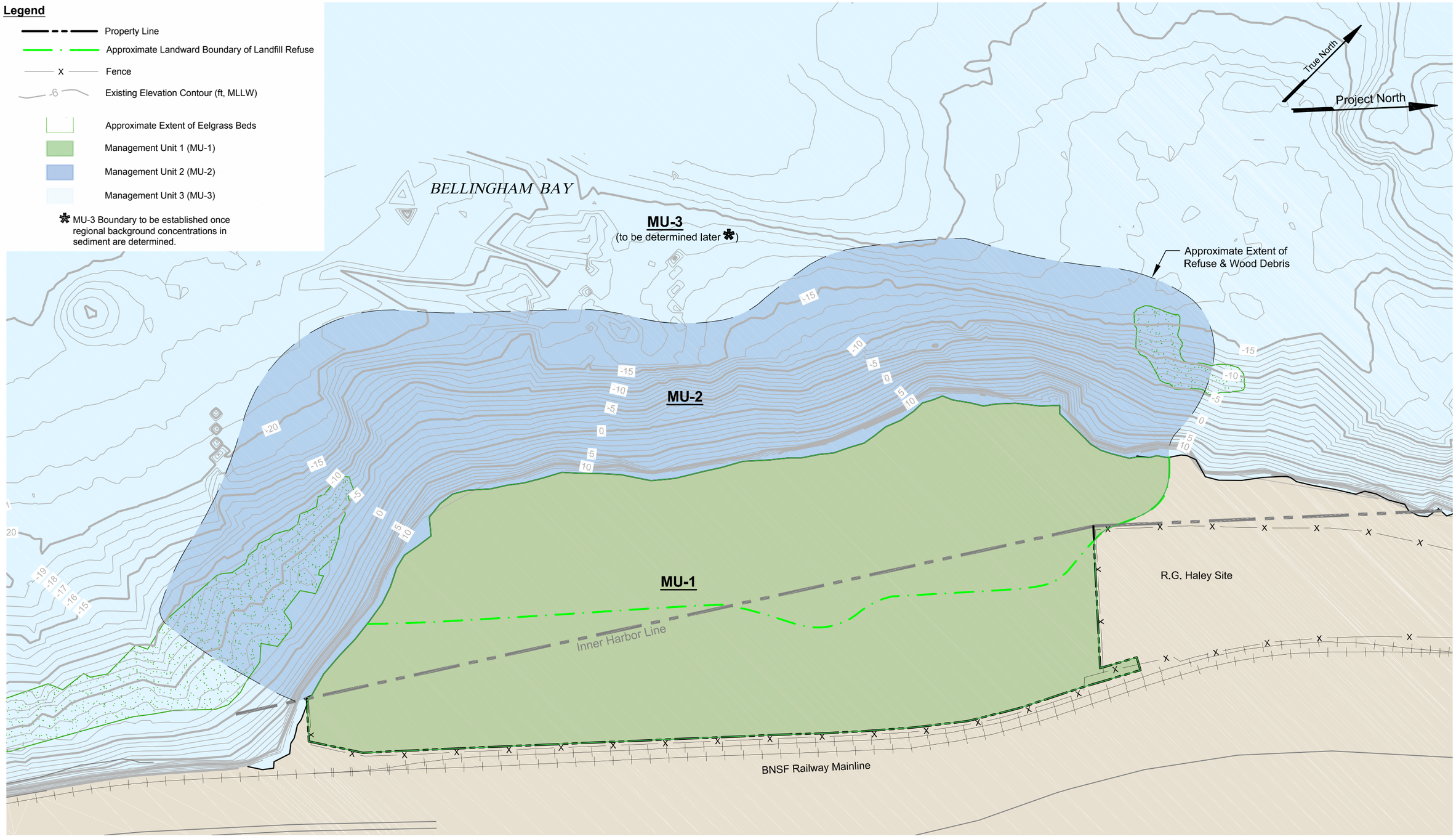
Property Conditions

Figure
2

Legend

- Property Line
- Approximate Landward Boundary of Landfill Refuse
- Fence
- Existing Elevation Contour (ft, MLLW)
- Approximate Extent of Eelgrass Beds
- Management Unit 1 (MU-1)
- Management Unit 2 (MU-2)
- Management Unit 3 (MU-3)

* MU-3 Boundary to be established once regional background concentrations in sediment are determined.



