Work Plan
Pre-Design Characterization
Cornwall Avenue Landfill Site
Bellingham, Washington

April 30, 2015

LANDAU ASSOCIATES
130 2nd Avenue South
Edmonds, WA 98020
(425) 778-0907

Work Plan
Pre-Design Characterization
Cornwall Avenue Landfill Site
Bellingham, Washington

This document has been prepared under the supervision and direction of the following key staff.

LANDAU ASSOCIATES, INC.

Kent Wiken, P.E.
Senior Associate Engineer

Lawrence D. Beard, P.E., L.G.
Principal

LDB/KWW/kes

TABLE OF CONTENTS

Page

FIGURES

APPENDICES

LIST OF ABBREVIATIONS AND ACRONYMS

BGS	Below Ground Surface
CAP	Cleanup Action Plan
City	City of Bellingham
cPAHs	Carcinogenic Polycyclic Aromatic Hydrocarbons
DGPS	differential global positioning system
DNR	Washington State Department of Natural Resources
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
ft	Feet
GP	Georgia Pacific
gpm	gallons per minute
GPS	global positioning system
IHS	Indicator Hazardous Substances
IPA	interim placement area
LFG	landfill gas
MHHW	mean higher high water
MHW	mean high water
MLLW	mean lower low water
MLW	mean low water
MNR	monitored natural recovery
MSL	mean sea level
MTCA	Model Toxics Control Act
MTL	mean tidal level
MU	Management Unit
PBT	Persistent Bioaccumulative Toxin
PCB	Polychlorinated Biphenyl
PID	Photoionization Detector
Port	Port of Bellingham
RCW	Revised Code of Washington
R.G. Haley site	R.G. Haley MTCA site
RI	Remedial Investigation
RTK	real time kinetic
SAP	Sampling and Analysis Plan
Site	Cornwall Avenue Landfill Site
SMS	Sediment Management Standards
TESC	Temporary Erosion and Sediment Control
USACE	U.S. Army Corps of Engineers
VOC	Volatile Organic Compound
WAC	Washington Administrative Code
WDFW	Washington Department of Fish & Wildlife
yd^3	cubic yard

This page intentionally left blank.

1.0 INTRODUCTION

In accordance with Consent Decree No. 14-2-02593-5, this document presents a Work Plan for implementation of investigation activities required for design of the final cleanup action at the Cornwall Avenue Landfill Site (Site) located in Bellingham, Washington (Figure 1). This Work Plan presents the scope for pre-design characterization activities, including a description of the proposed characterization activity and associated exploration locations and area of investigation. Additional details regarding investigation methods and procedures are presented in appendices to this Work Plan, including sampling and analysis plans (SAPs) for investigation elements for analytical and/or biological testing.

1.1 SITE BACKGROUND

Historically, the majority of the Site consisted of intertidal and subtidal areas of Bellingham Bay. From about 1888 to 1946, the Site was used for sawmill operations, including log storage and wood debris disposal. Between about 1946 and 1965, the Site was used for disposal of municipal and industrial refuse. Upon closure in 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. Significant shoreline erosion has occurred since closure of the landfill, which resulted in exposure of landfill refuse at the surface and redistribution of landfill refuse onto the adjacent beach area.

In an interim action conducted in 2011 and 2012, approximately 47,500 cubic yards (yd^3) of cement-stabilized, fine-grained sediment from the Gate 3 dredging project in Squalicum Outer Harbor was placed in covered interim placement areas (IPAs) on the landfill surface for future use as either contouring material or as part of the landfill capping system.

The R.G. Haley Model Toxics Control Act (MTCA) site (R.G. Haley 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 the area referred to herein as the “overlap area” (see Figure 2). Likewise, refuse from this Site is present in the southwestern portion of the R.G. Haley site uplands. Sediment contamination overlap also exists between these two sites.

The Whatcom Waterway sediment cleanup site – another MTCA site – is located adjacent and west of the Site in Bellingham Bay. The Whatcom Waterway sediment cleanup 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 related cleanup remedy (required by Consent Decree No. 07-2-02257-7) in the Cornwall Site area is monitored natural recovery (MNR). For the Whatcom Waterway sediment cleanup site, monitoring is expected to begin after the first phase of active cleanup measures are implemented (2015-2016). 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 (Ecology 2014; Landau Associates 2013). Coordination with these other site cleanups could result in changes to the cleanup remedy in the areas where the Site cleanup is applied. If substantial, these changes may require an amendment to the Consent Decree.

1.2 REGULATORY REQUIREMENTS

The Site is being cleaned up under the authority of 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 will be conducted under Consent Decree No. 14-2-02593-5 between the Washington State Department of Ecology (Ecology), the Port of Bellingham (Port), the City of Bellingham (City), and the Washington State Department of Natural Resources (DNR).

1.3 SITE CLEANUP OVERVIEW

The remedial investigation/feasibility study (RI/FS) identified a preferred cleanup action, which is the basis for the corresponding Cleanup Action Plan (CAP) dated October 10, 2014. At that time, the Site was subdivided into three Management Units (MUs) as shown on Figure 2. The CAP addressed two of the three units (MU-1 and MU-2). The outermost unit in the aquatic portion of the Site (MU-3) will be addressed following the establishment of regional background concentrations for Persistent Bioaccumulative Toxins (PBTs) in marine sediment. Once this has been completed, the CAP will be amended to address MU-3.

In summary, the cleanup action will consist of:

1. Capping the MU-1 area, including:
    - Construction of a low-permeability capping system, comprised of the interim action sediment overlain by a polyethylene liner or equivalent material, will be installed throughout MU-1. The capping system will provide a more durable physical separation layer to contain refuse and wood debris, and reduce infiltration and groundwater recharge from stormwater.
    - Construction of a landfill gas (LFG) management system to provide for the collection and passive ventilation of any generated volatile organic compounds (VOCs) or LFG from the existing landfill.
    - Management of stormwater runoff by grading the existing soil cover, low-permeability layer, and imported fill to provide adequate drainage and prevent stormwater ponding.
2. Protection of the MU-2 area, including:
    - Construction of a shoreline stabilization system using gravel and riprap approximately 3 ft thick, with a nominal 6-inch-thick layer of gravel placed over the rock to enhance the habitat value. The rock sizing and the use of a soft-bank technology cap under predicted

wave action will be part of the design to prevent exposure and migration of refuse and wood debris at the shoreline.

- A sand filter treatment layer will be installed beneath the shoreline stabilization layer to additionally serve as a cap and biotic barrier over the sediment, but primarily to provide filtration of groundwater that is discharging to Bellingham Bay.
- Construction of a thin layer sand cap (consisting of a nominal thickness of 6 inches of clean sand) which will extend from the boundary of the shoreline stabilization system to the outer limit of the extent of refuse and wood debris.

The property associated with the Site is located at the southern boundary of the Waterfront District subarea and the Site is planned for redevelopment as a public park and open space. It is anticipated that the cleanup action work described above will be constructed such that a City park can eventually be constructed on the Site without compromising the integrity of the cleanup action.

2.0 PRE-DESIGN CHARACTERIZATION

A number of pre-design characterization activities are required to provide the data and other information needed to design the final cleanup action for the Site. The proposed pre-design characterization activities include:

- Landfill gas monitoring and modeling
- Evaluation of existing stormwater drainage conditions
- Evaluation of the physical properties of the stabilized marine sediment material
- Evaluation of the refuse cover thickness and refuse surface elevation
- Land survey of the area boundaries, features, topography, and bathymetry
- Bioassay testing to evaluate the protectiveness of accumulated marine sediment cover over refuse and wood waste in the aquatic portion of the Site
- Evaluation of eelgrass extent and shoreline habitat conditions.

The following sections describe the activities proposed to address each of these activities.

2.1 LANDFILL GAS MODELING AND MONITORING

Preliminary estimates of LFG production indicate that a relatively small amount of gas is being produced at the landfill as the remaining portions of degradable waste are broken down. The final cleanup action will include a landfill cover system that incorporates LFG control to prevent the buildup of LFG beneath the cover, and additional elements, as needed, to reduce lateral migration. A computer model will be utilized to estimate the LFG production rate in order to design the collection system. A LFG model that provides an estimate of the total landfill gas production rate for the primary gases, methane and carbon dioxide, is often sufficient information to support design of LFG control systems. However, the standard models also estimate emissions rates for toxic or hazardous air pollutants that make up a small part of the LFG. These gas production rates are estimated by the models using emission factors compiled from landfills nationwide (EPA 1995; Compilation of Air Pollutant Emission Factors). As a result, the modeled emission estimates for these pollutants represent typical landfills, and are unlikely to be accurate for the Site based on its age and unique setting.

In order evaluate the need for gas treatment after collection, and to support air permitting, a limited landfill gas investigation is required to supplement the modeled LFG production estimate. The investigation will determine the concentrations of these pollutants in the LFG at this landfill, which can be used along with the modeled total LFG production rate to estimate annual emissions. The investigation will also be used to evaluate the accuracy of the model, and will provide data indicating which areas of the landfill have the highest LFG production, which will be used to design the collection system. LFG data will be collected from the following three sources (as shown on Figure 3), in accordance with the procedures detailed in the Upland SAP (Appendix A):

- 13 groundwater monitoring wells (existing)
- 4 LFG vents that are part of the LFG collection system that underlies the IPAs (existing)
- 13 temporary gas-monitoring probes that will be installed using direct-push technology.

In addition, open borings and test pits advanced during all phases of the pre-design exploration will be monitored using a Lower Explosive Limit (LEL) meter for Health and Safety purposes, and detections will be included on the boring/test pit logs. This LEL information will provide additional qualitative information as to the presence of LFG at each subsurface exploration location.

2.1.1 LANDFILL GAS MODELING

LFG production will be estimated using modeling software [Landfill Gas Emissions Model (LandGEM)], developed by the U.S. Environmental Protection Agency (EPA). The EPA developed the modeling software to provide a consistent approach for landfill owners to estimate the rate of LFG production and evaluate potential emissions. The model is commonly used to estimate LFG production for LFG control system design and to support air permitting. LandGEM assumes a first-order decay to model the process of anaerobic decomposition of organic waste, which produces LFG. The model input includes the quantity of waste deposited during each year of operation; however, because annual records of waste disposal quantities are not available, the total quantity of waste in place will be based on the observed thickness and extents of wood waste and municipal solid waste during the remedial investigation. The model will assume the waste was deposited equally throughout the known years of operation. Separate estimates of LFG production from wood waste and municipal solid waste will be prepared and later combined to determine the total anticipated production. Separating the waste type into individual modeling efforts will allow the fitting parameters related to total generation capacity and rate constants to be specific for the two types of waste, resulting in a more accurate model when the emissions data is combined.

The estimate will include consideration of the Clean Air Act (CAA) and the AP-42 (EPA 1995) emission factors for landfills to develop a range of potential production estimates. The concentration of individual VOCs in the LFG will likely be overestimated in the model. Therefore, site-specific VOC data will be collected as part of this investigation.

The results will be documented in a brief technical memorandum presented as an appendix to the Engineering Design Report (EDR) and will be used to support design of the LFG control system.

2.1.2 TEMPORARY MONITORING PROBE INSTALLATION

As shown on Figure 3, and described in detail in Appendix A (Upland Sampling and Analysis Plan), 13 temporary monitoring probes will be spaced throughout the upland landfill area, including the overlap area with the R.G. Haley Site. The probes will be installed at depths of 5 to 10 feet (ft) below ground surface (BGS) to evaluate conditions at 13 discrete points. A short, sacrificial screen will be placed at the bottom of the boring, covered with 1 ft of sand, and connected to the surface by Teflon tubing. The borings will be backfilled with hydrated bentonite chips to seal the borehole. A temporary cover will be placed over the completed monitoring points to protect the Teflon tubing until the point is sampled, which may not occur on the same day as the installation. After monitoring, the Teflon tubing can be cut just below the ground surface and the probe will be abandoned in-place, buried beneath the cover system.

2.1.3 LANDFILL GAS MONITORING – FIELD ANALYSIS

LFG monitoring will be conducted when barometric pressure is decreasing, to prevent air intrusion into the cover from diluting the sample. During a period when barometric pressure has been decreasing for at least 12 hours, LFG data will be collected from the temporary monitoring probes, the existing groundwater monitoring wells, and the LFG collection system vents using a Landtec™ GEM 2000 Plus landfill gas analyzer. The analyzer measures methane, oxygen, carbon dioxide, carbon monoxide, hydrogen sulfide, and differential pressure.

At each sampling location, an air-tight seal will be completed at the wellhead and the analyzer will be connected to measure the differential pressure between the monitoring point and the atmospheric pressure. After measuring differential pressure, the sampling location will be purged of air using a hand-pump or the intrinsically safe diaphragm pump in the landfill gas analyzer, to remove air that may have accumulated in well casings or within the sampling equipment. A minimum volume of air will be purged from the groundwater monitoring wells and the LFG vents equal to 3 times the well-casing volume. The hand-pump is the preferable purging option for these sample locations based on the larger purge volume that will be required. There is no minimum purge volume for the temporary monitoring probes, only a requirement that the gas concentration readings are stabilized. When concentrations are stable, the data will be recorded onto a field form, which is included in the Upland Sampling and Analysis Plan (Upland SAP, Appendix A). Field personnel will record the sample time, purge volume, gas concentrations, and other relevant observations or notes. After recording the LFG data, a photo-ionization detector (PID) will be used to measure VOCs at each location, and the data will be recorded onto the field form.

Calibration and calibration check requirements for the LFG analyzer will be conducted in accordance with procedures in the Upland SAP (Appendix A).

2.1.4 LANDFILL GAS MONITORING – SAMPLE COLLECTION FOR LABORATORY ANALYSIS

In addition to collecting LFG data with the hand-held analyzers, soil vapor samples will be collected and submitted to a laboratory for analysis of VOCs by EPA Method TO-15 to evaluate whether compounds are present that will require treatment and to support air permitting considerations. Selective ion monitoring will be conducted for vinyl chloride to achieve the lowest possible reporting limits. Sampling and analysis procedures are described in the Upland SAP (Appendix A).

Six LFG samples will be collected into pre-evacuated summa canisters, certified by the laboratory to be clean of contaminants. Samples will be collected using dedicated Teflon tubing through a stainless flow regulator set by the laboratory to collect the sample over a ½ hour period, to prevent over-drawing the sampling points and diluting the sample. The samples will be collected from the following locations:

- Two samples will be collected at the LFG vents with the highest methane concentrations. These sample locations are anticipated to provide the most representative LFG data because the IPAs create a low permeability cap over the refuse, creating conditions similar to those that will be present under the final capping system and limit the intrusion of ambient air that could dilute the sample. Additionally, the IPAs cover the majority of the municipal solid waste buried at this landfill and as such, are expected to be the best representation of the LFG emissions from the future LFG control system.
- One sample will be collected from the groundwater monitoring well or temporary monitoring probe with the highest VOC reading (by PID) in the R.G. Haley overlap area, where VOC concentrations are expected to be elevated in comparison to other areas of the landfill.
- Two additional samples will be collected from a location selected based on review of the LFG monitoring data.
- One sample will be collected in an upwind location to provide background air quality data.

Once this initial round of LFG sample collection has been completed, the two sample points showing the highest concentration of LFG will be re-sampled within a month of the original sample collection. The LFG collected in the second round will be tested to assess the variability in VOC concentrations, and the LFG gas treatment system, if required, will be designed based on the highest concentrations from the two rounds of monitoring.

The results of the monitoring and sampling activities will be included along with the LFG modeling results in a brief technical memorandum as an appendix to the EDR.

2.2 STORMWATER EVALUATION

An evaluation of the existing stormwater control features is needed to support the design of the landfill cover and drainage system. Additional data are necessary to determine which features can be decommissioned, which (if any) can be incorporated into the final cleanup action, and how to best manage stormwater accumulating and infiltrating on BNSF property near the northeast corner of the Site, as required by the CAP.

As shown on Figure 4, visible stormwater features include the stormwater detention basin at the south end of the Site, drainage ditches, stormwater catch basins at the north end of the Site, and an area that accumulates stormwater on the BNSF property near the northeast corner of the Site. There appear to be two stormwater outfalls on the Site which will be documented for evaluation during design of the final cleanup action. These outfalls consist of 1) an outfall near the northwest corner of the Site that discharged stormwater from the catch basins in the paved area at the north end of the Site associated with the former Georgia Pacific (GP) warehouse area (North Outfall) and, 2) a 30-ft-wide dispersion structure discharging at the south end of the site (South Outfall).

The condition and functionality of the North Outfall and associated stormwater system were evaluated during the RI/FS. The system was determined to be in poor condition with a number of plugged catch basins, and several areas of breaks and gaps in the concrete bell and spigot pipe based on a video survey of accessible portions of the system. The stormwater system was in too poor a condition to advance the video survey to the outfall. Although the outfall was not visible, apparently covered by rock and debris at the shoreline, observations during a heavy rainfall event indicated a significant upwelling of water [about 30 gallons per minute (gpm)] at the shoreline at the estimated location of the outfall, which was interpreted to be the outfall location. The primary purpose of the pre-design evaluation of the North Outfall is to identify the outfall location, so that the outfall can be properly abandoned, repaired, or replaced during the final cleanup action. All other elements of the northern stormwater system associated with former GP operations are planned for abandonment as part of the final cleanup action.

The outfall at the south end of the Site is associated with the existing stormwater detention basin shown on the south end of the Site. This basin was constructed GP in 2004 when the former warehouse was demolished and the upland area was re-graded for drainage. The discharge system was permitted by the City under a grading permit under standards established at that time. As shown on Figure 4, this system was constructed with a 30-ft-long dispersion trench and level spreader to disperse the outfall into the quarry spalls and the shoreline riprap prior to reaching Bellingham Bay.

Using Figure 4 and a base map and details, Landau Associates will conduct a pre-design characterization to include:

- Reviewing site drainage with an updated topographic plan and during rain events to observe and map drainages.
- Locating the existing North Outfall by inspecting the shoreline near the assumed outfall location (as indicated on Figure 4) for indications of concentrated stormwater flow during a rain event coinciding with low tide.

- Locating catch basins and evaluating the existing storm drain system for abandonment including:
  - Measuring the diameter of the remaining stormwater lines
  - Measuring the size of the catch basins
  - Video camera inspection of lines to determine the open length (for grouting if required as part of closure plan)
- Evaluating drainage run-on to the Site from the BNSF railroad, including the site of culvert and depression.
- Conducting a reconnaissance of the BNSF railroad during the wet season for a preliminary evaluation of stormwater conditions in the sump area and the west side of the railroad.
- Evaluating the condition of the existing stormwater detention basin by verifying the as-built conditions are as shown on the original design details provided on Figure 4.

The existing stormwater features will be identified for land surveying during the upland survey (see Section 2.5).

2.3 STABILIZED SEDIMENT TESTING

The CAP specifies that the stabilized sediment in the IPAs will be excavated and reworked, spread across the Site cover area, and compacted into a 2-ft-thick low-permeability soil layer to function as part of the landfill cap. Although the physical properties of the cement-stabilized material were evaluated during design of the interim action, a pre-design characterization is required to evaluate the physical properties of the material after curing for 3 years, including its workability and whether it exhibits the required permeability characteristics to function as a low permeability cap when it is reworked and compacted.

Landau Associates will collect representative samples and conduct testing of the stabilized sediment to confirm the suitability of the material as the low-permeability soil layer component of the landfill cap and help determine the level of construction effort that will be required to adequately process and compact this material. To accomplish this task, a track mounted drilling rig, travelling on mats and/or ramps to protect the IPA cover, will mobilize to the top of the IPAs and advance eight borings (approximately 120 ft apart) at the proposed boring locations shown on Figure 5. Note that the borings have been located at distance from the exiting LFG collection system laterals underlying the IPAs to avoid damage to the LFG system during the investigation.

Prior to drilling operations, an approximate 1-ft square hole will be carefully cut in the white liner material on the IPAs. The borings will then be drilled to extend through the full thickness of the IPAs (about 12 to 14 ft) and penetrate into the underlying landfill cover soils until landfill refuse is encountered. A geologic boring log will be prepared for each boring to document the conditions observed during drilling, including the composition and the depth of the materials encountered. Thin-walled tube samples (3-inch diameter by 30-inch long) will be recovered from the IPAs at the top surface and every 3 ft of depth, and preserved for laboratory testing. If the borings are not successful or only partially successful in obtaining stabilized sediment samples from the IPAs, a backhoe may also be used to excavate test pits within the IPAs. If necessary, these IPA tests may include excavating 3 to 4 test pits laterally into the side of the IPAs (from the toe of the IPA inward). Once the borings and/or test pits are completed, the exploration locations will be backfilled with bentonite chips mixed with soil cuttings and the IPA cover will be repaired by cutting new liner material to fit over any holes or rips with a minimum overlap of 3 inches and gluing into place with an adhesive approved by the liner manufacturer.

Representative soil samples will be tested in Landau Associates' geotechnical laboratory to determine the following (including the number of samples in parentheses):

- In-place moisture and density (16)
- Atterberg Limits (4)
- Grain-size distribution (4)
- Moisture/density compaction curves (4)
- Remolded permeability (4).

The results of the stabilized sediment testing will be evaluated and compared with the properties determined in 2011 during design of the sediment stabilization activities. The evaluation of the material's suitability for use as a low-permeability soil layer in the landfill cap will be presented in the EDR.

2.4 EXISTING LANDFILL COVER THICKNESS

It is necessary to determine the elevation of the refuse/wood waste surface and the thickness of the existing cover over the landfill refuse and wood waste present at the Site to develop the grading plan for the upland capping system. The elevation of the refuse/wood waste surface defines the limits for regrading existing Site soil without disturbing the underlying waste materials. The thickness of the existing soil cover will also affect how much soil will need to be imported to achieve the required elevations and grades for the upland capping system.

