Pre-Remedial Design Investigation Work Plan

I&J Waterway Site

Project Number: 036-001

Prepared for:

Port of Bellingham and
Bornstein Seafoods, Inc.

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List of Acronyms and Abbreviations

°C	degrees centigrade
µg/kg	microgram per kilogram
ASTM	American Society for Testing and Materials
bgs	below ground surface
bml	below mudline
BMP	Best Management Practice
Bornstein	Bornstein Seafoods, Inc
CAP	Cleanup Action Plan
CFR	Code of Federal Regulations
CRC	Cultural Resource Consultants, Inc.
City	City of Bellingham
cPAH	carcinogenic Polycyclic Aromatic Hydrocarbon
CPT	Cone Penetrometer Testing
CSL	Cleanup Screening Level
CWA	Clean Water Act
cy	cubic yard
DAHP	Department of Archaeology and Historic Preservation
DMMP	Dredged Material Management Program
DMMU	Dredged Material Management Unit
DRET	Dredge Elutriate Test
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
EPA	U.S. Environmental Protection Agency
HASP	Health and Safety Plan
HPA	Hydraulic Project Approval
HPAH	High-Molecular-Weight Polycyclic Aromatic Hydrocarbon
GMD	Glacial Marine Drift
IDP	Inadvertent Discovery Plan
IHS	Indicator Hazardous Substances
kg	kilogram
LAET	Lowest Apparent Effects Threshold
LPAH	Low-Molecular-Weight Polycyclic Aromatic Hydrocarbon
mg/L	milligram per liter
MHHW	Mean Higher High Water
MLLW	Mean Lower Low Water
MTCA	Model Toxics Control Act
ng/kg	nanogram per kilogram
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
PAH	Polycyclic Aromatic Hydrocarbon

PCB	Polychlorinated Biphenyls
PLP	Potentially Liable Parties
Port	Port of Bellingham
PRDI	Pre-Remedial Design Investigation
PQL	Practical Quantitation Limit
QAPP	Quality Assurance Project Plan
RCW	Revised Code of Washington
RI/FS	Remedial Investigation and Feasibility Study
RTK GPS	Real Time Kinematic Global Positioning System
SAP	Sampling and Analysis Plan
SCO	Sediment Cleanup Objective
SCU	Sediment Cleanup Unit
Site	I&J Waterway Site
SMS	Sediment Management Standards
SPT	Standard Penetration Tests
SQS	Sediment Quality Standard
SVOC	Semi-Volatile Organic Compound
TCLP	Toxicity Characteristic Leaching Procedure
TEF	Toxic Equivalency Factor
TEQ	Toxic Equivalents Quotient
TOC	Total Organic Carbon
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USCG	U.S. Coast Guard
USGS	U.S. Geological Survey
WAC	Washington Administrative Code
Work Plan	PRDI Work Plan

1 Introduction

The Pre-Remedial Design Investigation (PRDI) Work Plan describes the investigation activities needed to design the cleanup action for the I&J Waterway site in Bellingham, Washington (Figure 1-1). The I&J Waterway site includes two Sediment Cleanup Units (SCUs), SCU-1 and SCU-2. This PRDI Work Plan addresses SCU-1. A future separate PRDI Work Plan or an amendment to this PRDI Work Plan will address SCU-2. The PRDI Work Plan has been prepared to satisfy the requirements of Agreed Order No. DE 16186 (Agreed Order) and includes the required supporting plans: Sampling and Analysis Plan (SAP; Section 4), Inadvertent Discovery Plan (IDP; Appendix B), Quality Assurance Project Plan (QAPP; Appendix C), and Health and Safety Plan (HASP; Appendix D). The Port of Bellingham (Port) and Bornstein Seafoods, Inc. (Bornstein) are responsible for designing the cleanup action for SCU-1 in accordance with the Agreed Order.

Following design of the cleanup action for SCU-1, implementation will occur under a future separate legal agreement. Once the cleanup action for SCU-1 is complete, the cleanup action for SCU-2 will be designed and implemented.

1.1 Purpose of the Work Plan

This PRDI Work Plan was developed to document the purpose and scope of supplemental data collection necessary to design the cleanup action for SCU-1 defined in Exhibit B of the Agreed Order, the Cleanup Action Plan (CAP; Ecology 2019). The CAP describes the Department of Ecology's (Ecology) selected cleanup action for the I&J Waterway site, consistent with Model Toxics Control Act (MTCA) and Sediment Management Standards (SMS) requirements. Per Washington Administrative Code (WAC) 173-340-380, the CAP provided the following information:

- Summary of project background and current environmental conditions.
- Applicable cleanup requirements, including cleanup standards and other federal, state, and local laws applicable to the cleanup action.
- Summary description of the remedial alternatives evaluated in the Remedial Investigation and Feasibility Study report for the I&J Waterway site.
- Rationale for Ecology's selection of the cleanup action.
- A description of the selected cleanup action, including a description of the types, levels, and amounts of hazardous substances that will remain, and the measures that will be used to prevent migration and contact with those substances. Compliance monitoring and contingency actions, as well as institutional controls, are also described.
- Description of the schedule for implementation of the cleanup action.

In accordance with the Agreed Order requirements, the cleanup action for SCU-1 will move forward through the design process including development of an Engineering Design

Report (EDR) and construction plans and specification. This PRDI Work Plan outlines the data gaps and field data collection investigations necessary to complete the EDR.

1.2 Site Description

The I&J Waterway site is located within Bellingham Bay between Hilton Avenue and Bellwether Way on the Bellingham waterfront and was formerly called the Olivine-Hilton sediment site (Figure 1-1). It includes areas of contaminated marine sediment in the federally authorized I&J Waterway navigation channel and adjacent berthing areas, primarily located on state-owned aquatic land (Appendix A, Figures 1-1 and 1-2). The federally authorized navigation channel has an authorized channel depth of 18 feet below mean lower low water (MLLW). The Port owns the adjacent uplands to the south, east, and west, the aquatic areas are state-owned land, and the docks on the south side of the I&J Waterway site are currently owned by Bornstein. The upland areas near the I&J Waterway site include the former Olivine Corporation lease area and a property to its southwest that is currently leased to Bornstein. The United States of America owns the property north of the I&J Waterway site and the U.S. Coast Guard (USCG) berths vessels within the navigation channel and northern berthing areas.

1.3 Document Organization

This PRDI Work Plan is organized as follows:

- Section 2 summarizes existing information available from previous studies and describes the cleanup action for SCU-1 defined in the CAP.
- Section 3 identifies the data gaps to be addressed by the PRDI.
- Section 4 of this report is the SAP which describes in detail the work to be performed to fill identified data gaps.
- Section 5 presents the schedule for PRDI activities.
- Section 6 lists references.
- Appendix A contains key figures from previous cleanup documents, including figures summarizing existing chemical and biological data.
- Appendix B includes an IDP to be used during field activities. The IDP provides guidance for what to do if ground/sediment disturbing activities discover a cultural resource.
- Appendix C includes the QAPP describing the field investigation methodology and quality assurance.
- Appendix D is the project-specific HASP.

2 Site Background

Previous studies are summarized in the Remedial Investigation and Feasibility Study report for the I&J Waterway site (RI/FS; Anchor QEA 2015) and the CAP. This section includes excerpts that are relevant to SCU-1.

2.1 Previous Environmental Investigations

The I&J Waterway site is one of 12 cleanup sites in the Bellingham Bay Demonstration Pilot Project, a coordinated bay-wide effort by federal, tribal, state, and local governments to clean up contamination, control pollution sources, and restore habitat, with consideration for land and water uses. Earlier investigations were conducted for the Whatcom Waterway site, which includes more than 200 acres within the inner portion of Bellingham Bay from the I&J Waterway down to Boulevard Park. The I&J Waterway site overlaps the Whatcom Waterway site. Both sites share a number of relevant characteristics, and some of the analysis conducted for the Whatcom Waterway site informs the I&J Waterway site.

Contamination at the I&J Waterway site was originally identified in 1995 as part of the Whatcom Waterway investigation, which prompted additional sampling in 1996, 1998, and 2000 (Ecology 2019). Ecology identified the Port and Bornstein as potentially liable parties for the I&J Waterway site in 2004. In January 2005, Agreed Order DE1090 was signed by Ecology and the Port and required a remedial investigation and feasibility study report to be completed for the I&J Waterway site. Agreed Order Amendment No. 1 was signed in October 2005 and incorporated the Sediments RI/FS Work Plan (RETEC 2005) into the Agreed Order. The Port and Ecology executed a Second Amendment to the Agreed Order in April 2012, which incorporated the Work Plan Addendum (Anchor QEA 2012). Ecology identified the Olivine Corporation as a potentially liable party for the I&J Waterway site in 2016.

Sediment chemical and biological testing occurred in 2005, and additional bioassay testing was repeated on samples collected in early 2006 based on quality control criteria. Subsurface sediment cores were collected and tested in 2006 for suitability of open-water disposal under the Dredged Material Management Program (DMMP; RETEC 2006).

Additional work was conducted under the Second Amendment to the Agreed Order and associated Work Plan Addendum (Anchor QEA 2012). These additional activities included supplemental surface sediment chemical and biological testing, subsurface sediment chemical testing, storm drain solid chemical testing, a multibeam bathymetric survey, and structural conditions surveys in April and May 2012.

Separate from the cleanup studies, sediment cores were collected from the I&J Waterway by U.S. Army Corps of Engineers (USACE) in 2011 to evaluate the suitability of open-water disposal at the Bellingham Bay open-water disposal site of sediment dredged from federal navigation channels. Additional testing of archived samples collected by USACE was conducted as part of the I&J Waterway site supplemental investigation activities, which

were provided to Ecology in the Supplemental Investigation Memorandum in 2013 (Anchor QEA 2013a).

During remedial investigation activities, the Port identified data gaps that were key to developing the remedial alternatives. These data gaps included the need for additional information on sediment quality and strength beneath the dock, as described in the Sampling and Analysis Plan Memorandum (Anchor QEA 2013b). Additional surface and subsurface sampling and strength testing were conducted in the area beneath the dock in August 2013.

The RI/FS report required by agreed order DE1090 was finalized in February 2015.

2.2 Other Cleanup Sites

The I&J Waterway site overlaps the Whatcom Waterway site and is adjacent to the Central Waterfront site. This section describes the relationship of the I&J Waterway site to these sites.

A portion of the Phase 2 area of the Whatcom Waterway site overlaps the I&J Waterway site (Appendix A Figure 1-1). The primary contaminant at the Whatcom Waterway site is mercury, and the required cleanup described in the Consent Decree (Whatcom County Superior Court No. 07-2-02257-7) in the area of the I&J Waterway site is monitored natural recovery. Future compliance monitoring for both the I&J Waterway and Whatcom Waterway sites will be coordinated to the extent possible.

The Central Waterfront site is located adjacent to the I&J Waterway site, as shown in Figure 1-1. Petroleum hydrocarbons, metals and PAHs are present in surface and subsurface soil above cleanup levels in the area next to the waterway. A final cleanup action plan was completed in January 2020 (Agreed Order No. DE3441) and it primarily calls for capping. Capping will address the only potentially complete exposure pathway pertaining to sediment in the I&J Waterway, the soil erosion pathway. Construction of the cleanup action is expected to begin in 2021.

2.3 Current Conditions

This section provides a brief overview of current conditions at the I&J Waterway site relevant to SCU-1.

2.3.1 Lithology

The subsurface geology of the I&J Waterway area has been characterized in multiple investigations since the early 1990s. The sedimentary sequence is a function of fluvial sediment loads, deltaic growth rate, and the local depositional environment. A rapidly advancing delta front is characterized by an abundance of sands. Slower growth periods are characterized by finer grained sediments, principally silts, being deposited in lower

energy environments. The distributary channels within a delta also meander and shift, resulting in erosion and channel backfilling. Discharges from the Nooksack River, Whatcom Creek, and Squalicum Creek all contribute to the area sediment profiles, which commonly display sediment stratigraphy consisting of soft silts, inter-layered sands, gravelly sands, silty sands, and sandy silts. The natural depositional environment of the Waterway has been altered by dredging (including excavation of the original Waterway), maintenance dredging, and fill replacement during nearshore construction. The Waterway area sediments can be divided into the following major units:

- **Recent Deposits:** Recent deposits consist primarily of very soft, brown-black, slightly sandy, clayey silt with shell fragments and varying amounts of wood debris overlying a soft, dark gray silt with trace wood fragments. The thickness of the recent deposits varies between less than 1 foot and greater than 7 feet. In some cases, the physical sequences of the sediments have been disturbed, for example by shoreline construction, or by shoreline erosion. Contamination is present in the recent deposits, above the post-glacial fluvial deposits or glacial marine drift (GMD; described below).
- **Post-Glacial Fluvial Deposits:** This unit consists of medium dense, gray, non-silty to silty, fine to medium sand with multi-colored grains, shell fragments, and occasional gravel and silt lenses grading to gray silt with clay. This unit represents native fluvial sediments, primarily from Whatcom Creek, deposited prior to industrialization of the area. The base of this sand unit is gradational in nature and tends to be present between an elevation of approximately -18 to -21 feet MLLW near the head of I&J Waterway, especially beyond the head of the federal navigation channel.
- **Glacial Marine Drift (GMD):** The third major unit is a stiff to very stiff, damp to moist, gray, silty clay to clay with scattered gravels and occasional fine to medium sand layers. The drift was encountered at elevations ranging from -18 to -22 feet MLLW in the federal channel, based on results of sediment cores collected in 2006. The federal navigation channel and berthing areas were excavated out of the GMD layer and the most recent maintenance dredging occurred in 1966. This glacial outwash unit was also confirmed in adjacent upland borings advanced through fill at the Central Waterfront site.

