August 2020
Whatcom Waterway Site Cleanup

ANCHOR QEA

Pre-Remedial Design Investigation Work Plan, Addendum No. 3

Prepared for Port of Bellingham

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ABBREVIATIONS

±	plus or minus
Addendum	Addendum 2 to the *Pre-Remedial Design Investigation Work Plan*
ANC	apparent native contact
ASB	Aerated Stabilization Basin
ASTM	ASTM International
BST	Bellingham Shipping Terminal
CDF	confined disposal facility
cm	centimeters
COC	chain-of-custody
D/F	dioxin/furan
DGPS	differentially corrected global positioning system
DQO	data quality objectives
Ecology	Washington State Department of Ecology
GC	gas chromatography
GP West	Georgia-Pacific West, Inc.
Gravity	Gravity Marine Consulting, Inc.
LAET	lowest apparent effects threshold
LiDAR	Light Detection and Ranging
MLLW	mean lower low water
MS	matrix spike
MSD	matrix spike duplicate
NFG	National Functional Guidelines
ng/kg	nanogram per kilogram
PRDI	Pre-Remedial Design Investigation
QA/QC	quality assurance/quality control
RPD	relative percent difference
SCO	sediment cleanup objective
Site	Whatcom Waterway Site
SRIFS	Supplemental Remedial Investigation and Feasibility Study
SVOC	semivolatile organic compound
TOC	total organic carbon
TS	Total Solids
WDFW	Washington Department of Fish and Wildlife
Work Plan	*Final Pre-Remedial Design Investigation Work Plan*

1 Introduction

This document presents Addendum No. 3 (Addendum) to the *Final Pre-Remedial Design Investigation Work Plan* (PRDI Work Plan; Anchor Environmental 2008) for the Whatcom Waterway Site (Site) located in Bellingham, Washington. This Addendum describes the work to be performed to fill data gaps and support engineering and design activities for final cleanup of the Site.

The first Work Plan Addendum (Anchor QEA 2012a) was prepared to address data gaps in shoreline soil and groundwater quality in certain areas along the northern shoreline of the Whatcom Waterway site. The second Work Plan Addendum (Anchor QEA 2012b) was prepared to address geotechnical and environmental data gaps to support the wall and bulkhead design along the Central Waterfront Shoreline.

Cleanup of Site contaminated sediment is ongoing to meet the requirements of the Model Toxics Control Act and the Sediment Management Standards. The Consent Decree (No. 07-2-02257-7), amended in 2011 (Ecology 2007, 2011), defines cleanup requirements. The Port of Bellingham is leading cleanup efforts in coordination with the City of Bellingham, the Washington State Department of Natural Resources, and Meridian Pacific Highway, LLC.

Cleanup of a portion of the Site (the “Phase 1 Site Areas”) was completed in 2016. Post-construction monitoring shows that the cleanup was effective (Anchor QEA 2020a).

Design and permitting activities have been initiated for cleanup of the remaining areas of the Site (the “Phase 2 Site Areas”; Figure 1). Planned Phase 2 construction activities include dredging of contaminated sediments, confined disposal of dredged sediments within a portion of the Aerated Stabilization Basin (ASB), placement of clean sediment caps and anti-erosion layers in selected Site areas, and completion of related project activities at the Bellingham Shipping Terminal (BST) and other Phase 2 Site Areas.

Extensive environmental and geotechnical data were collected previously during the *Supplemental Remedial Investigation and Feasibility Study* (SRIFS; RETEC 2006) and later during implementation of the PRDI Work Plan (Anchor Environmental 2008). The previously collected PRDI data are described in the PRDI Data Report (Anchor QEA 2010) and will be used to support upcoming design activities.

This Addendum to the PRDI Work Plan describes supplemental sampling and analysis and survey activities to be conducted to resolve remaining pre-remedial design data gaps for the cleanup in Phase 2 Site Areas.

This Addendum also includes data collection activities to evaluate the potential source of elevated dioxin/furan (D/F) compounds in surface sediment near the head of Whatcom Waterway, and to evaluate sediment quality at two municipal storm drain outfalls.

Specific pre-design and source evaluation data needs are described in Section 2 of this document, and testing locations are shown in Figures 2 and 3. An Inadvertent Discovery Plan is included as Attachment B and provides guidance on cultural resource protection procedures. The remaining sections of this Addendum describe the planned sampling and analytical methods, quality assurance/quality control (QA/QC) procedures, and data management for the work. This Addendum is organized into the following sections:

- Section 2: Project Objectives
- Section 3: Data Generation and Acquisition
- Section 4: Assessments and Oversight
- Section 5: Data Validation and Usability
- Section 6: Schedule and Reporting
- Section 7: References

All work for this project will be conducted in compliance with the Site Health and Safety Plan (Anchor QEA 2020b). That document includes procedures to be used by all field personnel to protect against chemical and physical hazards, and includes applicable procedures to protect against potential COVID-19 exposures during performance of the work.

2 Project Objectives

This section describes the supplemental data needs for each area of the Site and defines objectives for the PRDI data collection activities. Sampling and analysis methods to be used to satisfy those data needs are presented in the remaining sections of this Addendum.

2.1 Pre-Design Data Needs

Pre-design data needs for the cleanup in Phase 2 Site Areas are described in this section. The data gaps were evaluated for each of the Phase 2 Site areas based on the cleanup work anticipated and the results of prior testing performed during previous site investigation, cleanup, and monitoring activities.

Contaminant testing data as part of the planned work include testing and vertical delineation of mercury and D/F compounds in planned sediment removal areas. In most areas these two contaminants will be used to design dredge prism design. However, some semivolatile organic compounds (SVOCs), including cPAH compounds, phenol, and methylphenol compounds, have been shown to be elevated in some Site areas (see Table 1). Where any of these SVOCs have been detected in excess of the Site cleanup levels in surface or subsurface sediment previously, testing for SVOCs has been included in the analytical program as described below.

Sediment Coring in Planned Open-Water Dredge Areas: Sediment coring is required to confirm the transitions between contaminated materials and clean underlying sediments in planned dredge areas:

- **Outer Waterway Dredge Areas (Units 1A, 1B, and Open-Water Portions of Unit 1C):**
  - *Data Needs:* Dredging in these Site Units is planned to extend to the interface between the contaminated sediments and underlying clean sediments. The elevation of that sediment interface has been estimated using previously collected sediment cores and a review of historical dredge depths for the waterway. Additional information is needed to refine and validate that design and to reduce dredge volume uncertainties.
  - *Planned Data Collection:* Based on a review of available data, sixteen supplemental coring locations were identified (Figure 2). Subsurface sediments will be collected from each of these locations and analyzed for mercury and D/F to define the interface between clean and contaminated sediments. SVOC compounds have not been shown to exceed cleanup levels in these areas during prior investigation, cleanup, or monitoring activities. Core samples will be analyzed on 1-foot intervals immediately above and below the apparent native contact (ANC) to define the elevation of this interface.

- **Proposed ASB Access Channel (Unit 2B and vicinity):**
  - *Data Needs:* Dredging of an access channel between the waterway and the ASB is proposed in the approximate location shown in Figure 2. A portion of this area was dredged during creation of the ASB in the late 1970s. However, detailed post-dredging records for this area are not available outside of the waterway boundaries. The dredging of the proposed access channel is expected to intercept both contaminated sediments and clean sediments. Previous investigations defined the quality of berm sediments, underlying sediments, and sediments within the ASB. But additional information is needed to define the transition between contaminated sediments and clean sediments in the areas between the waterway and the ASB berm.
  - *Planned Data Collection:* Based on a review of available data, six supplemental coring locations were identified for this area (Figure 2). Subsurface sediments will be collected from each of these locations and analyzed for mercury and D/F to define the interface between clean and contaminated sediments. SVOC testing will also be included for this area, because methylphenol compounds have been shown to be elevated in portions of the Inner Waterway (Table 1), and existing data are not sufficient to verify that these compounds are absent in the proposed access channel area. Core samples will be analyzed on 1-foot intervals immediately above and below the ANC to define the elevation of this interface.

- **Areas Near the BST (the Rail Span Area; Units 6B and 6C):**
  - *Data Needs:* An existing rail span (barge dock and loading ramp) is present in Units 6B and 6C. Surface sediment quality has naturally recovered in this area, resulting in compliance with Site cleanup levels. However, placement of an anti-erosion layer is needed to protect against prop wash scour that is expected to otherwise occur during rail span/barge terminal operations. Some dredging in nearshore areas will be required prior to placement of the anti-erosion layer due to shoaling that has occurred in the area since the last documented dredging event in the 1970s. Most sediments removed from this area are expected to be contaminated. Additional information is needed to verify this assumption and, if applicable, to define the transition between contaminated sediments and clean underlying sediments.
  - *Planned Data Collection:* Based on a review of available data, six supplemental coring locations were identified for this area (Figure 2). Subsurface sediments will be collected from each of these locations and analyzed for mercury, D/F, and SVOCs to assess sediment quality within the proposed dredge materials.

Supplemental Coring in Under-Pier Areas: Phase 2 Site cleanup actions include work in under-pier areas at the BST and at the Georgia-Pacific West, Inc. (GP West) Dock:

- **BST Under-Pier Coring (Unit 1C):**
  - *Data Needs:* Planned cleanup activities beneath the BST pier include removal of contaminated sediments to the extent practicable, followed by backfill with clean sediment. Sediment quality was evaluated in this area previously, as summarized in the SRIFS (RETEC 2006) and PRDI (Anchor QEA 2010) investigations. That work included both diver cores and hollow-stem auger borings. Supplemental sediment quality data are needed to verify the thicknesses of contaminated sediment in this area.
  - *Planned Data Collection:* Eight supplemental sediment cores will be placed beneath the BST pier structure (Figure 2). One row of four sediment cores will be placed on the middle slope, just below the toe of the existing armor layer. That armor layer extends down-slope from the face of the BST bulkhead structure to an estimated mid-slope elevation of between 14 and 18 feet below mean lower low water (MLLW; the location of this toe will be verified prior to coring using bathymetric and jet probing surveys as described below). The second row of four cores will be placed along the lower portion of the slope at an elevation of approximately 25 feet below MLLW. The cores will be collected using either vibracores or diver cores, depending on location accessibility. Subsurface sediments will be collected from each of these locations and analyzed for mercury, D/F, and SVOCs to define the interface between clean and contaminated sediments. Core samples will be analyzed on 1-foot intervals immediately above and below the ANC to define the elevation of this interface.

- **GP West Dock Under-Pier Coring (Unit 4 and Unit 2C):**
  - *Data Needs:* The GP West dock structure is located along the southern edge of Unit 2C. The detailed design for capping in this area has not been determined. Due to sediment shoaling, some dredging may be required to optimize waterway geometries during cap installation.
  - *Planned Data Collection:* Sediment quality was evaluated in this area during the SRIFS (RETEC 2006) and PRDI (Anchor QEA 2010) investigations. That work included both diver cores and hollow-stem auger borings. Supplemental sediment quality data are needed to verify the thicknesses of contaminated sediment in this area.
  - *Planned Data Collection:* Six supplemental sediment cores will be placed beneath the GP West Dock structure (Figure 2). One row of three sediment cores will be placed in the upper third of the slope. The second row of three cores will be placed along the lower third of the slope. The cores will be collected using either vibracores or diver cores, depending on location accessibility. Subsurface sediments will be collected from each of

these locations and analyzed for mercury, D/F, and SVOCs to define sediment quality within the upper sediment layers.

Supplemental Surveys in Shoreline Areas: Phase 2 Site cleanup actions include work in under-pier areas at BST and at the GP West dock structure and adjacent to the ASB berm. Additional bathymetric surveys, visual inspections, and jet probing surveys are needed to verify physical conditions in these areas. Planned survey data collection activities include the following:

- *Under-Dock Bathymetric Surveys:* Bathymetric surveys will be performed in under-dock areas of BST and the GP West dock using conventional survey equipment (lead lines and standard positioning equipment) to fill data gaps between previous multi-beam bathymetric surveys (used on the lower slope) and Light Detection and Ranging (LiDAR) surveys (used on the upper slope). The data gaps in these areas are associated with the presence of pilings at variable densities in the under-dock areas, which can interfere with the electronic survey methods.
- *Visual Inspections of Marine Structures:* Visual inspections will be performed to confirm existing conditions of the marine structures (docks, pilings, dolphins, and bulkheads) located in or near each of the remediation areas. This information will be used along with historical design documents and as-built records to assess the stability of these marine structures and determine associated requirements to support planned sediment remediation.
- *Jet Probe Surveys:* Jet probing consists of a diver-operated hand probe inserted 5 to 8 feet into the sediment column to assess physical properties of the underlying sediment. Jet probing will be used to confirm the locations and depths of armor stone and to confirm the locations and thicknesses of sediments located on top of the armor in several of the remediation areas.

Physical Testing of ASB Sediments:

- *Data Needs:* During construction of the confined disposal facility (CDF) within the ASB, the existing sediments inside the ASB will be dredged and re-handled. Extensive chemical, physical, and geotechnical testing data were collected in these areas as part of the SRIFS (RETEC 2006) and PRDI (Anchor QEA 2010) investigations. These existing data will be relied on for remedial design. However, targeted geotechnical testing will be performed to refine geospatial variability of the geotechnical properties of the ASB sediment, and to assess the extent of change (i.e., consolidation) that may have occurred in the 15 years since the last round of geotechnical testing was completed. These data will inform the design for sediment dredging, handling, and placement activities.
- *Planned Data Collection:* Physical and geotechnical data collection activities will include both performance of in situ vane shear testing and collection of selected sediment samples for geotechnical testing.

   - *Vane Shear Testing:* Vane shear testing uses a boat-deployed, hand-operated tool to assess the physical strength of the sediments. Vane shear testing will be performed throughout the ASB using a grid-based sampling strategy. At least 19 locations will be tested as shown in Figure 2. Depending on the degree of variability observed, additional locations may be tested.
   - *Supplemental Geotechnical Testing:* Sediment samples will be collected from up to four locations within the ASB for completion of geotechnical testing. The number and specific locations may be adjusted based on the results of vane shear testing. These samples will be analyzed for geotechnical parameters to assess sediment dredging, handling, and consolidation properties.

Updated Eelgrass Surveys:

- *Data Needs:* Under current agency guidance and best practices, current eelgrass surveys are needed in shallow-water areas where the project construction activities could potentially disturb eelgrass. Surveys were previously completed in 2008 as part of PRDI investigations but need to be updated given the elapsed time since those surveys were completed.
- *Planned Data Collection:* Eelgrass surveys will be conducted in planned shallow-water areas where eelgrass may be present. These are shown in Figure 3 and include areas along the BST shoreline (Units 1C and 6B/C), along the edges of the ASB (Units 2B, 5B, and 5), and along the edges of Unit 2C near the ASB, Log Pond, and GP West dock areas. Eelgrass surveys will comply with current protocols defined by the Washington Department of Fish and Wildlife (WDFW) as described in Attachment A.

2.2 Other Data Needs

In addition to collection of data to support planned work activities in Phase 2 Site Areas, targeted surface sediment testing will be performed in areas of the Whatcom Waterway Site and in Whatcom Creek to provide information on the status of source control.

2.2.1 Sampling Near Stormwater Outfalls

At the request of Ecology, surface sediment samples will be collected adjacent to the following two municipal stormwater outfalls discharging to the Site:

- **Laurel Street Outfall:** This municipal stormwater outfall discharges to Whatcom Waterway within Unit 2C, along the center-line of Laurel Street. The outfall discharges at the bulkhead along the southern shoreline of the waterway. The outfall services the commercial and mixed-use area located southeast of the GP West site. Surface sediments were collected near the outfall location last in 2008 as part of the first round of PRDI testing. This additional sampling effort will provide an updated snapshot of conditions near the point of discharge to the waterway.

- **Cornwall Street Outfall:** This municipal stormwater outfall discharges to Bellingham Bay in Unit 9. The discharge location is offshore of the beach at the intersection of Pine Street and Cornwall Avenue, and south of the Rail Span area (Units 6B and 6C). This outfall was recently replaced by the City and continues to convey stormwater from Cornwall Avenue and the vicinity. This outfall was not sampled during prior PRDI testing activities, although sediment testing has been conducted in the vicinity of the outfall previously, including extensive testing performed as part of remedial investigation for the RG Haley site (GeoEngineers 2016).

Surface sediment samples will be collected at the two above-described locations as shown in Figure 2. The sediments will be analyzed for priority pollutant heavy metals, D/F, and SVOCs.

2.2.2 Head of Waterway and Whatcom Creek Sampling

Elevated levels of D/F compounds at the head of Whatcom Waterway were detected during the 2017 and 2019 performance monitoring (Anchor QEA 2019, 2020a). These compounds are also known to be present in surface and subsurface sediments throughout most of Bellingham Bay. The full range of sources for these compounds in Bellingham Bay may include former combustion sources, former GP West pulp and paper mill operations, former wood-treating facilities, historical and ongoing stormwater and wastewater discharges, and atmospheric deposition. Ecology has defined a regional background concentration of 15 nanograms per kilogram (ng/kg) for D/F in Bellingham Bay (Ecology 2015).

During the 2017 and 2019 post-construction monitoring events, the thin layer of sediment depositing on top of the caps placed in the head of Whatcom Waterway was found to contain D/F concentrations exceeding the regional background concentration. Ecology requested that additional data be collected in adjacent areas of Whatcom Creek to assess the potential source of these D/F inputs.

During the current investigation, surface sediments will be collected at a total of 13 locations at the head of Whatcom Waterway and within Whatcom Creek (Figure 2). The locations do not target specific stormwater outfall locations, but rather are intended to provide information on the spatial distribution of D/F compounds throughout the transition area between Whatcom Creek and the head of Whatcom Waterway.

The sediments will be analyzed for mercury and D/F compounds. The information will be used to assess the potential source and significance of the ongoing D/F inputs.