The existing cover thickness and elevation of the waste surface will be determined using data collected from the temporary LFG monitoring points (per Section 2.1.2) and the borings advanced through the IPAs (per Section 2.3). Test pit excavations (1 day) will also be conducted using a backhoe to determine landfill cover thickness and waste surface elevation in areas of the Site not adequately characterized by the LFG and IPA borings. Geologic boring logs will be prepared for each exploration, documenting the composition of the cover soil and the depth of the refuse/wood waste surface BGS. The depth BGS to the cover soil/waste surface will be measured to an accuracy of ±0.1 ft.

The locations of the proposed explorations to characterize landfill cover thickness and waste surface elevation are shown on Figure 6. The ground surface elevation and location of each exploration will be surveyed as part of the upland land survey (Section 2.5). Land surface elevations will be determined with an accuracy of ±0.1 ft.

2.5 LAND SURVEYING

Upland and aquatic areas of the Site will be surveyed to support cleanup design activities. The scope of the bathymetric survey was previously approved by Ecology to allow the survey to be conducted during favorable tidal and weather conditions. Both upland and bathymetric surveys will be combined to provide a ½-ft contour plan of the Site appropriate for construction-level design. The horizontal datum for the survey is NAD83 WA North Zone, and the vertical datum NAVD88. However, the vertical datum will be converted to mean lower low water (MLLW) for in-water permitting and related aquatic habitat evaluations. Site zero elevation is equal to +0.49 feet MLLW for the conversion from NAVD88 at this location established by the National Oceanic and Atmospheric Administration National Geodetic Survey. The relationship of the NAVD and MLLW datum to other relevant datums are provided in Table 2-1.

Table 2-1- Site Elevation of other Datum

Datum	NAVD 88(ft)	MLLW (ft)
Highest Observed Tide	9.93	+10.42
Mean Higher High Water Level (MHHW)	8.02	+8.51
Mean High Water (MHW)	7.30	+7.79
Mean Tidal Level (MTL)	4.58	+5.07
Mean Sea Level (MSL)	4.46	+4.95
NGVD29 Datum	3.91	+4.40
Mean Low Water (MLW)	1.86	+2.35
NAVD88 Datum – Zero Elevation	0.00	+0.49
Mean Lower Low Water (MLLW) Datum	-0.49	0.00
City Datum – Zero Elevation	-1.73	-1.24
Lowest Observable Tide	-3.96	-3.47
Calculated Extremely Low Water Level	-4.99	-4.50

The bathymetric survey was completed between January 19 and January 27, 2015 during high tide conditions to provide data as high in the intertidal zone as possible and thus maximize the overlap with the upland survey limits. The bathymetric survey:

- Followed U.S. Army Corps of Engineers (USACE) Class 1 Specifications
- Included approximately 125 transects, 25 ft apart to produce ½-ft contour interval bathymetry, and

- Used real time kinetic (RTK) global positioning system (GPS) technology to obtain bathymetric data.

The 1-ft bathymetric contours derived from this recent survey are shown on the Work Plan Figures. Note that there is a gap between the bathymetric data and the uplands due to the limitations of bathymetric survey equipment in upper intertidal area. This gap will be filled during the upland survey, as discussed below.

The upland survey will include the following elements:

- A property boundary survey
- A 25-ft survey grid to produce ½-ft contour topography of uplands
- An intertidal shoreline during low tide to fill the gap in the upper intertidal area associated with the bathymetric survey
- IPA surface elevations at the same locations as the post-construction as-builts to estimate the amount of settlement that has occurred due to compression of the underlying refuse
- Existing perimeter berms
- Top of casing elevations for groundwater monitoring wells and ground surface for temporary gas monitoring points (shown on Figure 3) to a vertical accuracy of ±0.01 ft
- Pre-design characterization boring and test pit locations and elevations
- Existing outfall locations and elevations (if accessible), catch basins, swales, drainage features, culvert invert elevations, subsurface conveyances
- Asphalt pavement limits, gravel roads and slabs
- Existing City monuments and benchmarks
- Existing fencing.

The surveyor will use high-precision 2013 LIDAR data available from the City to enhance the ground-measured topography in areas that have little dynamic relief or excessive ground cover. The upland survey along the shoreline will be conducted during extreme low tides to extend land surveying as far into the intertidal zone as practicable because land surveying provides a higher level of accuracy than bathymetric surveying techniques, particularly in very shallow water. Additionally, features near the intertidal/upland interface will be carefully surveyed to ensure that the upland/aquatic interface is accurately delineated for use in evaluating the gain/loss in aquatic habitat as a result of the final cleanup action. Accurately delineating the intertidal/upland interface will require additional measurements to the general 25-ft grid that will generally be used for the topographic survey, including the following:

- Collecting additional measurements for steep slopes at the shoreline to more accurately delineate the intertidal/upland interface.
- Surveying the location and top elevation of erratics (e.g., boulders, construction debris) at the intertidal/upland interface and in the upper intertidal zone that extend into upland elevations.

- Collecting additional measurements or transects at the shoreline where rapid changes in shoreline alignment occurs (i.e., localized protrusions and depressions).

2.6 MARINE BIOASSAY SAMPLING AND TESTING

The CAP identifies cleanup levels based on physical criteria for protection of benthic organisms that requires a minimum of 1 ft clean sediment cover over wood waste or refuse, but requires that bioassay testing be conducted to confirm that the physical criteria are adequately protective. Previous investigations identified the area within MU-2 where the existing sediment achieves a minimum of 1-ft thickness of sediment overlying refuse or wood debris, as is shown on Figure 7. As required by the CAP, bioassay testing will be conducted within this area to verify that the minimum 1-ft cover is protective of benthic organisms. Five locations are proposed for bioassay testing at the locations shown on Figure 7. Additionally, a reference sample will be collected from an offsite location, as discussed in Appendix B, to provide the control sample for evaluating bioassay test results. Sediment quality at the northernmost sample location (CL-BA-5) could be affected by releases from the R.G. Haley site, which could be reflected in bioasssay results. The potential impact of R.G. Haley releases will be taken into consideration during evaluation of bioassay results.

The bioassay sample locations will be determined using GPS equipment with accuracy of ±2 ft horizontally. The sampling vessel will be anchored above each point and bioassay samples will be collected using a powered (pneumatic) grab sampler. The sampling and analysis procedures to be used for bioassay sample collection and laboratory analyses are provided in Appendix B.

An extensive eelgrass bed is present at the south end on the Site. The CAP currently calls for the installation of a shoreline stabilization system along the entire Site shoreline to prevent further erosion of the landfill into Bellingham Bay. Because of the habitat value of the eelgrass bed, the potential to stabilize the shoreline without covering all or a portion of the eelgrass bed will be evaluated during preliminary coastal engineering design of the stabilization system. If the Site shoreline could be stabilized without covering all or a portion of the eelgrass beds, it would still be necessary to determine whether sediment quality in the potentially uncovered portion of the eelgrass beds is protective of human health and the environment. As a result, two sediment samples will be collected from the eelgrass beds for potential testing, if preliminary coastal engineering results indicate at least a portion of the eelgrass beds could be left uncovered by the shoreline stabilization system.

The proposed locations of the surface sediment sample to be collected for potential chemical analysis is shown on Figure 7. The surface sediment samples will be frozen and archived at the analytical laboratory for potential future testing. If it is determined that at least a portion of the eelgrass bed could be retained without coverage by the shoreline stabilization system, the archived samples will be tested for the indicator hazardous substances (IHS) identified in the CAP for marine sediment, which consist of copper, cadmium, lead, silver, zinc, bis(2-ethylhexyl)phthalate, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), and polychlorinated biphenyls (PCBs). Subsequent testing may be required so the remaining sample will be preserve and testing requirements will be developed in conjunction with Ecology.

The SAP describing sampling and analysis procedures, analytical methods, and accuracy and precision requirements for sediment sample collection and chemical analyses is provided in Appendix B.

2.7 EELGRASS AND SHORELINE SURVEY

The eelgrass and shoreline survey will be conducted by Grette Associates to assess the existing habitat conditions at the Site. This information will update and expand on previously collected information, and will provide the level of detail required to support remedial design and permitting.

The purpose of the eelgrass survey is to delineate the existing eelgrass beds and the approximate number of turions present (based on turion densities), which will be used to assess the overall impacts of the cleanup action on the existing habitat conditions. An eelgrass turion is an individual cluster of eelgrass blades that extends from the eelgrass rhizomes (root system) up through the substrate. Since eelgrass is known to occur on the Site, the survey methodology was based on the Washington Department of Fish & Wildlife (WDFW) Preliminary/Intermediate Eelgrass/Macroalgae Habitat Survey Guidelines (WDFW 2008). The proposed eelgrass survey will apply a combination of the two guidelines and will be consistent with modifications previously approved by WDFW. As part of the survey, the entire approximately 1,750 lineal feet of the Cornwall Avenue Landfill Site shoreline will be surveyed. Prior to the field effort, approximately 43 transects will be established extending roughly perpendicular to the mean high high water (MHHW) elevation at the shoreline. The transects will be spaced about 40 ft apart and will extend from the MHHW out to a depth greater than -15 ft MHHW, as shown on Figure 8. Due to the turbidity present at the site and the adjacent eelgrass beds, eelgrass is not expected to occur below -15 ft MHHW. As a result, each transects will be approximately 300 ft in length. Along each transect, the presence of eelgrass will be recorded on a data form and flagged for later surveying by the professional surveyor conducting the upland survey (Wilson Engineering). The edge will be flagged by a diver deploying a buoy for the tender boat to survey in using differential GPS (DGPS) equipment. For all eelgrass encountered along the transects, the entire edge of the eelgrass bed will be completely surveyed. Grette Associates will also record substrate conditions (presence of natural sediment, wood waste, or landfill debris) every 20 ft along the transects. The delineation will map the waterward extent of eelgrass along the shoreline.

Along each transect, three plots will be sampled every 20 ft for eelgrass presence and density. Relative to the approximate center point of the transplant plot, turion density will be measured by placing a 0.25 square meter (m^2) quadrant at the 2, 6, and 10 o'clock position relative to north. The number of turions within the quadrant while in each of the three positions will be recorded, noting the general condition, approximate blade length, and presence of reproductive turions. Zero counts will also be included in the data collected from the site. Total turion count will be determined by multiplying average density by area (acres) of eelgrass. In addition to the presence of eelgrass, the survey will also collect information on the existing substrates and macroalgae presence and density along each transect.

Based on WDFW guidance, the eelgrass survey will occur between June 1 and October 1. Upon completion of the eelgrass survey, a technical memorandum will be prepared explaining the methods used and reporting the results of the eelgrass survey, which will be included as an appendix to the EDR.

Grette Associates will also conduct a shoreline survey to assess the existing habitat conditions and functions along the entire Site shoreline. The survey will focus on the existing substrates, debris, vegetation, and slopes. This survey will consist of biologists walking the shoreline, noting habitat structures, substrate and vegetation. For the purpose of recording and reporting, the shoreline will be separated into sections with similar habitat attributes. Biologists will collect qualitative data documenting the distribution of vegetation along each section of shoreline. Substrate characteristics, along with any other significant habitat features, will also be qualitatively documented. The existing substrates and debris along the shoreline will be delineated and mapped. This effort will be coordinated with the upland land survey of the Site in order to accurately map the location of existing substrates.

Upon completion of the shoreline survey, a technical memorandum will be prepared. The memorandum will describe the results of the survey, including the methods used to conduct the survey. The memorandum will also include a map of the shoreline displaying the existing structures along the shoreline, survey section locations, and any areas of interest (e.g., substantial vegetation, debris, etc), which will be included as an appendix to the EDR.

3.0 SAMPLING AND ANALYSIS PLANS

To guide field investigations, two SAPs were prepared to specify the type, quality, and quantity of data necessary to support the cleanup action design. The upland SAP (Appendix A) was prepared in accordance with WAC 173-340-820 and Ecology's Guidance on Sampling and Data Analysis Methods (Ecology Publication 94-49; Ecology 1995). The marine sediment SAP (Appendix B) was prepared in accordance with WAC 173-340-820, Ecology Publication 94-49, and the Puget Sound Sediment Management Standards (SMS) in Chapter 173-204 WAC. The SAPs are intended to provide consistent field and laboratory analytical procedures to guide the collection of data that are accurate, defensible, and of adequate quality to meet the objectives of the project. To this end, the SAPs provide procedures for the collection of representative samples from the Site, accurate documentation of field observations, decontamination to prevent cross-contamination, and proper management and disposal for investigation-derived wastes.

In addition to following the procedures outlined in the SAPs, field personnel will follow personal protection standards and mandatory safety procedures outlined in the Health and Safety Plan (Appendix C).

4.0 REPORTING

The results of the pre-design characterization and other previously completed studies will be used directly in the preparation of the construction-level design, and documented in the Engineering Design Report (EDR).

5.0 SCHEDULE

The pre-design characterization will be accomplished in upon approval of this Work Plan by Ecology, anticipated to be the late spring and summer of 2015. The landfill gas investigation, stormwater evaluation, stabilized sediment testing, and the existing landfill cover soil thickness evaluation will all be conducted prior to the upland survey such that the exploration points and surface features can be captured by the survey. The surveyor will also lay out the transect lines for the eelgrass survey. The bioassay sampling is not dependent on these other investigations; however, the sampling will be accomplished as soon as feasible after approval of the Work Plan. Based on WDFW guidance, the eelgrass and habitat survey should occur between June 1 and October 1.

6.0 REFERENCES

Bennett, Tom. 2015. Personal communication (conversation with Kent Wiken, P.E., Senior Associate Engineer, Landau Associates). Tom Bennett, Georgia Pacific TESC and Discharge System Designer. Re: *TESC and Discharge System Permitting Requirements.* February 12.

Ecology. 2014. *Cleanup Action Plan, Cornwall Avenue Landfill, Bellingham, Washington.* Washington State Department of Ecology. October 10.

Ecology. 1995. *Sediment Management Standards*, Chapter 173-204 Washington Administrative Code. Publication No. 96-252. December.

EPA. 1995. AP 42, Compilation of Air Pollutant Emission Factors.
Available at: http://www.epa.gov/ttnchie1/ap42/ U.S. Environmental Protection Agency. Fifth Edition. January.

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

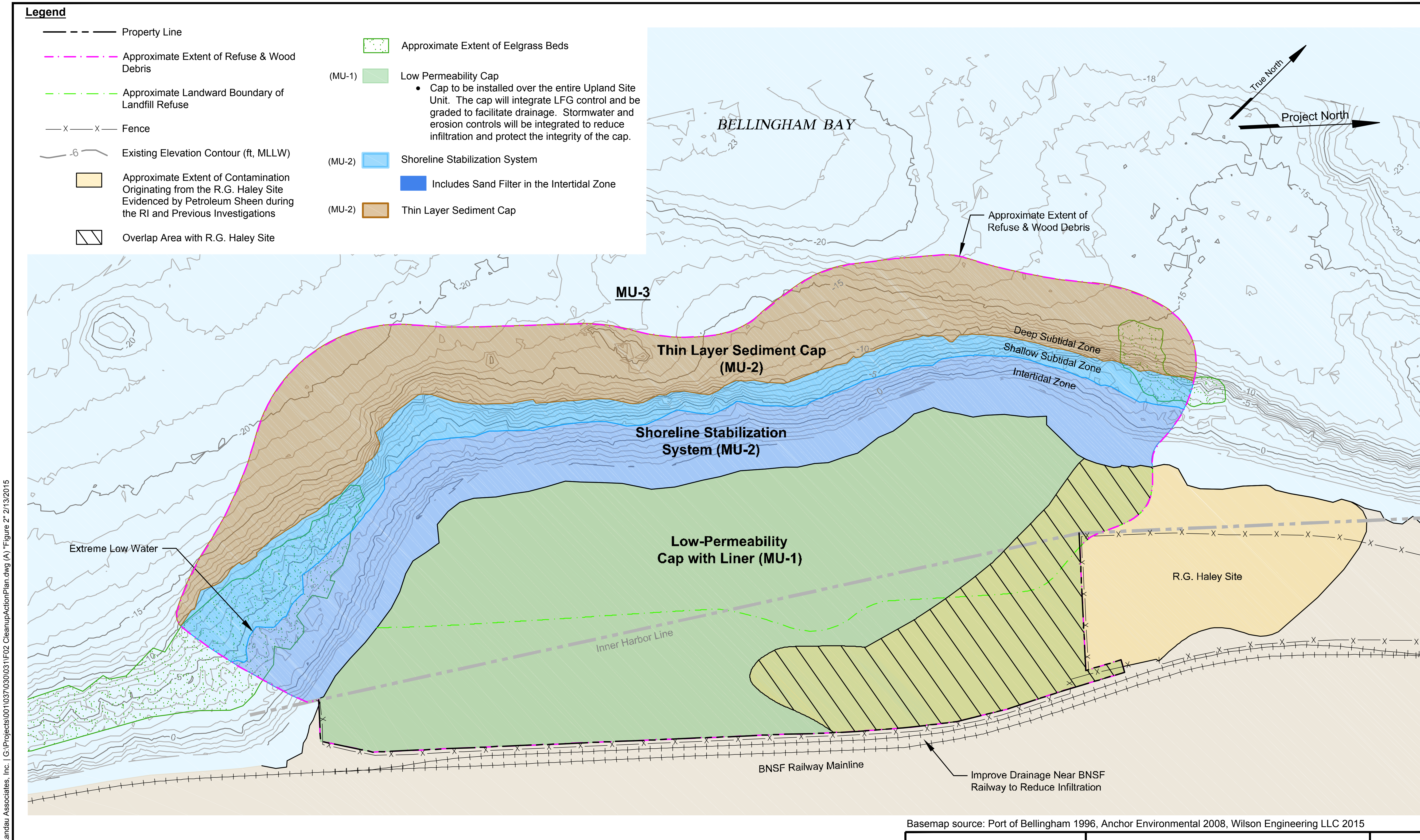
WDFW. 2008. Eelgrass/Macroalgae Habitat Interim Survey Guidelines. Available at:
http://wdfw.wa.gov/publications/00714/ Washington Department of Fish & Wildlife. June.

Data Source: Esri 2012

G:\Projects\001\037\030\031\VicMap.mxd 2/10/2015 NAD 1983 StatePlane Washington North FIPS 4601 Feet

LANDAU ASSOCIATES

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

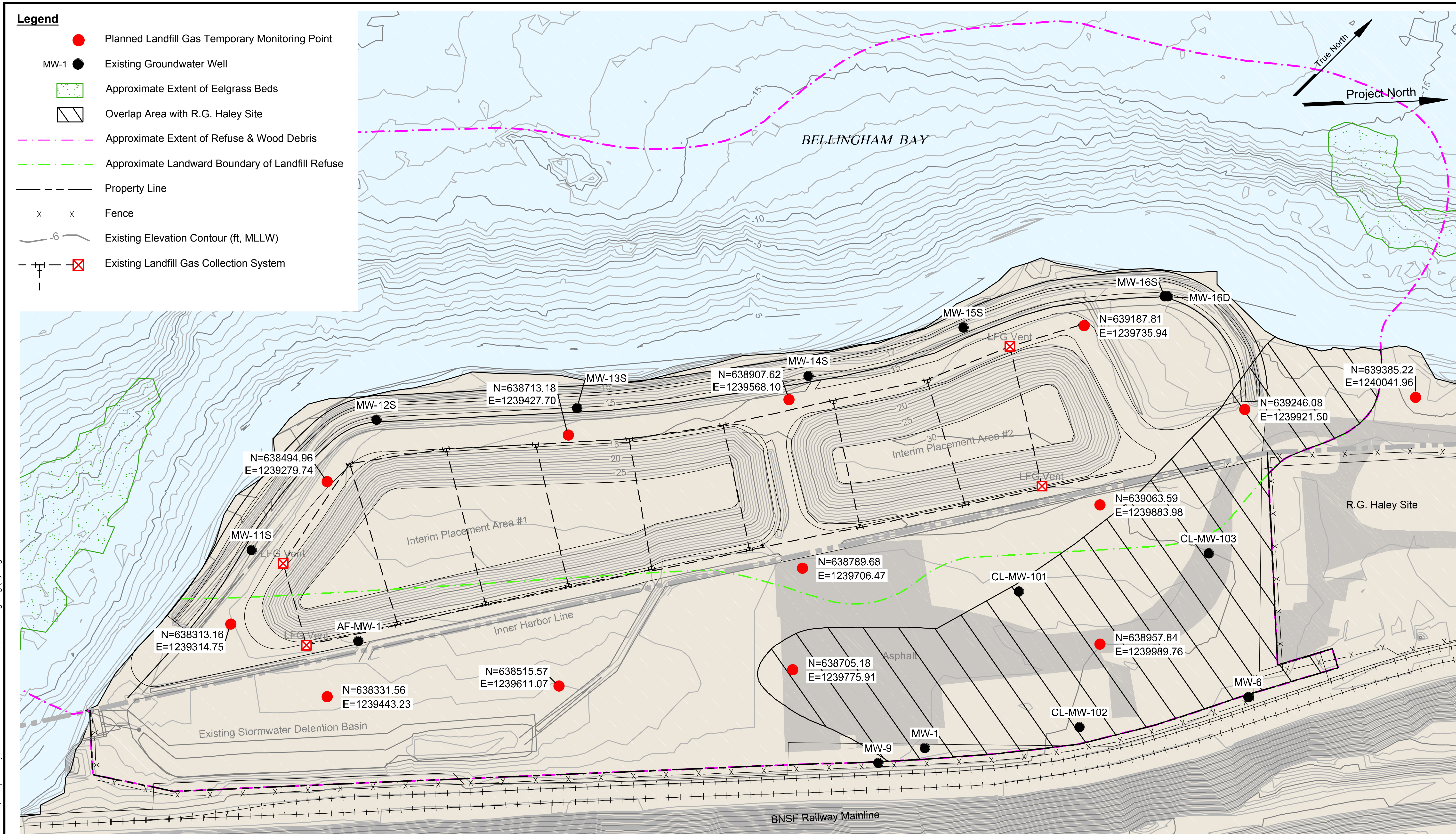


LANDAU ASSOCIATES

Pre-Design Work Plan
Cornwall Avenue Landfill
Bellingham, Washington

Site Cleanup Action

Figure 2



Basemap source: Port of Bellingham 1996, Anchor Environmental 2008, Wilson Engineering LLC 2015