2.3.2 Contaminants and Sources

The principal contaminants in surface sediment include nickel and polycyclic aromatic hydrocarbon (PAHs), with other contaminants (bis(2-ethylhexyl)phthalate, dimethyl phthalate, N-nitrosophenylamine, dibenzofuran, benzoic acid, and benzyl alcohol) in localized areas near the dock. The key contaminants in subsurface sediment include mercury, bis(2-ethylhexyl)phthalate, and 2,4-methylphenol, and localized areas along the southern edge and the head of I&J Waterway with benzoic acid, dibenzofuran, dimethyl

phthalate, phenol, and PAHs. Dioxin/furans are also present in surface and subsurface sediment at the I&J Waterway site and throughout much of Bellingham Bay. Contaminants and sources are further described below:

- Nickel contamination is from historical sources: The primary source of nickel within the I&J Waterway site surface sediments is historical activities at the Olivine Corporation facility, which operated a rock crushing plant for the mineral olivine. Nickel is a constituent within olivine ore and was periodically released to the Waterway through dust and wastewater. Potential surface soil erosion to the Waterway will be addressed as part of the cleanup of the Central Waterfront site.
- Bis(2-ethylhexyl)phthalate is from historical sources: Potential sources of phthalate contamination include stormwater outfalls. Leachate from the Roeder Avenue landfill and compressor oil that may have leaked from a compressor on the dock were previously determined not to be major contributors of bis(2-ethylhexyl)phthalate to the Waterway. Sediment concentrations of bis(2-ethylhexyl) phthalate continue to decrease in most areas of the Waterway, indicating that there are no ongoing significant sources.
- PAHs are predominantly from historical sources: Elevated PAHs are localized adjacent to the dock and along bulkhead/shoreline areas. Potential historical sources of PAHs include stormwater discharges, controlled and uncontrolled combustion sources (such as hog fuel burners and/or other fires), and the diesel fueling facility for boats at the dock between 1960 and the early 1980s. The fire that destroyed the main Bornstein building in 1985 and existing creosoted piles and bulkhead structures are also potential sources.
- Mercury and phenol contamination are predominantly from historical sources: The primary source of mercury within the I&J Waterway site sediment is the discharge of mercury containing wastewaters from the former Georgia-Pacific (GP) Chlor-Alkali Plant (located adjacent to the Whatcom Waterway) between 1965 and the 1970s. This historical source of mercury contamination has been controlled. Following initial pollution control upgrades by GP in the early 1970s, direct discharge of Chlor-Alkali Plant wastewaters to Whatcom Waterway was terminated. Then in 1999 the Chlor-Alkali Plant was closed by GP, eliminating the generation of mercury-containing wastewater. The cleanup of the Log Pond area of the Whatcom Waterway site in 2000 and 2001 controlled the secondary source of mercury by capping sediment with the highest levels of mercury contamination. Some regional and natural sources of mercury continue to exist, but these sources are not expected to result in exceedances of benthic criteria. Mercury concentrations in the I&J Waterway are lower in surface sediments than in subsurface sediments and are

expected to continue approaching natural background concentrations over time. Surface sediment concentrations were not present above benthic criteria values in 2005/2006, 2012, or 2013. In addition, mercury did not exceed the Whatcom Waterway site sediment bioaccumulation screening level of 1.2 milligrams per kilogram (mg/kg) (Ecology 2007) that includes the I&J Waterway site and is protective of both recreational and tribal fishing and seafood consumption practices. The primary sources of methyl-phenolic compounds within the I&J Waterway site sediment include log rafting and wood products handling that occurred as part of historic lumber company/mill operations, and potential lesser contributions from historical stormwater and wastewater discharges.

- Other contaminants from unknown historical sources: benzyl alcohol, benzoic acid, dimethylphthalate, N-nitrosodiphenylamine, and dibenzofuran are present in one or two samples above SMS criteria beneath the dock. Total polychlorinated biphenyls (PCBs) were detected above natural background in surface and subsurface sediment samples in the vicinity of the dock. Some contaminants exceed SMS criteria in subsurface sediment at IJ13-VC-102, but none are found in other areas of the I&J Waterway site, suggesting that there is no ongoing source of these contaminants. Sediment resuspension associated with propeller wash mixing near the dock could be contributing to slower sediment quality recovery than in other parts of the Site.
- Dioxin/furans are a bay-wide issue: Dioxin/furans are present at levels above background in surface and subsurface sediments as a result of historical and potential on-going sources throughout Bellingham Bay. Potential sources of dioxin/furans include activities associated with the historical GP mill, historical operations of the Oeser Company, and stormwater discharges. Other sources to Bellingham Bay may also include historical controlled and uncontrolled combustion sources (such as hog fuel burners and/or other fires).

Because primary sources of contamination have been controlled, the main focus of the cleanup action for the I&J Waterway site is to address residual contamination in sediment. Other contaminated sites located in the vicinity of the I&J Waterway site are being addressed by Ecology, see Section 2.2. Additionally, stormwater management practices have improved over the past several decades, reducing the contaminant load to the I&J Waterway site. The Port, the City of Bellingham (City), and Bornstein will continue to administer stormwater upgrades, maintenance, and best management practices required under National Pollutant Discharge Elimination System (NPDES) permits. Post-construction sediment evaluations will provide information on these source control efforts.

2.3.3 Nature and Extent of Contamination

The nature and extent of sediment contamination at the I&J Waterway site has been delineated through investigations in 2005/2006, 2012, and 2013 and is depicted in Figures 2-3, 2-4, and 2-5 of the CAP. These figures are included in Appendix A. The findings relevant to SCU-1 are summarized below:

- **Navigation Channel Sediment:** Navigation channel sediment includes the federal navigation channel and areas immediately adjacent to the channel, including the area by the USCG facility. Sediment generally consists of a layer of soft, silty contaminated sediment. Most of the surface sediment in the navigation channel in this area exceeds benthic biological criteria. Surface sediment contains elevated concentrations of carcinogenic polycyclic aromatic hydrocarbon (cPAHs) above natural background, with only one sample above preliminary human and ecological health criteria. Mercury is above natural background but not above benthic criteria or the Whatcom Waterway bioaccumulation screening level. Dioxin/furans are also elevated above background.

  Based on the composite dredge disposal characterization sampling (Figure 3-1, DMMU 3 and 5; RETEC 2006), subsurface sediment contains elevated nickel and mercury above benthic criteria, total PCBs above natural background (DMMU 5 only), and dioxin/furan above regional background. Core location I-1 indicates cleanup level exceedances for dimethyl phthalate, n-nitrosodiphenylamine, 2,4-dimethylphenol, and 2-methylphenol. The depth and thickness of the contaminated recent sediment layer varies with location but is generally between 3 and 7 feet in thickness. The vertical extent of contamination was delineated based on the presence of the native uncontaminated GMD (clay) layer in the navigation channel, which was exposed as a result of historical dredging activities.
- **Nearshore Bulkhead and Dock Sediment:** The southern shoreline of the Site consists of marine trade infrastructure, including the east and west bulkheads and the dock. CAP Figure 2-2 (Appendix A) presents a conceptual rendering of the nearshore bulkhead and dock areas. The slope from the bulkheads to the toe of the navigation channel is generally at or steeper than a 2H:1V slope. Chemical, biological, and preliminary human and ecological health criteria exceedances (CAP Figures 2-3, 2-4, and 2-5, included in Appendix A) have been identified in the nearshore area. Surface sediment in this area contains elevated nickel, PAHs (including cPAHs), and dioxin/furans, with elevated bis(2-ethylhexyl)phthalate, dibenzofuran, phenols, benzoic acid, benzyl alcohol, dimethylphthalate, and N-nitrosodiphenylamine present near the dock. Total PCBs were detected above natural background in surface sediment near the dock.

Based on the composite dredge disposal characterization sampling (DMMU 5 and 6; RETEC 2006), subsurface sediment contains elevated nickel, mercury, bis(2-ethylhexyl)phthalate, phenols, and dioxin/furans. Total PCBs were detected above natural background. Localized areas near the dock, specifically IJ13-VC-101 and -102, contain elevated benzoic acid, dibenzofuran, dimethylphthalate, 2-methylnaphthalene, and naphthalene. The depth and thickness of the contaminated recent sediment layer varies with location but is generally between 2 and 4 feet in thickness.

2.3.4 Fate and Transport Processes

Sediment within the I&J Waterway site is acted upon by natural and anthropogenic forces that affect the fate and transport of contaminants. Significant fate and transport processes include the following:

- **Sediment Natural Recovery:** Processes of natural recovery have been observed within the I&J Waterway site and extensively documented in Bellingham Bay as part of the Whatcom Waterway cleanup investigations. RI investigations for Whatcom Waterway and bathymetry comparisons for the I&J Waterway have documented depositional rates (average of 1.6 centimeters per year) and have verified consistent patterns of deposition and natural recovery. One potential exception to this general observation is in nearshore, under pier, and berth areas near the dock, where recovery rates may be reduced by the resuspension of fine-grained sediments from propeller wash or wave activity. In all other areas of the I&J Waterway site, cleaner sediments are consistently observed on top of impacted sediments.
- **Wind and Wave Processes:** The effects of wind/wave erosional forces represent the principal natural process affecting sediment stability. High-energy, nearshore areas such as at the head of the Waterway may have slower natural deposition of fine-grained sediments than other areas. In these areas, fine-grained sediments can be resuspended, mixed, or transported by wave energy. The erosional forces vary with location, water depth, sediment particle size, and shoreline geometry. These forces are minimal in deep-water areas that represent the majority of the I&J Waterway site.
- **Navigation Dredging and Shoreline Infrastructure:** Navigation dredging and the construction of associated shoreline marine trade infrastructure has been a prominent feature of the I&J Waterway site and has shaped the current lithology.

- **Other Erosional or Sediment Disturbing Processes:** Bioturbation and propeller wash can result in periodic disturbances of the sediment column and can enhance mixing of surface sediment with underlying sediment. These processes are ongoing and are incorporated in the empirically measured rates and performance of natural recovery. Propeller wash in particular affects sediment stability in nearshore navigation areas.

2.3.5 Exposure Pathways and Receptors

Exposure pathways and receptors at the I&J Waterway site are summarized below:

- **Protection of Benthic Organisms**: The primary environmental receptors are sediment-dwelling organisms. These benthic and epibenthic invertebrates are located near the base of the food chain and are important indicators of overall environmental health. Both chemical and biological monitoring are used to test for toxic effects. Chemical and biological standards specified under SMS are used to screen for such effects. The whole-sediment bioassays provide an ability to test for potential synergistic and antagonistic effects between multiple chemicals, and to test for potential impacts associated with parameters not measured as part of chemical testing.
- **Protection of Human and Ecological Health:** cPAHs are present in sediment at levels exceeding risk-based criteria. These compounds have mutagenic and carcinogenic properties that can impact human and ecological health. The highest concentrations of cPAHs are present along the bulkhead and shoreline areas (CAP Figure 2-5, Appendix A) and are generally within the area above benthic biological criteria. Dioxin/furans, mercury, and PCBs are present at concentrations above Puget Sound natural background levels, but are not associated with the historical contaminant releases that created the I&J Waterway site. These co-located contaminants will be addressed as part of the I&J Waterway site cleanup action.

The exposure pathways are complete for surface sediment. In addition, exposure pathways could become complete for subsurface sediment if it is uncovered.

2.4 Site Units

The RI/FS divided the I&J Waterway site into different areas or “site units” based on the following factors:

- **Physical Factors** including bathymetry, sediment particle size and texture, the characteristics of overwater structures, and adjacent shorelines.