3 Data Generation and Acquisition

This section describes the planned methods to be used during data generation and acquisition activities. This includes the survey or sampling design for each activity. For sediment testing activities, this section describes the planned sampling methods, sample handling and custody requirements, analytical methods, and data management and QA/QC procedures.

Sampling and analysis methods are comprehensively described below for the current work to optimize readability. These methods are consistent with those described in the 2008 PRDI Work Plan, with minor updates where applicable to address recent regulatory guidance or permitting requirements.

3.1 Eelgrass and Macroalgae Survey Methods

Updated eelgrass surveys are needed to map geographic extent in project nearshore work areas. Previous eelgrass surveys have been conducted as part of the 2008 PRDI (Anchor Environmental 2009) and more recently near the rail span located near the BST (Hart Crowser 2016).

Eelgrass and macroalgae surveys for Phase 2 construction activities will be conducted by Gravity Marine Consulting, Inc. (Gravity), in accordance with Washington Department of Fish and Wildlife *Eelgrass/Macroalgae Habitat Interim Survey Guidelines* (Attachment A; WDFW 2008). The eelgrass and macroalgae surveys will be conducted using towed video, sonar, diver, and/or shoreline survey methods along transects within the work areas along the BST (Units 1C and 6B/C), along the edges of the ASB (Units 2B, 5B, and 5C), along the edges of Unit 2C near the ASB, Log Pond, and GP West dock areas, and at the head of Whatcom Waterway (Unit 3A) and between the Roeder Avenue and Holly Street bridges, as shown in Figure 3. Eelgrass shoot density will be measured in planned sediment disturbance areas.

The survey patterns will include a combination of transects and roving to delineate the margin of eelgrass beds. Survey transects are anticipated to be placed along transects spaced 15 to 20 feet apart in the areas shown on Figure 3 along depth contours established relative to MLLW equal to 0 feet elevation. At average visibility, the survey will be conducted at a maximum of 15-foot transects; in an exceptional visibility scenario, the survey will be conducted at a maximum of 20-foot transects. Transect coverage will extend at least 25 feet waterward of the expected project footprint and at least to depths of -20 feet MLLW. If possible, the outer margin of the eelgrass or macroalgae bed will also be mapped where it extends beyond these boundaries.

The primary survey method will be towed underwater video camera. Video survey will be conducted throughout as much of the project area as is feasible. An underwater video camera will be deployed from an appropriately outfitted vessel, using a winch and lowered to approximately 1 foot above the sediment surface. The camera will be lowered or raised, as needed, depending upon the geography and visibility, and towed at a speed of 1 to 2 knots along a transect at each area. GPS coordinates will be recorded along the length of the transect. Following data collection, the video transects will be viewed to qualitatively identify the presence of eelgrass and macroalgae, and the results will be logged. Video data will be interpreted to delineate the boundaries of eelgrass beds, and other macroalgae and biological resources will be noted.

Supplementary diver and land-based (wading) surveys at low tide will be conducted in areas that are inaccessible by boat or too shallow for video use (e.g., between the bridges and under-pier areas). The presence or absence of eelgrass will be verified in these areas and recorded on data sheets by field staff. Following field surveys, eelgrass will be noted as present or absent and linked to location data to map the eelgrass beds.

Observations will be made at approximate 20-foot intervals along each transect. Additional observations will be recorded between the 20-foot observation points if an important change in biological resources is observed. The survey will focus on identifying and/or documenting the following conditions:

- *Eelgrass:* The presence or absence of eelgrass will be documented. If eelgrass is found, the number of shoots will be observed by a diver and will be counted and recorded.
- *Macroalgae:* Dominant and secondary species of macroalgae will be documented. For dominant species at an observation point, the species and estimated percent cover will be recorded. Secondary species present will also be documented.
- *Turbidity and Visibility:* Turbidity will be assessed visually by the survey team to determine the width that the transects will cover.
- *Vertebrate and Invertebrate Species:* Observations of any vertebrate or invertebrate species will be recorded. Species will be identified to the lowest taxonomic level possible, typically to species.
- *Habitat Characteristics:* Habitat conditions will be characterized based on the presence of any rocky outcroppings, debris, or other habitat features.

All of the information collected from the survey efforts will be compiled into a report that will meet Washington Department of Fish and Wildlife and U.S. Army Corps of Engineers criteria for eelgrass and macroalgae reporting (USACE 2018). A project site map indicating all survey transects and showing the qualitative distribution of eelgrass and macroalgae (boundaries of each patch), substrate characterization along each transect, approximate depth contours, and the approximate location of the proposed project footprint.

3.2 Under-Pier Bathymetric Survey Methods

Under-pier bathymetric surveys will be conducted along the southern shoreline of Whatcom Waterway, in areas beneath the former BST pier and GP West dock (Figure 3). These surveys will be conducted by Wilson Engineering, a licensed surveyor.

Under-pier bathymetric surveys will be performed using conventional (i.e., lead-line) survey methods and standard survey methodology capable of verifying X, Y locations in under-dock areas.

Prior to conducting the bathymetric surveys, a stilling gauge and logging pressure transducer will be placed at the BST pier to record tidal elevations. These elevation data will be used to correct the lead-line elevations for under-pier survey activities as well as for sediment sampling activities described below.

To support water depth measurements within the ASB, the elevation of the existing water level gauge located at the ASB stand-pipe will be confirmed by the surveyor.

Water depths beneath the piers will be collected in transects extending from the bulkhead alignment to the face of the pier structure. Point measurements shall be taken every 5 feet along the transect. The surveyor will verify the X, Y locations, water depth, and time of each measurement. A final depth-corrected table of measurements shall be provided documenting the position and water depth for each measurement. In under-dock areas exposed at low tide and where armor is present, the average diameter of the armor stone shall be recorded, and the elevation recorded shall represent the average condition of the slope at that location.

3.3 Jet Probe Survey Methods

Jet probing will be performed by Gravity using diver support. Jet probing will be performed at under-pier locations at BST and beneath the GP West dock, and along portions of the ASB shoreline (Figure 3).

Jet probing comprises the penetration of unconsolidated sediment in shallow water using a thin hollow probe assisted by water or air flow out of the probe tip. A jet probe can be used to estimate sediment type and stratigraphy, including the depth of hard objects or hard bottom.

The jet probe surveys will be conducted in a series of transects extending perpendicular to each shoreline. The diver will adjust the transect locations as necessary to avoid disturbing existing eelgrass beds, if present. Measurements will be taken at locations 5 to 15 feet apart along each transect. Locations will be verified by the jet probe contractor using a combination of a differentially corrected global positioning system (DGPS) and sonar-based underwater positioning technology.

Diver position will be monitored in real-time by the support crew (connected to the diver via intercom and video) to verify that the transects are in the appropriate locations.

Data will be collected every 5 to 15 feet. Starting at the shoreline/top of slope, each established station will be described by the diver and recorded. Descriptions at each station will include the following:

- Location
- Water depth measurements in feet
- Time of water depth measurement
- Observed surface substrate type (rock, sand, silt, or shell), color, and consistency
- Debris type and size
- Biological observations
- Estimated surface slope

After the descriptions of surface conditions at the station are completed, a support boat will deliver the diver the jet probe. The jet probe consists of a galvanized pipe, marked with foot graduations and connected to a hose and water pump. The diver will advance the probe into the sediment without additional water pressure (i.e., hand-probe) to obtain an approximate depth and consistency of the surface substrate (surficial sediment depth) until resistance or refusal is encountered. The boat-supported water pump will then be engaged to assist the probe's penetration through the sediment substrate layers. The diver will characterize the probing observations, typically including the following:

- Depth of layers penetrated
- Debris encountered
- Resistance levels
- Vibration
- Refusal depth
- Sediment plume color and density (if applicable)

Some stations may require multiple passes of the jet probe to properly characterize the area. The jet probing methods should remain flexible and be modified as necessary to ensure a safe work environment for the divers and support crew.

Survey results shall include tabulated transect locations and jet probe observations and a series of cross-sections summarizing the observations made along each transect.

3.4 General Sediment Testing Methods

This section describes methods to be applied to all surface and subsurface sediment testing. Sediment testing will be conducted by Anchor QEA and Gravity. Sampling and analysis methods specific to each area are discussed separately in Sections 3.5, 3.6, and 3.7, respectively.

3.4.1 Navigation and Positioning

In all open-water areas, sample positioning shall be verified using a vessel-mounted or hand-held DGPS. Planned coordinates for sampling stations are provided in Tables 2 and 3.

Samples will be collected from within plus or minus (±) 10 feet of the target locations unless sample recovery cannot be obtained at the planned location. The coordinates will be recorded for the actual sampling location relative to the Washington State Plane Coordinates, North, feet, North American Datum of 1983.

In cases where sampling cannot be performed at the target location, the sampling location may be adjusted to the nearest practicable sample location. The actual sample coordinates and reason that the location had to be moved will be documented as a deviation in the Data Report.

Vertical positioning will be achieved using a lead line collected at the sample location (i.e., lead line measurement will be taken adjacent to the deployed sampler) and measured to the nearest tenth of a foot. The recorded measurement will include the time the sample was collected (to the nearest minute) and the depth will represent the average surface water depth (average between the wave crests and troughs). If wavy conditions result in uncertainty regarding the depth measurement, the estimated uncertainty will be recorded.

Following data collection, the water depths will be converted to MLLW elevations using real-time water elevations measured using the stilling gauge and recording transducer (see Section 3.2).

3.4.2 Eelgrass Protection Methods

During collection of surface and subsurface samples in areas outside of the ASB, methods shall be employed to avoid disturbance of existing eelgrass beds. These methods shall be applied at all locations shallower than -20 feet MLLW.

Eelgrass protection methods to be applied during vessel-deployed vibracore and Van Veen grab sampling include the following:

- A video camera shall be fixed to the sampling equipment to provide real-time video observations of the sediment surface at the point of collection.
- The sampling equipment shall be deployed to near the mud-line at each target location.

- The video camera feed shall be observed by the sampling team prior to landing the sampling equipment on the mud-line.
- If no eelgrass is present at the target location, then the sampler may be deployed as intended.
- If eelgrass is present at the target sampling location, the location shall be adjusted within ± 10 feet to a nearby location with no eelgrass present. Relocation along slopes shall generally be at the same elevation.
- Return of unused grab sample materials shall follow the same procedures described above. Unused core samples are not to be returned to the sampling locations.

For diver-collected cores or grab samples, the same procedures described above shall be used, except that the diver will select the final sample location (avoiding any eelgrass present at the target location) based on direct visual observations.

3.4.3 Station and Sample Identification

Station and sample identifications for sediment testing are provided in Tables 2 and 3 and Figure 2. Each sample will be assigned a unique alphanumeric identifier. Sample identifiers are consistent with the PRDI Work Plan and will be identified according to the following procedure:

- The station ID will correspond to the sediment site unit, a numeric identifier, and the sample method:
  - DC = subsurface sediment diver core
  - SS = surface sediment grab
  - VC = subsurface sediment vibracore
- The sample interval will be the depth at which the sample is collected:
  - For cores, this will be in feet below the mudline (estimated in situ depth after considering compaction; see Section 3.6.2).
  - For grabs, this will be in centimeters below mudline (as measured in the grab).
- Date of collection, in the form of YYMMDD

As an example, a sediment core sample collected from the 1- to 2-foot interval mudline below on August 22, 2020, from station 3 in Unit 6 will have an ID of 6-03-VC-1-2-200822.

Each sample will have an adhesive plastic or waterproof paper label affixed to the container or baggie and will be labeled at the time of collection. The following information will be recorded on the container label at the time of collection:

- Project name
- Sample identifier
- Date and time of sample collection
- Analysis to be performed

3.4.4 Decontamination Procedures

The following general decontamination procedures will be followed for field sampling equipment:

1. Pre-wash rinse with tap or site water.
2. Wash with solution of tap water or site water and phosphate-free soap (e.g., Alconox).
3. Rinse three times with distilled water.
4. Cover (no contact) all decontaminated items with aluminum foil.
5. Store in a clean, closed container for next use.

All sampling containers used for sediment samples shall consist of certified pre-cleaned jars obtained from the analytical testing laboratory.

3.5 Surface Sediment Sampling Methods

This section describes the design for the sediment sampling activities at the head of Whatcom Waterway and within Whatcom Creek. Surface sediment samples will be collected both within the tide-flat locations between the Roeder Avenue and West Holly Street bridges, and at upstream locations located within Whatcom Creek (Figure 2).

This section also describes methods for characterization of sediments near the Laurel Street and Cornwall Avenue stormwater outfalls.

3.5.1 Sample Collection

Surface sediment samples will be collected from the 0- to 12-centimeter (cm) biologically active zone at locations shown in Figure 2 and Table 2. Sample locations shall be verified and recorded as described in Section 3.4.1. Two of the Whatcom Creek stations are located above the tidal estuary, and the thickness of the bioactive zone has not been confirmed in this area of the creek. However, for comparability to the other sample stations located in the tidal estuary, a sample thickness of 0 to 12 cm will be used for these two upper creek stations.

At submerged testing locations accessed by vessel, a Van Veen sampling device will be used to collect subtidal surface sediment samples. The grab sampler will be lowered from a cable wire. When the sampler reaches the mudline, the cable will be drawn taut and DGPS measurements will be recorded. Each surface grab sample will be retrieved aboard the vessel and evaluated for the following acceptance criteria:

- Overlying water is present and has low turbidity.
- Adequate penetration depth is achieved.
- Sampler is not overfilled.
- Sediment surface is undisturbed.

- No signs are evident of winnowing or leaking from sampling device.

Grab samples not meeting these criteria will be rejected and returned as near to the location of sample collection as possible. The vessel will be adjusted so as not to collect from the same exact location. The process will be repeated until criteria have been met or three attempts have been made. Deployments will be repeated within a 10-foot radius of the proposed sample location. If adequate penetration is not achieved after three attempts, the location of the sample station may be adjusted or a shallower depth of penetration may be accepted. These adjustments shall be noted as deviations in the sampling data report.

The sampling equipment will be decontaminated between stations following the methods described in Section 3.4.3.

The following information will be recorded on the sediment sampling form (Attachment C):

- Date, time, and name of person logging sample
- Sample location number and coordinates
- Depth of water at the location and surface elevation
- Sediment penetration and depth
- Sample recovery
- Whether the grab was accepted

3.5.2 Sample Processing and Analysis

Once a grab is accepted, overlying water will be siphoned off. Then, a decontaminated stainless-steel trowel, spoon, or equivalent will be used to collect only the upper 12 cm of sediment from inside the sampler without collecting any material that is touching the sidewalls. Debris and materials more than 0.5 inch in diameter will be omitted from sample containers. Sediment will be homogenized in a pre-cleaned stainless-steel bowl.

At some locations within Whatcom Creek it may be possible to collect the sediment sample from the shoreline or creek-bed location during low water. At these locations the sediment shall be collected directly from the sediment surface using pre-cleaned hand tools and a sampling depth of 0 to 12 cm. If this depth of penetration cannot be obtained at the target location, the contingency methods for vessel-collected grab samples shall be applied until a sample has been collected.

Surface sediment processing at all locations will include physical characterization in accordance with Method D-2488 (ASTM International [ASTM]) modified. Physical characterization includes the following elements, to be recorded on a sediment sampling form (Attachment C):

- Grain size distribution
- Density and consistency

- Plasticity
- Color and moisture content
- Biological structures (e.g., shells, tubes, macrophytes, and bioturbation)
- Presence of debris and quantitative estimate (e.g., wood chips or fibers, concrete, and metal debris)
- Presence of oily sheen
- Odor (e.g., hydrogen sulfide and hydrocarbon)

Sediment grab samples at the head of Whatcom Waterway and in Whatcom Creek will be submitted for mercury, D/F, total solids (TS), total organic carbon (TOC), and grain size (Tables 2 and 4).

Sediment samples collected at the Laurel Street and Cornwall Avenue stormwater outfalls will be analyzed for priority pollutant metals, SVOCs, D/F, TS, TOC, and grain size (Tables 2 and 4).

3.6 Subsurface Sampling Methods – Waterway Areas

This section describes the design for the subsurface sediment sampling activities in Site areas outside of the ASB.

3.6.1 Subsurface Sediment Collection

Subsurface sediment cores will be collected with a vibracore deployed by one of three methods, depending on location. Sample positioning and eelgrass avoidance methods will be followed for each method as described in Section 3.4.1 and 3.4.2. The three core sampling methods include the following:

- *Open-Water Vibracore Locations:* The open-water cores will be collected using a vessel-mounted vibracore. The vibracore will be deployed from the vessel using the A-frame and hydraulic winch. The vibracore will be energized as it nears the bottom and supported upright with the winch line during penetration into the sediment. Sediment cores will be collected to target depths of 12 to 15 feet below mudline for the open-water locations.
- *Under-Pier Vibracore Locations:* The vibracore will be deployed on a remote floating platform for the under-pier locations. This limited-access equipment will be required in some areas due to the under-pier elevations and pile spacing. Expected sample penetration for under-pier locations is at least 4 feet below mudline, or until refusal is encountered.
- *Contingent Diver Core Methods:* At locations where neither of the above-described methods can be used, a diver-deployed piston core sampler will be used. Penetration achieved by this method is typically less than what is achievable using vibracore methods. Expected penetration using the diver-deployed core sampler is approximately 3 feet below mud-line, depending on the sediment physical properties.