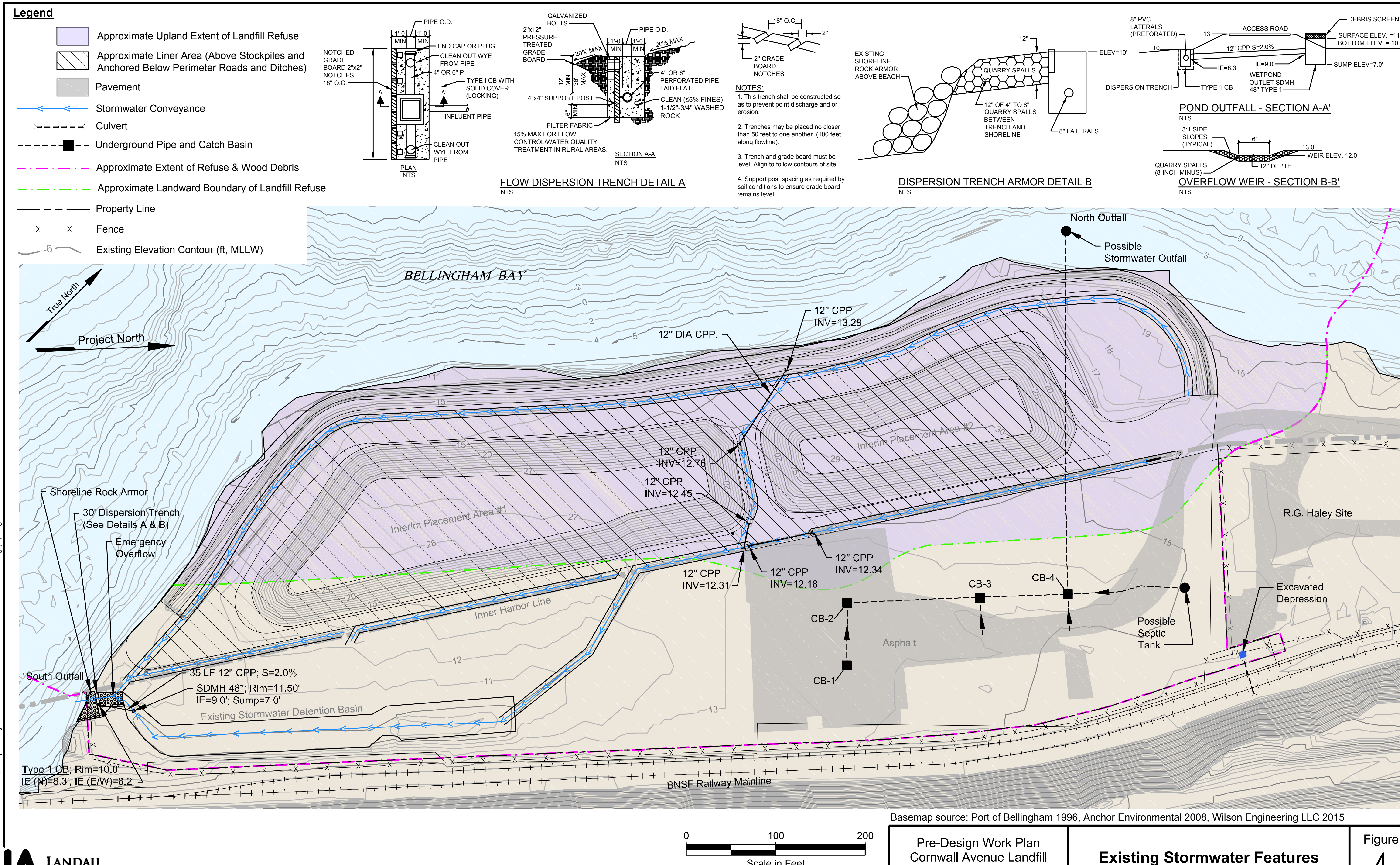
0 100 200

Scale in Feet

Landau Associates, Inc. | G:\Projects\001\037\030\031\F03 LFGasMonitoring.dwg (A) "Figure 3" 3/14/2015

LANDAU ASSOCIATES

Pre-Design Work Plan Cornwall Avenue Landfill Bellingham, Washington	Landfill Gas Monitoring Plan	Figure 3



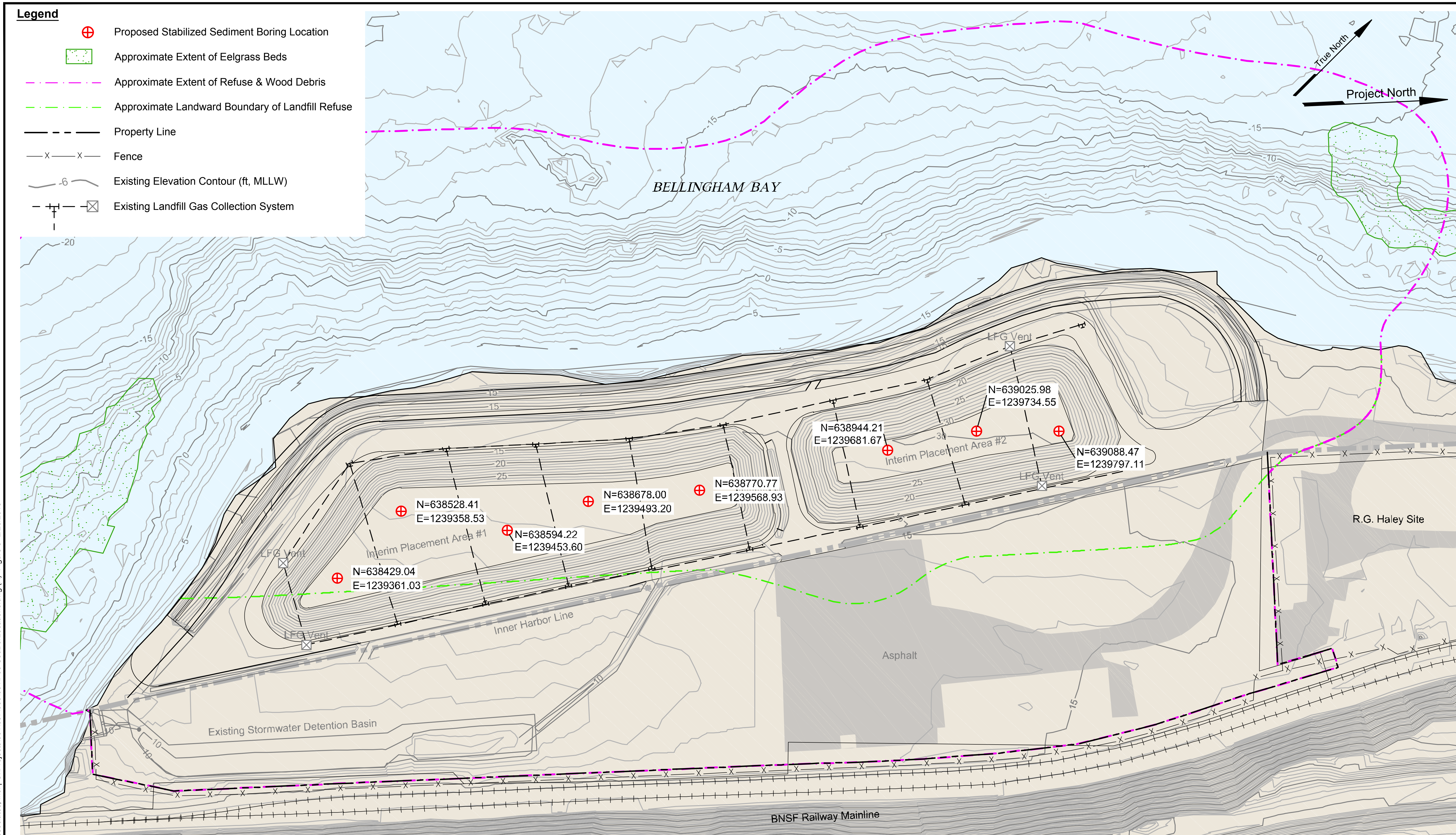
Landau Associates, Inc. | G:\Projects\001\037\030\031\F04 StormwaterEvaluation.dwg (A) "Figure 4" 3/14/2015

LANDAU ASSOCIATES

Pre-Design Work Plan
Cornwall Avenue Landfill
Bellingham, Washington

Existing Stormwater Features

Figure 4



Basemap source: Port of Bellingham 1996, Anchor Environmental 2008, Wilson Engineering LLC 2015

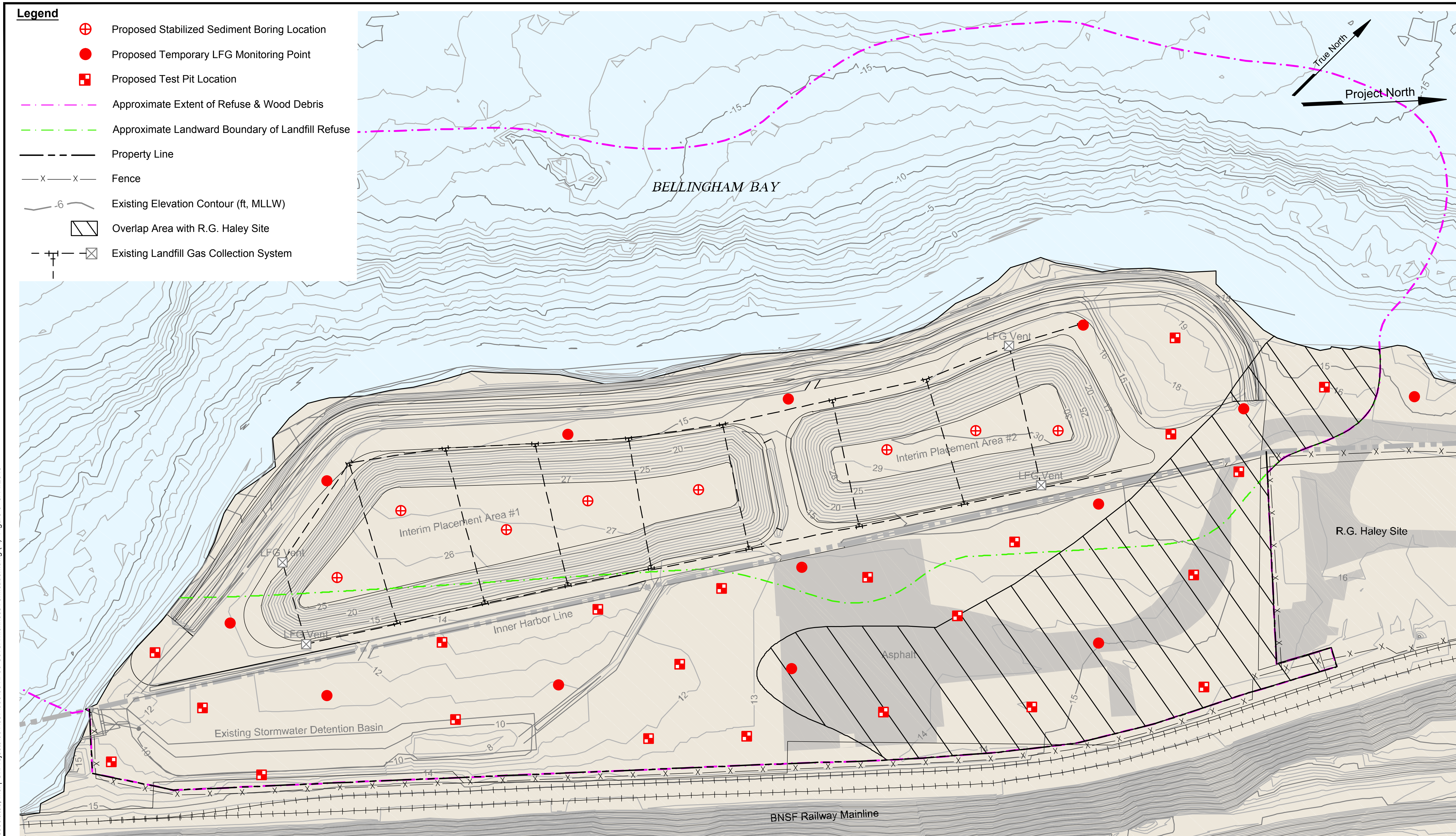
0 100 200
Scale in Feet

Landau Associates

Pre-Design Work Plan
Cornwall Avenue Landfill
Bellingham, Washington

Stabilized Sediment Boring Locations

Figure 5



Basemap source: Port of Bellingham 1996, Anchor Environmental 2008, Wilson Engineering LLC 2015

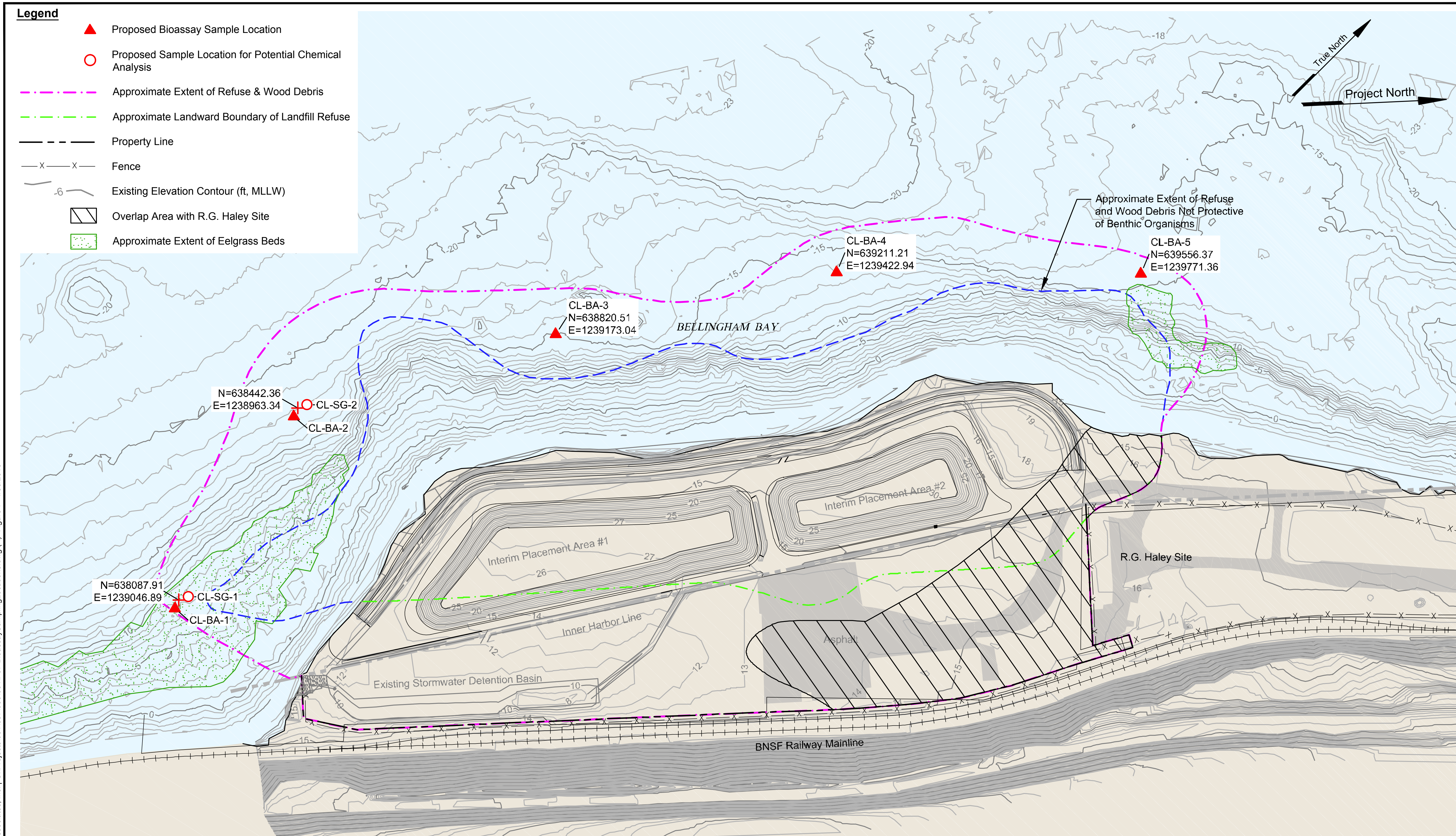
0 100 200
Scale in Feet

LANDAU ASSOCIATES

Pre-Design Work Plan
Cornwall Avenue Landfill
Bellingham, Washington

Cover Thickness Verification

Figure
6



Basemap source: Port of Bellingham 1996, Anchor Environmental 2008, Wilson Engineering LLC 2015

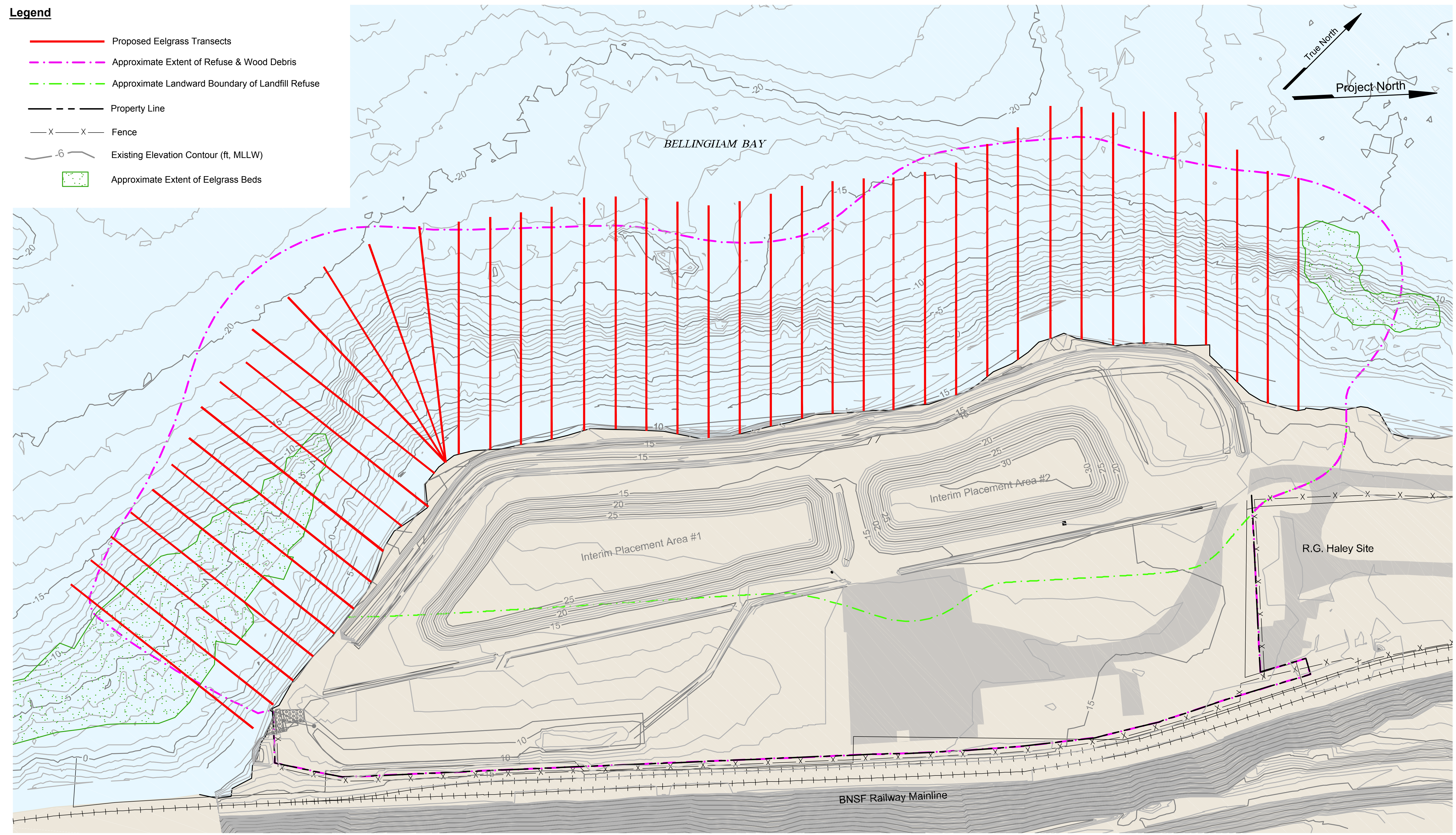
Landau Associates, Inc. | G:\Projects\001\037\030\031\F07 BioassaySamplingLocations.dwg (A) "Figure 7" 4/30/2015

Landau Associates

Pre-Design Work Plan
Cornwall Avenue Landfill
Bellingham, Washington

Bioassay Sampling Locations

Figure 7



Basemap Source: Port of Bellingham, 1996; Anchor Environmental, 2008; Wilson Engineering LLC, 2015

0 120 240
Scale in Feet

Landau Associates

Grette Associates LLC Environmental Consultants

Pre-Design Work Plan Cornwall Avenue Landfill Bellingham, Washington	Eel Grass Survey Plan	Figure 8

Landau Associates, Inc. | G:\Projects\001\037\030\031\F08 EelGrassSurveyPlan.dwg (A) "Figure 8" 2/25/2015

APPENDIX A

Upland Sampling and Analysis Plan (SAP)

Upland Sampling and Analysis Plan
Pre-Design Investigation
Cornwall Avenue Landfill Site
Bellingham, Washington

April 30, 2015

Prepared for

Port of Bellingham, Washington

LANDAU ASSOCIATES
130 2nd Avenue South
Edmonds, WA 98020
(425) 778-0907

TABLE OF CONTENTS

FIGURES

TABLES

1.0 INTRODUCTION AND BACKGROUND INFORMATION

This upland sampling and analysis plan (Upland SAP) describes the procedures for collecting landfill gas (LFG) data that will be used in the design phase of the final cleanup action for the Cornwall Avenue Landfill site (Site). This document provides information relating to conducting the geotechnical investigation, details for the installation of monitoring probes, field procedures for LFG monitoring and LFG sample collection, and laboratory quality control/quality assurance procedures for analyzing the LFG samples for volatile organic compounds (VOCs). The Site is located in Bellingham, Washington (Figure A-1). This Upland SAP is one of the required deliverables under the Consent Decree (No. 14 2 02593 5) between the Port of Bellingham (Port), City of Bellingham (City), the Washington Department of Natural Resources (DNR), and the Washington State Department of Ecology (Ecology).