- **Land Use and Navigation** including upland zoning, shoreline infrastructure, navigation uses, natural resources, ongoing waterfront revitalization activities, and potential interrelationships between cleanup considerations and these factors.
- **Natural Resources** including the types of existing aquatic habitats within the site unit.
- **Contaminant Distribution**, including patterns of surface and subsurface contamination and relative contaminant concentrations.

Figure 1-1 shows the I&J Waterway site units.

2.5 SCU-1 Cleanup Action

The cleanup action for the I&J Waterway site is shown on Figure 1-1. The cleanup action for the SCU-1 area includes removal of contaminated sediment in the Dock, Floating Dock, Berthing Area, and Navigation Channel West site units. Dredged sediments will be disposed in an upland permitted facility.

Contaminated sediment within SCU-1 that may be disturbed through future dredging and navigation activities will be removed by dredging to the extent technically feasible. Most of SCU-1 will be remediated by removal to a clean surface. Removal activities will incorporate best practices to limit sediment resuspension. A stable post-dredge side slope will be established between SCU-1 and SCU-2. The design will include a demarcation of the post-dredge boundary between SCU-1 and SCU-2 to limit the potential for accidental dredging in SCU-2. The demarcation could include a physical marker or an administrative control. Design of the side-slope will address physical effects (e.g. propeller wash) and seismic effects on sediment stability.

Removal of contaminated sediment from the Dock and Floating Dock units will require replacement of the existing dock and bulkhead. The Coast Guard facility will not be impacted by the SCU-1 cleanup action; appropriate offsets and slopes will be incorporated during design to maintain structural stability.

3 Data Gaps Analysis

This section provides a summary of the data gaps identified relating to design of the cleanup action for SCU-1. The data gap discussion is based on review of available documentation and focuses on field data collection needs. Data gaps identified have been organized in the following sections by the type and use of the information. The identified data needs are as follows:

- Base Map – in order to develop a complete project base map additional surveys are required including bathymetric survey, upland topographic survey, and utility mapping.
- Geotechnical Data – is required for dredgeability review, bulkhead and dock design, to assess post-cleanup slope stability, and to determine safe offsets from USCG facilities.
- Dredge Extent – to aid in defining the dredge prism, the presence and depth of the GMD will be documented using multiple complimentary methods. Subsurface chemistry will be evaluated at select locations on the waterway slope in the dock units where the GMD may not be the uppermost native sediment unit. In addition, the extent of cPAHs in surface sediment at the southwest corner of SCU-1 will be evaluated.
- Implementation Issues – the presence of debris, material handling and water quality during dredging, sediment disposal profiling, archaeological monitoring, and the impact of newly exposed dredged slopes represent potential implementation issues.

Additional data needed to complete design are as-built drawings of the USCG facility and existing Bornstein facility maps and documents.

There are several other design tasks that do not require field data collection and, as a result, these items are not listed as data gaps. Design elements that require an analysis of propeller wash, wind waves, or tidal current and circulation will be a desk top analysis performed using existing data. Likewise sea level rise evaluations would be performed using existing regulations and data or inundation mapping.

3.1 Base Map

Although there is some existing data available, the density/quality of the data is not sufficient to design the cleanup action for SCU-1. Existing data does not provide current information on the sediment bathymetry, the extent of in-water debris, or upland topography adjacent to SCU-1. A detailed base map showing current conditions is required to complete the design. Specifically, the following data are needed:

- Bathymetric survey. Higher density data (i.e., multi-beam bathymetric survey) is critical to adequately characterize existing physical conditions, including slope angles, potential slope stability concerns, presence of debris, and location of riprap.
- Topographic survey. Updated information is necessary to design the replacement dock and bulkhead. This information and as-built drawings will be used to generate up-to-date maps of existing topographic conditions along the shoreline adjacent to SCU-1
- Utility locations. Current maps of utility locations are required to support design. Utilities located adjacent to SCU-1 may be physically impacted by construction work. In addition, utilities may be required for construction activities (e.g., power connections for contractor work areas or stormwater/wastewater connections for sediment staging areas).

3.2 Geotechnical Information

Geotechnical data is needed to support design of the replacement bulkhead and dock structures as well as to evaluate dredge slopes. Existing geotechnical data only extends to a maximum depth of 10 feet. Deeper data is needed to design replacement structures. Data is also needed to design the cut slopes around the perimeter of the dredge prism.

Additional geotechnical information is needed both in the upland area adjacent to SCU-1 and within SCU-1:

- Stratigraphic units. Investigate the thickness and extent of soil and sediment stratigraphic units along the shoreline within and adjacent to the Dock Unit and Floating Dock Unit. This information will be used in the design of the bulkhead and docks.
- Characterization. Characterize the soil and sediment using both in-situ and laboratory tests. Properties such as the moisture content, density, grain-size distribution, and Atterberg limits are needed to develop properties for the soil and sediment, determine the seismic site classification, and to evaluate liquefaction potential.
- Engineering properties. Develop engineering properties for the soil and sediment using both in-situ and laboratory tests. Properties defining the stiffness, strength (friction angle and undrained strength), and consolidation behavior of the soil and sediment are needed for the design of the bulkhead, docks, and dredge slopes.

3.3 Dredge Extent

Based on the CAP, cleanup will require removal of sediment down to the GMD. As a result, the depth of the GMD needs to be identified as accurately as possible. Subsurface sediment data available to define the GMD surface includes: 1966 Navigation Channel Dredge soundings; 2005/2006 DMMU core log data (IJ-## series); and two vibracores from 2013 (IJ13-VC-101 and IJ13-VC-102; Figure 3-1).

The 2013 sediment cores, which are located on the shoreline slope under the dock, suggest that the GMD layer may be present around 8 feet below the mudline. Also located on this slope, core IJ-28 did not identify the GMD down to 7 feet below mudline and indicated that the sediment was grading more to sand with depth at the bottom of the core. Along with upland borehole data, this suggests the possibility that the post-glacial sand/silty sand could be the uppermost native soil unit in portions of the dredge area. Figure 3-5 from the RI/FS (see Appendix A) provides a conceptual geological cross-section that supports the potential presence of post-glacial fluvial sand deposits overlying the GMD in the dock area. Subsurface analytical data in this shoreline slope area will be used to determine the base of the dredge prism where the GMD is not the uppermost native soil unit.

A comparison of the 1966 Navigation Channel Dredge soundings to the 2005/2006 cores indicates that the cores consistently estimate the GMD layer is deeper than the soundings, by up to about 5 feet.

Additional data is needed throughout SCU-1 to delineate the GMD contact to refine the extent of removal. Sub-bottom profiling will be used in an attempt to identify the surface of the GMD throughout the dredge area. Interpretation of the sub-bottom profiling could prove difficult if the response between the recent and clay sediment deposits is not significant and if the surface of the GMD is highly variable. Sub-bottom profiling data and geotechnical data (discussed in Section 3.2) will be used to delineate the depth of the GMD.

The extent of elevated surface sediment cPAH concentrations in the southeast corner of SCU-1 was identified as a data gap. Interpolated cPAH data was used to help determine the southeast extent of SCU-1. Additional cPAH surface sediment data will be collected to confirm the extent of SCU-1 and the dredge prism.

3.4 Implementation Issues

The design of the cleanup action for SCU-1 requires additional information related to debris mapping, material handling and water quality, and post-dredge slope chemistry. In addition, measures are needed to protect potential archaeological and historic resources during PRDI field activities.

3.4.1 Subsurface Debris

High quality side scan sonar geo-referenced to high density multi-beam data can provide important information on the presence of surface debris, shallow subsurface debris under soft unconsolidated sediments, as well as the relative density of the debris and sediments.

These data are important to provide accurate volume calculations, select appropriate types of equipment for remediation, sequence remediation activities, and identify controls and procedures to be implemented during remediation.

3.4.2 Material Handling and Water Quality

Mechanical dredging is the likely method to be used to remove contaminated sediment. During dredging there is the potential for the release of contaminants. Best management practices (BMPs) to control the release of contaminants include, but are not limited to: controlling bucket speeds, prohibiting the grounding of barges, using specific bucket types, and limiting when full buckets can be opened. These types of BMPs minimize the dispersion of contaminated sediments and limit the development and production of dredge-related residuals while removing the impacted sediment. The use of appropriate BMPs will be required in the construction specifications and will be addressed during development and review of the Contractor's dredging plans, submitted prior to the start of construction activities. Water quality will be monitored during dredging to ensure compliance with water quality criteria (the future EDR will include a water quality monitoring plan). Actions triggered by in-water exceedances may include modification of the dredging activity or BMPs, implementation of additional BMPs, and/or temporary suspension of dredging.

A number of tests have been developed by the United States Army Corps of Engineers (Corps) and others to assess water quality effects due to dredging which can be completed prior to dredging activities. Though not typical, a Dredge Elutriate Test (DRET) can be performed to predict the concentration of contaminants, soluble and insoluble, present in the water column at the point of dredging. DRET analysis was completed at the Whatcom Waterway site in 2008 (Anchor 2010). The Whatcom Waterway site, which overlaps the I&J Waterway site, includes more than 200 acres within the inner portion of Bellingham Bay from the I&J Waterway down to Boulevard Park. Composite samples were analyzed for metals, PAHs, and SVOCs analytes. The results of the DRET analysis were used to develop criteria to evaluate water quality during the cleanup of Phase 1 areas of the Whatcom Waterway site, which included mechanical dredging. Results of the DRET analysis indicated that exceedances of water quality criteria were not likely to occur during dredging, however, Corps permit conditions required chemical monitoring for mercury and dioxin. The Whatcom Waterway site cleanup activities included pile removal, capping, and mechanical dredging which occurred between August 10, 2015 and March 21, 2016. During this time no chemical exceedance for mercury or dioxin was detected during water quality compliance monitoring events (Anchor 2018). In general I&J Waterway site sediment

chemical concentrations are similar or lower than chemical concentrations in the areas dredged at the Whatcom Waterway site. The cleanup action for both sites is similar and includes mechanical dredging and pile removal. Based on the similarities, existing data from the Whatcom Waterway site can be applied to the I&J Waterway site and used to develop the acute and chronic chemical criteria which will be detailed in the Water Quality Monitoring Plan.

The characterization of contaminated sediment for upland landfill disposal suitability will be accomplished based on the results of bulk sediment testing (extensive available data) and applicable leaching tests. Disposal facilities generally require testing by the Toxicity Characteristic Leaching Procedure (TCLP). Disposal profiles are typically developed based on recent data collected within the previous 12 months. Sometimes older data is used if site conditions remain stable. At this site, conditions are dynamic and older data may not be suitable for disposal profiling.

3.4.3 Archaeological and Historic Resources

Cultural Resource Consultants, Inc. (CRC) conducted background research to identify any recorded cultural resources and evaluated the potential for as-yet unrecorded cultural resources to be present (Appendix B). The project location was originally in the Bellingham Bay tide flats before historical filling. No archaeological sites within the project location have been recorded. The dock (Property ID: 717568) is historic in age but Washington Department of Archaeology and Historic Preservation (DAHP) has determined that it is not eligible for historic registers.

The I&J Waterway site is located water ward of the historical shoreline. During the 1900s, successive fill episodes reclaimed the tidelands including the project location. Industrial development and later commercial development subsequently spread into the area. Based on review of the site location, excavation (dredging) is expected to be within fill deposits of varying ages and may extend into marine sediments present below fill material.

Potential significant precontact resource materials could be present at the interface of fill and marine sediments or within the upper layers of marine sediments and would likely have been lost or discarded during resource procurement or could represent older deposits prior to the stabilization of modern sea levels. The I&J Waterway site is anticipated to have a low potential to contain precontact deposits and a low potential to contain historic era deposits. As such, it is not anticipated that project actions will have an impact on potentially significant (i.e. intact) archaeological deposits (CRC 2019).

Ecology also performed a cultural resources review under Executive Order 05-05 and determined that the project is unlikely to impact cultural resources or historic properties. Ecology consulted with DAHP, the Lummi Nation, and Nooksack Indian Tribe on this determination. The outcome of the consultation was a requirement for development and

use of an Inadvertent Discovery Plan for project actions. An Inadvertent Discovery Plan is included in Appendix B.

3.4.4 Post-Dredge Slope Chemistry

Dredging will result in exposed sediment slopes beyond the boundaries of SCU-1. Approximately 490 feet of the perimeter will slope into areas outside of the I&J Waterway site. Approximately 250 feet will slope into SCU-2 where the future cleanup includes monitored natural recovery (180 feet) and enhanced natural recovery (70 feet). There is a potential for chemical exceedances on these newly exposed slopes. As a result, subsurface sediment data are needed to characterize these areas that will become surface sediment after dredging.