Basemap source: Port of Bellingham 1996, Anchor Environmental 2008

0 150 300

Scale in Feet

LANDAU ASSOCIATES

Cornwall Avenue Landfill Bellingham, Washington	**Site Management Units**	Figure 3

Legend

- Property Line
- Approximate Landward Boundary of Landfill Refuse
- Fence
- Existing Elevation Contour (ft, MLLW)
- Former Building
- Approximate Extent of Contamination Originating from the R.G. Haley Site Evidenced by Petroleum Sheen during the RI and Previous Investigations

BELLINGHAM BAY

True North

Project North

Approximate Extent of Refuse & Wood Debris

Inner Harbor Line

Existing Stormwater Detention Basin

BNSF Railway Mainline

R.G. Haley Site

Basemap source: Port of Bellingham 1996, Anchor Environmental 2008

0 150 300

Scale in Feet

LANDAU ASSOCIATES

Cornwall Avenue Landfill Bellingham, Washington	**Extent of Refuse/Wood Waste and Upland Overlap Area**	Figure 4

Landau Associates, Inc. | G:\Projects\001\020\400\530\Cleanup Action Plan\Fig 04.dwg (A) "Figure 4" 5/20/2014

Legend

- Property Line
- Approximate Landward Boundary of Landfill Refuse
- X Fence
- -6 Existing Elevation Contour (ft, MLLW)
- Approximate Extent of Eelgrass Beds
- (MU-2) Management Unit
- (MU-1) Low Permeability Cap
  - Cap to be installed over the entire Upland Site Unit. The cap will integrate LFG control and be graded to facilitate drainage. Stormwater and erosion controls will be integrated to reduce infiltration and protect the integrity of the cap.
- (MU-2) Shoreline Stabilization System
- Includes Sand Filter in the Intertidal Zone
- (MU-2) Thin Layer Sediment Cap

BELLINGHAM BAY

MU-3

True North

Project North

Approximate Extent of Refuse & Wood Debris

Thin Layer Sediment Cap (MU-2)

Deep Subtidal Zone

Shallow Subtidal Zone

Intertidal Zone

Shoreline Stabilization System (MU-2)

Low-Permeability Cap with Scrim-Reinforced Liner (MU-1)