2.0 DESIGN-PHASE UPLAND INVESTIGATION SCOPE

The scope of the upland pre-design investigation addressed in this SAP is described in this section. The goal of the investigation is to develop the necessary data for designing the low permeability cap and LFG control system that will be implemented as part of the cleanup action to address contamination at the Site. The scope of the investigation generally includes LFG monitoring probe installation, field monitoring, collection and laboratory analysis of LFG samples, and characterization of the onsite stabilized sediment. Field monitoring will be conducted at three types of sample locations: existing groundwater monitoring wells, existing LFG vents that are part of an existing passive LFG collection system, and temporary monitoring probes that will be installed as part of this investigation. For the purposes of this report, the scope of the investigation is divided into the four following tasks:

1. LFG monitoring probe installation
2. LFG monitoring
3. LFG sample collection
4. Evaluating the geotechnical characteristics of the stabilized sediment construction.

3.0 FIELD PROCEDURES

The following sections provide details for conducting the scope of investigation described in Section 2.0.

3.1 LANDFILL GAS MONITORING PROBE INSTALLATION

The existing sample locations are limited in number and distribution. Additional sample locations will be added by installing temporary gas monitoring probes at the locations indicated on Figure A-2. The probes will be installed using direct-push methods by a Washington State licensed driller. The borings will be advanced through the soil cover in the locations indicated on Figure A-2 in order to place a vapor monitoring probe tip within the waste beneath the cover soil.

Prior to advancing any borings at the Site, the proposed drilling locations will be checked for underground utilities and will be adjusted, as needed, to prevent conflict. The direct-push sampler will be advanced to 5 feet (ft) below ground surface (BGS). The sampler provides a continuous sample core that will be evaluated to determine whether the cover soil has been penetrated, indicating an adequate depth has been reached for installation. If the probe has not penetrated through the cover soil, the probe will be advanced another 5 ft, to the maximum drilling depth of 10 ft BGS. The probe will be installed at either 5 or 10 ft BGS.

The temporary LFG monitoring probe will be constructed as follows:

- Place 6 inches of pea gravel at the bottom of the boring
- Lower a 1-inch stainless steel vapor sampling implant connected to ¼-inch (outside diameter) Teflon tubing to the pea gravel bedding
- Place 6 inches of pea gravel in the boring to cover the implant
- Backfill the remainder of the boring to ground surface with hydrated bentonite chips
- Attach a polycarbonate stop valve to the aboveground end of the Teflon tubing, leaving 5 to 6 ft of tubing extending above the ground surface.
- Place a temporary cover over the top of the newly installed probe to protect the tubing and stop-valve. A plastic bucket or similar apparatus will be used as an effective temporary cover to protect the tubing and valve, and mark the sample location.

Observations of cover soil thickness, unusual odors, and probe construction details will be recorded onto a field form. When monitoring is complete, the LFG monitoring point can be abandoned in place by cutting the tubing off just below the ground surface. It is not necessary to retrieve the implant following use.

3.2 LANDFILL GAS MONITORING

The investigation will include collecting LFG data from the following three types of sample locations at the Site, each identified on Figure A-2:

- Groundwater monitoring wells (13 existing)
- LFG vents that are part of the LFG collection system that underlies the interim placement areas (IPAs; 4 existing)
- Temporary gas-monitoring probes (13 to be installed as part of this investigation).

LFG monitoring will be conducted when barometric pressure is decreasing, to evaluate emissions at a time when ambient air intrusion through the cover is not expected, so the potential for dilution is minimized. During a period when barometric pressure has been decreasing for at least 12 hours, LFG data will be collected from the temporary monitoring probes, the existing groundwater monitoring wells, and the LFG collection system vents using a Landtec™ GEM 2000 Plus landfill gas analyzer. The analyzer measures methane, oxygen, carbon dioxide, carbon monoxide, hydrogen sulfide, and differential pressure.

LFG monitoring will include the following activities:

- Evaluate the sample location and create an air-tight sampling port.
- Measure differential pressure (required reporting limit 0.01 inches of water).
- For groundwater monitoring wells, measure the depth to water.
- Purge the sampling point of ambient air that may be in the well casing. For the groundwater monitoring wells and the LFG vents, this will be accomplished using a hand-pump by removing a volume of air equal to three times the volume of the well casing.
- Measure and record the stabilized readings for methane, carbon dioxide, carbon monoxide, oxygen, balance gas, hydrogen sulfide, and hydrogen using the LFG analyzer. It will generally require 1 to 2 minutes to acquire a stable reading. Stability will be evaluated in the field based on readings remaining relatively constant; typically within 1 percent by volume.
- Measure and record the concentration of VOCs using a photo-ionization detector (PID).

Time of reading, purge volume, gas concentrations, and other pertinent observations will be recorded onto the field form. If maximum concentrations of methane spike during the evaluation to a concentration more than 5 percent higher than the stabilized reading, the maximum methane concentration will be recorded along with the stable reading.

3.3 LANDFILL GAS SAMPLE COLLECTION

Samples of LFG will be collected from a subset of the sample locations for VOC analysis by EPA Method TO-15. Selective ion monitoring will be conducted for vinyl chloride to achieve the lowest reporting limits possible. Samples will be collected into 6-liter Summa canisters with a laboratory-supplied and calibrated flow control valve using dedicated Teflon tubing. The flow control valve will be calibrated to a flow rate not to exceed 200 mL/min (collection time of approximately 30 minutes).

Sample locations will be purged and monitored for LFG parameters as described in Section 2.3 prior to sample collection. After connecting the flow controller to the Summa canister, and the sample tubing to the flow controller inlet and sampling port, field personnel will open the valve on the sample tubing, then the needle valve on the Summa canister. A pressure gauge on the flow control valve will be monitored as the sample is collected. When the pressure gauge reads approximately 5 inches of mercury vacuum, the canister valve and then the tubing valve will be closed and the canister will be detached. With the canister valve closed and, the flow controller will be removed and a stainless swage-lock cap tightened onto the canister.

Sample name, time, starting and ending pressure will be recorded on the laboratory-supplied sample tag and chain of custody form. Field personnel will complete a sample collection form for each sample, indicating the sample name, starting and ending time, starting and ending canister pressure, time, and other pertinent information. The samples will maintained under chain of custody and delivered to a laboratory for analysis by EPA Method TO-15.

3.4 GEOTECHINCAL EVALUATION OF STABILIZED SEDIMENT

Landau Associates will collect samples of the stabilized sediment stored at the Site, and will conduct geotechnical testing to evaluate the suitability of the material as the low-permeability soil layer component of the landfill cap. The data will also be used to determine the level of construction effort that will be required to adequately process and compact this material. To accomplish this task, a track mounted drilling rig, travelling on mats and/or ramps to protect the IPA covers, will mobilize to the top of the IPAs and advance eight borings (approximately 120 ft apart) at the proposed boring locations shown on Figure A-3. Note that the borings have been located at distance from the existing LFG collection system laterals underlying the IPAs to avoid damage to the LFG system during the investigation.

Driven soil samples and thin-walled geotechnical samples (Shelby-tube samples) will be collected using an auger rig. Field procedures will be conducted in general accordance with the ASTM International (ASTM) standards listed below.

- ASTM D1452 – "Standard Practice for Soil Investigation and Sampling for Auger Borings"
- ASTM D1586 – "Standard Practice for Penetration Test and Split-Barrel Sampling of Soils"
- ASTM D1587 – "Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes"
- ASTM D2488 – "Standard Practice for Description and Identification of Soils (Visual Manual Procedures)"
- ASTM D4220 – "Standard Practice for Preserving and Transporting Soil Samples"
- ASTM D6151 – "Standard Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling"
- ASTM D7015 – "Standard Practice for Obtaining Undisturbed Block (Cubical and Cylindrical) Samples of Soils".

3.5 MANAGEMENT OF RESIDUAL WASTES

Waste generated during the installation of temporary LFG monitoring probes or geotechnical investigations will be drummed for offsite disposal.

3.6 FIELD INSTRUMENTS – CARE AND CALIBRATION

Periodic schedules for preventive maintenance of field instruments, including equipment testing, parts replacement, and general cleaning will be followed according to the manufacturer's instructions. Field equipment performance will be evaluated against check standards and calibration blanks, as appropriate, for each parameter before use and at least once during a sampling day or when a meter drift is suspected. Field instruments requiring calibration will include the LFG analyzer and the PID. The meters will be calibrated prior to use and records of the calibration standards, readings, and adjustments will be maintained with the field sampling forms. Instruments must be reading within 5 percent of the calibration standards to be considered valid. Additional calibration checks will be conducted in the field on the LFG analyzer and PID for span and zero gas standards and results will be recorded on the daily field form.

3.7 SAMPLE DOCUMENTATION AND HANDLING

A complete record of field activities will be maintained. Documentation necessary to meet quality assurance (QA) objectives for this project include: field notes and sampling forms, sample container labels, and sample chain-of-custody forms. All original documentation will be kept in the Landau Associates project files. The documentation and other project records will be safeguarded to prevent loss, damage, or alteration.

If an error is made on a document, corrections will be made by drawing a single line through the error and entering the correct information. The erroneous information will not be obliterated. Corrections will be initialed and dated, and, if necessary, a footnote explaining the correction will be added. Errors will be corrected by the person who made the entry, whenever possible. Documentation will include:

- Recordkeeping by field personnel of primary field activities
- Recordkeeping of all samples collected for analysis
- Use of sample labels and chain-of-custody tracking forms for all samples collected for analysis.

Field report forms will provide descriptions of all sampling activities, sampling personnel, weather conditions, and a record of all modifications to the procedures and plans identified in this SAP. The field report forms are intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during the sampling period.

After sample collection, the following information will be recorded on the field log sheet:

- Sample identification

- Date, time, of sample collection
- Name of person collecting the sample.

3.7.1 Sample Identification

All samples will be assigned an individual identification that will be recorded on the field forms, sample labels, and recorded onto a site plan. The samples will be identified in a manner that identifies the name of the Site [i.e., Cornwall Avenue Landfill (CL)]; the sample type [landfill gas (LFG) or stabilized sediment (STSED)], and the identification of the sample location. LFG vents will be identified as VENT-1 through VENT-4. The temporary LFG monitoring probes will be identified as P-1 to P-12. Stabilized sediment sample locations will be identified as B-1 through B-8. For soil samples, a sample number will be included and the sample interval will be noted on the field form.

Examples: CL-LFG-MW-12S, CL-LFG-VENT-2, CL-LFG-P-12
CL-STSED-B-4-S1, CL-STED-B-6-S2

3.7.2 Sample Container Labels

LFG sample labels will be supplied with the Summa canisters for VOC sampling. An indelible pen will be used to fill out each label. Each sample label will contain the project number, sample identification, pressure information, date and time of collection, and initial of the person(s) preparing the sample.

3.7.3 Sample Containers, Preservation, and Storage

LFG VOC samples will be collected in to 6-liter stainless steel Summa canisters. Canisters must be certified clean by the laboratory. Maximum holding and extraction times until analysis will be strictly adhered to by field personnel and the analytical laboratory. Analytical methods, sample containers, and holding times in Table A-1.

3.7.4 Sample Custody

The primary objective of sample custody is to create an accurate, written record that can be used to trace the possession and handling of samples so that their quality and integrity can be maintained from collection until completion of all required analyses. Adequate sample custody will be achieved by means of approved field and analytical documentation. Such documentation includes the chain-of-custody record, which is initially completed by the sampler and is, thereafter, signed by those individuals who accept custody of the sample. Sample custody procedures will only apply to samples collected for chemical analyses.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL

This section describes both field and laboratory QA/QC procedures and provides a description of the data quality review that will be performed on the analytical test results. Implementation of these procedures in conjunction with the sample collection and handling procedures described in Section 3.0 should provide a reasonable degree of confidence in the project data.

4.1 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL FOR LFG CHEMICAL ANALYSES

The laboratory conducting the LFG testing will be accredited by Washington State. QA/QC for chemical testing of LFG samples includes laboratory instrument QA/QC and analytical method QA/QC. Instrument QA/QC monitors the performance of the instrument and method QA/QC monitors the performance of sample preparation procedures. Laboratory QA/QC procedures will be conducted in accordance with EPA Method TO-15 (*Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*, EPA Document No. 625/R-96/010b; EPA 1999a) specifications, including initial and ongoing calibration, QC samples, and corrective actions per specifications in SW-846 (EPA 1996), and other QA/QC requirements as needed for selective ion monitoring for vinyl chloride.

When an instrument or method control limit is exceeded, the laboratory will contact Landau Associates' quality control officer immediately. The laboratory will be responsible for correcting the problem and will reanalyze the samples within the sample hold time if sample reanalysis is appropriate.

4.2 FIELD AND LABORATORY QUALITY CONTROL SAMPLES FOR CHEMICAL ANALYSES

Field and laboratory control samples that will be used for quality control purposes during the LFG investigation are described in the following subsections.

4.2.1 BACKGROUND AMBIENT AIR SAMPLE

One air sample will be collected in an area upwind of the Site to represent background conditions. The data will be used to evaluate Site conditions and overall data quality.

4.2.2 LABORATORY CONTROL SAMPLES AND SURROGATE SPIKES

A minimum of one laboratory control sample per 20 samples, or one laboratory control sample per sample batch if fewer than 20 samples are obtained in a sample event, will be analyzed for all parameters.

Project samples analyzed for organic compounds will be spiked with appropriate surrogate compounds as defined by the analytical method.

Frequency, acceptable recovery, and acceptable relative standard deviations will be in accordance with EPA guidance.

4.2.3 LABORATORY REPLICATE SAMPLE

A minimum of one laboratory duplicate or replicate analyses per 20 samples, not including laboratory QC samples, or one laboratory duplicate sample per batch of samples if fewer than 20 samples are obtained, will be included with each analysis. The relative percent difference between the laboratory replicate and the corresponding sample will be evaluated in accordance with EPA guidance to determine if corrective action is required.

4.2.4 LABORATORY METHOD BLANKS

A minimum of one laboratory method blank analyses per 20 samples analyzed, or one per batch if fewer than 20 samples will be analyzed to assess possible laboratory contamination. Method blanks will contain all reagents used for analysis. The generation and analysis of additional method, reagent, and glassware blanks may be necessary to verify that laboratory procedures do not contaminate samples.

4.3 LABORATORY PROCEDURES FOR GEOTECHNICAL SAMPLES

Samples of the stabilized sediment will be tested in Landau Associates' geotechnical laboratory to determine moisture content, Atterberg limits, grain-size distribution, moisture/density relationships, and the remolded permeability in accordance with the following test methods:

- ASTM D2216 – "Standard Test Methods for Determination of Water (Moisture) Content of Soil and Rock Mass"
- ASTM D4318 – "Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils"
- Method PSEP-PS – Grain Size Analysis
- ASTM D698 and D558 – "Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3) and "Standard Test Methods for Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures"
- ASTM D5084 – "Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Material Using a Flexible Wall Permeameter"

4.4 DATA QUALITY OBJECTIVES

Results from the investigation activities will be used to document and evaluate current environmental conditions at the Site. The sample results must be precise, accurate, representative, complete, and comparable to a degree commensurate with this use.

The QA procedures presented are based on data quality objectives (DQOs) that were developed in accordance with Ecology guidelines (Ecology 2004). The target control limits (the range within which project data of acceptable quality should fall) for data quality will be in accordance with EPA guidelines for samples subjected to chemical analysis. The target control limits will be used to evaluate data acceptability. The data quantitation limit goals for the TO-15 chemical analyses are listed on Table A-2.

4.5 DATA QUALITY EVALUATION

An internal data quality evaluation will be conducted on all chemical data collected as part of the investigation to determine acceptability of data results. Data quality evaluation will be conducted with guidance from applicable portions of EPA's *National Functional Guidelines for Organic Data Review* (EPA 1999b, 2008). The verification and validation check for each laboratory data package includes the following:

- Verification that the laboratory data package contains all necessary documentation (including chain-of-custody records; identification of samples received by the laboratory; date and time of receipt of the samples at the laboratory; sample conditions upon receipt at the laboratory; date and time of sample analysis; and, if applicable, date of extraction, definition of laboratory data qualifiers, all sample-related quality control data, and quality control acceptance criteria).
- Verification that all requested analyses, special cleanups, and special handling methods were performed.
- Evaluation of sample holding times.
- Evaluation of quality control data compared to acceptance criteria, including method blanks, surrogate recoveries, matrix spike results, laboratory duplicate and/or replicate results, and laboratory control sample results.

Data validation qualifiers are added to the sample results, as appropriate, based on the verification and validation check. The absence of a data qualifier indicates that the reported result is acceptable without qualification.

A written report will be prepared by the analytical laboratory documenting all the activities associated with sample analyses. At a minimum, the following will be included in the report:

- Results of the laboratory analyses and QA/QC results
- All protocols used during analyses
- Chain-of-custody procedures, including explanation of any deviation from those identified herein
- Any protocol deviations from this SAP
- Location and availability of the data
- Batch identification for each analysis method
- Digestion/extraction/analysis dates for each QA/QC parameter corresponding to each batch definition (i.e., all QA/QC data will be batch-specific)
- A case narrative.

As appropriate, this SAP may be referenced in describing protocols.

4.6 FIELD CORRECTIVE ACTIONS

During field operations and sampling activities, the field personnel will be responsible for conducting and reporting required corrective actions. A description of any action taken will be entered in the daily field notebook. The project manager will be consulted immediately if field conditions are such that conformance with this SAP is not possible. The field coordinator will consult with the Landau Associates project manager, who may authorize changes or exceptions to the QA/QC portion of this SAP, as necessary and appropriate.

4.7 DATA MANAGEMENT PROCEDURES

All laboratory analytical results, including QC data, will be submitted to Landau Associates. Following validation of the data, any qualifiers will be added to the Excel spreadsheets. All field data will be entered into an Excel spreadsheet and verified to determine all entered data is correct and without omissions and errors. Following receipt of all data, analytical results will be formatted electronically and downloaded to Ecology's Environmental Information Management (EIM) system.

* * * * *

This document has been prepared under the supervision and direction of the following key staff:

LANDAU ASSOCIATES, INC.

Jeremy M. Davis, P.E., CHMM
Associate Engineer

JMD/kes

5.0 REFERENCES

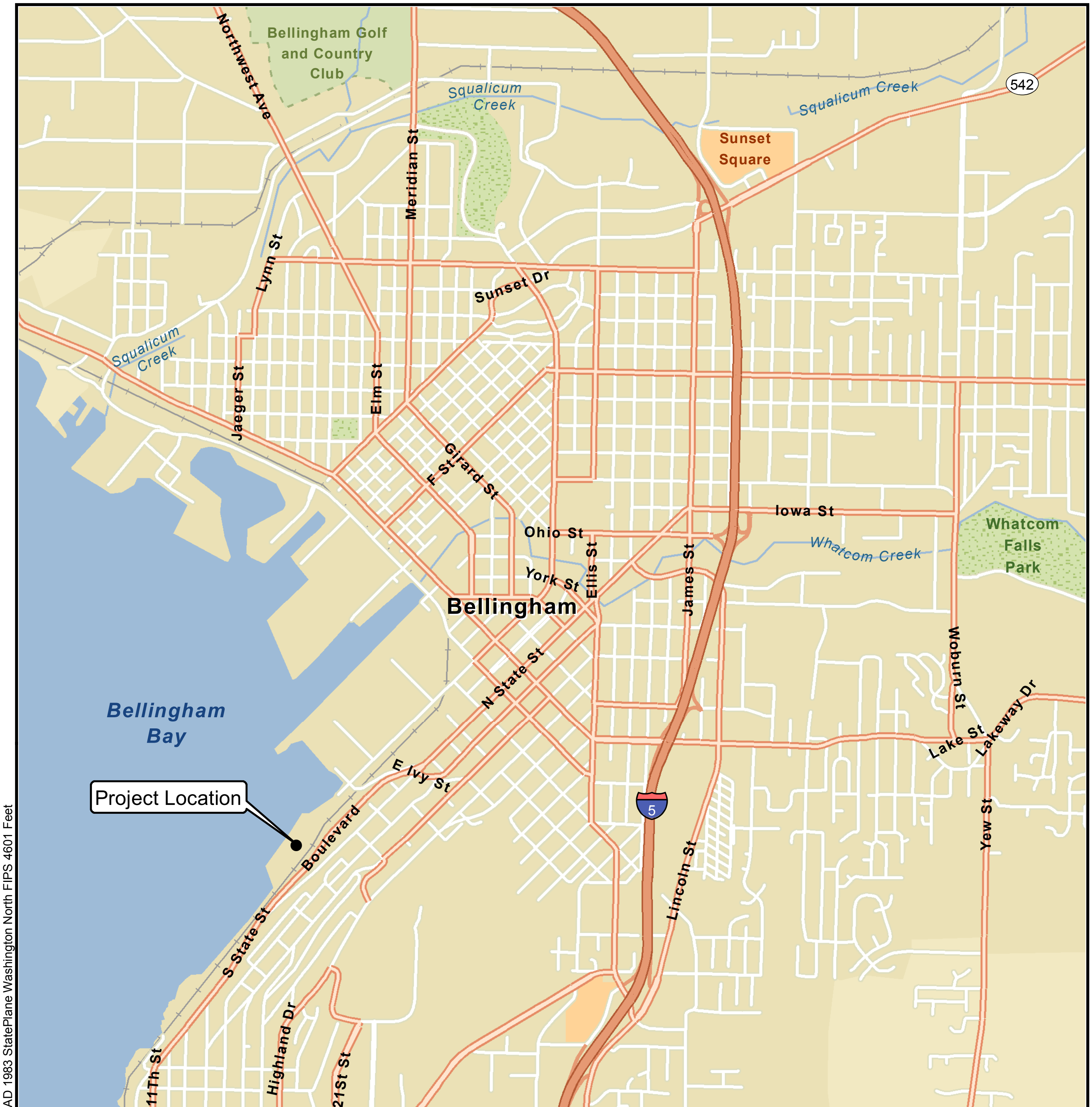
Ecology. 2004. *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies.* Washington State Department of Ecology. July.