The design process will determine an appropriate dredge side slope that is stable in the long-term and appropriate offsets from the USCG facility. The design will also evaluate approaches for addressing these newly exposed slopes and will consider options such as post-dredge sampling and post-dredge placement of a sand cover (similar to a residuals cover) without additional sampling.

To limit the potential for accidental dredging in SCU-2, the boundary between SCU-1 and SCU-2 may require physical demarcation and/or administrative controls.

4 Sampling and Analysis Plan

Based on the data gaps summarized in Section 3, additional data is needed to inform the design of the cleanup action for SCU-1. This section provides specific sampling and analysis protocols for the field sampling activities and provides detailed information regarding the field sampling objectives; sample location and frequency; and equipment and procedures to be used during the sampling. Specific quality assurance protocols are presented in the QAPP, included as Appendix C. The HASP for field sampling activities is provided in Appendix D.

For the in-water vibracore samples, a permit application will be submitted to the USACE for a Nationwide Permit 6 prior to the start of field work. The cone penetrometer testing (CPT) boreholes do not require approval from the Washington Department of Fish and Wildlife and the City, however they will be notified of the proposed work. In-water vibracores samples will be collected during two separate mobilizations as discussed in Section 4.3.

Figure 4-1 shows the sampling stations and Table 4-1 provides the purpose of each sampling station. The following sub sections provide details on how the data collection and sampling will be conducted.

4.1 Base Map

4.1.1 In-Water Survey

The proposed in-water work includes bathymetric (multibeam) and side-scan sonar surveys. The bathymetric survey will extend at least 100 feet beyond the outer boundaries of SCU-1. Sounding density will be approximately 1 sounding per square foot. The multibeam sonar head is mounted on the survey vessel and coupled with motion sensors, a positioning system, and a gyro to geo-reference each sounding. The sonar proposed for use is a 400 kHz Reson 7125 mutlibeam sonar on an articulated side mount on the survey vessel. A Renishaw Merlin mobile laser scanner will be mounted on top of the vessel and integrated with the vessels Inertial Navigation System. The multibeam will be used in a tilted configuration with 20 degrees of tilt to collect soundings to the waterline. Nearshore lines will be run to coincide with high tide to obtain the maximum amount of coverage up the beach. Additional cross-lines will be run perpendicular to the shoreline to serve as quality control checks. Multiple tracks will be completed to achieve 200% coverage so that debris can be observed from multiple angles. A geo-referenced side-scan mosaic with debris identification and general observations will be provided.

4.1.2 Upland Survey

The shoreline bank along the south-eastern border of SCU-1 will be surveyed using a mobile laser scanner mounted on the survey vessel. Survey lines will be collected at high tide to collect data to as high an elevation as possible as discussed in Section 4.1.1.

A topographic and utility survey will be performed on the upland area adjacent to the bank and stamped by a licensed surveyor in Washington State. Utility locating will be performed to support this work. Topography along the bank will be collected during low tides, where appropriate, to tie the bathymetric and upland topography together. Temporary bench marks will be established along the shoreline prior bathymetric surveying.

Existing utilities and outfalls will be documented and located prior to implementation of the removal action. Utility information initially obtained from the City, Port, and Bornstein will be field-verified using surface features and utility tracing as appropriate.

4.2 Geotechnical Information

Additional information will be collected to provide data and engineering properties for slope stability analysis for temporary and permanent cut slopes, for design of the bulkhead and dock structures, and for determining the appropriate setbacks from the USCG structures. The geotechnical investigation includes the following:

- 3 upland area geotechnical boreholes between the Bornstein building and the dock to approximately 60 feet below ground surface (bgs)
- 2 cone penetrometer test boreholes (CPTs) through the dock to approximately 60 to 100 feet below the mudline (bml)
- 4 in-water CPTs to approximately 10 to 20 feet bml
- 9 in-water vibracores to 4 feet below the GMD.

The geotechnical exploration program will consist of both offshore and upland investigations. There will be a total of 3 borings, 6 CPTs, and 9 vibracores. Locations are shown on Figure 4-1.

To perform the CPTs through the dock, the concrete surface of the dock will be saw cut, and then a piece of the underlying wood dock removed so the CPT probe can be lowered and advanced through the water and sediment. The dock will be repaired following the CPT work.

CPTs are pushed using a hydraulic system and the drilled borings will be performed using a mud rotary system. No physical samples are collected during CPT testing; the sediment is classified based on correlations between the tip resistance and sleeve friction, which are recorded continuously during the CPT test.

For the three upland borings, mud rotary drilling with a Shelby tube sampler will be used to conduct Standard Penetration Tests (SPT). SPT testing will be performed every 2.5 to 5 feet until the 60 feet bgs bottom of the boring is reached. The samples retrieved during SPT testing will be used to classify the soils and for laboratory testing. The soil classifications from the SPTs will be compared to those determined by the CPT to correlate the two methods. Index tests will be performed on selected samples sent to the laboratory to

confirm field classification of soil, estimate engineering properties, and estimate construction behavior.

Vibracore sediment sampling methods are discussed in Section 4.3.

The laboratory testing program will provide both the magnitude and the range of soil and sediment properties in each of the soil and sediment layers. Index tests that will be performed include Atterberg limits, grain size distribution, hydrometer, moisture content, and density. In addition to index tests, consolidation testing will be performed on relatively undisturbed Shelby tube samples to refine settlement estimates and corrosion testing will be performed to refine the design of foundation elements. While the actual testing program will depend on the samples retrieved during the drilling, the anticipated number of tests is shown in Table 4-2.

4.2.1 Positioning and Navigation

Positioning and navigation of the CPT barge and vibracore collection boat are discussed in Section 4.4.

The dock CPT locations may be moved based on accessibility and field obstructions. Efforts will be made to select locations which avoid pilings or other obstructions. Upland borings may be adjusted by up to 30 feet to avoid conflicts with the Bornstein facility operations and utilities.

4.2.2 Investigation Derived Waste Management

All sediment remaining after sampling in the field will be washed overboard at the collection site prior to moving to the next sampling station. Any sediment spilled on the deck of the sampling vessel will be washed into the surface waters at the collection site.

Sediment remaining after core processing and sampling will be collected in 55-gallon drums and consolidated. The 55-gallon drums will be stored in a secure area and labeled appropriately. Periodic composite sampling of remaining sediment will be performed to obtain representative data for sediment disposal profiling.

All soil cuttings obtained from the mud rotary soil boring activities will be collected in 55-gallon drums and consolidated. The 55-gallon drums will be stored in a secure area and labeled appropriately. After the completion of all soil borings, the 55-gallon drums will be transported for appropriate disposal. Periodic composite sampling of soil boring cuttings will be performed to obtain representative data for soil disposal profiling.

All disposable sampling materials and personnel protective equipment used in sample processing, such as disposable coveralls, gloves, and paper towels, will be placed in heavy duty garbage bags or other appropriate containers. Disposable supplies will be placed in a normal refuse container for disposal as solid waste.

4.3 Dredge Extent

Additional sediment samples are needed to refine the understanding of the GMD and the chemical distribution at select areas. Figure 4-1 shows the sampling stations, Table 4-1 provides the purpose of each sampling station, and Table 4-3 provides the laboratory testing program. Sediment will be collected in two separate events. Phase 1 will include surface samples at the southwest corner of the dredge footprint and subsurface samples within the dredge footprint. Phase 2 will include subsurface samples around the perimeter of the dredge footprint representing surface sediment on the post-dredge side slopes. The Phase 2 locations shown on Figure 4-1 are preliminary for illustration purposes only; the number and locations of samples will be determined once the dredge prism design is complete.

4.3.1 Surface Samples

Four surface grab samples will be collected at the locations shown on Figure 4-1. Initially, one sample (from location IJW-SS-14) of recent surface sediment will be submitted for analysis for cPAHs and the remaining surface samples (from locations IJW-SS-15, IJW-SS-16, and IJW-SS-17) will be archived at the laboratory. If the cPAH concentration exceeds the screening level at IJW-SS-14, archived samples will be analyzed.

Surface sediment samples collected for nature and extent testing will be collected from the 0- to 12-cm biologically active zone at locations presented on Figure 4-1. Table 4-1 presents a summary of the surface sediment location and sampling scheme details including chemical testing analyses.

A hydraulic Van Veen sampling device will be used to collect surface sediment samples. Sampling locations will be approached at slow boat speeds with minimal wake to minimize disturbance of bottom sediments prior to sampling. Sediment samples will be handled carefully to minimize disturbance during collection and transportation to the laboratory.

The grab sampler will be lowered over the side of the boat from a cable wire at an approximate speed of 0.3 feet per second. When the sampler reaches the mudline, the cable will be drawn taut and DGPS measurements 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 of winnowing or leaking from sampling device

Grab samples not meeting these criteria will be rejected near the location of sample collection, and the steps will be repeated until criteria have been met. Deployments will be

repeated within a 20-foot radius of the proposed sample location. If adequate penetration is not achieved after multiple attempts, less volume will be accepted and noted in the field notebook. Once accepted, overlying water will be siphoned off and 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 touching the sidewalls.

The sampler will be decontaminated between stations and rinsed with site water between grabs. After sample collection, the following information will be recorded on the Field Log Sheet, Sediment Sampling Form, and/or the field notebook:

- Date, time, and name of person logging sample
- Weather conditions
- Sample location number and coordinates
- Project designation
- Depth of water at the location and surface elevation
- Sediment penetration and depth
- Sediment sample interval
- Sample recovery
- Physical characteristics of the sediment, including color, texture, presence of anthropogenic material, and presence and type of biological structures, other debris, oil sheens, and odors

Homogenized sediment will be spooned immediately into appropriate pre-cleaned, pre-labeled sample containers, placed in coolers filled with ice or equivalent, and maintained at 4 degrees centigrade (°C) for delivery to the analytical laboratory. Care will be taken to ensure that sediment in contact with the walls of the sampler, as well as any large items or debris, are excluded from the sample. Materials greater than 0.5-inch in diameter and debris will be omitted from the sample containers. Surface sediment samples will be submitted for chemical and testing analysis (shown on Table 4-1).

In addition to the location information collected in the field, sample logging of bulk sediment not placed in sample containers will involve physical characterization in general accordance with the visual-manual description procedure (Method American Society for Testing and Materials [ASTM] D-2488 modified). The information will be recorded on the Sediment Sampling Forms. Physical characterization includes the following:

- Grain size distribution
- Density/consistency
- Plasticity
- Color, odors, presence of oily sheens and moisture content
- Biological structures (e.g., shells, tubes, macrophytes, bioturbation)

4.3.2 Subsurface Samples

Phase 1

Sediment core sampling will be completed at the locations shown on Figure 4-1. The cores will be advanced using vibracore methods from a boat. The cores will be advanced to 4 feet below the GMD contact, or until refusal is encountered. The GMD contact is anticipated to be in the upper 10 feet of sediment. It should be noted that native alluvium (sand) may be encountered above the GMD in locations on the slope in the Floating Dock Unit and toward the head of the waterway (IJW-SC-2, 3, 4, 5, and 6).

Each core will be visually classified in general accordance with ASTM D 2487 (Classification of Soils for Engineering Purposes). Color photos will be taken of cores prior to sampling, focusing on changes in stratigraphy and visible contamination. Vibracores are used as additional information with the CPTs to determine the depth of native deposits (alluvium or GMD), stratigraphy, and in-situ properties of the sediment.

Analytical sample jars will be filled from the following depths:

- **Sample Interval 1** - 0 to 2 foot layer of recent sediment above native GMD or alluvium
- **Sample Interval 2 (archived)** - 2 to 4 foot layer of recent sediment above native GMD or alluvium
- **Sample Interval 3 (archived)** - Top 2 feet of the native GMD or alluvium
- **Sample Interval 4 (archived)** - 2 to 4 foot layer below the top of the native GMD or alluvium, if deposit can be penetrated

Two samples (from locations IJW-SC-2 and 3) will be submitted for chemical analysis, as described below. All other samples (from locations IJW-SC-1, 4, 5, 6, 7, 8, and 9) will be archived.

As indicated on Table 4-1 two subsurface samples (from locations IJW-SC-2 and 3) of recent sediment from just above the native deposit (sample interval 1) will be submitted for analysis for indicator hazardous substances (IHSs; (PAHs, SVOCs [including bis(2-ethylhexyl)phthalate], and nickel) and TOC. Based on the findings of the IHS analysis, mercury, dioxins/furan, and dioxin-like PCB congeners may be analyzed. Analysis of archived sample intervals 2 through 4 (from locations IJW-SC-2 and 3) may also be completed based on the findings from the primary sampling and analysis.