Upon completing penetration at a given station, the vibracore will be shut down, the position recorded, and the sampler recovered. Once on board the vessel, the depth of core penetration will be measured and recorded (i.e., the total core length minus the void space within the core). The following data will be recorded on the sediment core collection log:

- Sampling location and time
- Depth of water to sediment mud-line (as measured by lead-line following procedures listed in Section 3.4.1)
- Approximate elevation of location as calculated from MLLW using measured depths and tide tables (this estimate will later be corrected based on actual tide elevations measured using the logging transducer installed as described in Section 3.2)
- Location coordinates from DGPS (and offsets as required for under-dock measurements where DGPS cannot be directly used)
- Names of field personnel collecting and handling the cores
- Observations made during core collection, including weather conditions, complications, ship traffic, and other details associated with the sampling effort
- Physical description of core tube (e.g., intact, bent, full core-catcher)
- Length and depth intervals of each core section and estimated recovery for each sediment sample as measured from MLLW
- Qualitative notation of apparent resistance of sediment column to coring (how the core drove)
- Any deviation from the approved PRDI Work Plan and this Addendum

Acceptance criteria for sediment core samples are as follows:

- Overlying water is present and the surface is intact
- Recovery is greater than 75 percent of drive length
- The required penetration depth is achieved

If refusal is encountered, or the recovery criteria are not met, the vessel will be slightly moved and a second core attempted, then, if needed, a third attempt. If refusal is encountered with the third attempt or recovery criteria are not met, additional cores will not be attempted unless operational problems are suspected. Refusal is defined as less than 5 cm of penetration per minute. Field personnel will determine which of the cores will be retained for processing and analyses but, in general, the longest of the three cores will be retained.

After the core is on deck and has been accepted, it will be stored upright until it can be transferred to shore for processing. The cutterhead will be removed, the upper liner tied off, and a cap will be placed over the end of the tube and secured firmly in place with duct tape. The core tube will then be removed from the sampler, and the other end of the core will be capped and taped. The core tube will be clearly labeled with permanent black pen with the location ID and an arrow pointing to the top of core. The core will be processed on the same day as collection, if possible, or stored upright and cool (4°C) overnight.

3.6.2 Subsurface Sediment Processing

The vibracore processing station will be located in a well-ventilated area within the Port property. Cores will be stored and transported according to ASTM D 4220 procedures (ASTM 2007). This procedure recommends that cores are stored upright and cool until processed. Cores will be tied upright on the vessel and then transported upright from the boat to the processing crew.

When processed, the entire core length contained within the polyethylene liner will be extracted from the core tube with the ends tied off and laid in a core processing tray. The liner will be cut open using a decontaminated stainless-steel box cutter. The core will then be split with decontaminated stainless-steel wire core splitters or spatulas into two halves for sampling.

Prior to further sampling, Anchor QEA field staff will delineate sampling intervals, take color photographs, and record a sediment description of each core on a standard core processing log (see Attachment C). Logs will include the following information:

- Drive length, recovered length, and percent sample recovery
- Location of ANC
- Physical soil description in accordance with ASTM D 2488 and ASTM D 2487 – Unified Soil Classification System procedures including soil type, density/consistency of soil, and color (ASTM 2017a, 2017b)
- Odor (e.g., hydrogen sulfide and petroleum)
- Visual stratification, structure, and texture
- Vegetation and debris (e.g., wood waste or fibers, paint chips, concrete, sand blast grit, and metal debris)
- Biological activity (e.g., detritus, shells, tubes, bioturbation, and live or dead organisms)
- Presence of oil sheen

All core samples will be processed in 1-foot intervals (based on estimated in situ depths calculated using site-specific water depths measured using the logging transducer). Sample archives will be collected from individual intervals. Core recovery correction will not be applied.

Samples will be generated by placing sediment from each interval into a decontaminated stainless-steel bowl and mixing until consistent in color and texture. Homogenized sediment will be spooned into pre-labeled laboratory-supplied jars for analyses.

3.6.3 Subsurface Sediment Testing Intervals and Tiered Analysis

Sediment core locations were selected to fill specific data gaps as defined in Section 2.1. Core sample locations are shown in Figure 2 and coordinates, target depths, and processing requirements are summarized in Table 3. Analyses, methods, analyte lists, and laboratory detection and reporting limits are listed in Table 4.

- Core samples will be processed in 1-foot intervals using estimated in situ depths. The ANC will be identified if evident. Analytical testing will then be conducted in a tiered manner based on sample location. The analytical testing tiers include the following:
  - Tier 1A – Initial testing for mercury and TS
  - Tier 1B – Contingent testing for mercury and TS
  - Tier 2A – Testing for D/F, TOC, and TS (and SVOC in selected areas)
  - Tier 2B – Contingent testing for D/F, TOC, and TS (and SVOC in selected areas)
- Tier 1A samples will be initiated using the following methods:
  - In areas where the estimated depth of the ANC can be compared against historical bathymetric data (Units 1A, 1B, and 1C), the two, 1-foot interval samples above and the two 1-foot intervals below the ANC will be submitted for Tier 1A analyses.
  - In areas where historical bathymetric data are limited (Units 2B and 6), the three intervals above and the three intervals below the ANC will be analyzed for Tier 1A parameters.
  - The upper four sample intervals from the under-pier cores (BST and GP West dock areas) will be initially submitted for Tier 1A analyses. For most under-pier cores this is expected to be all of the sample intervals collected. For under-pier samples collected via the vessel and A-frame sampler, additional deeper samples may be present and will be archived.
  - The remaining core samples (those not initially submitted for Tier 1A testing) from all cores will be archived for potential additional analyses. Additional samples may be submitted for Tier 1A analyses depending on field conditions.
- Once results from the Tier 1A analyses are received, Tier 1B analyses will be triggered if the contact between contaminated and clean sediments has not been identified (i.e., if the lower samples exceed the sediment cleanup objective (SCO) of 0.41 mg mercury/kg).
- Once the top of the clean interval has been identified for mercury, the Tier 2A analyses will be conducted on that interval to confirm that D/F concentrations are below the practical quantitation limit (5 ng/kg) for these compounds. For cores located in the under-dock areas, the ASB access channel area, and the rail span area, analysis for SVOC compounds will also be performed as part of Tier 2A testing. SVOC testing is not required for testing in open-water areas of Units 1A, 1B, or 1C.
- If D/F concentrations remain elevated in the Tier 2A samples analyzed, then analysis of the deeper sample intervals will be conducted until a D/F sample returns results below 5 ng/kg, or the deepest interval has been analyzed. Similarly, in cores where the Tier 2A sample was tested

for SVOC compounds and the measured concentrations exceed the SCO or corresponding lowest apparent effects threshold (LAET) value for these compounds, analysis of the deeper sample intervals will be conducted until the SCO/LAET has been met, or the deepest interval has been analyzed.

3.7 Geotechnical Testing Inside the ASB

This section describes the methods to be used for geotechnical testing at locations inside the ASB. These locations are shown in Figure 2. Eelgrass is not present inside the ASB, so the eelgrass avoidance procedures defined in Section 3.4.2 will not be applied.

3.7.1 Vane Shear Testing

In situ vane-shear strength testing will be conducted at a minimum of 19 locations (Table 5) within the ASB to test and record the shear strength of the soft sediments.

In situ vane shear testing will be conducted in the ASB from a small boat. Locations will be documented using DGPS as described in Section 3.4.1, with the exception that tide-correction to water depth measurements is not applicable and will not be employed. ASB water depths will be converted to elevations using daily ASB water depth measurements recorded at the ASB stand-pipe gauge. The elevation of the gauge will be confirmed during the site survey activities as described in Section 3.2.

Vane shear readings shall be recorded at each testing location. Duplicate measurements shall be collected at a minimum of 10% of the testing locations.

Additional testing locations may be added if excessive variability is noted between adjacent stations.

3.7.2 Collection of Subsurface Sediments for Laboratory Testing

Samples will be collected in the ASB at four different locations for laboratory geotechnical testing. Target locations are shown in Figure 2. However, the number and specific locations may be adjusted by the geotechnical engineer after review of vane shear testing data. Station and sample IDs, proposed coordinates, target sample depths, and planned analyses are listed in Table 6.

Samples collected for laboratory testing will be collected using a vibracore sampler or other method pending equipment access to the ASB. Multiple core samples may be obtained from each sampling location as necessary to collect the required sample volume.

Locations and water depths shall be recorded as described above for vane shear testing (Section 3.7.1). Target penetration depth for each core is approximately 6 feet or until the hard bottom contact is encountered (contact between the soft ASB sediments and the underlying sand layer). Penetration deeper than the hard bottom contact is not required.

Samples of ASB soft sediments shall be considered acceptable if the sample recovery is at least 60%.

Sample processing shall include logging as described in Section 3.6.2. However, samples shall not be sampled in 1-foot increments. Rather, samples from replicate cores at each target location shall be split into sediment intervals as directed by the geotechnical engineer following review of the vane shear test data.

ASB sediment samples from each location and interval designated by the geotechnical engineer shall be combined and homogenized in clean 5-gallon buckets. Samples shall be submitted to the testing laboratory (Harold Benny & Associates) for column settlement testing. Additional samples will be sent to a specialized laboratory (lab to be confirmed prior to initiating sampling) for specialized seepage-induced consolidation testing.

3.8 Investigation-Derived Waste

Based on available pre-characterization data obtained during prior sediment testing activities, no sediments classifying as a hazardous waste will be encountered during the current study. No hazardous materials requiring special disposal will be used during fieldwork for this study.

All disposable sampling materials and personal protective equipment used in sample collection and processing (e.g., disposable gloves and paper towels) will be placed in heavy-duty garbage bags for disposal as non-hazardous solid waste.

Sediment recovered in grab samples not retained for chemical analysis will be returned to the target sampling location, as adjusted to avoid areas of potential eelgrass.

Core samples will be processed at an upland location. Leftover sediment not retained for chemical analyses will be stored in buckets or drums at the processing location and will be managed as investigation-derived waste. This material will be managed by subtitle D landfill disposal in compliance with applicable regulations.

3.9 Sample Handling and Chain-of-Custody Requirements

Sample container requirements, holding times, and preservation requirements are listed in Table 7. Sample containers, instruments, working surfaces, technician protective gear, and other items that may come into contact with sample material must meet high standards of cleanliness. All equipment and instruments that will be used and are in direct contact with various media collected for chemical analyses must be made of glass, stainless steel, high density polyethylene, or polytetrafluoroethylene and will be cleaned prior to each day's use and between sampling or compositing events.

Samples are considered to be in one's custody if they are: 1) in the custodian's possession or view; 2) in a secured location (under lock) with restricted access; or 3) in a container that is secured with an official seal(s) such that the sample cannot be reached without breaking the seal(s). Chain-of-custody (COC) procedures will be followed for all samples throughout the collection, handling, and analysis process. The principal document used to track possession and transfer of samples is the COC form. Each sample will be represented on a COC form the day that it is collected. All data entries will be made using an indelible ink pen. Corrections will be made by drawing a single line through the error, writing in the correct information, and then dating and initialing the change. Blank lines and spaces on the COC form will be lined-out and dated and initialed by the individual maintaining custody.

All samples will be shipped or hand delivered to the analytical laboratory by Anchor QEA staff. Upon transfer of sample possession to the analytical laboratory, the person transferring custody of the sample container will sign the COC form. Upon receipt of samples at the laboratory, the receiver will record the condition of the samples on a sample receipt form. Table 7 presents the sample handling and storage requirements to be followed by field and laboratory staff.

Shipping procedures are as follows:

- Each cooler will be shipped via overnight delivery to the laboratory. In the event that Saturday delivery is required, staff will contact the analytical laboratory before 3 p.m. on Friday to ensure that the laboratory is aware of the number of containers and associated tracking numbers.
- Ice adequate to keep samples cool overnight will be sealed in separate plastic bags and placed in the shipping containers.
- Sample containers will be placed in a sealable plastic bag, packed to prevent breakage, and transported in a sealed ice chest or other suitable container.
- COC forms will be enclosed in a plastic bag and placed inside the cooler.
- Each cooler will be wrapped securely with packing or strapping tape, labeled fragile, and will be clearly labeled with the laboratory's shipping address and the consultant's return address. A signed and dated custody seal will be placed on each cooler prior to shipping.

3.10 Laboratory Analytical Methods

Chemical analyses will be conducted at Analytical Resources, Inc., an Ecology and National Environmental Laboratory Accreditation Program accredited laboratory. Table 4 presents the proposed analytes, evaluation criteria, analytical methods to be used, and target detection and reporting limits for the evaluation of sediment. All sample analyses will be conducted in accordance with methods approved by the Puget Sound Estuary Program (PSEP 1997) and Ecology. Prior to analyses, all samples will be maintained according to appropriate holding times and required temperatures for each analysis (Table 7).

The geotechnical laboratories will be Harold Benny & Associates and a specialized testing laboratory (laboratory to be confirmed prior to initiation of testing). The geotechnical laboratories will conduct all required analyses in accordance with applicable ASTM sampling methods or other accepted methods for completion of specialized testing as described in Section 3.7.2.

3.11 Quality Assurance and Quality Control

Requirements for QA/QC will include the collection of field QC samples as well as laboratory QC analyses. Field and laboratory QA/QC analytical frequencies are provided in Table 8. The overall DQO for field sampling and laboratory analysis is to produce data of known and appropriate quality to support the project objectives. Laboratory DQOs for precision, accuracy, and completeness are listed in Table 9.

Results of the QC samples from each sample group will be reviewed by the analyst immediately after a sample group has been analyzed. The QC sample results will then be evaluated to determine if control limits have been exceeded. If control limits are exceeded in the sample group, Anchor QEA will be contacted and corrective action (e.g., method modifications followed by reprocessing the affected samples) will be initiated prior to processing a subsequent group of samples.

3.11.1 Field QC Samples

Field duplicate samples will be collected to evaluate the variability attributable to sample homogenization and subsequent sample handling. Field duplicate samples will be collected from the same homogenized material as the original sample and analyzed as a separate sample. A minimum of one field duplicate sample will be analyzed for every 20 samples submitted initially for analyses. For triggered archive samples, laboratory duplicates will be requested at the same frequency to meet precision requirements. Field duplicates will be screened against a relative percent difference (RPD) value of 50% when parent and duplicate sample results are greater than five times the reporting limit. Results that are less than five times the reporting limit will be evaluated by the difference between them and screened against a control limit of ± two times the reporting limit.

In addition, a single rinsate blank sample will be collected for each field sampling method (subsurface and surface sediment) by rinsing laboratory deionized water over the decontaminated sample homogenization equipment. The rinsate blank samples will be analyzed for mercury and D/F.

All field QC samples will be documented on the field log and verified by the project QA/QC coordinator or a designee.

3.11.2 Laboratory QC Samples

Before analyzing the samples, the laboratory must provide written protocols for the analytical methods to be used, calculate method detection limits for each analyte in each matrix type, and establish an initial calibration curve for all analytes. The laboratory must demonstrate their continued proficiency through participation in inter-laboratory comparison studies and through repeated analyses of standard reference materials, calibration checks, method blanks, and spiked samples.

4 Assessments and Oversight

Once data are received from the laboratory, a number of QC procedures will be followed to provide an accurate evaluation of the data quality. Specific procedures will be followed to assess data precision, accuracy, and completeness.

4.1 Compliance Assessments

Laboratory and field performance audits consist of on-site reviews of QA systems and equipment for sampling, calibration, and measurement. Audits will not be conducted as part of this study. However, laboratory audit reports will be made available to the project QA manager upon request.

The laboratory is required to have written procedures addressing internal QA/QC. When these procedures have been submitted, the project QA manager will review them to ensure compliance with this Addendum. The laboratory must ensure that personnel engaged in sampling and analysis tasks have appropriate training.

4.2 Response and Corrective Actions

The project manager, QA manager, and field coordinator will work together to determine actions to be taken in the event of an error, problem, or nonconformance to protocols identified in this Addendum.

4.2.1 Field Activities

The field coordinator will be responsible for correcting equipment malfunctions during the field sampling effort. The QA manager will be responsible for resolving situations identified by the field coordinator that may result in noncompliance with this Addendum. All corrective measures will be immediately documented in the field logbook.

4.2.2 Laboratory

The laboratory is required to comply with their standard operating procedures. The laboratory managers will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this Addendum. All laboratory personnel will be responsible for reporting problems that may compromise quality data.

The laboratory managers will be notified if any QC sample grossly exceeds the laboratory in-house control limits. The analyst will identify and correct the anomaly before continuing with the sample analysis. If the anomaly cannot be corrected, the laboratory manager will notify the QA manager. A narrative describing the anomaly, steps taken to identify and correct the anomaly, and the treatment of the relevant sample batch (i.e., recalculation, reanalysis, and re-extraction) will be submitted with the data package.

4.3 Reports to Management

QA reports to project management will include verbal status reports, written reports on field sampling activities and laboratory processes, data validation reports, and final project reports. These reports shall be the responsibility of the project manager.

4.4 Documentation and Records

Records will be maintained documenting all activities and data related to sample collection and laboratory analyses. Results of data verification and validation activities will also be documented. Procedures for documentation of these activities are described in this section.

4.4.1 Field Records

Field samples will be documented using a custom field application or field collection logs (Attachment C). Additionally, the field coordinator or designee will keep a daily record of significant events, observations, and measurements on a daily log. Entries for each day will begin on a new page. The person recording information must enter the date and time and initial each entry.

In general, sufficient information will be recorded during sampling and surveys to reconstruct the event without relying on the memory of the field personnel.

The daily log will contain the following information, at a minimum:

- Project name
- Field personnel on site and time(s) present on site
- Site visitors
- Weather conditions
- Field observations
- Maps and/or drawings
- Sample collection date and time
- Sample collection method and description of activities
- Deviations from this Addendum
- Conferences associated with field sampling activities

4.4.2 Analytical Records

The laboratory will retain analytical data records. Additionally, Anchor QEA will retain them in its central project files. For all analyses, the data reporting requirements will include those items necessary to complete data validation, including copies of all raw data. The analytical laboratory will be required, where applicable, to report the following:

Project Narrative. This summary, in the form of a cover letter, will discuss problems, if any, encountered during any aspect of analysis. This summary will discuss, but not be limited to, QC, sample shipment, sample storage, and analytical difficulties. Any problems encountered, actual or perceived, and their resolutions will be documented in as much detail as appropriate.