Inner Harbor Line

Extreme Low Water

R.G. Haley Site

BNSF Railway Mainline

Improve Drainage Near BNSF Railway to Reduce Infiltration

Basemap source: Port of Bellingham 1996, Anchor Environmental 2008

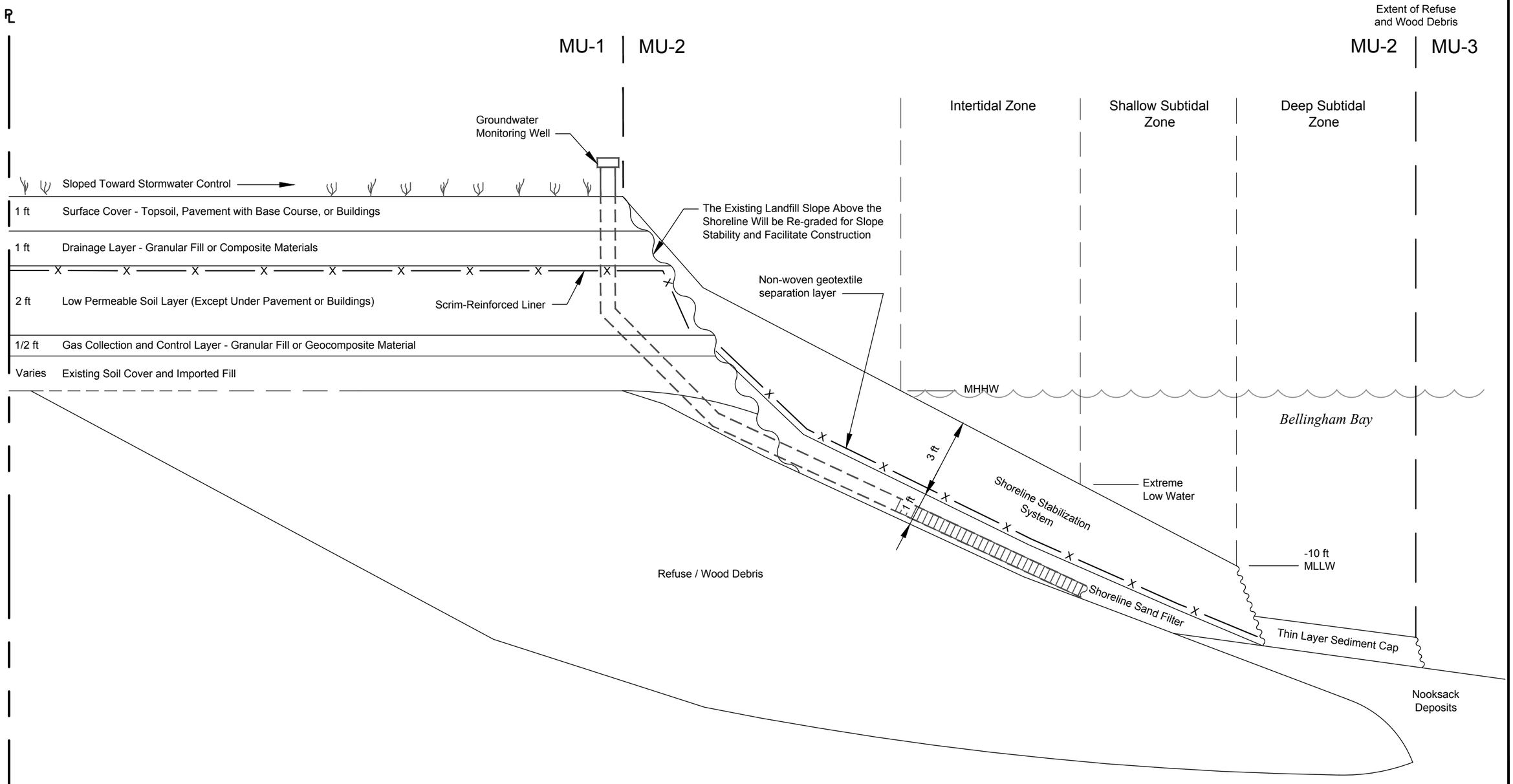
0 150 300

Scale in Feet

LANDAU ASSOCIATES

Cornwall Avenue Landfill Bellingham, Washington	**Selected Cleanup Action Conceptual Site Plan**	Figure 5

Landau Associates, Inc. | G:\Projects\001\020\400\530\Cleanup Action Plan\Fig 05 (No RG).dwg (A) "Figure 5" 5/20/2014



Note

1. The profiles presented on this figure provide conceptual-level design details. The final selection of materials, layer thickness, and details for transitioning between zones will be determined during the remedial design process.

Not to Scale

Cornwall Avenue Landfill Bellingham, Washington	**Selected Cleanup Action Conceptual Site Profile**	Figure 6

LANDAU ASSOCIATES

TABLE 1
SITE HISTORY
CORNWALL AVENUE LANDFILL SITE
BELLINGHAM, WASHINGTON

Year	Owner	Historical Activity/Operations
1888-1946		Sawmill, log storage, wood debris disposal
1946-1965	Port of Bellingham (lease holder on state-owned portion)	See below
1954-1962	City of Bellingham (sublease on state-owned portion from Port)	Refuse disposal
1962-1965	American Fabricators (sublease on state-owned portion from Port)	Refuse disposal (leased land to the City for an extension of the landfill; landfill was closed in 1965)
1971-1985	Georgia Pacific West (leaseholder, including sublease on state-owned portion from Port)	
1985	Georgia Pacific West	Purchased portion of the Site from the Port (“fee-owned portion”)
2005	Port of Bellingham	Repurchased “fee-owned portion” from Georgia Pacific West
2005	City of Bellingham	Purchased an ownership interest in the “fee-owned portion” from the Port
2012	City of Bellingham	Acquired remaining “fee-owned portions” of the Site from the Port

TABLE 2
SITE CLEANUP LEVELS
CORNWALL AVENUE LANDFILL SITE
BELLINGHAM, WASHINGTON

Indicator Hazardous Substances	Sediment (mg/kg - dry)	Groundwater (mg/L)	Basis for Cleanup Level
Groundwater			
Manganese	---	0.1	Surface Water ARAR - Human Health – Marine – Clean Water Act §304
NH_3-Ammonia (mg NH_3/L)	---	0.035	Surface Water ARAR - Aquatic Life - Marine/Chronic - Ch. 173-201A WAC
Sediment			
PBT IHSs			
Cadmium	1	---	Natural background (a)
Lead	21	---	Natural background (a)
cPAHs	0.016	---	Natural background (a)
PCBs	0.006	---	PQL for individual PCB Aroclor
Other IHSs			
Copper	390	---	SMS, dry weight
Silver	6.1	---	SMS, dry weight
Zinc	410	---	SMS, dry weight
Bis(2-ethylhexyl)phthalate	47 (b)	---	SMS, carbon normalized value

cPAHs - carcinogenic polycyclic aromatic hydrocarbons
IHS - Indicator Hazardous Substance
PBT - persistent bioaccumulative toxin
PQL - Practical Quantitation Limit
SCO - Sediment Cleanup Objective
SCUM - Sediment Cleanup Users Manual
SMS - Sediment Management Standards
WAC - Washington Administrative Code

(a) Cleanup levels currently based on natural background values as established by Ecology in the revised Sediment Cleanup Users Manual (SCUM); however, final cleanup levels may be adjusted accordingly upon completion of the regional background concentration study for Bellingham Bay (currently in progress).

(b) Sediment cleanup level is based on carbon-normalized SMS SCO.