Table 4-3 summarizes locations to be analyzed for chemistry. Sediment sample intervals and sediment sample locations may vary based on field observations for all sample stations. Samples may also be collected at any unique lithology or visual contamination/debris layer at all subsurface sediment sample locations.

Sediment samples may also be collected from other locations, these will be archived and subsequent analysis may be completed based on the findings from the primary sampling and analysis. Samples will also be submitted for physical testing. These samples will be selected based on visual classification to represent the major sediment units found in the core. The anticipated number of physical tests is shown in Table 4-4.

Phase 2

A second sediment core sampling event will be conducted after the dredge prism has been determined. Phase 2 will include 4 to 8 subsurface sample locations representing post-dredge side slope surface sediment. The locations shown on Figure 4-1 are preliminary for illustration purposes only; the number and location of samples will be determined once the dredge prism design is complete.

The cores will be advanced using vibracore methods from a boat. Each core will be visually classified in general accordance with ASTM D 2487 (Classification of Soils for Engineering Purposes). Color photos will be taken of cores prior to sampling, focusing on changes in stratigraphy and visible contamination. One sample will be collected at the estimated depth of the anticipated post-dredge sediment surface. Samples will be submitted for analysis for the IHSs (PAHs, SVOCs [including bis(2-ethylhexyl)phthalate], and nickel) and TOC. All stations will have archived samples collected for mercury, dioxins/furans, and dioxin-Like PCB congeners. Mercury, dioxins/furan, and dioxin-like PCB congeners will only be analyzed if the results for the IHS analyses do not exceed cleanup levels. Analysis of each archived sample will not automatically be triggered by a clean result in the initial sample. A subset (approximately 50%) of archived samples will be selected for analysis based on a review of all the data.

Subsurface Collection Methods

Subsurface sediment (chemistry and physical testing) will be collected by vibracore. A vibracore collects a continuous profile of subsurface sediments by utilizing a high frequency vibrating coring device that penetrates into the underlying sediments with minimal distortion.

Prior to deployment, the following procedure will be used to decontaminate sample tubes:

- Rinse and pre-clean with potable water
- Wash and scrub the tubes in a solution of laboratory grade, non-phosphate-based soap and potable water
- Rinse with potable water
- Rinse three times with distilled water
- Seal both ends of each core tube with aluminum foil

The aluminum foil will be removed immediately prior to placement into the coring device. Care will be taken during sampling to avoid contact of the sample tube with potentially contaminated surfaces.

Sediment samples will be collected in the following manner:

- Vessel will maneuver to the proposed sample location
- A decontaminated core tube the length of the desired penetration depth will be secured to the vibratory assembly and deployed from the vessel
- The cable umbilical to the vibrator assembly will be drawn taut and perpendicular, as the core rests on the bottom sediment
- Location of the umbilical hoist will be measured and recorded by the location control personnel, and depth to sediment will be measured with a survey tape attached to the head assembly
- A 4-inch-diameter, thin-walled, aluminum tube will be vibratory-driven into the sediment using two counter-rotating vibrating heads
- A continuous core sample will be collected to the designated coring depth or until refusal
- The depth of core penetration will be measured and recorded
- The vibrator will be turned off and the core barrel will be extracted from the sediment using the winch
- While suspended from the A-frame, the assembly and core barrel will be sprayed off and then placed on the vessel deck
- The core sample will be evaluated at the visible ends of the core tube, the length of recovered sediment will be recorded, and, if accepted, the core tube will be sectioned into 4 to 6.5-foot lengths.

Acceptance criteria for sediment core samples are as follows:

- Overlying water is present and the surface is intact
- The core tube appears intact without obstruction or blocking
- Recovery is greater than 75 percent of drive length

Once the core samples are deemed acceptable, the cutter head will be removed 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 labeled with permanent black pen and scribed with the location ID and an arrow pointing to the top of core. The cores will then be cut into appropriate lengths for transport to the processing station. Cores will be cut to a maximum length of 6.5 feet. The cores will be sealed tightly enough to prevent leakage or disturbance during transport to the processing station.

Cores will be logged and processed at the processing station. The processing station will be a portable field trailer, with a freezer, set up in close proximity to the site. Discrete samples will be taken directly from the selected depth interval and spooned into laboratory supplied jars. Composited samples will be placed in a decontaminated stainless steel bowl and mixed using a decontaminated stainless steel mixing spoon or trowel. The composited sediment will be mixed until homogenous in color and texture and then spooned into laboratory supplied jars for analyses. Chemistry and physical samples will follow the same collection methods.

4.3.3 Positioning and Navigation

Sediment sampling stations (surface and subsurface) will be surveyed using a real time kinematic global positioning system (RTK GPS), or similar. The RTK GPS includes a receiver unit onboard the sampling vessel and a Coast Guard beacon differential receiver. The RTK GPS unit will receive radio broadcasts of GPS signals from satellites. The Coast Guard beacon receiver will acquire corrections to the GPS signals to produce positioning accuracy to within 1 to 2 feet.

Northing and easting coordinates of the vessel will be updated every second and displayed directly on a computer aboard the vessel. The coordinates will then be processed in real time and stored at the time of sampling using the positioning data management software package HYPACK®, or similar. Washington State Plane Coordinates, North (NAD 83) will be used for the horizontal datum. The vertical datum will be the National Oceanic and Atmospheric Administration (NOAA) mean lower low water (MLLW) datum. Vertical control will be provided by the ship's depth finder and corrected for tidal influence. Tide elevation will be determined by using the RTK GPS and using local tide gauges to verify equipment readings.

To ensure the accuracy of the navigation system, a checkpoint will be located at a known point such as a pier face, dock, piling, or similar structure that is accessible by the sampling vessel. At the beginning and end of each day, the vessel will be stationed at the check point, a GPS position reading will be taken, and the reading will be compared with the known land-survey coordinates. The two position readings should agree, within the limits of survey vessel operational mobility, to within 1 to 2 feet.

An onboard computer will display the vessel's position during sampling operations. Proposed coordinates (Table 4-5) will have been previously stored in the vessel's computer. The proposed station location will be displayed on the area map on the computer screen, and the vessel's location will be displayed as a moving dot on that map. The range and bearing from the vessel to the proposed station location (target position) will be displayed on the screen. The scale of the grid will be magnified as the vessel nears the proposed station location. During sampling, vessel position can be monitored constantly using this computer display and the RTK GPS. Actual sample location coordinates will be determined

when the sampler is on the bottom, and the cable is taut and perpendicular to the water surface.

4.3.4 Sub-bottom Profiling Survey

A sub-bottom profiler will be used to investigate the sub-surface stratigraphy and depth-to-GMD within the SCU-1 boundary. Data will be collected utilizing a small survey vessel to maximize data coverage in shallow regions. Survey line spacing will be approximately 10 meters and extend from the shallow-water operational limit of the boat to 10 meters beyond the offshore limit of dredging area. A minimum of 4 cross lines will be collected. To the extent possible, the survey will be performed at high tide to maximize coverage.

Vessel navigation will be managed in QINSy to ensure that pre-planned track lines are surveyed systematically. Sub-bottom data will be processed in SonarWiz. Profiles will be interpreted and sub-surface features digitized

4.4 Implementation Issues

4.4.1 Subsurface Debris Survey

Section 3.4 identified the need for additional information to map the extent of debris on-top and within the sediment. This information is used to inform dredging means and methods. Physical constraints at the site, including a narrow shoreline exposed briefly during low tide, limit the ability for visual inspections of the extent of debris. Using high quality side scan sonar geo-referenced to high density multi-beam data will provide important information on the presence of surface debris, shallow subsurface debris under soft unconsolidated sediments, as well as the relative density of the debris and sediments. This information will be used with the other in-water surveying work discussed in Section 4.1 and sub-bottom profiling discussed in Section 4.3.4.

5 Schedule

Table 5-1 presents the anticipated schedule for completing the work outlined in this Work Plan. In accordance with the Agreed Order, the results of the Phase 1 field work will be incorporated into the draft EDR, which is anticipated to be submitted to Ecology in early 2021. Phase 2 field work will occur after Ecology has reviewed the dredge prism presented in the Draft EDR.

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Tables

Table 4-1 Summary of Sampling Stations

Sample ID	Purpose	Slope Stability	Dock & Bulkhead Design	Extent of Dredge Prism	Extent of cPAH in Surface Sediment	Post-Dredge Side Slope Chemistry
Surface and Subsurface (Vibracore) – Phase 1						
IJW-SS-14	Surface Grab – Assess extent of cPAHs in surface sediment in the vicinity of historical sample locations IJ13-SS-102 and IJW-SS-03				x	
IJW-SS-15	Surface Grab – Assess extent of cPAHs in surface sediment in the vicinity of historical sample locations IJ13-SS-102 and IJW-SS-03				x	
IJW-SS-16	Surface Grab – Assess extent of cPAHs in surface sediment in the vicinity of historical sample locations IJ13-SS-102 and IJW-SS-03				x	
IJW-SS-17	Surface Grab – Assess extent of cPAHs in surface sediment in the vicinity of historical sample locations IJ13-SS-102 and IJW-SS-03				x	
IJW-SC-1	Subsurface - Stratigraphy and in-situ sediment properties, support slope stability evaluation, and refine extent of dredge prism (GMD)	x		x		
IJW-SC-2	Subsurface - Stratigraphy and in-situ sediment properties, support slope stability evaluation, and refine extent of dredge prism (GMD and chemistry)	x		x		
IJW-SC-3	Subsurface - Stratigraphy and in-situ sediment properties, support slope stability evaluation, and refine extent of dredge prism (GMD and chemistry)	x		x		
IJW-SC-4	Subsurface - Stratigraphy and in-situ sediment properties, support slope stability evaluation, and refine extent of dredge prism (GMD)	x		x		
IJW-SC-5	Subsurface - Stratigraphy and in-situ sediment properties and refine extent of dredge prism (GMD)			x		
IJW-SC-6	Subsurface - Stratigraphy and in-situ sediment properties and refine extent of dredge prism (GMD)			x		
IJW-SC-7	Subsurface - Stratigraphy and in-situ sediment properties and refine extent of dredge prism (GMD)			x		
IJW-SC-8	Subsurface - Stratigraphy and in-situ sediment properties, support slope stability evaluation, refine extent of dredge prism (GMD), and correlate GMD findings with CPTs (IJW-CPT-5)	x		x		
IJW-SC-9	Subsurface - Stratigraphy and in-situ sediment properties, support slope stability evaluation, and refine extent of dredge prism (GMD)	x		x		
Subsurface (Vibracore) – Phase 2 (see Note 2)						
IJW-SC-10	Subsurface – Estimate surface sediment chemistry of post-dredge side slopes					x
IJW-SC-11	Subsurface – Estimate surface sediment chemistry of post-dredge side slopes					x
IJW-SC-12	Subsurface – Estimate surface sediment chemistry of post-dredge side slopes					x
IJW-SC-13	Subsurface – Estimate surface sediment chemistry of post-dredge side slopes					x
IJW-SC-14	Subsurface – Estimate surface sediment chemistry of post-dredge side slopes					x

Sample ID	Purpose	Slope Stability	Dock & Bulkhead Design	Extent of Dredge Prism	Extent of cPAH in Surface Sediment	Post-Dredge Side Slope Chemistry
IJW-SC-15	Subsurface – Estimate surface sediment chemistry of post-dredge side slopes					x
Cone Penetrometer						
IJW-CPT-1	Stratigraphy and in-situ sediment/soil properties for dock/bulkhead design, support slope stability evaluation, and refine extent of dredge prism (GMD)	x	x	x		
IJW-CPT-2	Stratigraphy and in-situ sediment/soil properties for dock/bulkhead design, support slope stability evaluation, and refine extent of dredge prism (GMD)	x	x	x		
IJW-CPT-3	Stratigraphy and in-situ sediment/soil properties for floating dock pile design, support slope stability evaluation, and refine extent of dredge prism (GMD)	x	x	x		
IJW-CPT-4	Stratigraphy and in-situ sediment/soil properties, support slope stability evaluation, and refine extent of dredge prism (GMD)	x		x		
IJW-CPT-5	Stratigraphy and in-situ sediment/soil properties, support slope stability evaluation, refine extent of dredge prism (GMD), and correlate GMD findings with vibracores (IJW-SC-09) and historical vibracores (IJ-18)	x		x		
IJW-CPT-6	Stratigraphy and in-situ sediment/soil properties for USCG setback design, support slope stability evaluation, and refine extent of dredge prism (GMD)	x	x	x		
Mud Rotary						
IJW-SB-1	Physical characterization and in-situ properties of soil for design of the bulkhead and dock	x	x			
IJW-SB-2	Physical characterization and in-situ properties of soils for design of the bulkhead and dock	x	x			
IJW-SB-3	Physical characterization and in-situ properties of soils for design of the bulkhead and dock	x	x			

Notes:

GMD – glacier marine drift

cPAH – carcinogenic polycyclic aromatic hydrocarbon

1. Shaded cells denote surface and subsurface locations that include chemistry testing (detailed in Section 4.3).Samples will be collected from all subsurface locations and archived. Surface samples from locations IJW-SS-15, -16, and -17 will be archived and subsequent analysis may be completed based on the results from the analysis of IJW-SS-14. Sediment samples will be collected for testing per Table 4-3.
2. All sample station locations are approximate and may change by up to 30 feet to avoid interfering with facility operations or to avoid debris/obstructions. Phase 2 subsurface locations shown on Figure 4-1 will be updated based on final dredge prism.