Chain-of-Custody Records. Legible copies of the COC forms will be provided as part of the data package. This documentation will include the time of receipt and condition of each sample received by the laboratory. Additional internal tracking of sample custody by the laboratory will also be documented on a sample receipt form. The form must include all sample shipping container temperatures measured at the time of sample receipt.

Sample Results. The data package will summarize the results for each sample analyzed. The summary will include the following information when applicable:

- Field sample identification code and the corresponding laboratory identification code
- Sample matrix
- Date of sample extraction
- Date and time of analysis
- Weight and/or volume used for analysis
- Final dilution volumes or concentration factor for the sample
- Identification of the instrument used for analysis
- Method detection limits
- Method reporting limits accounting for sample-specific factors (e.g., dilution, TS)
- Analytical results with reporting units identified
- Data qualifiers and their definitions

QA/QC Summaries. This section will contain the results of the laboratory QA/QC procedures. Each QA/QC sample analysis will be documented with the same information required for the sample results. No recovery or blank corrections will be made by the laboratory. The required summaries follow; additional information may be requested:

- **Calibration Data Summary:** This summary will report the concentrations of the initial calibration and daily calibration standards, and the date and time of analysis. The response factor, percent relative standard deviation, percent difference, and retention time for each analyte will be listed, as appropriate. Results for standards to indicate instrument sensitivity will be documented.
- **Internal Standard Area Summary:** The stability of internal standard areas will be reported.

- **Method Blank Analysis:** The method blank analyses associated with each sample and the concentration of all compounds of interest identified in these blanks will be reported.
- **Surrogate Spike Recovery:** This will include all surrogate spike recovery data for organic compounds. The name and concentration of all compounds added, percent recoveries, and range of recoveries will be listed.
- **Matrix Spike Recovery:** This will report all matrix spike (MS) recovery data for organic and metal compounds. The name and concentration of all compounds added, percent recoveries, and range of recoveries will be listed. The RPD for all duplicate analyses will be included.
- **Matrix Duplicate:** This will include the percent recovery and associated RPD for all matrix spike duplicate (MSD) analyses.
- **Laboratory Control Sample:** All laboratory control sample recovery data for organic and metal compounds will be reported. The name and concentration of all compounds added, percent recoveries, and range of recoveries will be listed. The RPD for all duplicate analyses will be included.
- **Relative Retention Time:** This will include a report of the relative retention time of each analyte detected in the samples for both primary and conformational analyses.

Original Data. Legible copies of the original data generated by the laboratory will include the following:

- Sample extraction, preparation, identification of extraction method used, and cleanup logs
- Instrument specifications and analysis logs for all instruments used on days of calibration and analysis
- Calculation worksheets for inorganic analyses
- Reconstructed ion chromatograms for all samples, standards, blanks, calibrations, spikes, replicates, and reference materials
- Original printouts of full scan chromatograms and quantitation reports for all gas chromatography (GC) and/or GC/mass spectrometry samples, standards, blanks, calibrations, spikes, replicates, and reference materials
- Enhanced spectra of detected compounds with associated best-match spectra for each sample

All instrument data shall be fully restorable at the laboratory from electronic backup. The laboratory will be required to maintain all records relevant to project analyses for a minimum of 5 years. Data validation reports will be maintained in the central project files with the analytical data reports.

4.4.3 Data Reduction

Data reduction is the conversion of raw data to final results. Methods or procedures for data reduction shall be documented. The following procedures will be implemented to verify the accuracy of data reduction:

- Technical staff will document, review, and QC their own work to ensure accuracy.
- Major calculations will be subject to an independent senior technical review to ensure that both the methods and the calculations are correct and consistent with the approved PRDI Work Plan, including approved supplementals to the Work Plan.
- The project manager will be responsible for ensuring that data reduction is conducted in a manner that produces high quality data via review and approval of concepts, methods, assumptions, and calculations.

5 Data Validation and Usability

Data generated in the field and at the laboratories will be verified and validated according to methods and procedures described in this section.

5.1 Data Review, Validation, and Verification

During the validation process, analytical data will be electronically and/or manually evaluated for method and laboratory QC compliance, and their validity and applicability for program purposes will be determined.

Based on findings of the validation process, data validation qualifiers may be assigned. Validated project data, including qualifiers, will be entered into the project database, thus enabling this information to be retained or retrieved as needed.

5.2 Validation and Verification Methods

Laboratory data will be provided in both PDF and EQuIS electronic format and uploaded to Anchor QEA's project database. Once data are received from the laboratory, a number of QC procedures will be followed to provide an accurate evaluation of data quality.

Stage 2B validations (EPA 2009) will be performed for all testing parameters. Level 4 validations will be performed for D/F analyses.

Data quality review will be completed by Anchor QEA (or a subconsultant) in accordance with U.S. Environmental Protection Agency National Functional Guidelines (NFG) for Data Review (EPA 2016, 2017) by considering the following:

- Data completeness
- Holding times
- Method blanks
- Surrogates
- Detection limits
- Laboratory control samples
- Replicates
- MS/MSD samples
- Initial and continuing calibrations
- Internal standard area counts
- Sediment reference materials

Data will be validated in accordance with the project-specific DQOs (Table 9), analytical method criteria, and the laboratory's internal performance standards based on its standard operating procedures. The results of the data quality review, including assigning qualifiers in accordance with the NFG and a tabular summary of qualifiers, will be generated by the database manager and submitted to the QA/QC Manager for final review and confirmation of data validity.

Laboratory data, which will be electronically provided and loaded into Anchor QEA's project database, will undergo a check against the laboratory hard copy data. Data will be validated or reviewed manually, and qualifiers, if assigned, will be entered manually. The accuracy of all manually entered data will be verified by a second party. Data tables and reports will be exported from EQuIS to Excel tables.

Field datasheets or data entries will be checked for completeness and accuracy prior to database entry. Data generated in the field will be documented electronically or on hard copy and provided to the database manager, who is responsible for data entry into the database. Manually entered data will be checked by a second party. Field documentation will be filed in the main project file after data entry and checking are complete.

5.3 Reconciliation with User Requirements

The QA manager will review data at the completion of the task to determine if DQOs have been met.

If data do not meet the project's specifications, the QA manager will review the errors and determine if the problem is due to calibration/maintenance, sampling techniques, or other factors and will suggest corrective action, if appropriate. The problem will be corrected by retraining, revising techniques, or replacing supplies/equipment; if not, the DQOs will be reviewed for feasibility. If specific DQOs are not achievable, the QA manager will recommend appropriate modifications. If matrix interference is suspected to have attributed to the exceedance, adequate laboratory documentation must be presented to demonstrate that instrument performance and/or laboratory technique did not bias the result. In cases where the DQOs have been exceeded and corrective actions did not resolve the outlier, data will be qualified per NFG. In these instances, the usability of data will be determined by the extent of the exceedance.

Rejected data will be assigned an "R" qualifier and will not be used for any purposes. Data qualified with a "J" flag will be used, but the basis for the J-flag will be documented in the data validation report and data uncertainties will be considered during use of the data for project reporting.

6 Schedule and Reporting

Field activities are anticipated to occur during August and September of 2020. Laboratory and data analyses will occur on a tiered approach between September and December of 2020. A Data Report will be provided to Ecology as an appendix to the draft Engineering Design Report (scheduled to be submitted to Ecology by January 31, 2021). The Data Report will include a presentation and summary of all of the following:

- Eelgrass and macroalgae surveys
- Under-pier bathymetric surveys
- Surface sediment testing (including data validation)
- Subsurface sediment testing (including data validation)
- ASB geotechnical testing

PRDI chemical testing data will also be entered into the Environmental Information Management database.

7 References

Anchor Environmental, 2008. *Final Pre-Remedial Design Investigation Work Plan*. Prepared for the Port of Bellingham. 2008.

Anchor Environmental, 2009. *Underwater Video and Dive Survey of Eelgrass and Macroalgae Report.* March 2009.

Anchor QEA (Anchor QEA, LLC), 2010. *Pre-Remedial Design Investigation Data Report – Whatcom Waterway Cleanup Site*. Prepared for the Port of Bellingham.

Anchor QEA, 2012a. Letter to: Lucille T. McInerney, PE, and Brian Sato, PE, Toxics Cleanup Program, Department of Ecology, Northwest Regional Office. Regarding: Whatcom Waterway Site – Consent Decree No. 07-2-02257-7 – Pre-Remedial Design Investigation Work Plan Addendum. July 2, 2012.

Anchor QEA, 2012b. Whatcom Waterway Site – Consent Decree No. 07-2-02257-7 – Pre-Remedial Design Investigation Work Plan Addendum 2.

Anchor QEA, 2019. *Year 1 Compliance Monitoring Report, Whatcom Waterway Cleanup in Phase 1 Site Areas*. Prepared for the Port of Bellingham. April 2019.

Anchor QEA, 2020a. *Year 3 Monitoring Report, Whatcom Waterway Cleanup in Phase 1 Site Areas*. Prepared for the Port of Bellingham. June 2020.

Anchor QEA, 2020b. *Health and Safety Plan. Whatcom Waterway Site Cleanup*. Prepared for the Port of Bellingham. August 2020.

Ecology (Washington State Department of Ecology), 2007. *Consent Decree 07-2-022577, Whatcom Waterway Site, Bellingham, Washington*. 2007.

Ecology, 2011. *Consent Decree: Whatcom Waterway Site. First Amendment to Consent Decree. Re: Whatcom Waterway Site, Bellingham, Washington*. August 19, 2011.

Ecology, 2015. *Bellingham Bay Regional Background Sediment Characterization Final Data Evaluation and Summary Report*. Publication No. 15-09-044. February 2015.

EPA (U.S. Environmental Protection Agency), 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*. EPA 540-R-08-005. January 2009.

EPA, 2016. *National Functional Guidelines for High Resolution Superfund Methods Data Review*. EPA Office of Superfund Remediation and Technology Innovation. EPA-542-B-16-001; OLEM 9200.3-115. April 2016.

EPA, 2017. *National Functional Guidelines for Inorganic Superfund Methods Data Review*. EPA Office of Superfund Remediation and Technology Innovation. EPA-540-R-2017-001; OLEM 9355.0-135. January 2017.

GeoEngineers, 2016. *Final Remedial Investigation/Feasibility Study, R.G. Haley Site, Bellingham, Washington.* Prepared for the City of Bellingham. February 1, 2016.

Hart Crowser, 2016. *Microvegetation Report, Port of Bellingham Rail Repurpose.* Prepared for PND Engineers. July 25, 2016.

PSEP (Puget Sound Estuary Program), 1997. *Puget Sound Estuary Program: Recommended Guidelines for Sampling Marine Sediment, Water Column, and Tissue in Puget Sound*. Prepared for USEPA Region 10 and the Puget Sound Water Quality Authority. Puget Sound Water Quality Authority, Olympia, Washington.

RETEC, 2006. *Supplemental Remedial Investigation and Feasibility Study. Volume 1: RI Report and Draft Supplemental Remedial Investigation and Feasibility Study. Volume 2: FS Report*. Prepared for Port of Bellingham. 2006

USACE (U.S. Army Corps of Engineers), 2018. *Components of a Complete Eelgrass Delineation Report*. January 9, 2018.

WDFW (Washington Department of Fish and Wildlife), 2008. *Eelgrass/Macroalgae Habitat Interim Survey Guidelines*. June 2008.

Tables

Table 1

Summary of Previous Testing for Semivolatile Organic Compounds in Proposed Coring Areas

Site Units	Contaminant	Number of SQS/LAET Exceedances								Additional SVOC Testing Recommended During 2020 PRDI
		1996/1998 RI Grabs	1996 RI Cores	2002 PRDE Grabs	2002 PRDE Cores	2008 PRDI Grabs	2008 PRDI Cores	2017 Monitoring Grabs	2019 Monitoring Grabs	
1A/1B (Outer Waterway Open-Water Areas)	PAH	None	None	--	None	--	--	--	--	No
	Phenol	None	None	--	None	--	--	--	--	
	Methylphenols	None	None	--	None	--	--	--	--	
1C (Outer Waterway Open-Water Areas)	PAH	None	None	--	None	--	None	None	None	No
	Phenol	None	None	--	None	--	None	None	None	
	Methylphenols	None	None	--	None	--	None	None	None	
1C (BST Under-Dock Area)	PAH	None	**Yes**	--	--	--	None	--	--	**Yes**
	Phenol	None	**Yes**	--	--	--	None	--	--	
	Methylphenols	None	**Yes**	--	--	--	None	--	--	
2B/5C (ASB Access Channel Area)	PAH	None	None	None	--	None	None	--	--	**Yes**
	Phenol	None	**Yes**	None	--	None	None	--	--	
	Methylphenols	None	**Yes**	**Yes**	--	None	None	--	--	
2C (GP Under-Dock Area)	PAH	None	**Yes**	--	--	--	--	--	--	**Yes**
	Phenol	None	None	--	--	--	--	--	--	
	Methylphenols	**Yes**	**Yes**	--	--	--	--	--	--	
6B/6C (Barge Dock Area)	PAH	None	--	None	--	--	None	None	None	**Yes**
	Phenol	**Yes**	--	None	--	--	None	None	None	
	Methylphenols	**Yes**	--	**Yes**	--	--	None	None	None	

Notes:

--: Testing of this type was not performed for SVOC compounds in this site unit during the indicated study.

ASB: Aerated Stabilization Basin

BST: Bellingham Shipping Terminal

Grab: Grab sample of surface sediment (0-12 cm below mudline)

GP: Georgia-Pacific West, Inc.

LAET: lowest apparent effects threshold

None: Testing was performed for these compounds but no exceedances of SQS or LAET values were detected.

PAH: polycyclic aromatic hydrocarbon

PRDE: Pre-Remedial Design Evaluation

PRDI: Pre-Remedial Design Investigation

RI: Remedial Investigation

SQS: Sediment Quality Standards

SVOC: semivolatile organic compound

Table 2
Sediment Grab Sampling Summary

Station ID	Target Coordinates[1,2] (NAD83 WA State Plane)		Target Penetration (cm)[2]	Sample ID[3,4]	Analyses/Archive
	Easting (X)	Northing (Y)			
WC-01-SS	1241988.2	643676.8	12	WC-01-SS-DEPTH-DATE	Hg, D/F, SVOCS, TOC, TS, grain size, archive
WC-02-SS	1242106.4	643547.9	12	WC-02-SS-DEPTH-DATE	Hg, D/F, SVOCS, TOC, TS, grain size, archive
WC-03-SS	1242061.2	643751.8	12	WC-03-SS-DEPTH-DATE	Hg, D/F, SVOCS, TOC, TS, grain size, archive
WC-04-SS	1242067.9	643663.0	12	WC-04-SS-DEPTH-DATE	Hg, D/F, SVOCS, TOC, TS, grain size, archive
WC-05-SS	1242154.5	643646.2	12	WC-05-SS-DEPTH-DATE	Hg, D/F, SVOCS, TOC, TS, grain size, archive
WC-06-SS	1242222.7	643897.6	12	WC-06-SS-DEPTH-DATE	Hg, D/F, SVOCS, TOC, TS, grain size, archive
WC-07-SS	1242268.0	643850.7	12	WC-07-SS-DEPTH-DATE	Hg, D/F, SVOCS, TOC, TS, grain size, archive
WC-08-SS	1242381.3	644060.8	12	WC-08-SS-DEPTH-DATE	Hg, D/F, SVOCS, TOC, TS, grain size, archive
WC-09-SS	1242441.6	644014.3	12	WC-09-SS-DEPTH-DATE	Hg, D/F, SVOCS, TOC, TS, grain size, archive
WC-10-SS	1242449.7	644261.0	12	WC-10-SS-DEPTH-DATE	Hg, D/F, SVOCS, TOC, TS, grain size, archive
WC-11-SS	1242528.2	644193.5	12	WC-11-SS-DEPTH-DATE	Hg, D/F, SVOCS, TOC, TS, grain size, archive
WC-12-SS	1242929.6	644547.4	12	WC-12-SS-DEPTH-DATE	Hg, D/F, SVOCS, TOC, TS, grain size, archive
WC-13-SS	1243080.0	644712.4	12	WC-13-SS-DEPTH-DATE	Hg, D/F, SVOCS, TOC, TS, grain size, archive
WW-01-SS	1241202.2	642496.4	12	WW-01-SS-DEPTH-DATE	SVOCs, metals, D/F, TOC, TS, grain size, archive
WW-02-SS	1240593.6	639934.1	12	WW-02-SS-DEPTH-DATE	SVOCs, metals, D/F, TOC, TS, grain size, archive

Notes:

1. NAD 83/98 (Washington State Plane NAD 83 Lambert Conformal North Zone Grid, Per the 1998 Adjustment)
2. Actual locations and penetration depths will be dependent on field conditions.
3. Sediment material from the 0 to 12 cm interval will be homogonized and analyzed as indicated.
4. Depths and dates will be determined during sampling.

cm: centimeters
D/F: dioxins/furans
Hg: mercury
ID: identification
SVOC: semivolatile organic compound
TBD: to be determined
TOC: total organic carbon
TS: total solids