EPA. 2008. *USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review.* USEPA-540-R-08-01. U.S. Environmental Protection Agency. Office of Superfund Remediation and Technology Innovation. Washington, D.C. June.

EPA. 1999a. *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*. U.S. Environmental Protection Agency Document No. 625/R-96/010b.

EPA. 1999b. *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review.* EPA-540/R-99-008. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Washington, D.C. October.

EPA. 1996. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846).* Available at: http://www.epa.gov/solidwaste/hazard/testmethods/sw846/online/index.htm U.S. Environmental Protection Agency, Office of Solid Wastes.



N

0 0.5 1

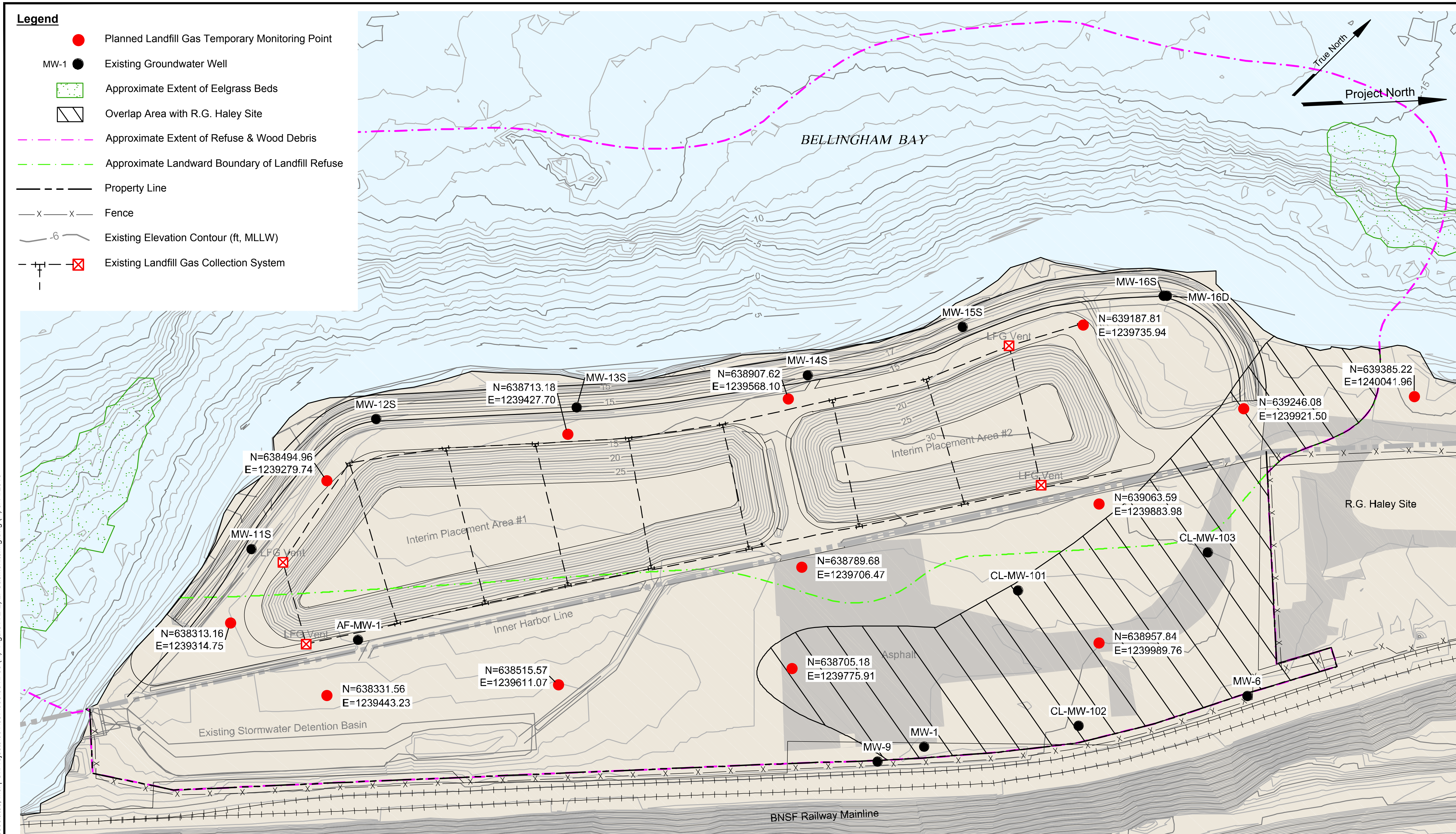
Miles

Data Source: Esri 2012

G:\Projects\001\037\030\031\VicMap.mxd 2/13/2015 NAD 1983 StatePlane Washington North FIPS 4601 Feet

LANDAU ASSOCIATES

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



Basemap source: Port of Bellingham 1996, Anchor Environmental 2008, Wilson Engineering LLC 2015

0 100 200
Scale in Feet

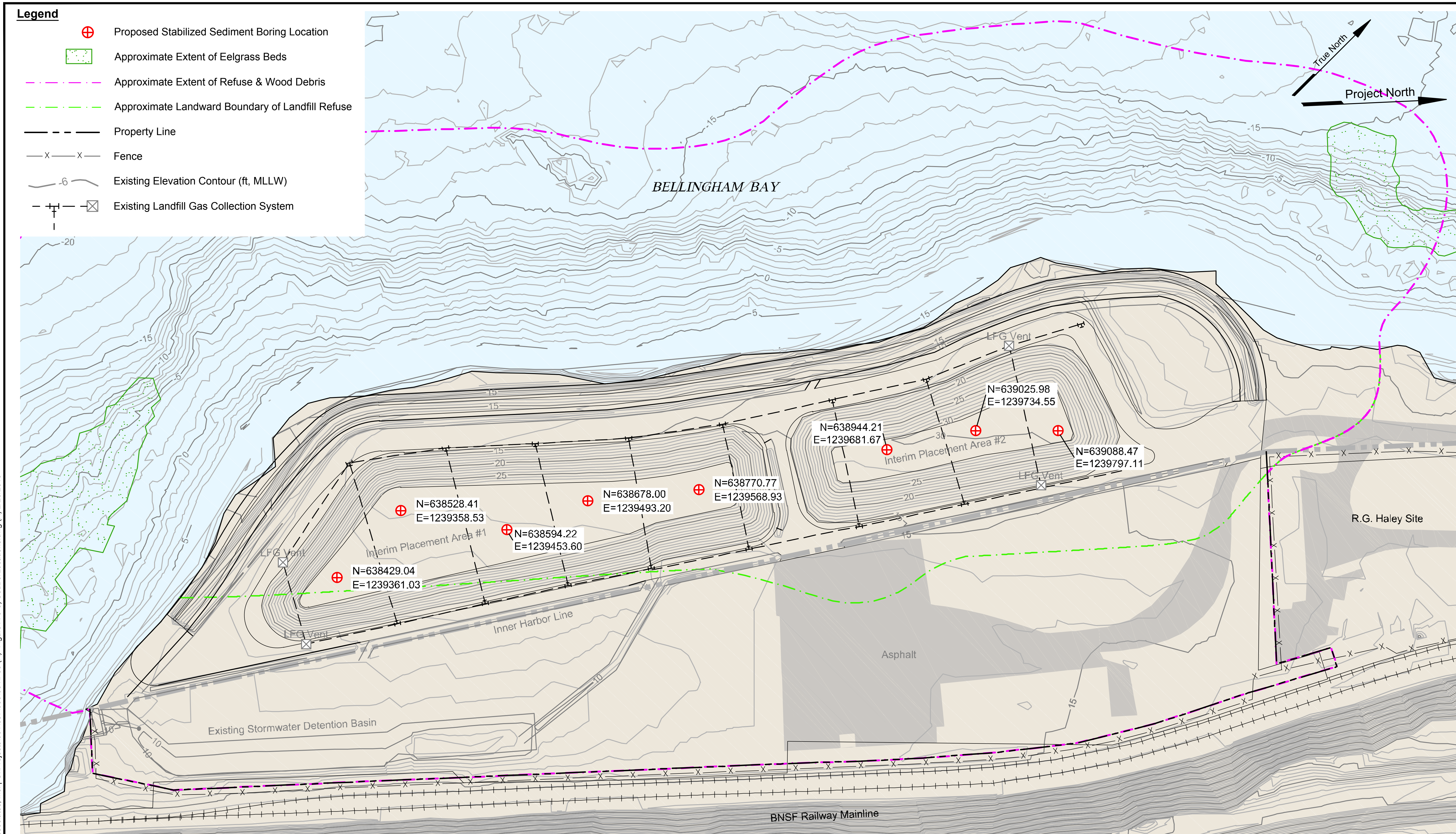
Landau Associates

Pre-Design Work Plan
Cornwall Avenue Landfill
Bellingham, Washington

Landfill Gas Monitoring Plan

Figure
A-2

Landau Associates, Inc. | G:\Projects\001\037\030\031\F03 (A) "Figure A-2"2) LFGasMonitoring.dwg (A) 3/14/2015



Basemap source: Port of Bellingham 1996, Anchor Environmental 2008, Wilson Engineering LLC 2015

0 100 200
Scale in Feet

LANDAU ASSOCIATES

Pre-Design Work Plan
Cornwall Avenue Landfill
Bellingham, Washington

Stabilized Sediment Boring Locations

Figure
A-3

Landau Associates, Inc. | G:\Projects\001\037\030\031\F05 (A) "Figure A-3"3) SedBorLocations.dwg (A) 2/26/2015

TABLE A-1
ANALYTICAL METHODS, SAMPLE CONTAINERS, AND HOLDING TIMES
CORNWALL AVENUE LANDFILL SITE
BELLINGHAM, WASHINGTON

Sample Type	Recommended Method	Container	Preservation	Maximum Holding Time
Landfill Gas	EPA Method TO-15[1]	6-Liter Stainless Steel Summa Canister	None	30 days

Notes:
EPA = US Environmental Protection Agency
1 - Selective ion monitoring to be conducted for vinyl chloride

TABLE A-2
QUANTITATION LIMIT GOALS
CORNWALL AVENUE LANDFILL SITE
BELLINGHAM, WASHINGTON

Parameter		EPA Method TO-15 Quantitation Limit Goals	
VOCs		***ug/M^3***	***ppbv***
1	Propene	0.50	0.29
2	Dichlorodifluoromethane (CFC 12)	0.50	0.10
3	Chloromethane	0.50	0.24
4	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	0.50	0.072
5	Vinyl Chloride[1]	0.06	0.005
6	1,3-Butadiene	0.50	0.23
7	Bromomethane	0.50	0.13
8	Chloroethane	0.50	0.19
9	Ethanol	5.0	2.7
10	Acetonitrile	0.50	0.30
11	Acrolein	2	0.87
12	Acetone	5.0	2.1
13	Trichlorofluoromethane (CFC 11)	0.50	0.089
14	2-Propanol (Isopropyl Alcohol)	5	2
15	Acrylonitrile	0.50	0.23
16	1,1-Dichloroethene	0.50	0.13
17	Methylene Chloride	0.50	0.14
18	3-Chloro-1-propene (Allyl Chloride)	0.50	0.16
19	Trichlorotrifluoroethane (CFC 113)	0.50	0.065
20	Carbon Disulfide	5	1.6
21	trans-1,2-Dichloroethene	0.50	0.13
22	1,1-Dichloroethane	0.50	0.12
23	Methyl tert-Butyl Ether	0.50	0.14
24	Vinyl Acetate	5.0	1.4
25	2-Butanone (MEK)	5	1.7
26	cis-1,2-Dichloroethene	0.50	0.13
27	Ethyl Acetate	1	0.14
28	n-Hexane	0.50	0.14
29	Chloroform	0.50	0.10
30	Tetrahydrofuran (THF)	0.50	0.17
31	1,2-Dichloroethane	0.50	0.12
32	1,1,1-Trichloroethane	0.50	0.092
33	Benzene	0.50	0.16
34	Carbon Tetrachloride	0.50	0.080
35	Cyclohexane	1	0.15
36	1,2-Dichloropropane	0.50	0.11
37	Bromodichloromethane	0.50	0.075
38	Trichloroethene	0.50	0.093
39	1,4-Dioxane	0.50	0.14
40	Methyl Methacrylate	1	0.12
41	n-Heptane	0.50	0.12
42	cis-1,3-Dichloropropene	0.50	0.11
43	4-Methyl-2-pentanone	0.50	0.12
44	trans-1,3-Dichloropropene	0.50	0.11
45	1,1,2-Trichloroethane	0.50	0.092
46	Toluene	0.50	0.13
47	2-Hexanone	0.50	0.12
48	Dibromochloromethane	0.50	0.059
49	1,2-Dibromoethane	0.50	0.065
50	n-Butyl Acetate	0.50	0.11
51	n-Octane	0.50	0.11
52	Tetrachloroethene	0.50	0.074
53	Chlorobenzene	0.50	0.11
54	Ethylbenzene	0.50	0.12
55	m,p-Xylenes	1.0	0.23

TABLE A-2
QUANTITATION LIMIT GOALS
CORNWALL AVENUE LANDFILL SITE
BELLINGHAM, WASHINGTON

Parameter		EPA Method TO-15 Quantitation Limit Goals	
VOCs		***ug/M³***	***ppbv***
56	Bromoform	0.50	0.048
57	Styrene	0.50	0.12
58	o-Xylene	0.50	0.12
59	n-Nonane	0.50	0.095
60	1,1,2,2-Tetrachloroethane	0.50	0.073
61	Cumene	0.50	0.10
62	alpha-Pinene	0.50	0.090
63	n-Propylbenzene	0.50	0.10
64	4-Ethyltoluene	0.50	0.10
65	1,3,5-Trimethylbenzene	0.50	0.10
66	1,2,4-Trimethylbenzene	0.50	0.10
67	Benzyl Chloride	0.50	0.097
68	1,3-Dichlorobenzene	0.50	0.083
69	1,4-Dichlorobenzene	0.50	0.083
70	1,2-Dichlorobenzene	0.50	0.083
71	d-Limonene	0.50	0.090
72	1,2-Dibromo-3-chloropropane	0.50	0.052
73	1,2,4-Trichlorobenzene	0.50	0.067
74	Naphthalene	0.50	0.095
75	Hexachlorobutadiene	0.50	0.047

Abbreviations:

EPA = US Environmental Protection Agency
ppbv = Parts per million by volume
ug/M^3 = micrograms per cubic meter
1 - Vinyl chloride to be analyzed by selective ion monitoring to achieve indicated quantitation limit goals.

APPENDIX B

Marine Sediment Sampling and Analysis Plan (SAP)

Marine Sediment Sampling and Analysis Plan
Pre-Design Investigation
Cornwall Avenue Landfill Site
Bellingham, Washington

April 30, 2015

Prepared for

Port of Bellingham, Washington

LANDAU ASSOCIATES
130 2nd Avenue South
Edmonds, WA 98020
(425) 778-0907

TABLE OF CONTENTS

FIGURES

TABLES

1.0 INTRODUCTION AND BACKGROUND INFORMATION

This sampling and analysis plan (SAP) describes the sample collection, handling, and laboratory analysis procedures for conducting sediment characterization required for design of the final cleanup action for the Cornwall Avenue Landfill site (Site) located in Bellingham, Washington (Figure B-1). This SAP is one of the required deliverables under the Consent Decree (No. 14 2 02593 5) between the Port of Bellingham (Port), City of Bellingham (City), the Washington Department of Natural Resources (DNR), and the Washington State Department of Ecology (Ecology). The objective of this SAP is to identify the scope of work for design-phase sediment characterization as well as sediment sampling procedures, sample handling, and analytical testing methodologies. This SAP was prepared consistent with the requirements of Washington Administrative Code (WAC) 173-340-820, the Sediment Management Standards (SMS; WAC 173-204; Ecology 1995), and the Sediment Cleanup Users Manual II (SCUM II; Ecology 2015).

The cleanup action plan (CAP) identifies cleanup levels based on physical criteria for protection of benthic organisms that requires a minimum of 1 foot (ft) clean sediment cover over wood waste or refuse, but requires that bioassay testing be conducted to confirm that the physical criteria are adequately protective. Previous investigations identified the area within Management Unit 2 (MU-2) where the existing clean sediment achieves the minimum 1-ft thickness of clean sediment overlying refuse or wood debris, as is shown on Figure B-2. As required by the CAP, bioassay testing will be conducted within this area to verify that the minimum 1-ft cover is protective of benthic organisms.

An extensive eelgrass bed is present at the south end of the Site. The CAP currently calls for the eelgrass bed to be covered by the shoreline stabilization system required to prevent further erosion of the landfill into Bellingham Bay. Because of the habitat value of the eelgrass bed, the potential to stabilize the shoreline without covering all or a portion of the eelgrass bed will be evaluated during preliminary coastal engineering evaluations of stabilization system design. If the Site shoreline could be stabilized without covering all or a portion of the eelgrass beds, it would still be necessary to determine whether sediment quality in the potentially uncovered portion of the eelgrass beds is protective of human health and the environment. As a result, a sediment sample will be collected from the eelgrass beds for potential chemical testing, but will only be submitted for chemical analysis if preliminary coastal engineering results indicate at least a portion of the eelgrass beds could be left uncovered by the shoreline stabilization system.

2.0 DESIGN-PHASE SEDIMENT INVESTIGATION SCOPE

To address the design-phase sediment data needs identified in Section 1.0, three sediment surface grab samples will be collected within the area identified on Figure B-2 where at least a 1-ft accumulation of clean sediment was measured during Ecology's 2008 sediment investigation. The results of that testing was presented in the Site remedial investigation/feasibility study (RI/FS) report (Landau Associates 2013). Additionally, one surface sediment sample will be collected for potential chemical testing near the bioassay sample collected from the eelgrass bed at the south end of the Site.

The proposed design-phase sediment investigation scope of work is presented in the following sections. Specific field procedures, analytical methods, and quality assurance/quality control (QA/QC) are described in subsequent sections of this SAP.

2.1 TOXICITY (BIOASSAY) TESTING

Toxicity tests (bioassay) will be performed using sediment collected at the locations shown on Figure B-2. The toxicity test will be used to determine if the chemical concentrations detected in the sediment are toxic to benthic organisms. If the tests meet the biological effects criteria, the physical criteria identified in the CAP for marine sediment protective of benthic organisms (at least 1-ft accumulation of clean sediment over refuse or wood waste) will be considered adequate. If the tests do not meet the biological effects criteria, additional discussion with Ecology will be required to determine appropriate criteria for protection of benthic organisms.

In addition to collecting samples from the locations shown on Figure B-2, a reference sample will be collected for use in the toxicity tests. Toxicity testing requires that appropriate reference sediment be collected and tested with Site sediment. Concurrent tests on reference sediment are conducted to control possible sediment grain size effects on bioassay organisms. Bioassays will be conducted using reference sediment samples with grain size that are similar to the project sediment sample used for toxicity testing (the percent fines for the reference sample will be within 20 percent of the project sample percent fines). The reference samples will be collected from an area where no known chemical contamination is present. Reference sample(s) will be collected from Carr Inlet or Sequim Bay.

Three sediment toxicity tests (bioassay) will be conducted on the samples: acute 10-day amphipod mortality, acute larval mortality/abnormality, and chronic 20-day juvenile polychaete growth rate. The acute 10-day amphipod mortality test will be conducted using adult amphipods, *Ampelisca abdita*. This species was selected based on the interstitial water salinity [greater than or equal to (≥) 25 parts per trillion (ppt)] and percentage of fine-grain sediments (≥60 percent fines) as recommended by Ecology in SCUM II (Ecology 2015). If the project sample contains less than 60 percent fines, the species will be modified appropriately. The acute larval mortality/abnormality test will be conducted using *Mytilus galloprovincialis* (blue mussel) or the *Crassostrea gigas* (pacific oyster). Modifications to the acute larval mortality/abnormality test, as described below, have been conducted using these species. Selection of an appropriate test species for the acute larval mortality/abnormality is dependent on the seasonal availability of adult organisms that can produce viable gametes. Consequently, for this project, the laboratory will select the best available echinoderm larvae, during the week preceding delivery of the initial sediment samples. These may include the *Dendraster excentricus* (sand dollar) or, if necessary, the *Strongylocentrotus purpuratus* (purple sea urchin) or *Strongylocentrotus droebachiensis* (green sea urchin) if the *Mytilus galloprovincialis* or the *Crassostrea gigas* are not available. The chronic 20-day juvenile polychaete growth rate will be conducted using *Neanthes arenoceodentata*.