Table 4-2 Geotechnical Laboratory Testing Program

Test Type	Number of Analyses
Sieve Analysis (ASTM D-421/422)	15
Atterberg Limits (ASTM D-4318)	10
Moisture Content (ASTM D-2216) and Specific Gravity (ASTM D-854)	25
Consolidation Test (ASTM D-2435)	2
Corrosion Suite (pH, resistivity, redox potential, chloride concentration, and sulfate concentration)	3

Table 4-3 Surface and Subsurface Sediment Laboratory Testing Program

Sample ID	Purpose	Depth of Boring (ft bml)	Sample Depth(s) ft bml	Analyses	Collection Method
Phase 1					
IJW-SS-14	Assess horizontal extent of cPAHs in surface sediment to refine dredge prism	Not applicable	0-12 cm	cPAHs	Surface Grab
IJW-SS-15[5]					
IJW-SS-16[5]					
IJW-SS-17[5]					
IJW-SC-2	Assess vertical extent of subsurface contamination to refine dredge prism	4 ft into the native GMD or alluvium[1]	0-2 ft above native GMD or alluvium contact; additional samples archived[2]	IHS[3]	Vibracore
IJW-SC-3					
Phase 2					
Sediment Core Locations TBD[4]	Assess subsurface contamination at the depth representing post-dredge side slope surface sediment	2 ft below surface of post-dredge side slope	0-1 ft below surface of post-dredge side slope	IHS[3]	Vibracore

Notes:

Ft bml – feet below sediment/mud line surface

Cm = centimeters

cPAH – carcinogenic polycyclic aromatic hydrocarbon

PAH – polycyclic aromatic hydrocarbon

SVOC – Semi-Volatile Organic Compound

PCB – polychlorinated biphenyls

1. Core will be advanced 4 feet into the native glacial marine drift (GMD) or alluvium, or refusal.
2. Samples will also be collected from the following 3 depths: Sample Interval 2 - Recent sediment 2 to 4 feet above native glacial marine drift or alluvium, Sample Interval 3 - Upper 2 feet of native glacial marine drift or alluvium, Sample Interval 4 - 2 to 4 feet from top of native glacial marine drift or alluvium. Samples will also be collected at any unique lithology or visual contamination/debris layer. These samples will be archived and subsequent analysis may be completed based on the findings from the primary sampling and analysis.
3. Indicator Hazardous Substance (IHS) analysis includes: PAHs, SVOCs, and nickel. Based on the findings of the IHS analysis samples may be analyzed for mercury, dioxin/furans, and dioxin-like PCB congeners.
4. Locations will be determined once the dredge prism is final.
5. These samples will be archived and subsequent analysis may be completed based on the findings from the analysis of IJW-SS-14.

Table 4-4 Stratigraphy Laboratory Testing Program

Test Type	Number of Analyses
Sieve Analysis (ASTM D-421/422)	8
Atterberg Limits (ASTM D-4318)	8
Consolidation Test (ASTM D-2435)	1

Table 4-5 Proposed Station Coordinates

Sample ID	Easting	Northing
IJW-SS-14	644206.92	1239853.13
IJW-SS-15	644167.09	1239855.78
IJW-SS-16	644167.34	1239824.04
IJW-SS-17	644206.95	1239815.81
IJW-SC-1	644206.92	1239853.13
IJW-SC-2	644364.48	1240019.38
IJW-SC-3	644411.28	1240070.37
IJW-SC-4	644470.95	1240082.22
IJW-SC-5	644454.61	1240025.48
IJW-SC-6	644370.86	1239913.92
IJW-SC-7	644305.93	1239882.08
IJW-SC-8	644391.53	1239875.80
IJW-SC-9	644283.66	1239905.84
IJW-SC-10	To be determined after the dredge prism is finalized	
IJW-SC-11		
IJW-SC-12		
IJW-SC-13		
IJW-SC-14		
IJW-SC-15		
IJW-CPT-1 (upland)	644239.52	1239879.81
IJW-CPT-2 (upland)	644317.93	1239968.88
IJW-CPT-3	644432.53	1240053.89
IJW-CPT-4	644267.04	1239791.36
IJW-CPT-5	644400.96	1239885.56
IJW-CPT-6	644532.17	1240023.11
IJW-SB-1 (upland)	644206.98	1239914.54
IJW-SB-2 (upland)	644293.55	1239988.75
IJW-SB-3(upland)	644384.87	1240095.13

Notes:

1. Horizontal Datum - Washington State Plane Coordinates, North (NAD 83)
2. All sample locations are approximate and may change by up to 30 feet to avoid interfering with facility operations or to avoid debris/obstructions.

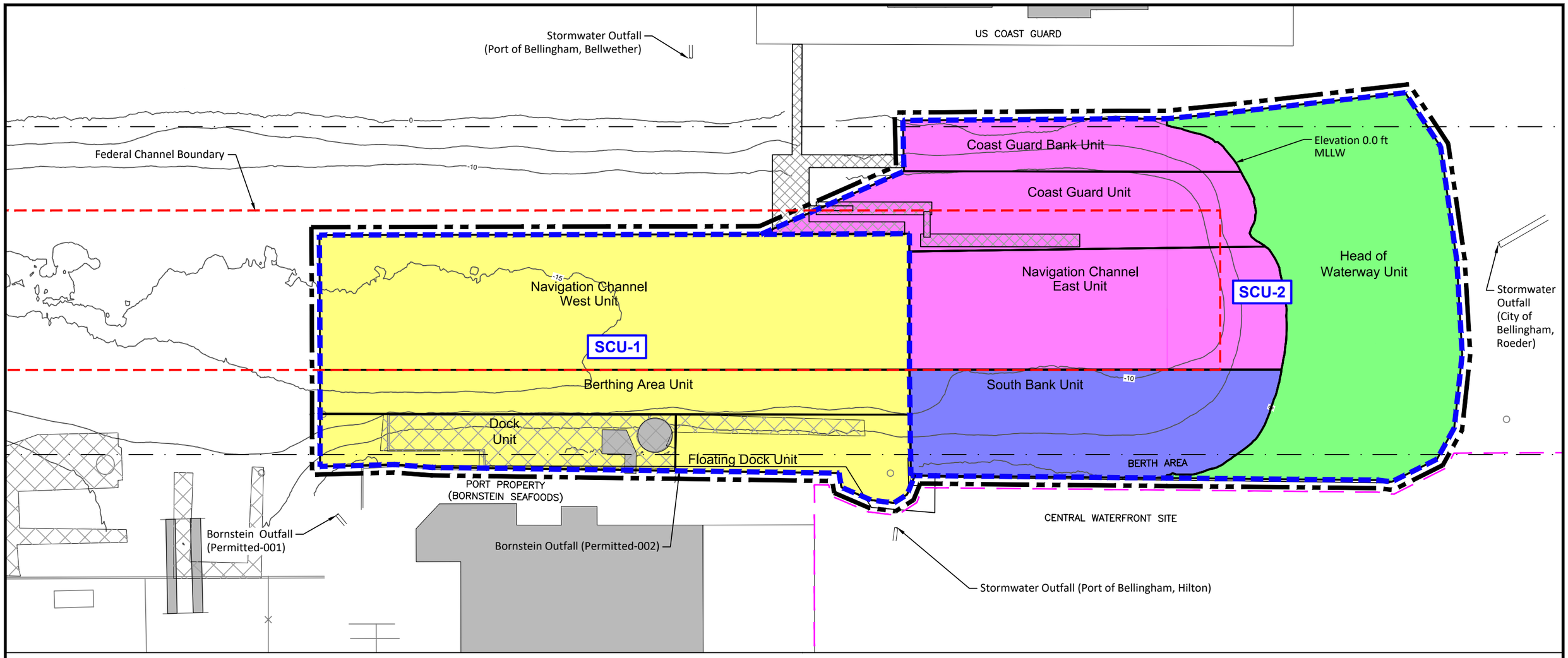
Table 5-1 PRDI Activities and Anticipated Schedule

PRDI Task or Deliverable	Agreed Order Schedule	Anticipated Schedule
Phase 1 Sampling		
Upland Topographic and Utility Survey	Within 120 days of Ecology approval of Final PRDI Project Plans or other date approved by Ecology	May 4-8, 2020 (See Note 1)
Mud Rotary Borings		May 18-22, 2020 (See Note 1)
Bathymetric Survey and Sub-bottom Profiling		May 18-22, 2020 (See Note 1)
Cone Penetrometer Testing (includes locations through the dock and within the waterway)		June 15-26, 2020 (See Note 1)
Surface and Subsurface Sediment Sampling		June 22-26, 2020 (See Notes 1 and 2)
Phase 2 Sampling		
Subsurface Sediment Sampling	After Ecology review of the dredge prism in the Draft EDR (Draft EDR will be submitted within 180 days of completion of the PRDI work)	2nd Quarter 2021

Notes:

1. All task schedules are dependent on availability of subcontractors and local, state, and federal mandates limiting work activities due to the COVID-19 outbreak.
2. In-water work is dependent on permit issuance.

Figures



LEGEND:

- Docks or Piers (Over Water Structures)
- Existing Structures
- Federal Channel Boundary
- Central Waterfront Site Boundary
- I&J Waterway Boundary
- -10 Bathymetric Contour (5-foot interval)
- Site Boundary
- Sediment Cleanup Unit (SCU) Boundary

Sediment Cleanup

- Site Unit
- Dredging
- Capping
- Enhanced Natural Recovery
- Monitored Natural Recovery

N

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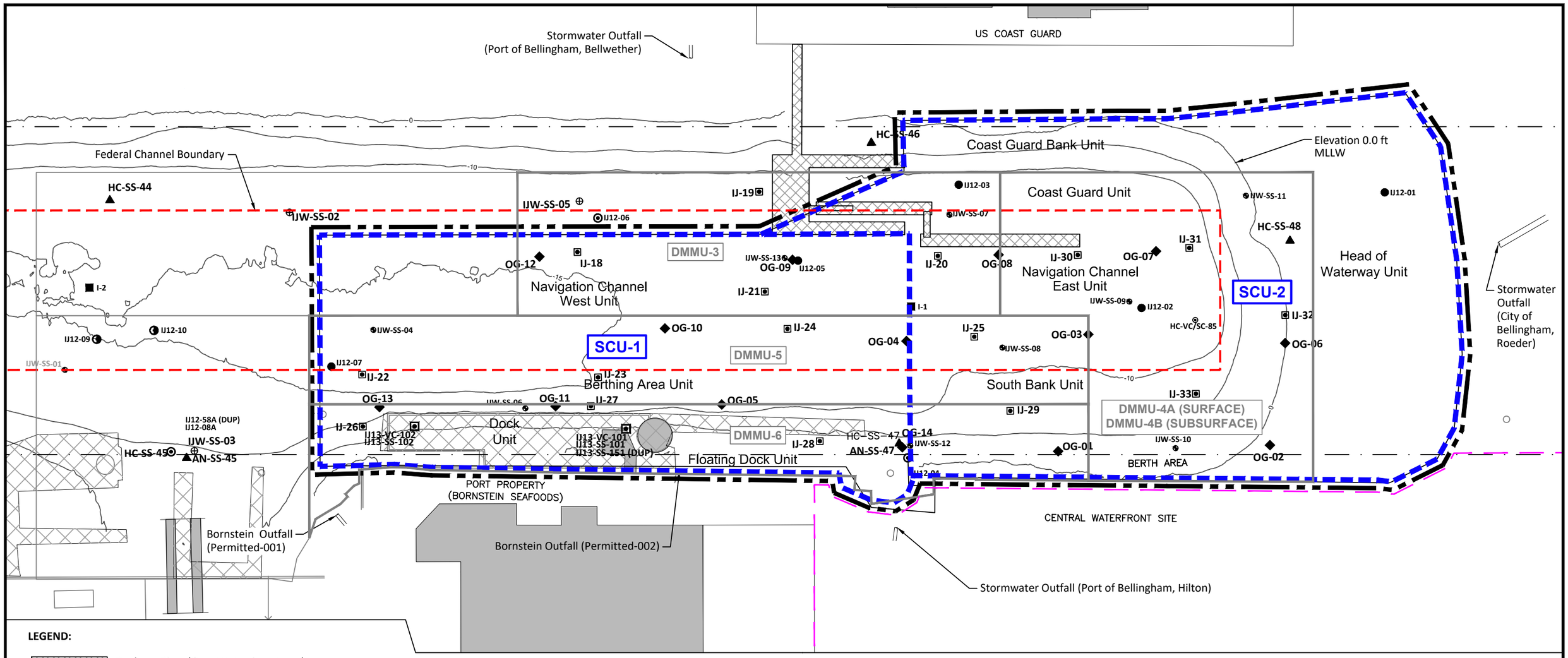
SCALE IN FEET

CRETE CONSULTING, INC.