Table 3
Sediment Core Sampling Summary

Unit	Station ID	Target Coordinates[1,2] (NAD83 WA State Plane)		Target Penetration (feet)[2]	Estimated ANC (feet bgs)	Sample Intervals (feet)[3]	Testing Intervals (feet)[3]	Sample ID[3,4]	Tier 1 Analyses
		Easting (X)	Northing (Y)						
1A	1A-07-VC	1237740.0	639507.1	12	4	1	0 - 2' above ANC	1A-07-VC-DEPTH-DATE	Archive
							2' above ANC		Hg, TS, Archive
							2' below ANC		
							2' below ANC - bottom of core		Archive
	1A-08-VC	1237902.3	639339.7	12	4	1	0 - 2' above ANC	1A-08-VC-DEPTH-DATE	Archive
							2' above ANC		Hg, TS, Archive
							2' below ANC		
							2' below ANC - bottom of core		Archive
	1A-09-VC	1238035.8	639793.9	12	4	1	0 - 2' above ANC	1A-09-VC-DEPTH-DATE	Archive
							2' above ANC		Hg, TS, Archive
							2' below ANC		
							2' below ANC - bottom of core		Archive
	1A-10-VC	1238198.1	639626.5	12	4	1	0 - 2' above ANC	1A-10-VC-DEPTH-DATE	Archive
							2' above ANC		Hg, TS, Archive
							2' below ANC		
							2' below ANC - bottom of core		Archive
1B	1B-11-VC	1238331.6	640080.7	12	4	1	0 - 2' above ANC	1B-11-VC-DEPTH-DATE	Archive
							2' above ANC		Hg, TS, Archive
							2' below ANC		
							2' below ANC - bottom of core		Archive
	1B-12-VC	1238493.9	639913.3	12	4	1	0 - 2' above ANC	1B-12-VC-DEPTH-DATE	Archive
							2' above ANC		Hg, TS, Archive
							2' below ANC		
							2' below ANC - bottom of core		Archive
	1B-13-VC	1238627.4	640367.5	12	4	1	0 - 2' above ANC	1B-13-VC-DEPTH-DATE	Archive
							2' above ANC		Hg, TS, Archive
							2' below ANC		
							2' below ANC - bottom of core		Archive
	1B-14-VC	1238789.7	640200.1	12	4	1	0 - 2' above ANC	1B-14-VC-DEPTH-DATE	Archive
							2' above ANC		Hg, TS, Archive
							2' below ANC		
							2' below ANC - bottom of core		Archive
	1B-15-VC	1238923.2	640654.3	12	4	1	0 - 2' above ANC	1B-15-VC-DEPTH-DATE	Archive
							2' above ANC		Hg, TS, Archive
							2' below ANC		
							2' below ANC - bottom of core		Archive
	1B-16-VC	1239085.5	640486.9	12	4	1	0 - 2' above ANC	1B-16-VC-DEPTH-DATE	Archive
							2' above ANC		Hg, TS, Archive
							2' below ANC		
							2' below ANC - bottom of core		Archive

Table 3
Sediment Core Sampling Summary

Unit	Station ID	Target Coordinates[1,2] (NAD83 WA State Plane)		Target Penetration (feet)[2]	Estimated ANC (feet bgs)	Sample Intervals (feet)[3]	Testing Intervals (feet)[3]	Sample ID[3,4]	Tier 1 Analyses
		Easting (X)	Northing (Y)						
1C	1C-09-VC	1239032.3	640757.2	15	10	1	0 - 2' above ANC	1C-09-VC-DEPTH-DATE	Archive
							2' above ANC		Hg, TS, Archive
							2' below ANC		
							2' below ANC - bottom of core		Archive
	1C-10-VC	1239194.7	640589.8	15	10	1	0 - 2' above ANC	1C-10-VC-DEPTH-DATE	Archive
							2' above ANC		Hg, TS, Archive
							2' below ANC		
							2' below ANC - bottom of core		Archive
	1C-11-VC	1239245.3	640953.2	15	6	1	0 - 2' above ANC	1C-11-VC-DEPTH-DATE	Archive
							2' above ANC		Hg, TS, Archive
							2' below ANC		
							2' below ANC - bottom of core		Archive
	1C-12-VC	1239405.8	640784.0	15	9	1	0 - 2' above ANC	1C-12-VC-DEPTH-DATE	Archive
							2' above ANC		Hg, TS, Archive
							2' below ANC		
							2' below ANC - bottom of core		Archive
	1C-13-VC	1239475.3	641177.3	15	9	1	0 - 2' above ANC	1C-10-VC-DEPTH-DATE	Archive
							2' above ANC		Hg, TS, Archive
							2' below ANC		
							2' below ANC - bottom of core		Archive
	1C-14-VC	1239637.6	641009.8	15	9	1	0 - 2' above ANC	1C-11-VC-DEPTH-DATE	Archive
							2' above ANC		Hg, TS, Archive
							2' below ANC		
							2' below ANC - bottom of core		Archive
1C Under-Pier[6]	1C-15-VC	1239727.5	641011.6	4	--	1	0 - 4	1C-13-VC-DEPTH-DATE	Hg, TS, Archive
	1C-16-VC	1239741.6	640997.1	4	--	1	0 - 4	1C-16-VC-DEPTH-DATE	Hg, TS, Archive
	1C-17-VC	1239860.0	641141.8	4	--	1	0 - 4	1C-17-VC-DEPTH-DATE	Hg, TS, Archive
	1C-18-VC	1239873.9	641127.4	4	--	1	0 - 4	1C-18-VC-DEPTH-DATE	Hg, TS, Archive
	1C-19-VC	1239994.5	641270.5	4	--	1	0 - 4	1C-19-VC-DEPTH-DATE	Hg, TS, Archive
	1C-20-VC	1240008.2	641256.1	4	--	1	0 - 4	1C-20-VC-DEPTH-DATE	Hg, TS, Archive
	1C-21-VC	1240125.7	641402.4	4	--	1	0 - 4	1C-21-VC-DEPTH-DATE	Hg, TS, Archive
	1C-22-VC	1240139.7	641388.0	4	--	1	0 - 4	1C-22-VC-DEPTH-DATE	Hg, TS, Archive

Table 3
Sediment Core Sampling Summary

Unit	Station ID	Target Coordinates[1,2] (NAD83 WA State Plane)		Target Penetration (feet)[2]	Estimated ANC (feet bgs)	Sample Intervals (feet)[3]	Testing Intervals (feet)[3]	Sample ID[3,4]	Tier 1 Analyses
		Easting (X)	Northing (Y)						
2B[6]	2B-02-VC	1240034.1	641972.4	15	Variable	1	0 - 3' above ANC	2B-02-VC-DEPTH-DATE	Archive
							3' above ANC		Hg, TS, Archive
							3' below ANC		
							3' below ANC - bottom of core		Archive
	2B-03-VC	1240084.3	641920.5	15	Variable	1	0 - 3' above ANC	2B-03-VC-DEPTH-DATE	Archive
							3' above ANC		Hg, TS, Archive
							3' below ANC		
							3' below ANC - bottom of core		Archive
	2B-04-VC	1240122.9	642058.2	15	Variable	1	0 - 3' above ANC	2B-04-VC-DEPTH-DATE	Archive
							3' above ANC		Hg, TS, Archive
							3' below ANC		
							3' below ANC - bottom of core		Archive
	2B-05-VC	1240173.1	642006.3	15	Variable	1	0 - 3' above ANC	2B-05-VC-DEPTH-DATE	Archive
							3' above ANC		Hg, TS, Archive
							3' below ANC		
							3' below ANC - bottom of core		Archive
	2B-06-VC	1240212.8	642140.6	15	Variable	1	0 - 3' above ANC	2B-06-VC-DEPTH-DATE	Archive
							3' above ANC		Hg, TS, Archive
							3' below ANC		
							3' below ANC - bottom of core		Archive
	2B-07-VC	1240263.0	642088.7	15	Variable	1	0 - 3' above ANC	2B-07-VC-DEPTH-DATE	Archive
							3' above ANC		Hg, TS, Archive
							3' below ANC		
							3' below ANC - bottom of core		Archive
2C Under-Pier[6]	2C-03-VC	1240810.5	642041.9	4	--	1	0 - 4	1C-13-VC-DEPTH-DATE	Hg, TS, Archive
	2C-04-VC	1240844.0	642007.3	4	--	1	0 - 4	2C-04-VC-DEPTH-DATE	Hg, TS, Archive
	2C-05-VC	1241102.3	642331.8	4	--	1	0 - 4	2C-05-VC-DEPTH-DATE	Hg, TS, Archive
	2C-06-VC	1241135.8	642297.2	4	--	1	0 - 4	2C-06-VC-DEPTH-DATE	Hg, TS, Archive
	2C-07-VC	1241401.0	642616.5	4	--	1	0 - 4	2C-07-VC-DEPTH-DATE	Hg, TS, Archive
	2C-08-VC	1241434.4	642581.9	4	--	1	0 - 4	2C-08-VC-DEPTH-DATE	Hg, TS, Archive

Table 3
Sediment Core Sampling Summary

Unit	Station ID	Target Coordinates[1,2] (NAD83 WA State Plane)		Target Penetration (feet)[2]	Estimated ANC (feet bgs)	Sample Intervals (feet)[3]	Testing Intervals (feet)[3]	Sample ID[3,4]	Tier 1 Analyses
		Easting (X)	Northing (Y)						
6[6]	6-01-VC	1239794.7	640664.4	15	Variable	1	0 - 3' above ANC	6-01-VC-DEPTH-DATE	Archive
							3' above ANC		Hg, TS, Archive
							3' below ANC		
							3' below ANC - bottom of core		Archive
	6-02-VC	1239842.8	640692.0	15	Variable	1	0 - 3' above ANC	6-02-VC-DEPTH-DATE	Archive
							3' above ANC		Hg, TS, Archive
							3' below ANC		
							3' below ANC - bottom of core		Archive
	6-03-VC	1239863.1	640484.2	15	Variable	1	0 - 3' above ANC	6-03-VC-DEPTH-DATE	Archive
							3' above ANC		Hg, TS, Archive
							3' below ANC		
							3' below ANC - bottom of core		Archive
	6-04-VC	1239944.4	640528.1	15	Variable	1	0 - 3' above ANC	6-04-VC-DEPTH-DATE	Archive
							3' above ANC		Hg, TS, Archive
							3' below ANC		
							3' below ANC - bottom of core		Archive
	6-05-VC	1240006.5	640310.6	15	Variable	1	0 - 3' above ANC	6-05-VC-DEPTH-DATE	Archive
							3' above ANC		Hg, TS, Archive
							3' below ANC		
							3' below ANC - bottom of core		Archive
	6-06-VC	1240055.8	640341.4	15	Variable	1	0 - 3' above ANC	6-06-VC-DEPTH-DATE	Archive
							3' above ANC		Hg, TS, Archive
							3' below ANC		
							3' below ANC - bottom of core		Archive

Notes:
1. NAD 83/98 (Washington State Plane NAD 83 Lambert Conformal North Zone Grid, Per the 1998 Adjustment)
2. Actual locations and penetration depths will be dependent on field conditions.
3. The entire length of the core will be processed in 1-foot intervals and analyzed as indicated. If ANC is not encountered, the bottom four to six intervals of the core will be analyzed.
4. Depths and dates will be determined during core processing.
5. Dioxin/furan and total organic carbon analyses will be determined once the clean contact for Hg is determined. See Addendum 2 text for the tiered analyses approach.
6. SVOC analyses will be conducted once the clean contact for Hg is determined in these areas. See Addendum 2 text for the tiered analyses approach.
ANC: apparent native contact
bgs: below sediment surface
Hg: mercury
ID: identification
SVOC: semivolatile organic compound
TS: total solids

Table 4
Analytical Testing Criteria and Reporting Limits

Parameter	Method	SMS Freshwater Sediment		SMS Marine Sediment[1]		SMS Marine Sediment[2]		Bellingham Bay Regional Background[3]	Puget Sound Natural Background[4]	MDL	MRL
		SCO (mg/kg)	CSL (mg/kg)	SCO (mg/kg OC)	CSL (mg/kg OC)	SCO (µg/kg)	CSL (µg/kg)				
Geotechnical Analyses											
Grain size	ASTM D422	--	--	--	--	--	--	--	--	0.02	0.1
Conventionals (%)											
Total solids	SM 2540G	--	--	--	--	--	--	--	--	0.1	0.1
Total organic carbon	EPA 9060A	--	--	--	--	--	--	--	--	0.1	0.1
Metals (mg/kg)											
Mercury	EPA 7471B	0.66	0.8	--	--	0.41	0.59	--	0.2	0.00525	0.025
Antimony	EPA 6010C	--	--	--	--	--	--	--	--	0.360	5.00
Arsenic	EPA 6010C	14	120	--	--	57	93	--	11	0.470	5.00
Beryllium	EPA 6010C	--	--	--	--	--	--	--	--	0.016	0.100
Cadmium	EPA 6010C	2.1	5.4	--	--	5.1	6.7	--	0.8	0.034	0.200
Chromium	EPA 6010C	72	88	--	--	260	270	--	62	0.132	0.500
Copper	EPA 6010C	400	1200	--	--	390	390	--	45	0.0660	0.200
Lead	EPA 6010C	360	> 1300	--	--	450	530	--	21	0.190	2.00
Nickel	EPA 6010C	26	110	--	--	--	--	--	50	0.280	1.00
Selenium	EPA 6010C	11	>20	--	--	--	--	--	--	0.498	5.00
Silver	EPA 6010C	0.57	1.7	--	--	6.1	6.1	--	0.24	0.0540	0.300
Thallium	EPA 6010C	--	--	--	--	--	--	--	--	0.370	5.00
Zinc	EPA 6010C	3200	>4200	--	--	10	960	--	93	0.210	1.00
PAHs (µg/kg)											
Total LPAH	8270E	--	--	370	780	5200	5200	--	--	--	--
Naphthalene	8270E	--	--	99	170	2100	2100	--	--	5.25	20.0
Acenaphthylene	8270E	--	--	66	66	1300	1300	--	--	4.77	20.0
Acenaphthene	8270E	--	--	16	57	500	500	--	--	5.13	20.0
Fluorene	8270E	--	--	23	79	540	540	--	--	4.95	20.0
Phenanthrene	8270E	--	--	100	480	1500	1500	--	--	4.69	20.0
Anthracene	8270E	--	--	220	1200	960	960	--	--	5.93	20.0
2-Methylnaphthalene[e]	8270E	--	--	38	64	670	670	--	--	5.67	20.0
Total HPAHs	8270E	--	--	960	5300	12000	17000	--	--	--	--
Fluoranthene	8270E	--	--	160	1200	1700	2500	--	--	4.52	20.0
Pyrene	8270E	--	--	1000	1400	2600	3300	--	--	5.55	20.0
Benzo(a)anthracene	8270E	--	--	110	270	1300	1600	--	--	5.18	20.0
Chrysene	8270E	--	--	110	460	1400	2800	--	--	5.22	20.0
Total benzo(b,j,k)fluoranthenes	8270E	--	--	230	450	3200	3600	--	--	10.2	40.0
Benzo(a)pyrene	8270E	--	--	99	210	1600	1600	--	--	6.48	20.0
Indeno(1,2,3-cd)pyrene	8270E	--	--	34	88	600	690	--	--	5.99	20.0
Dibenz(a,h)anthracene	8270E	--	--	12	33	230	230	--	--	6.16	20.0
Benzo(g,h,i)perylene	8270E	--	--	31	78	670	720	--	--	5.82	20.0
cPAH Bap TEQ	--	--	--	--	--	--	--	86	21	--	--
Total PAHs	--	17000	30000								

Table 4
Analytical Testing Criteria and Reporting Limits

Parameter	Method	SMS Freshwater Sediment		SMS Marine Sediment[1]		SMS Marine Sediment[2]		Bellingham Bay Regional Background[3]	Puget Sound Natural Background[4]	MDL	MRL
		SCO (mg/kg)	CSL (mg/kg)	SCO (mg/kg OC)	CSL (mg/kg OC)	SCO (μg/kg)	CSL (μg/kg)				
SVOCs (μg/kg)											
Phenol	8270E	120	210	--	--	420	1200	--	--	8.23	20.0
2-Methylphenol	8270E	--	--	--	--	63	63	--	--	7.84	20.0
4-Methylphenol	8270E	260	2000	--	--	670	670	--	--	14.7	20.0
2,4-Dimethylphenol	8270E	--	--	--	--	29	29	--	--	26.8	100
Pentachlorophenol	8270E	1200	>1200	--	--	360	690	--	--	31.3	100
Dioxin/furans (ng/kg)											
2,3,7,8-TCDF	EPA 1613B	--	--	--	--	--	--	--	--	0.063	1.0
2,3,7,8-TCDD	EPA 1613B	--	--	--	--	--	--	--	--	0.14	1.0
1,2,3,7,8-PeCDF	EPA 1613B	--	--	--	--	--	--	--	--	0.15	1.0
2,3,4,7,8-PeCDF	EPA 1613B	--	--	--	--	--	--	--	--	0.15	1.0
1,2,3,7,8-PeCDD	EPA 1613B	--	--	--	--	--	--	--	--	0.18	1.0
1,2,3,4,7,8-HxCDF	EPA 1613B	--	--	--	--	--	--	--	--	0.14	1.0
1,2,3,6,7,8-HxCDF	EPA 1613B	--	--	--	--	--	--	--	--	0.18	1.0
2,3,4,6,7,8-HxCDF	EPA 1613B	--	--	--	--	--	--	--	--	0.11	1.0
1,2,3,7,8,9-HxCDF	EPA 1613B	--	--	--	--	--	--	--	--	0.21	1.0
1,2,3,4,7,8-HxCDD	EPA 1613B	--	--	--	--	--	--	--	--	0.18	1.0
1,2,3,6,7,8-HxCDD	EPA 1613B	--	--	--	--	--	--	--	--	0.15	1.0
1,2,3,7,8,9-HxCDD	EPA 1613B	--	--	--	--	--	--	--	--	0.22	1.0
1,2,3,4,6,7,8-HpCDF	EPA 1613B	--	--	--	--	--	--	--	--	0.21	1.0
1,2,3,4,7,8,9-HpCDF	EPA 1613B	--	--	--	--	--	--	--	--	0.16	1.0
1,2,3,4,6,7,8-HpCDD	EPA 1613B	--	--	--	--	--	--	--	--	0.56	2.5
OCDF	EPA 1613B	--	--	--	--	--	--	--	--	1.1	2.5
OCDD	EPA 1613B	--	--	--	--	--	--	--	--	4.3	10
WHO 2005 Mammalian TEQ	--	--	--	--	--	--	--	15	4	--	--

Notes:

1. Applicable to polar organic compounds when the TOC concentration is 0.5% - 3.5%.
2. Applicable to polar organic compounds when the TOC concentration is outside of the 0.5% - 3.5% range.
3. Ecology, 2015. Bellingham Bay Regional Background Sediment Characterization Final Data Evaluation and Summary Report. Publication No. 15-09-044. February 2015.
4. Ecology, 2019. Sediment Cleanup User's Manual (SCUM). Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards, Chapter 173-204 WAC. Publication No. 12-09-057. Second Revision December 2019.