Toxicity testing will be in compliance with the procedures and QA/QC performance standards described in the Puget Sound Estuary Program (PSEP; 1995) as revised by subsequent agency-approved updates and as described in Chapter 4 and Appendix C of SCUM II (Ecology 2015).

Due to the fine-grained nature of the material at the sample locations and the potential for entrainment and bias of the test results, a modified test-termination procedure will be added to the acute larval mortality/abnormality test. This involves re-suspension of the larvae and sediment at the end of the exposure period, as described in *Bioassay endpoint refinements: Bivalve larval and Neanthes growth bioassays* (Kendall et al. 2013), a Sediment Management Annual Review Meeting (SMARM) paper provided in Appendix B of SCUM II (Ecology 2015).

To accurately evaluate the performance of the reference material during the juvenile polychaete growth rate test, the test will be modified such that any inorganic materials present in the gut of the polychaete used in the project sample, the reference material sample, and laboratory control samples, will not be included in the measurement of the final mass of the biological tissue. This modification protocol is also described in Kendall et al. (2013). The modification includes additional combustion of the test organisms following determination of the dry-weight so that any inorganic material in the polychaete gut is reduced to an ash residue and the residue is then subtracted from the dry-weight to determine an ash-free dry-weight.

Based on the presence of photo-activated PAHs and the relatively shallow nature of the in-water portion of the Site [water depths of 4 meters or less at mean lower low water (MLLW) for greater than 25% of Site sediment], bioassays will be performed in the presence of full spectrum laboratory lighting as described in Appendix C of SCUM II (Ecology 2015).

2.2 POTENTIAL CHEMICAL TESTING

The proposed location of the surface sediment sample to be collected for potential chemical analysis is shown on Figure B-2. The surface sediment sample will be frozen and archived at the analytical laboratory for potential future testing. If it is determined that at least a portion of the eelgrass bed could be retained without coverage by the shoreline stabilization system, the archived sample will be tested for the indicator hazardous substances (IHS) identified in the CAP for marine sediment, which consist of copper, cadmium, lead, silver, zinc, bis(2-ethylhexyl)phthalate, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), and polychlorinated biphenyls (PCBs).

3.0 FIELD INVESTIGATION PROCEDURES

This section presents investigation methods and procedures to be used in the field during the sediment investigation.

3.1 STATION POSITIONING METHODS

The objective of the station positioning is to accurately establish and record the positions of all sampling locations within ±2 meters (6.56 ft). The northing and easting coordinates of the proposed sediment sampling station locations in State Plane Coordinates are provided in Table B-1. Station locations will be surveyed in the field using a Trimble NT300D differential global positioning system (DGPS) or equivalent DGPS with the use of a known survey control point. Sampling station coordinates will be reported relative to the North American Datum of 1983 (NAD83). Planned sampling location coordinates will be entered into the sampling vessel's onboard GPS unit.

Vertical position control at each location will be evaluated by using a lead line (or weighted tape) to measure from the water surface to the sediment surface. The elevation of the mudline at each location will be calculated by measuring depth of water at each location and subtracting it from the tide elevation. Mudline elevations will be recorded based on the mean lower low water (MLLW) datum.

3.2 SEDIMENT SAMPLE COLLECTION FOR CHEMICAL TESTING

Surface sediment samples for chemical testing will be collected using a powered (pneumatic) grab sampler. A hydraulic winch system will be used to deploy the sampler at a rate not exceeding 1 meter/second to minimize the bow wake associated with sampler descent. Once the sampler hits the bottom, the jaws will be activated and then the sampler will be brought to the deck of the vessel at a rate not exceeding 1 meter/second to minimize any washing and disturbance of the sediment within the sampler. The date, time, mudline elevation, sample depth, and location of sample acquisition will be recorded on the sample collection form.

Once onboard, the sampler will be secured, any overlying water will be carefully siphoned off, and the sample will be inspected to determine acceptability. Criteria used to determine acceptability are those detailed in PSEP (1997) guidelines. These criteria include but are not limited to:

- Minimal or no excessive water leakage from the jaws of the sampler
- No excessive turbidity in the water overlying the sample
- The sampler is not overfilled with sediment
- The sediment surface appears to be intact with minimal disturbance
- The penetration depth is sufficient (10 cm; dependent on grain size).

If the sample meets acceptability criteria, the sediment will be characterized on the field sample collection form. This characterization will include color, odor, sheen, grain size, a soil description consistent with the Visual Manual Method (ASTM International 2009), and field-screening results (e.g., photo-ionization detector readings). If after multiple sampling attempts, a surface sample does not meet acceptability criteria (e.g., over-penetration), the sample will still be collected but the sampler will document the reasons for not meeting criteria on the sample collection form.

Once the sample has been characterized, the sediment will then be homogenized and sub-sampled for chemical analysis (if applicable). Sediment will be collected from the bioactive zone (top 10 cm of the sediment) from an area large enough to ensure adequate sample volume and excluding portions that are touching the power-grab sampler. This collected sediment will exclude large, unrepresentative material (e.g., shells, woody debris). Sediment will be homogenized to obtain a smooth consistency (based on color and texture) in decontaminated stainless steel bowls, using a decontaminated stainless steel spoon. After sufficient homogenization, sediment will be placed into laboratory-supplied containers, placed on ice, and stored in coolers at approximately 4°C until transported to the laboratory.

3.3 SEDIMENT SAMPLE COLLECTION FOR TOXICITY TESTING

Samples for toxicity testing, including reference samples, will be collected from the upper 10 centimeters (cm) using the procedures described in Section 3.2 for collection of surface sediment for chemical analysis.

Field grain size wet sieving will be conducted for determining the appropriate reference sediments. This process separates the sediment sample into size fractions greater than 62.5 micrometers (µm) (i.e., sand and gravel) and less than 62.5 µm (i.e., silt and clay) for classification of sand and silt/clay fractions. This process helps determine appropriate reference stations with similar grain size fractions (by volume) during field operations. This procedure requires a 62.5-µm sieve, a funnel with a diameter slightly greater than that of the sieve frame, a 100-millileter (ml) graduated cylinder, a squirt bottle, a supply of distilled water, and a bowl for collecting rinse water. Procedures for field grain size sieving are as follows:

- Place a 62.5 µm (4-phi or 0.0025-inch mesh or #230 mesh size) sieve in a funnel with a bowl underneath.
- Moisten the sieve using a light spray of distilled water.
- Place exactly 50 ml of sample in the 100-ml graduated cylinder, add 20 to 30 ml of distilled water, and stir to fluidize the sample.
- Pour the sample into the sieve and thoroughly rinse any residue from the 100-ml graduated cylinder and stir into the sieve.

- Wash the sediment onto the sieve with distilled water using a water pique or squirt bottle having low water pressure.
- Continue wet sieving until only clear water passes through the sieve. This is accomplished by sieving an appropriate sample quantity (i.e., a sample volume that is not too large) and by efficient use of rinse water. Both of these techniques may require experimentation before routine wet sieving is started. Upon completion of sieving, carefully return the contents (i.e., sand and gravel fraction) of the sieve to the 100-ml graduated cylinder.
- Tap the graduated cylinder gently to settle the solid material.
- Read the volume of solid material from the scale on the side of the graduated cylinder and record the value. The fraction of sample with grain size greater than 62.5 µm is the ratio of the volume of material retained in the sieve to the original volume (50 ml).

3.4 DECONTAMINATION

All field sampling equipment, including the pneumatic power grab sampler, stainless steel bowls and spoons, and sample core tubes will be decontaminated in the following manner:

- Rinsed with clean Site water
- Scrubbed with a phosphate-free detergent solution (e.g., Alconox)
- Rinsed with clean Site water.

Equipment used during core processing at the laboratory will be rinsed with clean tap water, scrubbed with Alconox, and rinsed with de-ionized water.

3.5 SAMPLE DOCUMENTATION AND HANDLING

A complete record of field activities will be maintained. Documentation necessary to meet quality assurance (QA) objectives for this project include: field notes and sampling forms, sample container labels, and sample chain-of-custody forms. All original documentation will be kept in the Landau Associates project files. The documentation and other project records will be safeguarded to prevent loss, damage, or alteration.

If an error is made on a document, corrections will be made by drawing a single line through the error and entering the correct information. The erroneous information will not be obliterated. Corrections will be initialed and dated, and, if necessary, a footnote explaining the correction will be added. Errors will be corrected by the person who made the entry, whenever possible. Documentation will include:

- Recordkeeping by field personnel of primary field activities
- Recordkeeping of all samples collected for analysis
- Use of sample labels and chain-of-custody tracking forms for all samples collected for analysis.

Field report forms will provide descriptions of all sampling activities, sampling personnel, weather conditions, and a record of all modifications to the procedures and plans identified in this SAP. The field report forms are intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during the sampling period.

After sample collection, the following information will be recorded on the field log sheet:

- Sample identification
- Date and time of sample collection
- Name of person collecting the sample
- Sample location coordinates
- Depth of water at the location
- Surface water elevation at the time of sample collection
- Sampler penetration depth
- Physical observations including presence of debris (e.g., wood debris), color, presence of sheen (or other visible contamination), apparent grain size, and odor.

3.5.1 SAMPLE IDENTIFICATION

All sediment samples will be assigned an individual identification. The samples will be identified in a manner that identifies the name of the Site [i.e., Cornwall Avenue Landfill (CL)]; identifies the sample type location [i.e., surface sediment grab (SG), bioassay testing (BA)]; and identifies the location of the sample (i.e., station number). Additionally, samples collected for bioassay testing will also integrate "BA" into the sample label. Examples of the sample identification nomenclature that will be used at the Site include:

- The sample name for toxicity testing will be **CL-BA-1-(mm/dd/yy)** for the first sediment sample collected from the Site for toxicity testing.
- The reference sample(s) collected for bioassay testing will be labeled **REF-1-(mm/dd/yy)** and **REF-2-(mm/dd/yy)** (if applicable).
- The surface sediment sample collected for potential chemical testing will be identified as **CL-SG-1-(mm/dd/yy)**.

3.5.2 SAMPLE CONTAINER LABELS

Sample labels will be made of waterproof material and will be self-adhering. An indelible pen will be used to fill out each label. Each sample label will contain the project number, sample identification, preservation technique (if applicable), analyses, date and time of collection, and initial of the person(s) preparing the sample.

3.5.3 SAMPLE CONTAINERS, PRESERVATION, AND STORAGE

Samples submitted to the laboratory for chemical analysis will be placed in the appropriate sample container provided by the laboratory. The samples will be preserved by cooling to a temperature of 4°C or frozen as required by the analytical method. Maximum holding and extraction times until analysis will be strictly adhered to by field personnel and the analytical laboratory. Analytical methods, sample containers, and holding times for each chemical analysis to be performed during the surface sediment quality investigation are provided in Table B-2.

All samples archived at the laboratory will be properly packed in coolers and maintained at 4ºC. Original chain-of-custody forms and analysis request forms will accompany the samples to the laboratory.

3.5.4 SAMPLE CUSTODY

The primary objective of sample custody is to create an accurate, written record that can be used to trace the possession and handling of samples so that their quality and integrity can be maintained from collection until completion of all required analyses. Adequate sample custody will be achieved by means of approved field and analytical documentation. Such documentation includes the chain-of-custody record, which is initially completed by the sampler and is, thereafter, signed by those individuals who accept custody of the sample.

3.6 MANAGEMENT OF RESIDUAL WASTES

Excess sediment generated during sediment sampling will be returned to the water at the station where it was collected.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL

This section describes both field and laboratory QA/QC procedures and provides a description of the data quality review that will be performed on the analytical and biological test results. Implementation of these procedures in conjunction with the sample collection and handling procedures described in Section 3.0 should provide a reasonable degree of confidence in the project data.

4.1 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL FOR BIOASSAY, CHEMICAL, AND PHYSICAL ANALYSES

Bioassay toxicity testing will be in compliance with the QA/QC performance standards described in PSEP (1995) as revised by subsequent agency-approved updates and as described in SCUM II (Ecology 2015). Quality control procedures will include negative controls, positive controls, reference sediment samples, laboratory replicates, and measurements of water quality during testing.

QA/QC for chemical testing of sediment samples includes laboratory instrument QA/QC and analytical method QA/QC. Instrument QA/QC monitors the performance of the instrument and method QA/QC monitors the performance of sample preparation procedures. The laboratory quantitation limit goals for chemical analysis of Site IHS are presented in Table B-3. The analytical laboratory will be responsible for instrument and method QA/QC. QA/QC procedures to be performed by the laboratory are summarized in Table B-4 for analyses of organic compounds, Table B-5 for analyses of metals, and Table B-6 for analyses of conventional parameters. The frequency that each procedure should be implemented and the control limits for the procedures are also summarized in Tables B-4, B-5, and B-6. When an instrument or method control limit is exceeded, the laboratory will contact Landau Associates' quality control officer immediately. The laboratory will be responsible for correcting the problem and will reanalyze the samples within the sample hold time if sample reanalysis is appropriate.

4.2 FIELD AND LABORATORY QUALITY CONTROL SAMPLES FOR CHEMICAL ANALYSES

Field and laboratory control samples that will be used for quality control purposes during the sediment investigation are described in the following subsections.

4.2.1 BLIND FIELD DUPLICATE

A blind field duplicate will be collected for the one surface sediment sample being collected for chemical testing. The blind field duplicate will consist of a split sample collected at a single sample location. The sample will be homogenized, split into duplicate sample containers, and submitted blind to the laboratory as two discrete samples. The blind field duplicate samples will be used to evaluate data precision. The blind field duplicate will be analyzed for the same Site IHS as the primary sediment sample.

4.2.2 LABORATORY MATRIX SPIKE

A minimum of one laboratory matrix spike will be included with each analysis. These analyses will be conducted to provide information on accuracy and to verify that extraction and concentration levels are acceptable. The laboratory spikes will follow EPA guidance for matrix and blank spikes.

4.2.3 LABORATORY MATRIX SPIKE DUPLICATE

A minimum of one laboratory matrix spike duplicate will be included with each organic analysis. These analyses will be conducted to provide information on the precision of chemical analyses. The laboratory spikes will follow EPA guidance for matrix and blank spike duplicates.

4.2.4 LABORATORY DUPLICATES

A minimum of one laboratory duplicate per 20 samples, not including laboratory QC samples, or one laboratory duplicate sample per batch of samples if fewer than 20 samples are obtained, will be included with each analysis. Laboratory triplicates will be analyzed for TOC and total solids. These analyses will be conducted to provide information on the precision of chemical analyses. The laboratory duplicate will follow EPA guidance in the method.

4.2.5 LABORATORY METHOD BLANKS

One laboratory method blank will be analyzed for all parameters (except total solids) to assess possible laboratory contamination. Dilution water will be used whenever possible. Method blanks will contain all reagents used for analysis. The generation and analysis of additional method, reagent, and glassware blanks may be necessary to verify that laboratory procedures do not contaminate samples.

4.2.6 LABORATORY CONTROL SAMPLE

One laboratory control sample will be analyzed for all parameters except total solids.

4.2.7 SURROGATE SPIKES

Samples analyzed for organic constituents will be spiked with appropriate surrogate compounds as defined by the analytical methods.

4.3 DATA QUALITY EVALUATION

An internal data quality evaluation will be conducted on all sample data collected as part of the surface sediment investigation to determine acceptability of data results. Data quality evaluation will be conducted with guidance from applicable portions of EPA's *National Functional Guidelines for Organic Data Review* (EPA 1999, 2008) and the *National Functional Guidelines for Inorganic Data Review* (EPA 2004, 2010). The verification and validation check for each laboratory data package includes the following:

- Verification that the laboratory data package contains all necessary documentation (including chain-of-custody records; identification of samples received by the laboratory; date and time of receipt of the samples at the laboratory; sample conditions upon receipt at the laboratory; date and time of sample analysis; and, if applicable, date of extraction, definition of laboratory data qualifiers, all sample-related quality control data, and quality control acceptance criteria).
- Verification that all requested analyses, special cleanups, and special handling methods were performed.
- Evaluation of sample holding times.
- Evaluation of quality control data compared to acceptance criteria, including method blanks, surrogate recoveries, matrix spike results, laboratory duplicate and/or replicate results, and laboratory control sample results.

Data validation qualifiers are added to the sample results, as appropriate, based on the verification and validation check. The absence of a data qualifier indicates that the reported result is acceptable without qualification.

Data qualification arising from data validation activities will be described in the data validation report, rather than in individual corrective action reports.

Care will be taken by the laboratory to not use method detection limits and to use practical quantitation limits in accordance with SCUM II (Ecology 2015).

4.3.1 Laboratory Reports

A written report will be prepared by the analytical laboratory documenting all the activities associated with sample analyses. At a minimum, the following will be included in the report:

- Results of the laboratory analyses and QA/QC results
- All protocols used during analyses
- Chain-of-custody procedures, including explanation of any deviation from those identified herein
- Any protocol deviations from this SAP
- Location and availability of the data
- Batch identification for each analysis method
- Digestion/extraction/analysis dates for each QA/QC parameter corresponding to each batch definition (i.e., all QA/QC data will be batch-specific)
- A case narrative.

As appropriate, this SAP may be referenced in describing protocols.

4.4 DATA MANAGEMENT PROCEDURES

All laboratory analytical results, including QC data, will be submitted to Landau Associates. Following validation of the data, any qualifiers will be added to the Excel spreadsheets. All field data will be entered into an Excel spreadsheet and verified to determine all entered data is correct and without omissions and errors. Following receipt of all data, analytical results will be formatted electronically and downloaded to Ecology's Environmental Information Management (EIM) system.

* * * * * * * * * *

This document has been prepared under the supervision and direction of the following key staff:

LANDAU ASSOCIATES, INC.

Lawrence D. Beard, P.E.
Principal

5.0 REFERENCES

Ecology. 2015. Sediment Cleanup Users Manual II. Publication No. 12-09-057. March.

Ecology. 1995. *Sediment Management Standards*, Chapter 173-204 Washington Administrative Code. Publication No. 96-252. December.

EPA. 2010. *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review*. USEPA-540-R-10-011. U.S. Environmental Protection Agency. Office of Superfund Remediation and Technology Innovation. Washington, D.C. January.

EPA. 2008. *USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review*. USEPA-540-R-08-01. U.S. Environmental Protection Agency. Office of Superfund Remediation and Technology Innovation. Washington, D.C. June.

EPA. 2004. *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*. EPA 540-R-04-004. U.S. Environmental Protection Agency. Office of Superfund Remediation and Technology Innovation. October.

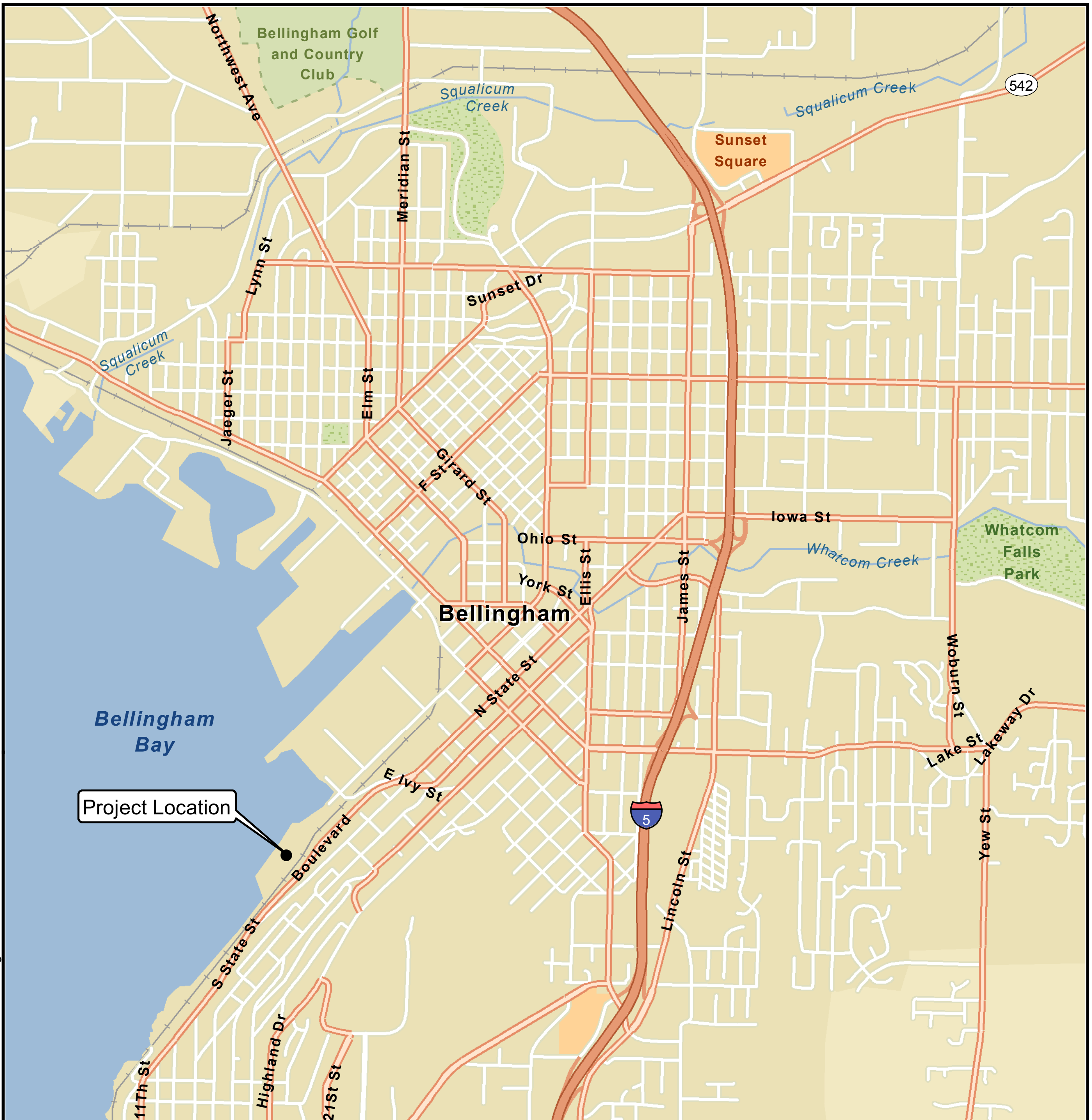
EPA. 1999. *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*. EPA-540/R-99-008. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Washington, D.C. October.