Port of Bellingham - I&J Waterway Site
Pre-Remedial Design Investigation Work Plan
April 8, 2020

Cleanup Action

Figure 1-1



LEGEND:

- Docks or Piers (Over Water Structures)
- Existing Structures
- Federal Channel Boundary
- Central Waterfront Site Boundary
- I&J Waterway Boundary
- -10 Bathymetric Contour (5-foot interval)
- Site Boundary
- Sediment Cleanup Unit (SCU) Boundary
- DMMU-1 Composite DMMU Dredge Disposal Characterization Sample Areas (RETEC 2005)

RI/FS Sediment Sampling Station

- Subsurface Sediment Chemistry Sample Location (USACE 2011)
- Surface Sediment Chemistry Sample Location (Anchor QEA 2013)
- Colocated Surface Grab and Core Location (Anchor QEA 2013)
- Surface Sediment Chemistry and Bioassay Sample Location (Anchor QEA 2013)
- Archive Surface Sediment Sample Location (Anchor QEA 2013)
- IJ-28 Subsurface DMMP Composite Sample Location (RETEC 2006)
- IJW-SS-02 Surface Sample Chemistry Location (RETEC 2006)
- IJW-SS-10 Surface Sample Chemistry and Bioassay Location (RETEC 2006)
- HC-VC/SC-85 Whatcom Waterway Sediment Core (Hart Crowser 1997)

Historical Sampling Station

- HC–SS–47 Whatcom Waterway Sediment Grab Sample Location (Hart Crowser 1997)
- AN–SS–47 Bioassay Sample Location (Anchor Environmental 2000)
- OG–10 Surface Sediment Grab Sample Location (ThermoRetec 2001)

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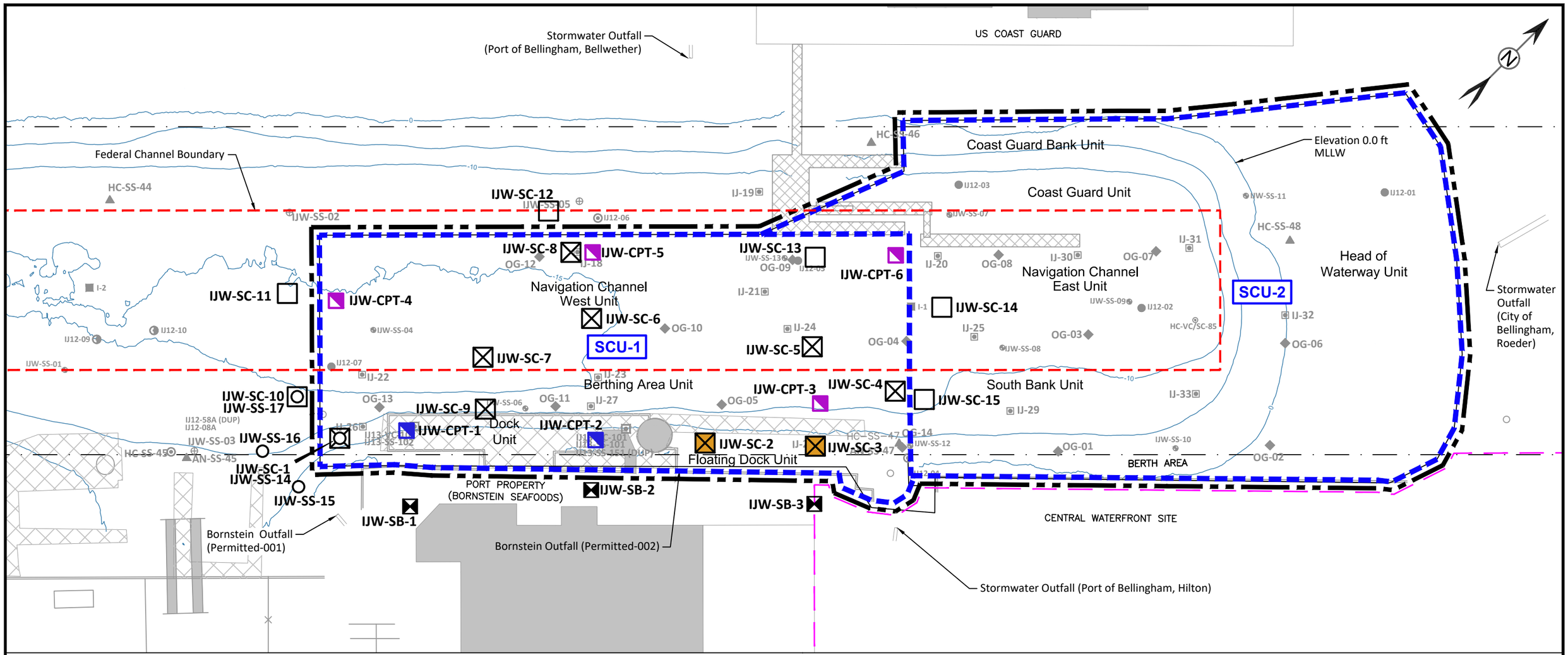
Port of Bellingham - I&J Waterway Site
Pre-Remedial Design Investigation Work Plan
April 8, 2020

Historical Sample Stations

Figure 3-1



LEGEND:

- Docks or Piers (Over Water Structures)
- Existing Structures
- Federal Channel Boundary
- Central Waterfront Site Boundary
- I&J Waterway Boundary
- -10 Bathymetric Contour (5-foot interval)
- Site Boundary
- Sediment Cleanup Unit (SCU) Boundary

RI/FS Sediment Sampling Station

- Subsurface Sediment Chemistry Sample Location (USACE 2011)
- Surface Sediment Chemistry Sample Location (Anchor QEA 2013)
- Colocated Surface Grab and Core Location (Anchor QEA 2013)
- Surface Sediment Chemistry and Bioassay Sample Location (Anchor QEA 2013)
- Archive Surface Sediment Sample Location (Anchor QEA 2013)
- IJ-28 Subsurface DMMP Composite Sample Location (RETEC 2006)
- IJW-SS-02 Surface Sample Chemistry Location (RETEC 2006)
- IJW-SS-10 Surface Sample Chemistry and Bioassay Location (RETEC 2006)
- HC-VC/SC-85 Whatcom Waterway Sediment Core (Hart Crowser 1997)

Proposed Pre-Remedial Design Sampling Station (See Note 1)

- CPT - Coast Guard Setback, Sediment Properties, GMD
- CPT - Bulkhead and Dock, GMD
- Mud Rotary - Bulkhead and Dock, GMD
- Vibracore - Dredge Prism, (Subsurface Chemistry), GMD, Collected during Phase 1 of Sampling Activities
- Vibracore - Dredge Prism, GMD, Collected during Phase 1 of Sampling Activities
- Vibracore - Dredge Prism Side Slope, Collected during Phase 2 of Sampling Activities (See Note 2)
- Surface Grab - Dredge Prism, Chemistry, Collected during Phase 1 of Sampling Activities

Historical Sampling Station

- HC-SS-47 Whatcom Waterway Sediment Grab Sample Location (Hart Crowser 1997)
- AN-SS-47 Bioassay Sample Location (Anchor Environmental 2000)
- OG-10 Surface Sediment Grab Sample Location (ThermoRetec 2001)

0 60 120
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CRETE CONSULTING, INC.

Notes

1. All proposed-pre-remedial design sample station locations are approximate and may change by up to 30 feet to avoid interfering with facility operations or to avoid debris/obstructions.
2. Locations to be determined after the dredge prism is finalized.

Port of Bellingham - I&J Waterway Site
Pre-Remedial Design Investigation Work Plan
April 8, 2020

Sediment Cleanup Unit 1
Proposed Sample Locations
Figure 4-1

Appendix A

Key Figures from the Cleanup Action Plan and Remedial Investigation and Feasibility Study

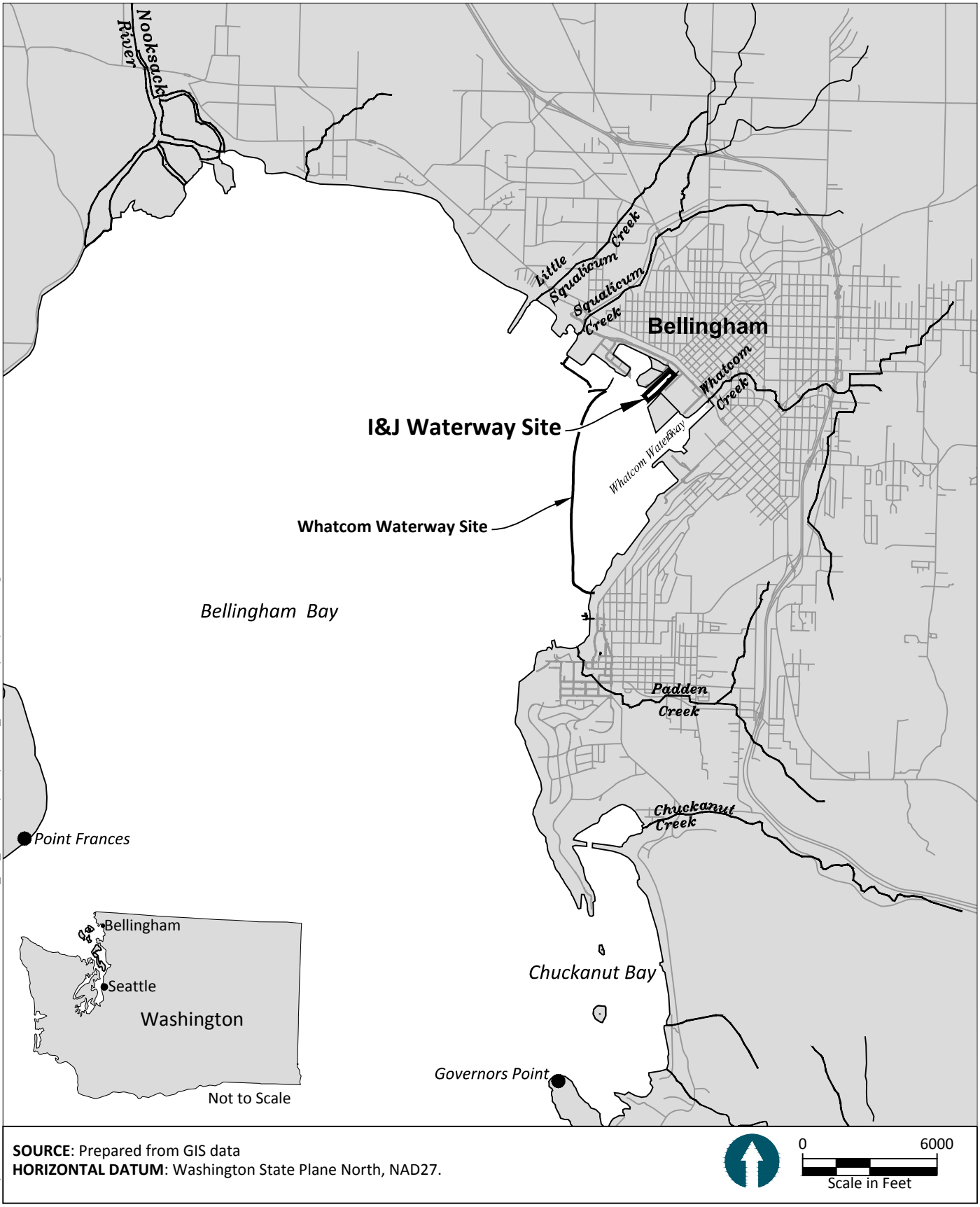

Figure 1-1
Site Location
Cleanup Action Plan
I&J Waterway Site
Port of Bellingham