ASTM: ASTM International
cPAH: carcinogenic polycyclic aromatic hydrocarbon
CSL: Cleanup Screening Level
EPA: U.S. Environmental Protection Agency
HPAH: high molecular weight PAH
LPAH: low molecular weight PAH
MDL: method detection limit
mg/kg: milligram per kilogram
MRL: method reporting limit
ng/kg: nanogram per kilogram
PAH: polycyclic aromatic hydrocarbon
SCO: Sediment Cleanup Objective
SMS: Sediment Management Standards
SVOC: semivolatile organic compound
TEQ: toxic equivalency
WHO: World Health Organization

Table 5
Vane Shear Testing Summary

Station ID	Target Coordinates[1,2] (NAD83 WA State Plane)		Sample ID[3]	Analyses/Archive
	Easting (X)	Northing (Y)		
8-01-VS	1239564.1	642928.7	8-01-VS-DATE	Vane Shear testing
8-02-VS	1239722.4	643082.0	8-02-VS-DATE	Vane Shear testing
8-03-VS	1239885.7	643240.1	8-03-VS-DATE	Vane Shear testing
8-04-VS	1240052.6	643401.8	8-04-VS-DATE	Vane Shear testing
8-05-VS	1239570.8	642589.7	8-05-VS-DATE	Vane Shear testing
8-06-VS	1239733.6	642747.3	8-06-VS-DATE	Vane Shear testing
8-07-VS	1239891.8	642900.6	8-07-VS-DATE	Vane Shear testing
8-08-VS	1240055.1	643058.6	8-08-VS-DATE	Vane Shear testing
8-09-VS	1240222.1	643220.3	8-09-VS-DATE	Vane Shear testing
8-10-VS	1239760.2	642391.6	8-10-VS-DATE	Vane Shear testing
8-11-VS	1239920.9	642547.2	8-11-VS-DATE	Vane Shear testing
8-12-VS	1240079.2	642700.5	8-12-VS-DATE	Vane Shear testing
8-13-VS	1240242.5	642858.6	8-13-VS-DATE	Vane Shear testing
8-14-VS	1240409.5	643020.3	8-14-VS-DATE	Vane Shear testing
8-15-VS	1239911.4	642238.0	8-15-VS-DATE	Vane Shear testing
8-16-VS	1240070.1	642391.7	8-16-VS-DATE	Vane Shear testing
8-17-VS	1240228.4	642545.0	8-17-VS-DATE	Vane Shear testing
8-18-VS	1240391.7	642703.0	8-18-VS-DATE	Vane Shear testing
8-19-VS	1240558.6	642864.7	8-19-VS-DATE	Vane Shear testing

Notes:

1. NAD 83/98 (Washington State Plane NAD 83 Lambert Conformal North Zone Grid, Per the 1998 Adjustment)

2. Actual locations and penetration depths will be dependent on field conditions.

3. Depths and dates will be determined during sampling.

ID: identification

Table 6
ASB Geotechnical Testing Samples

Station ID	Target Coordinates[1,2] (NAD83 WA State Plane)		Target Penetration Depth (cm)[2]	Sample ID[3,4]	Analyses/Archive[5]
	Easting (X)	Northing (Y)			
8-07-SS	1239693.4	642957.4	0-3 or 3-6 feet	8-07-SS-DEPTH-DATE	Column Settlement/Seepage Induced Consolidation
8-08-SS	1240107.7	642523.0	0-3 or 3-6 feet	8-08-SS-DEPTH-DATE	Column Settlement/Seepage Induced Consolidation
8-09-SS	1240025.9	643261.3	0-3 or 3-6 feet	8-09-SS-DEPTH-DATE	Column Settlement/Seepage Induced Consolidation
8-10-SS	1240438.2	642838.3	0-3 or 3-6 feet	8-10-SS-DEPTH-DATE	Column Settlement/Seepage Induced Consolidation

Notes:

1. NAD 83/98 (Washington State Plane NAD 83 Lambert Conformal North Zone Grid, Per the 1998 Adjustment)
2. Actual locations and penetration depths will be dependent on field conditions; 2 samples will be collected from 0-3 feet depth and 3-6 feet depth each.
3. Sediment material from the target intervals will be homogonized and analyzed as indicated.
4. Depths and dates will be determined during sampling.
5. Testing assignment will be determined following collection of the Aerated Stabilization Basin (ASB) soft sediments.

cm: centimeters
ID: identification

Table 7

Sample Preservation and Handling Requirements

Analysis	Container	Holding Time	Preservative
Grain size	16 oz glass or HDPE	6 months	2 - 6°C
Total organic carbon/ total solids	8 oz glass	14 days	< 6°C
		6 months	< 0°C
Metals (except mercury)	4 oz glass	6 months	< 6°C
		2 years	< 0°C
Mercury		28 days	< 6°C
SVOCs	16 oz glass	14 days to extraction	< 6°C
		1 year to extraction	< 0°C
		40 days to analysis	< 6°C
Dioxin/furans	8 oz amber glass	1 year to extraction	< 0°C
		1 year to analysis	
Archive	16 oz glass	--	< 0°C

Notes:

°C: degrees Celsius

HDPE: high density polyethylene

oz: ounce

SVOC: semivolatile organic compound

Table 8
Quality Control Analysis Summary for Chemical Testing

Analysis	Field Duplicate	Rinsate Blank	Initial Calibration	Ongoing Calibration	Matrix Duplicates	Matrix Spikes	LCS/OPR/ SRM[3]	Matrix Spike Duplicates[4]	Method Blanks	Labeled Compounds
Grain size	1 per 20 samples	NA	Daily[1]	NA	NA	NA	NA	NA	NA	NA
Total solids	1 per 20 samples	NA	Daily[1]	NA	1 per 20 samples	NA	NA	NA	NA	NA
Total organic carbon	1 per 20 samples	NA	Daily or each batch	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	NA	1 per 20 samples	NA
Metals	1 per 20 samples	1 per event per sampling method	Daily or each batch	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	NA	1 per 20 samples	NA
SVOCs	1 per 20 samples	1 per event per sampling method	As needed[2]	Every 12 hours	NA	2 per 20 samples	3 per 20 samples	4 per 20 samples	1 per 20 samples	Every sample
Dioxin/furans	1 per 20 samples	1 per event per sampling method	As needed[2]	Every 12 hours	1 per 20 samples	N/A[5]	1 per 20 samples	N/A[5]	1 per 20 samples	Every sample

Notes:

1. Calibration and certification of drying ovens and weighing scales are conducted bi-annually.
2. Initial calibrations are considered valid until the continuing calibration no longer meets method specifications. At that point, a new initial calibration is analyzed.
3. The Puget Sound SRM will be analyzed in association with the dioxin/furan analyses at a rate of one per project.
4. Matrix spike duplicates may be analyzed in place of matrix duplicates for applicable methods.
5. Isotope dilution per the analytical method

NA: not applicable

LCS: laboratory control sample

OPR: ongoing precision and recovery

SRM: sediment reference material

SVOC: semivolatile organic compound

Table 9
Data Quality Objectives for Chemical Testing

Parameter	Precision	Accuracy	Completeness
Grain size	± 30% RPD	NA	95%
Total solids	± 20% RPD	NA	95%
Total organic carbon	± 30% RPD	75-125% R	95%
Metals	± 30% RPD	70-130% R	95%
SVOCs	± 35% RPD	50-150% R	95%
Dioxin/furans	± 35% RPD	50-150% R	95%

Notes:

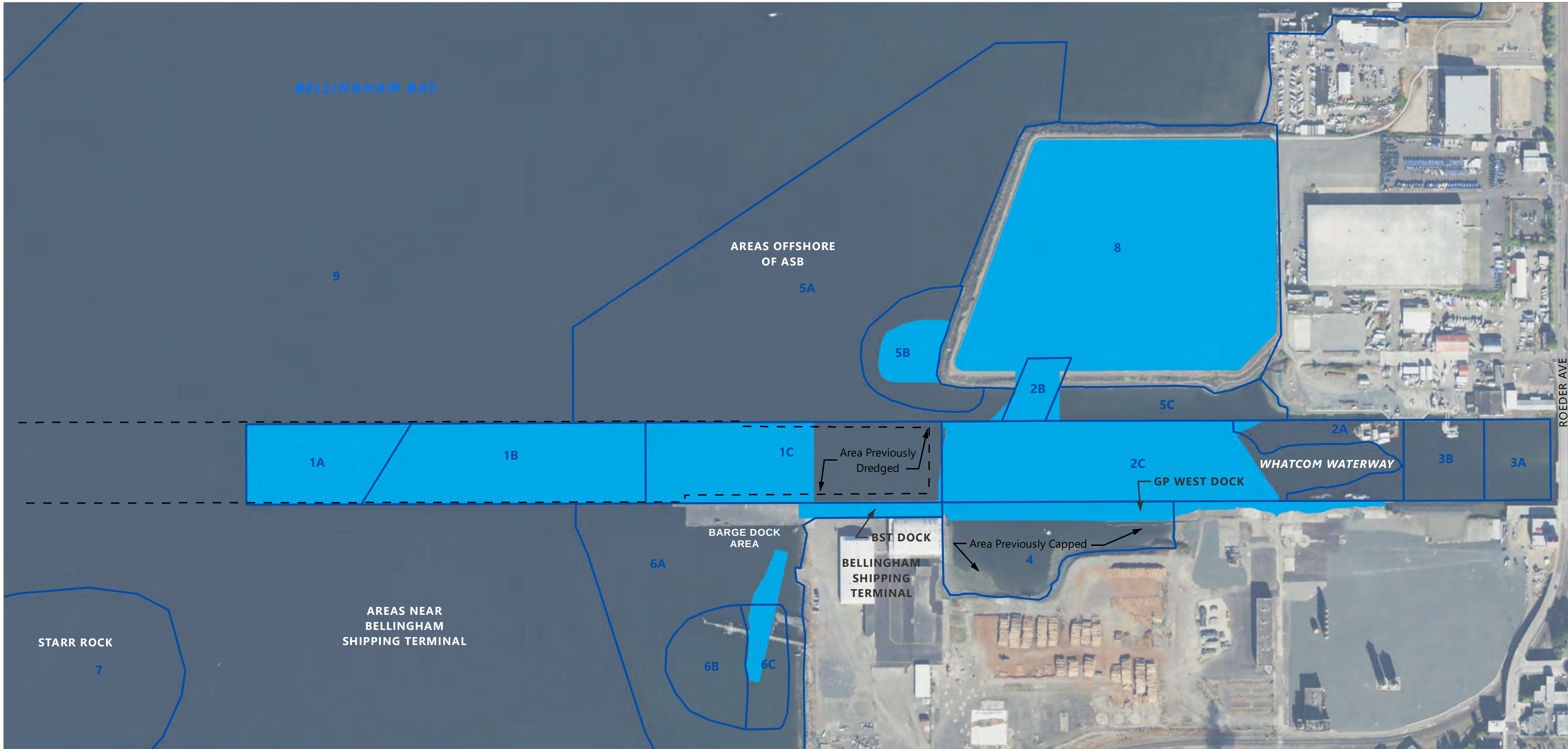
RPD: relative percent difference

R: recovery

NA: not applicable

SVOC: semivolatile organic compound

Figures



LEGEND:

Sediment Site Unit

Federal Navigation Channel

Planned Phase 2 Work Areas

NOTES:

1. Site Units are shown based on those in Figure 2-3 Cleanup Action Plan, Whatcom Waterway Site, September 2007. Unit 9 boundary updated based on PRDI findings.
2. Horizontal datum: Washington State Plane North, NAD 83 U.S. Survey Feet.
3. Unit 2B was established in the Cleanup Action Plan based on the anticipated marina access channel location. This location will be adjusted during final design.

0 400 Feet

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Filepath: \\orcas\gis\Jobs\Port_of_Bellingham_0007\Whatcom_Waterway_Ph2\Maps\PRDI_Work_Plan_Addendum_3_2020\AQ_WP_fig1_PlannedWorkAreas_Ph2.mxd

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Figure 1
Planned Phase 2 Work Areas
Addendum 3 to the PRDI Work Plan
Whatcom Waterway Site Cleanup

LEGEND:

Sediment Site Unit

Federal Navigation Channel

Proposed Sample Locations

Vibracore

Under-Pier Core

Sediment Grab

ASB Vane Shear (Note 4)

ASB Select Geotechnical Testing (Note 5)

NOTES:

1. Site Units are shown based on those in Figure 2-3 Cleanup Action Plan, Whatcom Waterway Site, September 2007. Unit 9 boundary updated based on PRDI findings.
2. Horizontal datum: Washington State Plane North, NAD 83 U.S. Survey Feet.
3. Unit 2B was established in the Cleanup Action Plan based on the anticipated marina access channel location. This location will be adjusted during final design.
4. In-situ vane shear testing will be completed in the ASB to assess soft sediment strength properties.
5. Select sampling of the ASB soft sediments will be completed for laboratory testing to evaluate sediment compressibility and dewatering properties.

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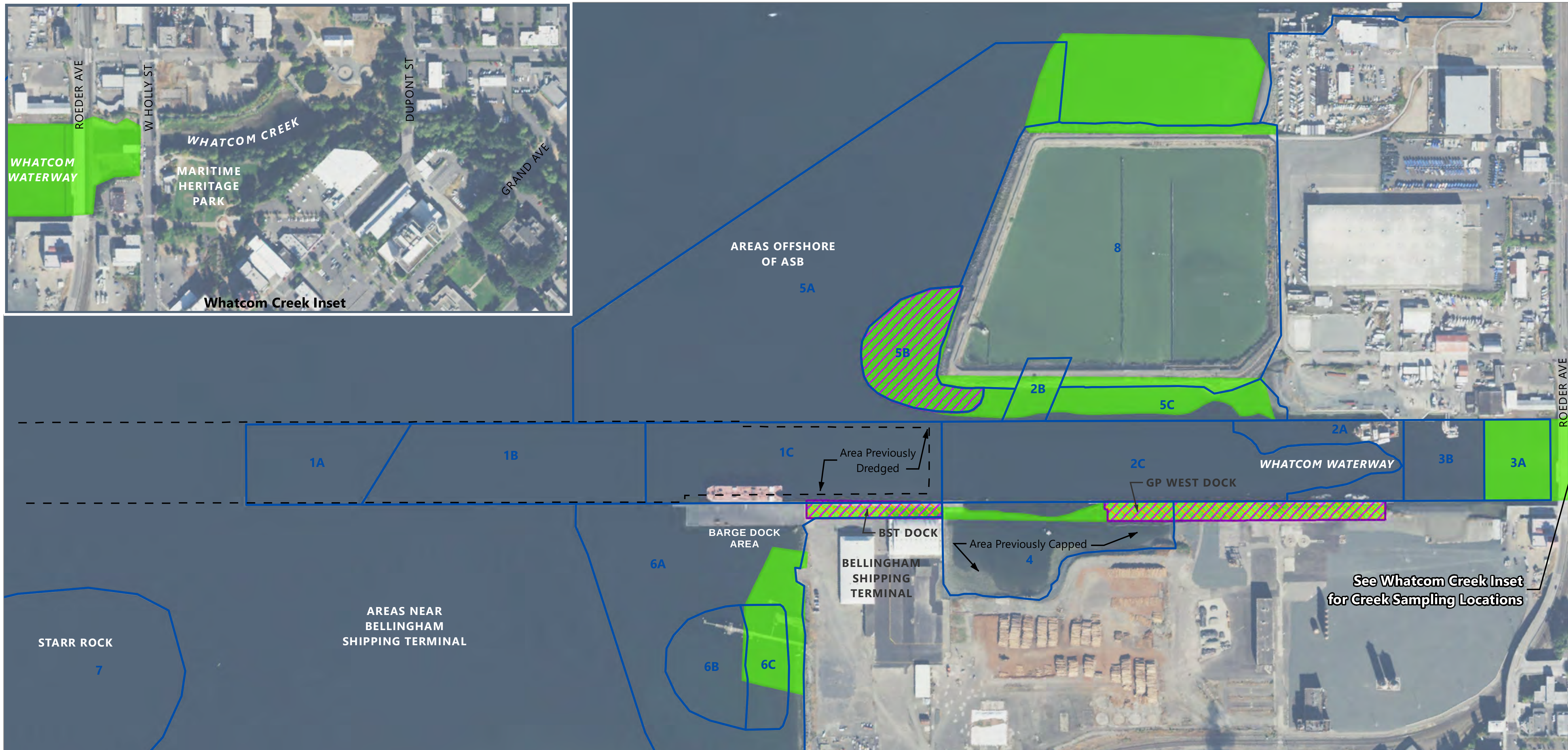
Figure 2

Proposed Waterway Sampling Locations

Addendum 3 to the PRDI Work Plan

Whatcom Waterway Site Cleanup



LEGEND:

Sediment Site Unit

Federal Navigation Channel

Proposed Survey Type

Jet Probe (Note 4)

Under-Pier Surveys (Note 5)

Eelgrass and Macroalgae

NOTES:

1. Site Units are shown based on those in Figure 2-3 Cleanup Action Plan, Whatcom Waterway Site, September 2007. Unit 9 boundary updated based on PRDI findings.
2. Horizontal datum: Washington State Plane North, NAD 83 U.S. Survey Feet.
3. Unit 2B was established in the Cleanup Action Plan based on the anticipated marina access channel location. This location will be adjusted during final design.
4. Jet probing proposed to be conducted within units 1C Under-pier, 2C Under-pier, and 5B.
5. Additional under-pier survey data will be collected to fill bathymetry data gaps. Additional intertidal data will be collected by hand or lead line along approximate 50ft transects within these under-pier areas.