EPA. 1996. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846).* Available at: http://www.epa.gov/solidwaste/hazard/testmethods/sw846/online/index.htm U.S. Environmental Protection Agency, Office of Solid Wastes.

Kendall, D., McMillan, R., Gardiner, B., Hester, B., and Word, J.D. 2013. *Bioassay endpoint refinements: Bivalve larval and Neanthes growth bioassays.* DMMP/SMS clarification paper. June 5.

PSEP. 1997. *Recommended guidelines for sampling marine sediment, water column, and tissue in Puget Sound*. U.S. Environmental Protection Agency, Region 10, Seattle, WA and Puget Sound Water Quality Authority, Olympia, WA. Puget Sound Estuary Program.

PSEP. 1995. *Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments*. Interim Final Report, Puget Sound Estuary Program, US Environmental Protection Agency, Region 10, Seattle, Washington. July.

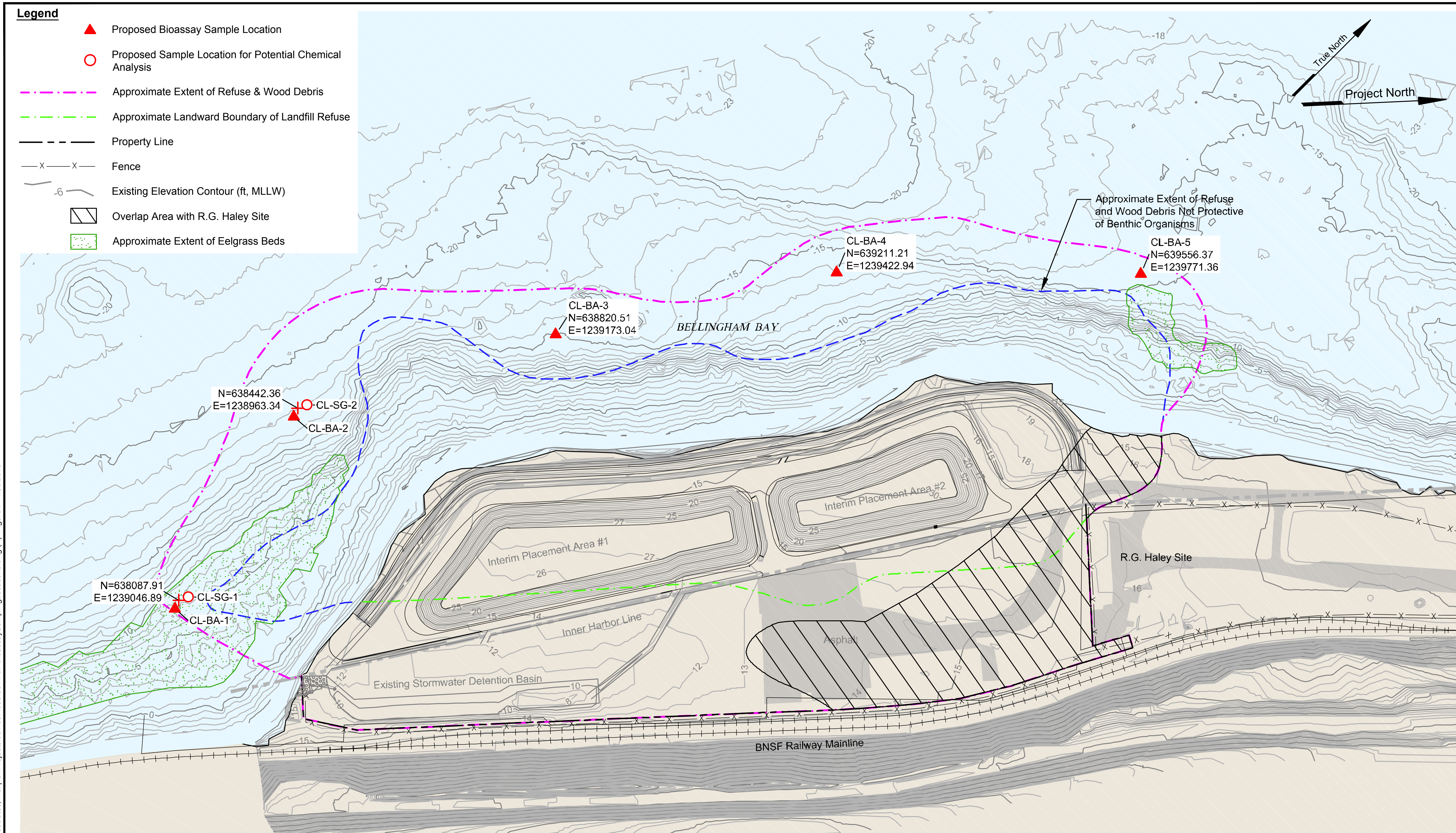


Data Source: Esri 2012

G:\Projects\001\037\030\031\VicMap.mxd 2/17/2015 NAD 1983 StatePlane Washington North FIPS 4601 Feet

Landau Associates

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



Basemap source: Port of Bellingham 1996, Anchor Environmental 2008, Wilson Engineering LLC 2015

0 150 200
Scale in Feet

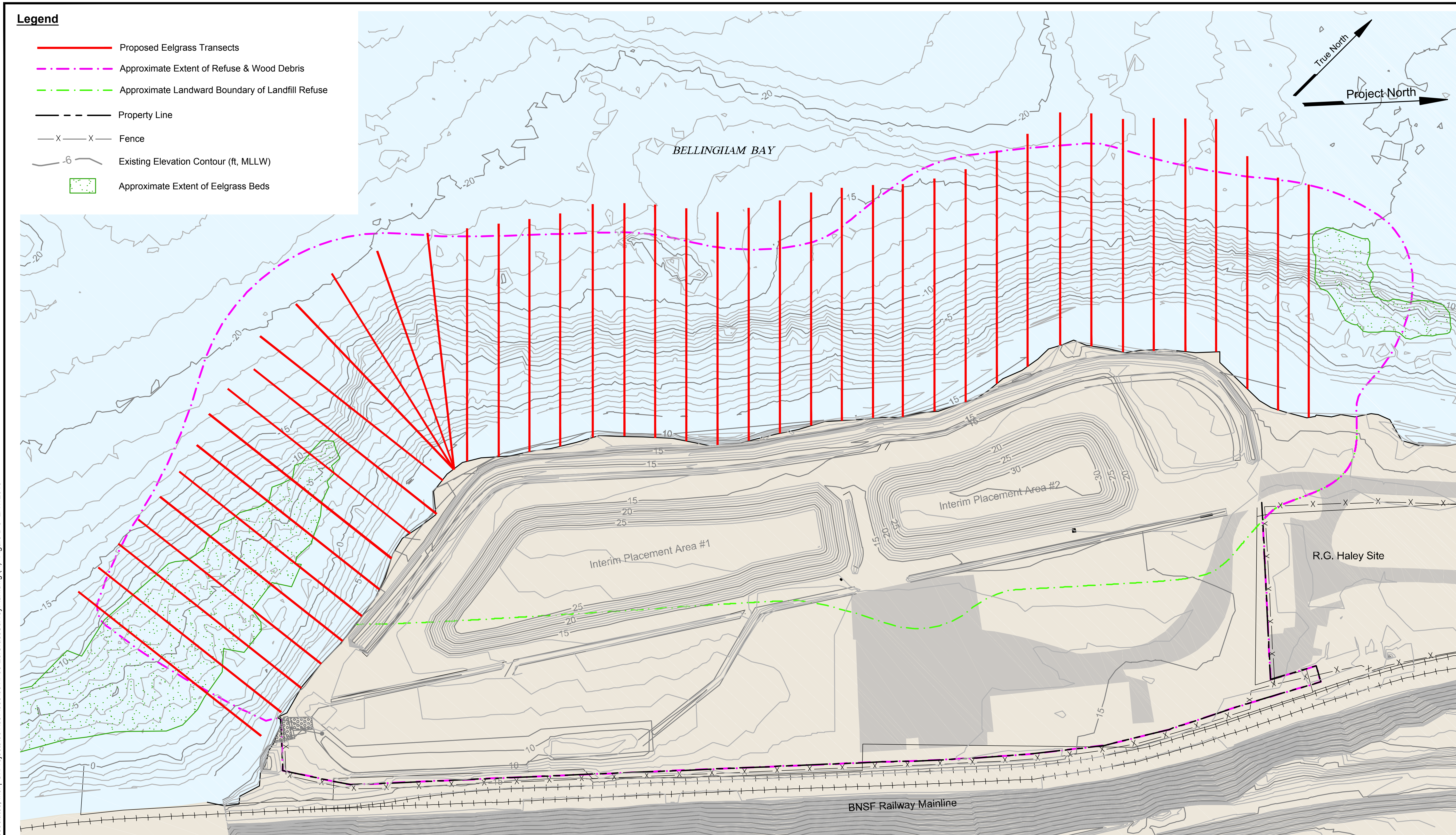
Landau Associates, Inc. | G:\Projects\001\037\030\031\F07 BioassaySamplingLocations.dwg (A) "Figure 7" 4/30/2015

LANDAU ASSOCIATES

Pre-Design Work Plan
Cornwall Avenue Landfill
Bellingham, Washington

Bioassay Sampling Locations

Figure
B-2



Basemap Source: Port of Bellingham, 1996; Anchor Environmental, 2008; Wilson Engineering LLC, 2015

0 120 240
Scale in Feet

LANDAU ASSOCIATES

Grette Associates LLC ENVIRONMENTAL CONSULTANTS

Pre-Design Work Plan
Cornwall Avenue Landfill
Bellingham, Washington

Eel Grass Survey Plan

Figure B-3

Landau Associates, Inc. | G:\Projects\001\037\030\031\F08 EelGrassSurveyPlan.dwg (A) "Figure B-3" 2/17/2015

TABLE B-1
PROPOSED SEDIMENT SAMPLE LOCATIONS AND DESIGNATIONS
CORNWALL AVENUE LANDFILL SITE
BELLINGHAM, WASHINGTON

Sample Location Name	Sample Type	Coordinates (Feet) (a)	
		Northing	Easting
CL-BA-1	Sediment Bioassay Surface Grab	638372.80	1239070.55
CL-BA-2	Sediment Bioassay Surface Grab	638820.51	1239173.04
CL-BA-3	Sediment Bioassay Surface Grab	639301.52	1239513.89
CL-SG-1	Sediment Chemical Surface Grab	638372.80	1239070.55

(a) Washington State Plane North Zone; North American Datum of 1983 (NAD83).

TABLE B-2
SAMPLE SIZE, CONTAINERS, AND ANALYTICAL METHODS
CORNWALL AVENUE LANDFILL SITE
BELLINGHAM, WASHINGTON

Sample Type	Recommended Method	Container	Preservation	Maximum Holding Time
Metals (Cu, Cd, Pb, Ag, Zn)	6010B/6020 or 7471A/245.5	8 oz - WMG with teflon-lined lid	Cool, 4^{o}C	6 months, 28 days for mercury
Semivolatiles (BEHP)	8270C/1625C	8 oz - WMG with teflon-lined lid	Cool, 4^{o}C	14 days (a), 1 year (b)
cPAHs	8270-SIM	8 oz - WMG with teflon-lined lid	Cool, 4^{o}C	14 days (a), 1 year (b)
PCBs (Congener)	1668A	4 oz - amber WMG with teflon-lined lid	Cool, 4^{o}C	14 days (a), 1 year (b)
TOC	9060	4 oz - WMG with teflon-lined lid	Cool, 4^{o}C	28 days, 6 months (b)
Total Solids	PSEP	4 oz - WMG with septa lid	Cool, 4^{o}C	14 days, 6 months (b)
Grain Size	Plumb 1981	1-16 oz WMG	Cool, 4^{o}C	6 months

(a) Holding time shown is from sample collection to extraction; holding time from extraction to analysis is 40 days.
(b) Holding time shown is from sample collection to extraction if sample is frozen.

Abbreviations:
BEHP = bis(2-Ethylhexyl)phthalate
cPAHs = carcinogenic polycyclic aromatic hydrocarbons
PCBs = Polychlorinated Biphenyls
PSEP = Puget Sound Estuary Program
TOC= Total Organic Carbon
WMG = Wide Mouth Glass
oz = ounces
^{o}C = degrees Celsius

TABLE B-3
QUANTITATION LIMIT GOALS
CORNWALL AVENUE LANDFILL SITE
BELLINGHAM, WASHINGTON

		Site Cleanup Level (mg/kg dw)	Quantitation Limit Goals (mg/kg dw) (a)
Metals			
	Cadmium	1	0.1
	Copper	390	0.2
	Lead	21	0.1
	Silver	6.1	2
	Zinc	410	1
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)			
	Benzo(a)anthracene		0.005
	Benzo(a)pyrene		0.005
	Chrysene		0.005
	Dibenz(a,h)anthracene		0.005
	Indeno(1,2,3-cd)pyrene		0.005
	Benzofluoranthenes (total)		0.005
	cPAH TEQ	TBD	
Other Semivolatile Organics			
	bis(2-Ethylhexyl)phthalate	0.47 (b)	0.1
Polychlorinated Biphenyls (PCBs)			
	Total PCBs (Congener Analysis)	TBD	0.000001 (c)

Numerical Criteria Notes:

(a) Reporting limit goals are based on current laboratory data and may be modified during the investigation process as methodology is refined. Laboratory reporting will be based on the lowest standard on the calibration curve. Instances may arise where high sample concentrations, nonhomogeneity of samples, or matrix interferences preclude achieving the desired reporting limits.

(b) Dry weight equivalent of organic carbon normalized cleanup level of 47 mg/kg organic carbon based on a 1 percent TOC content.

(c) Quantitation limit for individual PCB congeners = 1 pg/g; co-eluting congeners will elevate the reporting limit by 1 pg/g for each congeners in the co-eluting set.

Abbreviations:

cPAHs = carcinogenic polycyclic aromatic hydrocarbons
dw = dry weight
mg/kg = milligram per kilogram
pg/g = picogram per gram
TBD = To be determined
TEQ = Toxicity Equivalency
TOC = Total Organic Carbon

TABLE B-4
QUALITY CONTROL PROCEDURES FOR ORGANIC ANALYSES
CORNWALL AVENUE LANDFILL SITE
BELLINGHAM, WASHINGTON

Quality Control Procedure	Frequency	Control Limit	Corrective Action
Instrument Quality Assurance/Quality Control			
Initial Calibration	See reference method(s) in Table B-2	See reference method(s) in Table B-2	Laboratory to recalibrate and reanalyze affected samples
Continuing Calibration	See reference method(s) in Table B-2	See reference method(s) in Table B-2	Laboratory to recalibrate if correlation coefficient or response factor does not meet method requirements
Method Quality Assurance/Quality Control			
Holding Times	Not applicable	See Table B-2	Qualify data or collect fresh samples in cases of extreme holding time or temperature exceedance
Reporting Limits	Annually	See Table B-3	Laboratory must initiate corrective actions (which may include additional cleanup steps as well as other measures) and contact the QA/QC coordinator and/or project manager immediately
Method Blanks	One per sample batch or every 20 samples, whichever is more frequent, or when there is a change in reagents	Analyte concentration < PQL	Laboratory to eliminate or greatly reduce laboratory contamination due to glassware, reagents, or analytical system; reanalyze affected samples
Analytical (Laboratory) Replicates and Matrix Spike Duplicates	1 duplicate analysis with every sample batch or every 20 samples, whichever is more frequent. Use analytical replicates when samples are expected to contain target analytes. Use matrix spike duplicates when samples are not expected to contain target analytes.	Compound- and matrix-specific relative percent difference (RPD) of ≤35% applied when the analyte concentration is greater than PQL	Laboratory to redigest and reanalyze samples if analytical problems suspected, or to qualify the data if sample homogeneity problems suspected and the project manager consulted
Matrix Spikes	One per sample batch or every 20 samples, whichever is more frequent; spiked with the same analytes at the same concentration as the LCS	Compound- and matrix-specific	Matrix interferences should be assessed and explained in the case narrative accompanying the data package
Surrogate Spikes	Added to every organics sample as specified in analytical protocol	Compound-specific	Follow corrective actions specified in SW-846 (EPA 1996).
Laboratory Control Samples (LCS), Certified or Standard Reference Material	One per analytical batch or every 20 samples, whichever is more frequent	Compound-specific, recovery and relative standard deviation for repeated analyses should not exceed the control limits specified in the method of Table B-2 or performance-based intralaboratory control limits, whichever is lower	Laboratory to correct problem to verify the analysis can be performed in a clean matrix with acceptable precision and recovery; then reanalyze affected samples
Field Quality Assurance/Quality Control			
Field Replicates	At project manager's discretion	Not applicable	Not applicable
Field Blanks	At project manager's discretion	Analyte concentration ≤ PQL	Compare to method blank results to rule out laboratory contamination; modify sample collection and equipment decontamination procedures

Abbreviations:
EPA = U.S. Environmental Protection Agency
PQL = Practical Quantitation Limit

TABLE B-5
QUALITY CONTROL PROCEDURES FOR METALS ANALYSES
CORNWALL AVENUE LANDFILL SITE
BELLINGHAM, WASHINGTON

Quality Control Procedure	Frequency	Control Limit	Corrective Action
Instrument Quality Assurance/Quality Control			
Initial Calibration	Daily	Correlation coefficient $\geq$ 0.995	Laboratory to optimize and recalibrate the instrument and reanalyze any affected samples
Initial Calibration Verification	Immediately after initial calibration	90 - 110% recovery or performance-based intralaboratory control limits, whichever is lower	Laboratory to resolve discrepancy prior to sample analysis
Continuing Calibration Verification	After every 10 samples or every 2 hours, whichever is more frequent, and after the last sample	90 -110% recovery	Laboratory to recalibrate and reanalyze affected samples
Initial and Continuing Calibration Blanks	Immediately after initial calibration, then 10% of samples or every 2 hours, whichever is more frequent, and after the last sample	Analyte concentration < PQL	Laboratory to recalibrate and reanalyze affected samples
ICP Interelement Interference Check Samples	At the beginning and end of each analytical sequence or twice per 8-hour shift, whichever is more frequent	80 - 120% of the true value	Laboratory to correct problem, recalibrate, and reanalyze affected samples
Method Quality Assurance/Quality Control			
Holding Times	Not applicable	See Table B-2	Qualify data or collect fresh samples
Detection Limits	Not applicable	See Table B-3	Laboratory must initiate corrective actions and contact the QA/QC coordinator and/or the project manager immediately
Method Blanks	With every sample batch or every 20 samples, whichever is more frequent		Laboratory to redigest and reanalyze samples with analyte concentrations < 10 times the highest method blank
Analytical (Laboratory) Replicates and Matrix Spike Duplicates	1 duplicate analysis with every sample batch or every 20 samples, whichever is more frequent. Use analytical replicates when samples are expected to contain target analytes. Use matrix spike replicates when samples are not expected to contain target analytes.	Relative Percent Difference (RPD) $\leq$ 20 % applied when the analyte concentration is greater than PQL	Laboratory to redigest and reanalyze samples if analytical problems suspected, or to qualify the data if sample homogeneity problems suspected and the project manager consulted
Matrix Spikes	With every sample batch or every 20 samples, whichever is more frequent	75 - 125% recovery applied when the sample concentration is < 4 times the spiked concentration for a particular analyte	Laboratory may be able to correct or minimize problem; or qualify and accept data
Laboratory Control Samples, Certified or Standard Reference Material	Overall frequency of 5% of field samples	80 - 20% recovery, or performance-based intralaboratory control limits, whichever is lower	Laboratory to correct problem to verify the analysis can be performed in a clean matrix with acceptable precision and recovery; then reanalyze affected samples

TABLE B-5
QUALITY CONTROL PROCEDURES FOR METALS ANALYSES
CORNWALL AVENUE LANDFILL SITE
BELLINGHAM, WASHINGTON

Quality Control Procedure	Frequency	Control Limit	Corrective Action
Field Quality Assurance/Quality Control			
Field Replicates	At project manager's discretion	Not applicable	Not applicable
Field Blanks	At project manager's discretion	Analyte concentration $\leq$ PQL	Compare to method blank results to rule out laboratory contamination; modify sample collection and equipment decontamination procedures

Abbreviations:
EPA = U.S. Environmental Protection Agency
PQL = Practical Quantitation Limit

Instrument and method QA/QC monitor the performance of the instrument and sample preparation procedures, and are the responsibility of the analytical laboratory. When an instrument or method control limit is exceeded, the laboratory is responsible for correcting the problem and reanalyzing the samples. Instrument and method QA/QC results reported in the final data package should always meet control limits (with a very small number of exceptions that apply to difficult analytes as specified by EPA for the Contract Laboratory Program). If instrument and method QA/QC procedures meet control limits, laboratory procedures are deemed to be adequate. Matrix and field QA/QC procedures monitor matrix effects and field procedures and variability. Although poor analytical procedures may also result in poor spike recovery or duplicate results, the laboratory is not held responsible for meeting control limits for these QA/QC samples. Except in the possible case of unreasonably large exceedances, any reanalyses will be performed at the request and expense of the project manager.