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Figure 3

Proposed Eelgrass, Jet Probing, and Structural Survey Locations

Addendum 3 to the PRDI Work Plan
Whatcom Waterway Site Cleanup

Attachment A
Washington Department of Fish and Wildlife
Eelgrass Survey Guidance

Eelgrass / Macroalgae Habitat Interim Survey Guidelines

Introduction

Under the Washington Administrative Code (WAC), eelgrass and macroalgae are defined as saltwater habitats of special concern (WACs 220-110-250 (3)(a, b)). In administering the Hydraulic Project Approval (HPA) process, the Washington Department of Fish and Wildlife (WDFW) requires proponents for projects to: 1) avoid impacting eelgrass and macroalgae, 2) minimize unavoidable impacts, and 3) mitigate for any impacts. Mitigation for the loss of eelgrass typically entails providing eelgrass enhancement away from the project footprint. Because establishment of new eelgrass for mitigation is often unsuccessful, project proponents need to address this uncertainty by increasing the scope of their mitigation effort, such as planting an area larger than the project impact footprint. For macroalgae mitigation measures, the WDFW Area Habitat Biologist (AHB) shall be consulted.

In known or suspected eelgrass areas, proponents shall survey to delineate the spatial extent of eelgrass and macroalgae presence in the project area. If the project cannot be moved or redesigned to avoid direct eelgrass and macroalgae impacts, surveys are required for quantifying potential impacts. Surveys shall be conducted by divers/biologists who are qualified to identify the predominant eelgrass and macroalgae species in the project area. Deviations from the survey guidelines shall be approved by the AHB prior to conducting eelgrass or macroalgae surveys. Survey results and interpretation will be subject to WDFW approval.

Preliminary Surveys

Preliminary surveys are conducted to:

1) determine if eelgrass or macroalgae are present at the proposed project site,

2) evaluate if the project can be located and constructed to avoid impacting eelgrass or macroalgae, and

3) establish a location for the project that will minimize impacts when avoidance is not possible.

Preliminary surveys shall provide:

- A project site map indicating all survey transects and showing the qualitative distribution of eelgrass and macroalgae (boundaries of each patch), as well as substrate characterization along each transect. The map should also indicate approximate depth contours and the approximate location of the proposed project footprint (e.g., the dimensions of the pier, ramp and float).

Protocol Guidance

1. Transects should be referenced to a permanent physical feature at the project site in such a way that transects can be precisely relocated in the future.

2. Transect length and location should be determined by project and site specifics, and should include the landward margin of the eelgrass or macroalgae habitat, if present. Transect coverage should extend at least 25 feet waterward of the project footprint, and, if possible, to the outer margin of the eelgrass or macroalgae bed.

3. To document the potential for eelgrass or macroalgae impacts from a project, at least one transect should be aligned along the proposed centerline of the project footprint. Additional transects shall be conducted on either side of the project footprint at 10 and 25 feet from the outer edges of the proposed structure. The inner and outer edges of each eelgrass or macroalgae patch shall be documented along each transect and noted on the site map.

4. Depth contours should be established relative to mean lower low water equal to 0.0 feet elevation (MLLW=0.0 ft.). Tidal reference and correction should be noted on the site map.

5. Survey documentation must include the date and time of the survey, name of the surveyor and their affiliation, turbidity/visibility measurements, presence of invertebrate and vertebrate species, and anecdotal observations pertinent to habitat characterization of the project site (e.g., presence of rocky outcroppings, debris, etc.).

6. Conducting surveys between June 1 and October 1 is strongly preferred because the full extent of eelgrass and macroalgae distribution can be more accurately mapped. However, preliminary surveys may be conducted at any time during the year.

To meet the need to minimize eelgrass and macroalgae impacts, and the requirement to document the centerline of the project footprint, some flexibility at the time of the survey may be necessary. A preferred method is to establish a transect parallel to the shoreline, along the midpoint of the eelgrass or macroalgae bed, to locate any open patches where a new centerline for the project could be placed. Typically, an open area sufficient to accommodate a ten-foot buffer around the project footprint will be necessary.

If the preliminary survey shows that the project can be located and built without impacting eelgrass or macroalgae, the preliminary survey will meet the needs for mapping the project area. However, if the project footprint potentially impacts existing eelgrass or macroalgae beds, advanced surveys to quantify the extent of impact and document mitigation success, will be required.

Advanced Surveys

Advanced surveys shall occur between June 1 and October 1 and are conducted to:

1. quantify the impact from the project to eelgrass and macroalgae, and

2. quantify the performance of mitigation actions.

Quantifying Impacts

The standard protocols described below are designed to give accurate estimates of project impacts. Eelgrass density is determined by sampling with quadrats along transects. Two methods are typically used to determine project impacts and required mitigation. Project impacts are calculated as the total area of eelgrass affected by the project, as determined by the AHB. Alternatively, project impacts can be monitored in the project area to determine eelgrass or macroalgae loss and required mitigation. Sampling results are used to calculate the size of the mitigation project required to compensate for impacts that cannot be avoided.

As noted above, a project proponent may choose to monitor post-project impacts directly. The size of the required mitigation obligation may be reduced by this approach (e.g., in cases where post project impacts were less than anticipated). However, this approach will require additional monitoring of survey transects for a number of years to evaluate potential changes to eelgrass densities in the project area and within a reference site. This approach involves potentially higher mitigation ratios due to the delay in mitigation project construction (e.g., adjusting for temporal loss of function).

Alternative sampling designs are allowed, when agreed to in consultation with the AHB. This may be particularly appropriate when the potential impacts have been avoided to the maximum extent possible, and only a few small patches of eelgrass remain within or near the project footprint. In such a case, a full census of impacted eelgrass may be the most cost-effective option (e.g., counting all eelgrass shoots in the impact area). Alternatively, a stratified sampling of the existing patches may be a better choice (e.g., taking density estimates in the eelgrass patches only).

Statistical Considerations

1. Measuring mitigation success (or direct impacts of a project) requires comparing eelgrass densities at a mitigation (or impact) site versus a reference site. These comparisons must be statistically rigorous, and include the following statistical considerations:

   - Low probability of a Type I error - concluding there is loss of eelgrass when, in fact, there is not. This issue is addressed by selecting a small value for α in statistical analyses, usually 0.10.
   - Low probability of a Type II error - failing to detect a loss of eelgrass when, in fact, there is one. Selecting a small value for β (applying high statistical power, $(1-\beta)$) ensures this. Power set at 0.90 provides low probability of a Type II error.
   - Effect threshold - the difference in mean eelgrass density between sites.

The WDFW has established monitoring standards for these surveys: a) $\alpha = 0.10$, b) power $(1 - \beta) = 0.90$, and c) a difference of mean eelgrass density of $\geq 20\%$. Surveys using an alternative design must meet or exceed these standards.

Standard Protocols for Quantifying Impact

1. For a linear project, a single transect should be aligned along the centerline of the footprint.
2. A minimum of 30 samples must be taken within the area of eelgrass or macroalgae. Samples consist of eelgrass shoot counts within a (minimum) ¼ m^2 area quadrat. Sampling stations may be placed randomly along the transect, or for simplicity, evenly spaced along the same line starting at a random point (i.e., stratified random). Convert raw sample counts to shoot densities per square meter ($\#/m^2$).
3. Using the sample data, calculate mean eelgrass density ($\bar{x}_{project}$) in the impact area, as well as sample variance (s^2).

Assessing Mitigation Performance

Eelgrass density often varies substantially among locations and through time, making it difficult to measure mitigation success. To address this uncertainty, WDFW requires the use of a reference site to account for regional differences in eelgrass density and temporal variability. Use of a reference site can also improve monitoring efficiency, supporting rigorous results with fewer samples. The reference site should be chosen to match the characteristics of the mitigation area.

Quantifying Mitigation Performance

Reference Site Characterization

1. Choose a reference site near the proposed mitigation site. The reference site should be similar to the mitigation site in depth profile, substrate, turbidity, and disturbance regimes.
2. Within the reference site, take a minimum of 30 samples, either randomly or stratified randomly. Samples involve counting eelgrass shoots within a (minimum) ¼ m^2 area quadrat. Samples can be larger than ¼ m squares, but all samples need to reference the area from which they were taken so that the data can be converted to shoot densities (#/m^2).
3. Calculate the mean density of eelgrass at the reference site ($\bar{x}_{reference}$) as well as sample variance (s^2).

Mitigation Area Extent

The objective of eelgrass mitigation is to replace lost shoots and an area equivalent to the impacted area. If the mean density of eelgrass is lower at the reference site than within the impact area, the size of the mitigation project needs to be enlarged such that the reference site has the same total number of shoots as the impact site. For example, if the project impacts an area of 10 m^2, with a mean eelgrass density of 20 shoots/m^2, while the reference area has a mean shoot density of 10 shoots/m^2, the mitigation area would need to be at least 20 m^2 (to achieve a 1:1 mitigation ratio). However, if the reference site has greater density than the impact area, no area adjustment to the mitigation site would be necessary to address density differences. In addition, other factors can influence mitigation ratios and thus the required size of the mitigation area.

Mitigation Sampling and Performance

Mitigation monitoring consists of sampling both the reference site and the mitigation area at three and five-years following the completion of the mitigation project. Sampling one year following project completion is recommended to detect early failures at the mitigation site, but the need for this can be determined on a site-specific basis. Enough samples must be taken at the two sites to be able to detect significant differences in eelgrass density at the mitigation site versus the reference site using the statistical considerations noted above. A Microsoft Excel spreadsheet (Sample_Size_Calculator.xls) programmed to calculate the required sample size is provided by WDFW. Specific directions for entering data are included on the spreadsheet. The sample size calculator uses the following formula, modified from Zar (1999).

$$N = [2*s^2_{reference}/(\bar{x}_{reference} - \bar{x}_{mitigation})^2] * (t_{\alpha(1), v} + t_{\beta(1), v})^2$$

Where: N = required sample size in each site (i.e., mitigation and reference),
$s^2_{reference}$ = sample variance from the reference site,
$\bar{x}$ = sample mean
t = percentage values from Student's t-distribution
$_v$ = degrees of freedom

If the required number of samples is prohibitively expensive, due to inherent variability of eelgrass density, the statistical power of the monitoring may be lowered. This will entail a larger mitigation project to account for the increased statistical uncertainty.

Statistical Testing

At year three and five post construction, the proponent is required to re-sample and compare (statistically) eelgrass densities at the reference and mitigation site (using the prescribed number of plots defined in the equation above). We suggest using a two-sample, one-tailed t-test for comparison of eelgrass mean densities from mitigation versus reference areas. The statistical null hypothesis in this case is - H_0: eelgrass density at the mitigation site ≥ eelgrass density at the reference site.

The year-three sample is designed to detect potential early failures in eelgrass growth at the mitigation site, relative to the reference site, that may suggest the need for additional actions at the mitigation site (e.g., additional transplants). Final mitigation success or failure will be based on year-five survey results and statistical testing (H_0: eelgrass density at the mitigation site ≥ density at reference site, and total shoot abundance criteria has been met). Failure to meet prescribed eelgrass density (i.e., rejecting the null hypothesis) and shoot abundance will require implementation of contingency actions identified in the mitigation plan.

Attachment B
Inadvertent Discovery Plan

INADVERTENT DISCOVERY PLAN

July 2020

PLAN AND PROCEDURES FOR THE UNANTICIPATED DISCOVERY OF CULTURAL RESOURCES AND HUMAN SKELETAL REMAINS

Project Title: Whatcom Waterway Pre-Remedial Design Investigation
Project Proponent: Port of Bellingham
Project ID Number: FSID: 2899, CSID: 219
County: Whatcom
Address: Project is within Bellingham Bay and the mouth of Whatcom Creek
Section, Township, Range: 25, 38N, 2E

1. INTRODUCTION

This Inadvertent Discovery Plan (IDP) outlines procedures to perform in the event of discovering cultural resources or human remains, in accordance with Washington State preservation laws. These laws concern historic preservation, archaeology, human remains and cemeteries.

2. RECOGNIZING CULTURAL RESOURCES

A cultural resource discovery could be prehistoric or historic. Examples include:

a. An accumulation of shell, burned rocks, or other food related materials.
b. Bones or small pieces of bone.
c. An area of charcoal or very dark stained soil with artifacts.
d. Stone tools or waste flakes (i.e. an arrowhead. or stone chips).
e. Clusters of tin cans or bottles, logging or agricultural equipment that appears to be older than 50 years.
f. Buried railroad tracks, decking, or other industrial materials.

See cultural resource images in Appendix A.

3. ON-SITE RESPONSIBILITIES

STEP 1: *Stop Work.* If any employee, contractor or subcontractor believes that he or she has discovered a cultural resource, leave it in place and stop work in the area (about a 100-foot radius). Do not allow vehicles, equipment, and unauthorized personnel to traverse the discovery area. Delineate and secure the area to protect the integrity of the discovery. Upon encountering cultural resources within a boring, discontinue all further work within that boring.

STEP 2: *Notify the Project Manager:* The Project Manager or alternate will make all calls and necessary notifications.

Brian Gouran Cell: (360) 296-2441 Email: Briang@portofbellingham.com	Ben Howard Cell: (206) 334-6794 Email: Benh@portofbellingham.com

If human skeletal remains are encountered, treat them with dignity and respect at all times. Cover the remains with a tarp or other materials (not soil or rocks) for temporary protection and to shield them from being photographed. **Do not call 911 or speak with the media. Do not take pictures. Follow the procedure described in Section 5.**

4. PROJECT MANAGER RESPONSIBILITIES UPON DISCOVERY OF POTENTIAL CULTURAL RESOURCES

a. *Protect Potential Find*: Ensure no work occurs within the discovery area (expected to be a 30- foot radius around potential find unless otherwise indicated). Delineate and secure the discovery area to protect the integrity of the discovery.
b. *Direct Sampling/Construction Activities Elsewhere*: Direct sampling/construction activities away from the discovery area prior to contacting the concerned parties.
c. *Contact the Department of Ecology*: Maintain regular communications until treatment of the discovery is completed as set forth in this IDP:

Department of Ecology (Ecology) Contacts:

Project Manager Lucy McInerney, P.E. Office: 425-649-7272 Cell: 425-410-1400 lucy.mcinerney@ecy.wa.gov	Cultural Resource Specialist Donna Podger Office: 360-407-7016 Cell: 360-584-8825 donna.podger@ecy.wa.gov

d. *Provide Archaeological Examination*: Ensure that a qualified professional archaeologist examines the find. If the archaeologist determines that the find:
   - Is not archaeological or historical material, or human remains/funerary objects; work may proceed with no further delay.
   - Is archaeological or historical material; contact the Washington Department of Archaeology and Historic Preservation (DAHP) and affected Tribes. See contacts below. Document discoveries as described in Section 6.
   - May be human remains or funerary objects. **Follow the procedure described in Section 5.**
e. *Protect Confirmed Find*: The archaeologist may refine the boundaries of the cultural resource discovery area. Do not work in this designated area until treatment of the discovery is completed, following the procedures set forth in this IDP.

DAHP Contacts:

Allyson Brooks, Ph.D. State Historic Preservation Officer 360-586-3066 allyson.brooks@dahp.wa.gov	Rob Whitlam, Ph.D. State Archaeologist Office: 360-586-3080 Cell: 360-890-2615 rob.whitlam@dahp.wa.gov

Alternate: Lance Wollwage, Ph.D. Assistant State Archaeologist Office: 360-586-3536 Cell: 360-890-2616 lance.wollwage@dahp.wa.gov	
Tribal Contacts:Lena Tso, THPO Lummi Nation Office: 360-312-2257 lena@lummi-nsn.gov	Scott Schuyler, Cultural Resources Upper Skagit Tribe Office: 360-854-7009 sschuyler@upperskagit.com
Larry Campbell, THPO Swinomish Tribal Community Office: 360-466-7314 lcampbell@swinomish.nsn.us	Trevor Delgado, THPO Nooksack Tribe Office: 360-592-5176 ext. 32234 tdelgado@nooksack-nsn.gov

5. SPECIAL PROCEDURES FOR THE DISCOVERY OF HUMAN SKELETAL REMAINS

If human skeletal remains are encountered, cease all work that may cause further disturbance to the remains, and secure and protect the discovery area. Do not touch, move, or further disturb the remains.

Project Manager: Immediately call the Bellingham Police Department.

Bellingham Police Department (360) 778-8800	

The Bellingham Police Department will contact the Medical Examiner, who will determine if the remains are human and whether the discovery site constitutes a crime scene. If the remains constitute a crime scene (forensic), the medical examiner will retain jurisdiction. If they do not constitute a crime scene (non-forensic), the medical examiner will notify DAHP.

DAHP will have jurisdiction over non-forensic remains until provenance of the remains is established.

Sampling/construction in the discovery area may resume only as directed by the medical examiner/law enforcement personnel for forensic remains and by DAHP for non-forensic remains.

6. DOCUMENTATION OF CULTURAL RESOURCES

The Project Manager will ensure the proper documentation and field assessment of any discovered cultural resources by a qualified professional archaeologist in cooperation with all parties: DAHP, Ecology, and affected tribes.

All prehistoric and historic cultural material discovered during sampling will be recorded by a qualified professional archaeologist using standard and approved techniques. Site overviews, features, and artifacts will be photographed; stratigraphic profiles and soil/sediment descriptions will be prepared for minimal subsurface exposures. Discovery locations will be documented on scaled site plans and site location maps. The appropriate DAHP forms will be prepared.

Cultural features, horizons, and artifacts detected in buried sediments may require further evaluation using hand-dug test units. Units may be dug in controlled fashion to expose features, collect samples from undisturbed contexts, or to interpret complex stratigraphy. A test excavation unit or small trench might also be used to determine if an intact occupation surface is present. Test units will be used only when necessary to gather information on the nature, extent, and integrity of subsurface cultural deposits to evaluate the site's significance. Excavations will be conducted using state-of-the-art techniques for controlling provenience, and the chronology of ownership, custody, and location recorded with precision.

Spatial information, depth of excavation levels, natural and cultural stratigraphy, presence or absence of cultural material, and depth to sterile soil, regolith, or bedrock will be recorded for each probe on a standard form. Test excavation units will be recorded on unit-level forms, which include plan maps for each excavated level, and material type, number, and vertical provenience (depth below surface and stratum association where applicable) for all artifacts recovered from the level. A stratigraphic profile will be drawn for at least one wall of each test excavation unit.

Sediments excavated for purposes of cultural resources investigation will be screened through 1/8-inch mesh, unless soil conditions warrant 1/4-inch mesh.

All prehistoric and historic artifacts collected from the surface and from probes and excavation units will be analyzed, catalogued, and temporarily curated. Ultimate disposition of cultural materials will be determined in consultation with DAHP, Ecology, and the affected tribes.

If field assessment work exposes human skeletal remains, the process described in Section 5 will be followed.

Within 30 days of concluding fieldwork, the Project Manager will provide a technical report summarizing the work and findings of the professional archaeologist to Ecology, DAHP, and the affected tribes.

7. PROCEEDING WITH WORK

Work outside the designated discovery area may continue while documentation and assessment of the discovery proceeds.

Work inside the discovery area may resume only after treatment of the discovery is completed in accordance with this IDP, and with the concurrence of the Project Manager, DAHP, affected tribes, and Ecology. For forensic human remains, the county examiner and law enforcement personnel must concur with resumption of work.

8. IDP AVAILABILITY AND USE

The IDP must be immediately available on site, be implemented to address any discovery, and be available by request by any party. The IDP must be discussed and reviewed with all personnel performing fieldwork in advance of commencing fieldwork.

APPENDIX A
Cultural Resource Images

Print images in color for accuracy.

Implement the IDP if…

You see chipped stone artifacts.

- Glass-like material
- Angular
- “Unusual” material for area
- “Unusual” shape
- Regularity of flaking
- Variability of size

Implement the IDP if…

You see ground or pecked stone artifacts.

- Striations or scratching
- Unusual or unnatural shapes
- Unusual stone
- Etching
- Perforations
- Pecking
- Regularity in modifications
- Variability of size, function, and complexity

Implement the IDP if…

You see bone or shell artifacts.

- Often pointed if used as a tool
- Often wedge shaped like a "shoe horn"
- Often smooth
- Unusual shape
- Carved

Bone Awls from Oregon and Bone Wedge from California

Implement the IDP if…

You see bone or shell artifacts.

- Often smooth
- Unusual shape
- Perforated
- Variability of size

Tooth Pendant and Bone Pendants from Oregon and Washington

Implement the IDP if…

You see fiber or wood artifacts.

- Wet environments needed for preservation
- Variability of size, function, and complexity
- Rare

Artifacts from Mud Bay, Olympia, Washington

Implement the IDP if…

You see historic period artifacts.

Artifacts from Downtown Seattle, Alaskan Way Viaduct (Upper Left and Lower) and Unknown Site (Upper Right)

Implement the IDP if…

You see strange, different or interesting looking dirt, rocks, or

- Human activities leave traces in the ground that may or may not have artifacts associated with them
- “Unusual” accumulations of rock (especially fire-cracked rock)
- “Unusual” shaped accumulations of rock (e.g., similar to a fire ring)
- Charcoal or charcoal-stained soils
- Oxidized or burnt-looking soils
- Accumulations of shell
- Accumulations of bones or artifacts
- Look for the “unusual” or out of place (e.g., rock piles or accumulations in areas with few rock)

Unknown Sites

Implement the IDP if…

You see strange, different or interesting looking dirt, rocks, or

- "Unusual" accumulations of rock (especially fire-cracked rock)
- "Unusual" shaped accumulations of rock (e.g., similar to a fire ring)
- Look for the "unusual" or out of place (e.g., rock piles or accumulations in areas with few rock)

Site on Muckleshoot Indian Reservation, near WSDOT ROW along SR 164

Implement the IDP if…

You see strange, different or interesting looking dirt, rocks, or

- Often have a layered or "layer cake" appearance
- Often associated with black or blackish soil
- Often have very crushed and compacted shells

Site located within WSDOT ROW near Anacortes Ferry Terminal

Implement the IDP if…

You see historic foundations or buried structures.

45KI924, In WSDOT ROW for SR 99 Tunnel

Attachment C

Field Forms

Daily Log

ANCHOR QEA

PROJECT NAME: DATE:

SITE ADDRESS: PERSONNEL:

WEATHER:	WIND FROM:	N	NE	E	SE	S	SW	W	NW	LIGHT	MEDIUM	HEAVY
		SUNNY		CLOUDY		RAIN		?		TEMPERATURE:	° F . ° C	

[Circle appropriate units]

TIME	COMMENTS

Signature:

Sediment Core Collection Log

Job:
Job No:
Field Staff:
Contractor:
Vertical Datum:

Station ID:
Attempt No.
Date:
Logged By:
Horizontal Datum: NAD83 WA State Plane North, feet

Field Collection Coordinates:

Lat/Northing:

Long/Easting:

A. Water Depth

DTM Depth Sounder:

DTM Lead Line:

B. Water Level Measurements

Time:

Height:

Source:

C. Mudline Elevation

Recovery Measurements (prior to cuts)

Core Collection Recovery Details:

Core Accepted: Yes / No

Core Tube Length:

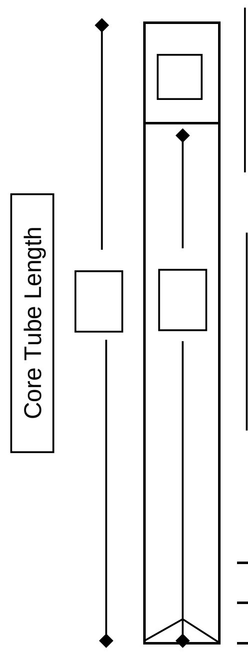
Drive Penetration:

Headspace Measurement:

Recovery Measurement:

Recovery Percentage:

Total Length of Core To Process:



Drive Notes:

Sections To Process:

A:

B:

C:

D:

Core Field Observations and Description:

Sediment type, moisture, color, minor modifier, MAJOR modifier, other constituents, odor, sheen, layering, anoxic layer, debris, plant matter, shells, biota

Notes:

Sediment Core Processing Log

ANCHOR QEA

Job:	Station ID:
Job No.	Date/Time:
No. of Sections:	Core Logged By:
Drive Length:	Attempt #:
Recovery:	Type of Core ☐ Mudmole ☐ Vibracore ☐ Diver Core
% Recovery:	Diameter of Core (inches)
Notes:	

Recovered Length (ft)	Size % Gravel	Size % Sand	Size % Fines	**Classification and Remarks** (Density, Moisture, Color, Minor Constituent, MAJOR Constituent, with Additional Constituents, Sheen, Odor)	Recovered Length (ft)	PID	Sample	Summary Sketch

Surface Sediment Collection Log

Job: | Station:
Job No: | Date:
Field Staff: | Sample Method:
Contractor: | Proposed Coordinates: Lat.
Long.

Water Height

DTM Depth Sounder: ____________

DTM Lead Line: ____________

Mudline Elevation (datum): calculated after sampling ____________

Tide Measurements

Time: ________

Height: ________

Sample Acceptability Criteria:

1) Overlying water is present
2) Water has low turbidity
3) Sampler is not overfilled
4) Surface is flat
5) Desired penetration depth

Notes: ____

Grab #	Time	Confirmed Coordinates (datum)		Sample Accept (Y/N)	Recovery Depth (in)	Comments: jaws close, good seal, winnowing, overlying water, surface intact, etc
		NAD 83 (N)	NAD 83 (E)			

Sample Description: MAJOR CONSTITUENT GROUP NAME. Moisture content, density/consistency, color, major constituent (%), minor constituents (%), plasticity. Amount and shape of minor constituents (e.g., wood, shells). Biota. Sheen, odor. Structure descriptions

Sample Depth:

Sample Containers:

Analyses:

Sediment Description Key

Visual Sediment Descriptions consist of the following:

MAJOR CONSTITUENT GROUP NAME. Moisture content, density/consistency, color, major constituent (%), minor constituents (%), plasticity. Amount and shape of minor constituents (e.g., wood, shells). Biota. Sheen, odor (as needed). Structure descriptions (as needed). Use parenthesis to denote interpretation (e.g., asphalt, glass).

Examples:

SILT with SAND (MH) Moist, soft, olive gray, 80% fines, 20% f-sand, medium plasticity, contains fine gravel and anthropogenics (brick and plastic fragments), sulfide odor.

CLAYEY GRAVEL with SAND (GC) Moist, dense, dark brown, 70% f-c gravel, 15% m-sand, 15% low plasticity fines, gravel is subrounded up to 3".

Sediment Description Terminology

MAJOR and minor Group Name			
Gravel	Sand	Silt	Clay
** For Group Name of Major Unit follow flow charts in ASTM D2488. Incorporate use of terms 'Lean, Sandy, Gravelly, Fat, Elastic'*			
** MAJOR is written in all CAPITAL LETTERS (i.e., SILTY SAND), If minor sand/gravel constituents >15% use 'with GRAVEL' or 'with SAND'*			

Moisture Content	
Dry	Little perceptible moisture (upland only), dusty or powdery
Wet	Visible free water
Moist	No visible water (most sediment)

Density/Consistency	
SILT or CLAY	
Consistency:	***Notes:***
Very Soft	Soupy
Soft	Easily penetrated, just starting to be cohesive
Firm	Molded by figure pressure
Hard	Can indent and mold by finger pressure
Very Hard	modeling clay (rolls to a ball)
SAND or GRAVEL	
Consistency:	***Notes:***
Very Loose	Freefall: May occur at the top of a core or grab
Loose	Easy penetration: May occur at the top of a core or grab
Medium Dense	Moderate penetration: Typically down core due to compaction or compression
Dense	Hard Penetration: Bottom of a core, typical to glacial deposits
Very Dense	Refusal: Bottom of a core, typical to glacial deposits

Color and Shading				
Example Colors:	Black		Browns (olive, yellow, red)	Grays (gray, olive, brown)
Shades:	Light	Dark	Very Dark	Mottling: Streaks or spots of a minor color within the larger color unit

Descriptors* – Sand and Gravel			
Grain size	Sand: fine, medium, coarse	Gravel: fine (0.19-0.75") and coarse (0.75-3")	Cobbles: >3"
Grading	Well graded: many sizes	Poorly graded: homogenous	
Grain color	(black, white, grey, yellow, etc.)	*(*State percentage of fines, gravel, and sand either in text or in columns provided on log.)*	
Rounding	(subrounded, subangular, angular, rounded)		

Plasticity	
Non-plastic, low, medium, high	**For fine-grained soil, describe plasticity of the unit after grain size percentages (...80% fines, 20% sand, low plasticity)* **For coarse grained soil, describe the plasticity of the fines as part of the percentage description (…80% medium sand, 20% low plasticity fines)*

Other Minor Constituents: % volume			
Other Minor Constituents:	Anthropogenics (aggregates, trash)	Organics (wood debris, fresh/decomposed)	Biota (peat, worms, shells, grass, etc.)
Percent:	Call out volume in 5% increments		

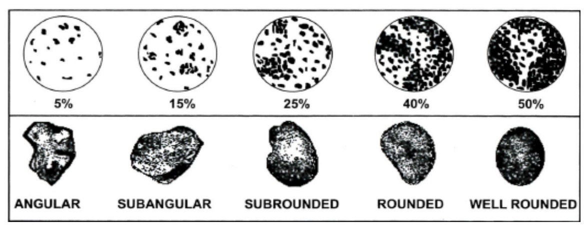
Odor Descriptions		
Hydrocarbon-like	H_2S - like (Hydrogen sulfide - like)	Septic - like
Intensity: slight, moderate, and strong		

Sediment Description Key

Product	
Hydrocarbon Stained	Visible brown or black stains (fine grained)
Hydrocarbon Coated	Visible brown or black coating (coarse grained)
Hydrocarbon Wetted	Visible brown or black hydrocarbon wetting on soil. Hydrocarbon appears as a liquid and is not held by soil grains (pools)
Sheen	
Describe sheen as necessary with percentages (5% increments)	**No odor or sheen observed unless noted*
Visual Description Terminology:	
Rainbow	Multicolored
Metallic	Metallic gray-colored
Florets	Semi-circular and flat (2-D)
Blebs	Semi-circular and spherical (3-D)
Structure and Other Sediment Descriptions	
Blocky	Cohesive soil that can be broken down into smaller lumps
Decomposed	Visible sign of decomposition or discoloration
Fresh	No visible sign of decomposition or discoloration
Gummy	Cohesive, pliable soil with high percentage of clay
Bed	Greater than 1/2" thick
Thin bed	Up to 1/2" thick
Laminated beds	Thin beds (<1/2" thick) lying between or alternating within a greater unit
Stratified beds	Beds (>1/2" thick) lying between or alternating within a greater unit
Layer	A bed or thin bed of minor constituents
Pockets	Semicircular to circular inclusion/deposit
Winnowed	Loss of material that occurred during coring
Anthropogenic	Debris originated from human activity

MAJOR DIVISONS			GROUP SYMBOL	GRAPHIC SYMBOL	TYPICAL DESCRIPTIONS
HIGHLY ORGANIC SOILS			PT		Peat, Humus and Other Highly Organic Soils
COARSE-GRAINED SOILS More than 50% retained on No. 200 (0.075 mm) sieve	GRAVELS More than 50% of coarse fraction retained on No. 4 (4.75 mm) sieve	CLEAN GRAVELS Less than 5% fines	GW		Well-graded Gravels, Gravel-Sand Mixtures, < 5% Fines *
			GP		Poorly-graded Gravels, Gravel-Sand Mixtures, < 5% Fines *
		GRAVELS WITH FINES Greater than 12% fines	GM		Silty Gravels, Gravel-Sand-Silt Mixtures, > 12% Fines *
			GC		Clayey Gravels, Gravel-Sand-Clay Mixtures, > 12% Fines *
	SANDS More than 50% of coarse fraction passing No. 4 (4.75 mm) sieve	CLEAN SANDS Less than 5% fines	SW		Well-graded Sands, Gravelly Sands, < 5% Fines *
			SP		Poorly-graded Sands, Gravelly Sands, < 5% Fines *
		SANDS WITH FINES Greater than 12% fines	SM		Silty Sands, Sand-Silt Mixtures, > 12% Fines *
			SC		Clayey Sands, Sand-Clay Mixtures, > 12% Fines *
FINE-GRAINED SOILS 50% or more passes the No. 200 (0.075 mm) sieve	SILTS AND CLAYS Liquid Limit less than 50	INORGANIC	ML		Inorganic Silts and Very Fine Sands, Rock Flour, Silty Sands of Slight Plasticity
			CL		Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
		ORGANIC	OL		Organic Silts and Organic Silty Clays of Low Plasticity
	SILTS AND CLAYS Liquid Limit greater than 50	INORGANIC	MH		Inorganic Silts, Micaceous or Diatomaceous Fine Sand or Silty Soils
			CH		Inorganic Clays of High Plasticity, Fat Clays
		ORGANIC	OH		Organic Clays of High Plasticity

*NOTE: The use of dual group symbols are required if percent fines are between 5 and 12% (e.g. GW-GC).



Chain of Custody Record & Laboratory Analysis Request

Laboratory Name: ____________________
Date: ____________________
Project Name: ____________________
Project Number: ____________________
Project Manager: ____________________
Phone Number: ____________________
Shipment Method: ____________________

					Test Parameters																		
Line	**Field Sample ID**	**Collection Date/Time**	**Matrix**	**No. of Containers**	**Mercury**	**Total Solids**	**Grain Size**	**Total Organic Carbon**	**Dioxin/Furans**	**Archive**													**Comments/Preservation**
1																							
2																							
3																							
4																							
5																							
6																							
7																							
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18																							

Notes: ____________________

Relinquished By:	Company: Anchor QEA, LLC	Received By:	Company:
Signature/Printed Name	Date/Time	Signature/Printed Name	Date/Time
Relinquished By:	Company:	Received By:	Company:
Signature/Printed Name	Date/Time	Signature/Printed Name	Date/Time

Distribution: A copy will be made for the laboratory and client. The Project file will retain the original.

Investigation-derived Waste Drum Log

Drum Number:	Investigation-derived Waste (IDW) Medium:
Accumulation Start Date:	Manifest Number:
Accumulation End Date:	Manifest Date:
Transport Contractor:	Lab ID Number:
Transport Pick-up Date:	Characterization Date:
Manifest Copy Received from Waste Facility: _______________	Date:

Samples placed in Drum	Date of Placement	Comment	Initials

IDW Medium:

Field Deviation Form

Form No. ________

Deviation subject: ____

Project name:

Standard procedure for field collection:

Reason for deviation:

Description of deviation:

Special equipment, materials, or personnel required:

Initiator's Name:	**Date:**
Project Manager:	**Date:**
QA Coordinator:	**Date:**