TABLE B-6
QUALITY CONTROL PROCEDURES FOR CONVENTIONAL ANALYSES
CORNWALL AVENUE LANDFILL SITE
BELLINGHAM, WASHINGTON

	Suggested Control Limit						
Analyte	**Initial Calibration (a)**	**Continuing Calibration (a)**	**Calibration Blanks (a)**	**Laboratory Control Samples**	**Matrix Spikes (a,b)**	**Laboratory Triplicates (a,b)**	**Method Blank (a,b)**
Grain size	N/A	N/A	N/A	N/A	N/A	20% RSD	N/A
Total organic carbon	Correlation coefficient ≥0.995	90 - 110% recovery	Analyte concentration ≤ PQL	80 -120% recovery	75 -125% recovery	20% RSD	Analyte concentration ≤ PQL
Total solids	N/A	N/A	N/A	N/A	N/A	20% RSD	Analyte concentration ≤ PQL

(a) EPA and PSEP control limits are not available for conventional analytes. The control limits provided above are suggested limits only. They are based on EPA control limits for metals analyses (see Table B-5), and an attempt has been made to take into consideration the expected analytical accuracy using PSEP methodology. Corrective action to be taken when control limits are exceeded is left to the Project Manager's discretion. The corrective action indicated for metals in Table B-5 may be applied to conventional analytes.

(b) When applicable, the QA/QC procedures indicated in this table should be completed at the same frequency as for metals analyses (see Table B-5).

Abbreviations:

N/A = Not applicable
RSD = Relative Standard Deviation
PQL = Practical quantitation limit
EPA = U.S. Environmental Protection Agency
PSEP = Puget Sound Estuary Program
QA/QC = Quality assurance and quality control

APPENDIX C

Health and Safety Plan

LANDAU ASSOCIATES
ENVIRONMENTAL | GEOTECHNICAL | NATURAL RESOURCES

WORK LOCATION PERSONNEL PROTECTION AND SAFETY EVALUATION FORM

Attach Pertinent Documents/Data
Fill in Blanks As Appropriate

Job No.:	0001037.030.031		
Prepared by:	Jeremy Davis/Allison Bergseng	Reviewed by:	Christine Kimmel
Date:	February 13, 2015	Date:	February 17, 2015

A. WORK LOCATION DESCRIPTION

1. **Project Name:** Cornwall Avenue Landfill
2. **Location:** Bellingham, WA. The landfill site is located at the terminus of Cornwall Avenue adjacent to Bellingham Bay.
3. **Anticipated Activities:** 12 Landfill Gas Probe Installations; Landfill Gas Monitoring; Stormwater Evaluation; 8 Soil Borings into Stabilized Sediments; Land Survey; Test pits, Marine Bioassay Sampling; Eelgrass and Shoreline Survey.
4. **Size:** Approximately 16.5 acre
5. **Surrounding Population:** None adjacent. (See 6)
6. **Buildings/Homes/Industry:** The Site is bounded by Bellingham Bay, the R.G. Haley cleanup site (a former wood treating facility), and BNSF Railway Company tracks
7. **Topography:** Level to moderate slopes
8. **Anticipated Weather:** Variable weather, wind, rain, sun; Temperature, 40-90 °F
9. **Unusual Features:** The Site is largely unpaved, with the exception of an area of asphalt pavement in the northeastern portion of the Site. Currently, the most significant aboveground features of the Site are two large piles of low-permeability cover material, capped with an FML in the Interim Placement Areas (IPAs) as well as stormwater drainage and conveyance and shoreline berms.
10. **Site History:** From 1888 to 1946 – sawmill operations and wood debris disposal
From 1953 to 1965 – municipal solid waste disposal
From 1971 to 2005 – industrial operations by Georgia Pacific West
Investigations from 1992 to 2012 identified contaminants discussed below in Section 3.

B. HAZARD DESCRIPTION

1. Background Review: ☒ Complete ☐ Partial

If partial, why?

2. Hazardous Level: ☐ B ☐ C ☒ D ☐ Unknown

Justification: Existing data regarding site conditions and media handling procedures to minimize contact.

3. Types of Hazards: (Attach additional sheets as necessary)

A. ☒ Chemical ☒ Inhalation ☒ Explosive
☒ Biological ☒ Ingestion ☒ O2 Def. ☒ Skin Contact

a. Describe: Airborne particulate matter – could be generated during drilling but is not likely significant due to direct-push installation methods.

b. Landfill refuse – ammonia, copper, lead, silver, zinc, polychlorinated biphenyls (PCBs), , low levels of bis(2-ethylhexyl)phthalate (BEP) Dioxins/furans, mercury, pentachlorophenol, cPAHs, and petroleum hydrocarbons have been identified in the refuse on site or in nearby sediment. Additionally, biological hazards are associated with the refuse.

c. Soil or groundwater contaminated with petroleum hydrocarbons from a nearby contaminated site.

d. Sediment - Dioxins/furans, mercury, pentachlorophenol, cPAHs, and petroleum hydrocarbons are likely to be present in sediment, given the proximity of the Haley and Whatcom Waterway sites

e. Landfill gas – landfill gas could be encountered in borings, landfill gas may contain methane, hydrogen sulfide, and trace VOCs.

B. ☒ Physical ☒ Cold Stress ☒ Noise ☒ Heat Stress ☐ Other

Describe: Over Water Activities-Drowning and cold exposure due to over water activities. Weather related illness due to exposure. Elevated noise levels while working around construction/drilling equipment

C. ☐ Radiation

Describe:

4. Nature of Hazards:

☒ Air	Describe: potential for volatile organics constituents to be released from refuse ; potential explosion hazard related to methane release from landfill, potential for hydrogen sulfide (H_2S) gas
☒ Soil	Describe: potential for contact with or ingestion of contaminated soil or refuse.
☒ Surface Water	Describe: Drowning exposure during over water activities
☒ Sediment	Describe: potential for contact with or ingestion of contaminated soil or refuse.
☒ Groundwater	Describe: groundwater may be contaminated from the refuse and therefore the contaminants.
☒ Other	Describe: refuse layer may contain contaminant or biological hazards

5. Chemical Contaminants of Concern ☐ N/A

Contaminant	PEL (ppm)	I.D.L.H. (ppm)	Source/Quantity Characteristics	Route of Exposure	Symptoms of Acute Exposure	Instruments Used to Monitor Contaminant
PCBs	0.001 mg/m3	5 mg/m3	Sediment Max conc.= 0.16 mg/kg	Inhalation, ingestion	Chloracne, irritation	Visible Dust
Copper	1 mg/m3	100 mg/m3	In groundwater Max conc.= 57.6 ug/L In Soil Max conc. = 75.2 mg/kg	Inhalation, ingestion	Irritation of eyes and nose, kidney damage	Visible Dust
Mercury	0.05 mg/m3	10 mg/m3	In soil Max conc.= 1.71 mg/kg	Inhalation, ingestion, absorption, and skin or eye contact	Irritation to eyes/skin. Chest pain, tremors, irritability, lassitude, gastrointestinal distress.	Visible Dust
Lead	0.05 mg/m3	100 mg/m3	In soil Max conc.= 89 mg/kg	Inhalation, ingestion	Insomnia, abdominal pain, kidney disease	Visible Dust
Zinc	15 mg/m3	500 mg/m3	In soil Max conc.= 237 mg/kg	Inhalation, ingestion	Irritation to respiratory system; chills, muscle ache, nausea, cough	Visible Dust
Pentachlorophenol	0.5 mg/m^3	2.5 mg/m^3	Potentially in landfill refuse and sediment	Inhalation, skin absorption, ingestion, skin and/or eye contact	Eye irritant, nose, throat; sneezing, cough; lassitude (weakness, exhaustion), anorexia, weight loss; sweating; headache, dizziness; nausea, vomiting; dyspnea (breathing difficulty), chest pain; high fever; dermatitis	Visible Dust
bis(2-ethylhexyl)phthalate (BEP)	5 mg/m^3	5000 mg/m^3	In sediment Max conc.= 85 mg/kg	Inhalation, ingestion, skin and/or eye contact	Eye irritant, mucous membrane; in animals: liver damage; teratogenic effects; [potential occupational carcinogen]	Visible Dust

Dioxins/furans	N/A	N/A	Potentially in landfill refuse and sediment	Inhalation, ingestion, skin and eye contact	Eye irritant; allergic dermatitis; chloracne; porphyria; gastrointestinal disturbances; possible reproductive effects; in animals: liver, kidney damage; hemorrhages.	Visible Dust
cPAHs [as benzo(a)pyrene]	0.2	10	In sediment Max conc. = 0.16	Inhalation, ingestion, skin and eye contact	Attacks respiratory system, skin and bladder (carcinogenic)	Visible Dust
Ammonia	50	300	In sediment Max conc. = 13 (mg-N/kg)	inhalation, ingestion (solution), skin and/or eye contact (solution/liquid)	Eye irritant, nose, throat; dyspnea (breathing difficulty), wheezing, chest pain; pulmonary edema; pink frothy sputum; skin burns, vesiculation; liquid: frostbite	Visible Dust
Landfill gas (methane, trace VOCs, and H_2S)	10% LEL	NV	Generated in refuse	Inhalation	Asphyxiation	CGI/PID
Petroleum Hydrocarbons	100	400	In soil and groundwater Max soil conc. 31,000 mg/kg diesel Max groundwater conc. = 2,470 mg/L	Inhalation, ingestion	Headaches, nausea, dizziness, potential carcinogen	CGI/PID

Notes:

6. Physical Hazards of Concern ☐ N/A

Hazard	Description	Location	Procedures Used to Monitor Hazard
Moving parts of drill rig, falling and flying objects	Drill rigs of all types have many moving parts which can pinch, crush, or come loose from the rig and cause injury.	Near drill rig	Alert observation of surroundings. Minimize time spent near drill rig, no loose clothing. Use of safety glasses, reflective vest, hard hat, and steel toed boots.
Noise	Drill rigs are noisy, particularly direct push probe rigs	Near drill rig	Wear hearing protection whenever drill rig is operating
Explosion	Presence of methane in subsurface	Drill location	Verify drill rig is electrically ground to minimize potential sparks.
Landfill Gas	Exposure to Landfill gas vapors including hydrogen sulfide gas	Drill location	A monitoring instrument such as a 4 gas analyzer should be placed near the opening of the hole to monitor gas levels. The breathing zone should also be monitored of those working near the hole. The site should be evacuated if the action levels on the instruments are exceeded.
Drowning	Potential for drowning while sampling via boat	On the Water	Approved and non-altered PFDs will be worn while on the water. The buddy system (field team working in pairs) will be observed.
Slips, trips, and falls	While moving around site	Any Area	Alert observation of surroundings. Keep work area organized and free of debris.

Cuts, scrapes, punctures, bruising, and back strain	Working with hand tools (shovels, trowels, hand augers) to remove samples	During sample collection on Landfill	Ensure proper tools for the job, inspect tools prior to use, wear leather work gloves, use proper lifting, be alert of surroundings while using tools.
Weather Related Illness	Exposure to hot or cold temperatures, wind, and rain.	Onsite	Have drinking water accessible, wear appropriate clothing (light for heat, warm for cold), wear sunscreen protection, avoid caffeine, and take short breaks as needed.

7. Work Location Instrument Readings ☐ N/A

Location: ____________________

Percent O_2: ____________________ Percent LEL: ____________________

Radioactivity: ____________________ PID: ____________________

FID: ____________________ Other: ____________________

Other: ____________________ Other: ____________________

Other: ____________________ Other: ____________________

Location: ____________________

Percent O_2: ____________________ Percent LEL: ____________________

Radioactivity: ____________________ PID: ____________________

FID: ____________________ Other: ____________________

Other: ____________________ Other: ____________________

Other: ____________________ Other: ____________________

Location: ____________________

Percent O_2: ____________________ Percent LEL: ____________________

Radioactivity: ____________________ PID: ____________________

FID: ____________________ Other: ____________________

Other: ____________________ Other: ____________________

Other: ____________________ Other: ____________________

Location: ____________________

Percent O_2: ____________________ Percent LEL: ____________________

Radioactivity: ____________________ PID: ____________________

FID: ____________________ Other: ____________________

Other: ____________________ Other: ____________________

Other: ____________________ Other: ____________________

8. Hazards Expected In Preparation For Work Assignment ☒ N/A

Describe:

C. PERSONAL PROTECTIVE EQUIPMENT

1. Level of Protection

☐ A ☐ B ☐ C ☒ D (modified)

Location/Activity:

☐ A ☐ B ☒ C ☐ D

Location/Activity: Upgrade to Level C if Action Levels are exceeded (Attachment 1).

2. Protective Equipment (specify probable quantity required)

Respirator ☐ N/A

☐ SCBA, Airline

☐ Full-Face Respirator

☒ Half-Face Respirator (Cart. organic vapor) (Only if upgrade to Level C)

☐ Escape mask

☐ None

☐ Other:

☐ Other:

Clothing ☐ N/A

☐ Fully Encapsulating Suit

☐ Chemically Resistant Splash Suit

☐ Apron, Specify:

☒ Tyvek Coverall (Only if upgrade to Level C)

☐ Saranex Coverall

☒ Safety Vest

☒ Other: Dedicated field clothing; long sleeves and pants, rain gear, as needed to avoid splash, Coast Guard Approved Flotation Device if working over water

☒ Other: Coast Guard Approved Flotation Device if working over water

Head & Eye ☐ N/A

☒ Hard Hat

☐ Goggles

☐ Face Shield

☒ Safety Eyeglasses

☒ Other: Hearing Protection

Hand Protection ☐ N/A

☐ Undergloves; Type:

☒ Gloves; Type: Nitrile

☒ Overgloves; Type: While handling refuse with potential to cut skin

☐ None

☐ Other:

Foot Protection ☐ N/A

☒ Neoprene Safety Boots with Steel Toe if working by shoreline or over water

☐ Disposable Overboots

☒ Other: Steel-toed work boots

3. Monitoring Equipment ☐ N/A

☒ CGI ☒ PID

☐ O^2 Meter ☐ FID

☐ Rad Survey ☐ Other

☐ Detector Tubes (optional)

Type:

D. DECONTAMINATION

PERSONAL DECONTAMINATION

☒ Required ☐ Not Required

If required, describe:

Wash hands and face with water and soap before each break. Minimize hand to mouth actions while onsite.

EQUIPMENT DECONTAMINATION

☒ Required ☐ Not Required

If required, describe and list equipment:

Non dedicated sampling equipment will be decontaminated between sampling intervals using a three step process:

- Remove visual contamination and wash with a mixture of Alconox soap and tap water
- Rinse with tap water
- Rinse with deionized water

Down-the-hole drilling equipment will be decontaminated between borings using a high pressure steam cleaner.

E. PERSONNEL

	Name	Work Location Title/Task	Medical Current	Fit Test Current
1.	**Allison Bergseng**	**Field Representative**	☒	☒
2.	**Steve Shaw**		☐	☐
3.	**Celene Blair**		☐	☐
4.	**Stephanie Renando**		☐	☐
5.	**Brian Christianson**		☐	☐
6.	**Jeremy Davis**		☐	☐
7.			☐	☐
8.			☐	☐
9.			☐	☐
10.			☐	☐

Site Safety Coordinator: Steve Shaw

F. ACTIVITIES COVERED UNDER THIS PLAN

Task No.	Description	Preliminary Schedule
1	Landfill Gas Monitoring and Temporary Probe Installation	Winter/Spring 2015
2	Stormwater Evaluations	Spring 2015
3	Test Pits	Winter/Spring 2015
4	Stabilized Sediment Testing (8 borings)	Winter/Spring 2015
5	Marine Bioassay Sampling (Soil sampling)	Winter/Spring 2015
6	Eelgrass and Shoreline Survey (Grette and Associates)	Summer/Fall 2015

G. SUBCONTRACTOR'S HEALTH AND SAFETY PROGRAM EVALUATION ☐ N/A

Name and Address of Subcontractor:

EVALUATION CRITERIA

Item	Adequate	Inadequate	Comments
Medical Surveillance Program	☐	☐	
Personal Protective Equipment Availability	☐	☐	
Onsite Monitoring Equipment Availability	☐	☐	
Safe Working Procedures Specification	☐	☐	
Training Protocols	☐	☐	
Ancillary Support Procedures (if any)	☐	☐	
Emergency Procedures	☐	☐	
Evacuation Procedures Contingency Plan	☐	☐	
Decontamination Procedures Equipment	☐	☐	
Decontamination Procedures Personnel	☐	☐	

GENERAL HEALTH AND SAFETY PROGRAM EVALUATION: ☐ Adequate ☐ Inadequate

Additional Comments: Contractor training and safety procedures are maintained in accordance with Basis Agreement with Landau Associates

Evaluation Conducted By: ______________________________ Date: ____________

Name and Address of Subcontractor:

EVALUATION CRITERIA

Item	Adequate	Inadequate	Comments
Medical Surveillance Program	☐	☐	
Personal Protective Equipment Availability	☐	☐	
Onsite Monitoring Equipment Availability	☐	☐	
Safe Working Procedures Specification	☐	☐	
Training Protocols	☐	☐	
Ancillary Support Procedures (if any)	☐	☐	
Emergency Procedures	☐	☐	
Evacuation Procedures Contingency Plan	☐	☐	
Decontamination Procedures Equipment	☐	☐	
Decontamination Procedures Personnel	☐	☐	

GENERAL HEALTH AND SAFETY PROGRAM EVALUATION: ☐ Adequate ☐ Inadequate

Additional Comments: Contractor training and safety procedures are maintained in accordance with Basis Agreement with Landau Associates

Evaluation Conducted By: ____________________________ Date: ______________

EMERGENCY FACILITIES AND NUMBERS

Hospital:

St Joseph's Hospital
2901 Squalicum Pkwy
Bellingham, Washington 98225

Directions: Attachment 2

Telephone: Information: **(360) 715-6420**

Emergency Transportation Systems (Fire, Police, Ambulance) – **911**

Emergency Routes – Map (Attachment 1)

Emergency Contacts:

	Offsite	**Onsite**
Jeremy Davis	425-778-0907	206-601-7614 (cell)
Larry Beard	425-778-0907	206-999-0690 (cell)
Christine Kimmel	425-778-0907	206-786-3801 (cell)

In the event of an emergency, do the following:

1. Call for help as soon as possible. Call 911. Give the following information:
   - WHERE the emergency is – use cross streets or landmarks
   - PHONE NUMBER you are calling from
   - WHAT HAPPENED – type of injury
   - WHAT is being done for the victim(s)
   - YOU HANG UP LAST – let the person you called hang up first.

2. If the victim can be moved, paramedics will transport to the hospital. If the injury or exposure is not life-threatening, decontaminate the individual first. If decontamination is not feasible, wrap the individual in a blanket or sheet of plastic prior to transport.

HEALTH AND SAFETY PLAN
APPROVAL/SIGN OFF FORMAT

I have read, understood, and agreed with the information set forth in this Health and Safety Plan (and attachments) and discussed in the Personnel Health and Safety briefing.

Allison Bergseng Name	Signature	Date
Brian Christianson Name	Signature	Date
Celene Blair Name	Signature	Date
Stephanie Renando Name	Signature	Date
Name	Signature	Date
Steve Shaw Site Safety Coordinator	Signature	Date
Christine Kimmel Landau Health and Safety Manager	Signature	Date
Lawrence D. Beard, P.E., L.G. Project Manager	Signature	Date

Personnel Health and Safety Briefing Conducted By:

Name	Signature	Date

ATTACHMENT 1

ACTION LEVELS FOR RESPIRATORY PROTECTION

Monitoring Parameter	Reading	Level of Protection
Visible Dust	Elevated above background	Stop work to implement dust suppression; contact Site Safety Coordinator; if dust cannot be suppressed, Level C)
CGI (LEL)	10% LEL sustained	Stop work, evacuate immediate area, stop engines, allow gas to dissipate. Re-monitor before resuming activities
VOCs`	PID reading >25 ppm in breathing zone for more than 15 minutes or >35 ppm for momentary peak.	Evacuate the area or upgrade to Level C - half-face respirator with organic vapor / HEPA cartridge.
VOCs	>25 ppm and <100 ppm	Stop work and allow conditions to return to background, resume work in level
VOCs	>100 ppm	Stop Work, contact H&S Manager

ATTACHMENT 2

MAP AND DIRECTIONS TO HOSPITAL

HOSPITAL

St Joseph's Hospital
2901 Squalicum Pkwy
Bellingham, Washington 98225
Information: (360) 715-6420

DIRECTIONS FROM CORNWALL AVENUE LANDFILL

A Cornwall Ave

1. Head **northeast** on **Cornwall Ave** toward **E Ivy St** About 6 mins	go 2.0 mi total 2.0 mi
2. Turn **right** onto **Plymouth Dr** About 1 min	go 0.4 mi total 2.4 mi
3. Take the 2nd **left** onto **Ellis St**	go 456 ft total 2.4 mi
4. Take the 1st **left** onto **Squalicum Pkwy** Destination will be on the right About 1 min	go 0.4 mi total 2.9 mi

B **PeaceHealth St. Joseph Medical Center**
2901 Squalicum Pkwy, Bellingham, WA 98225