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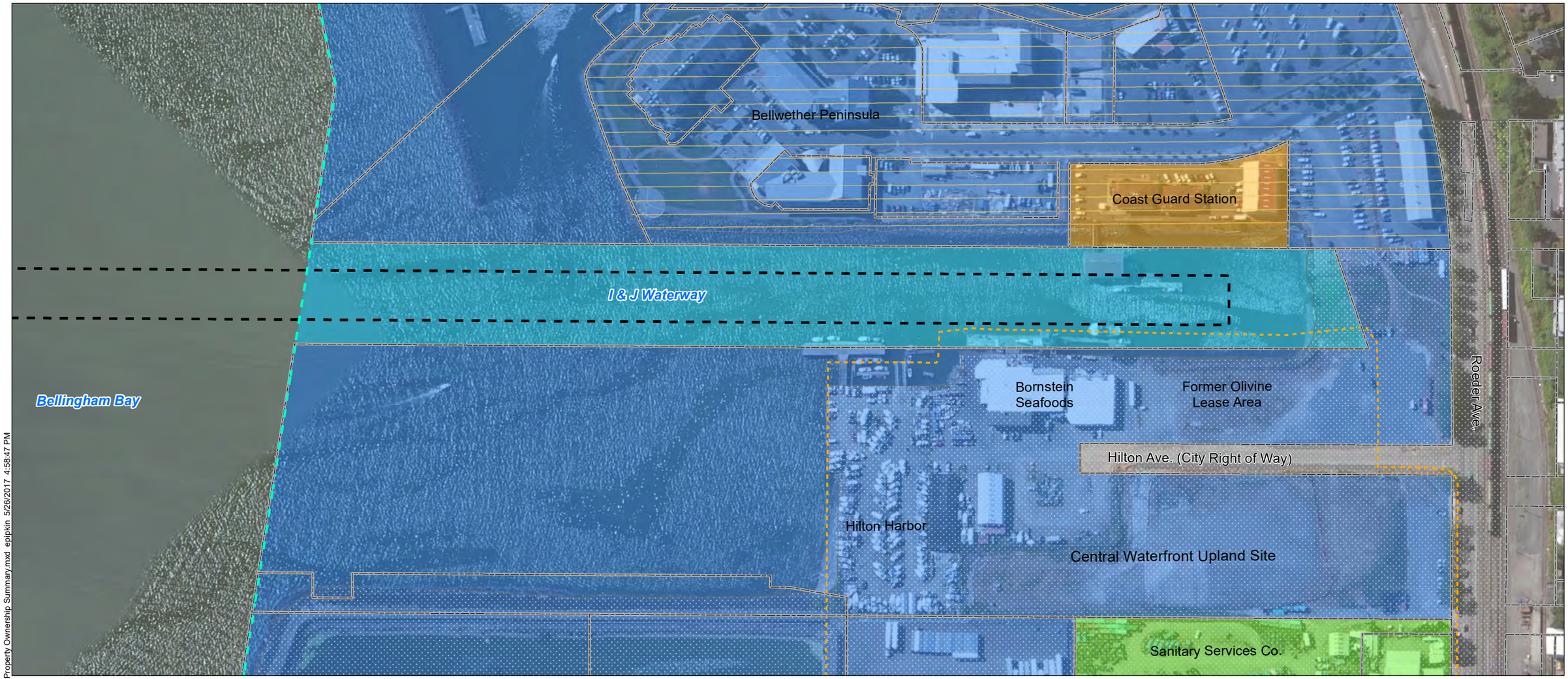
State of Washington



Q:\Jobs\090007-01_I_and_J_Waterway\Maps\2017_05\Property Ownership Summary.mxd epipkin 5/26/2017 4:58:47 PM

LEGEND

- Inner Harbor Line
- Federal Navigation Channel (Authorized to -18 Feet MLLW)
- Whatcom County Tax Parcel

Parcel Owner

- Port of Bellingham
- Sanitary Services Co.
- USA
- State Owned
- Central Waterfront Site Boundary

Zoning Designation

- Commercial, Mixed/Planned
- Waterfront District Urban Village

Feet
0 100 200 300 400

NOTES:
1. Parcels data approximated from Whatcom County parcel data and Port of Bellingham site figures.
2. Harbor line provided by Washington Department of Natural Resources.
3. Land use adjacent to south shoreline zoned Industrial/Mixed Use.

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Figure 1-2
Summary of Property Ownership and Land Use
Cleanup Action Plan
I&J Waterway Site
Port of Bellingham

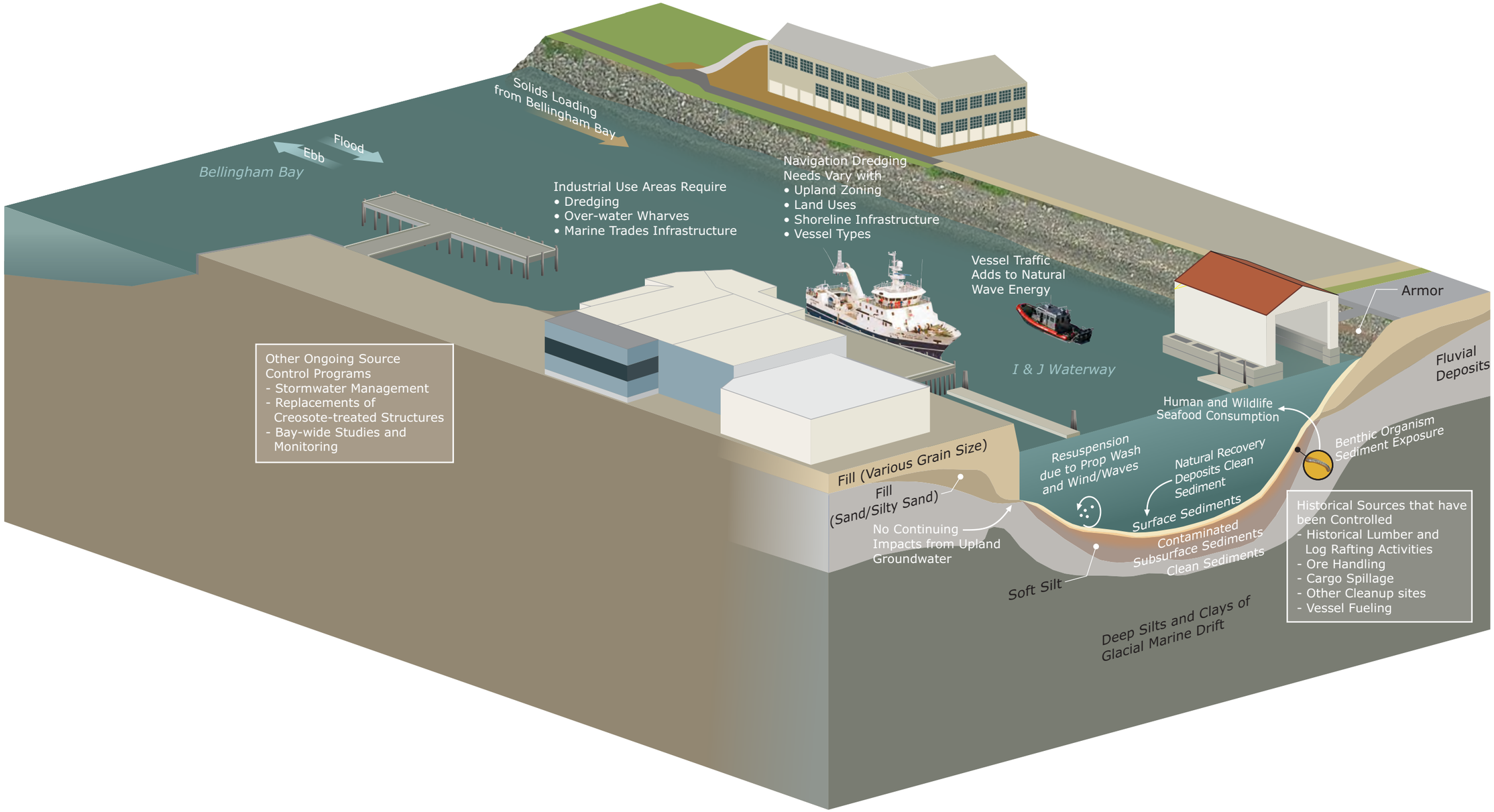

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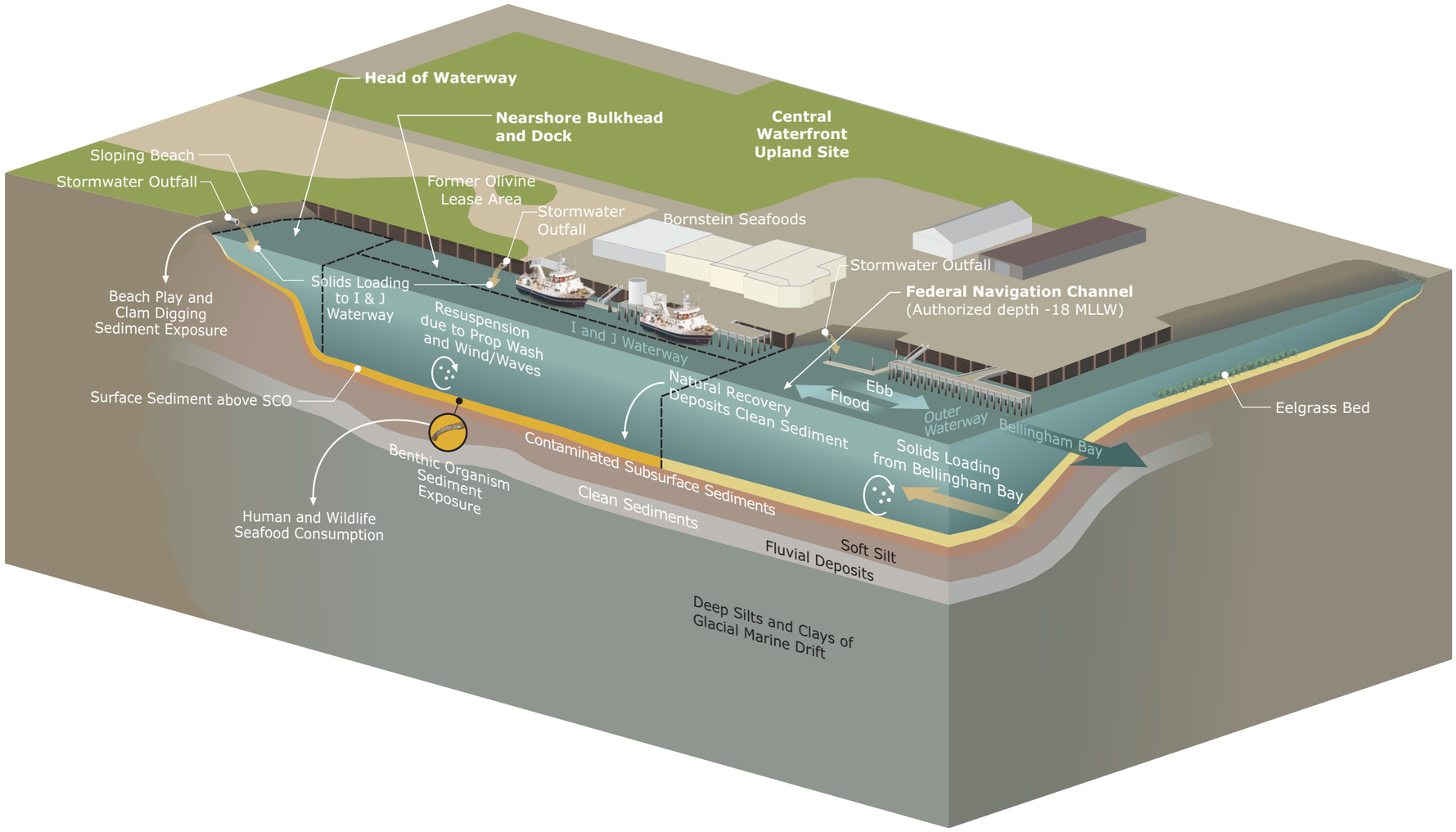
Figure 2-1
Conceptual Site Model - Part 1 of 2
Waterway Conceptual Cross Section and Northern Shoreline
Cleanup Action Plan
I & J Waterway Site
Port of Bellingham



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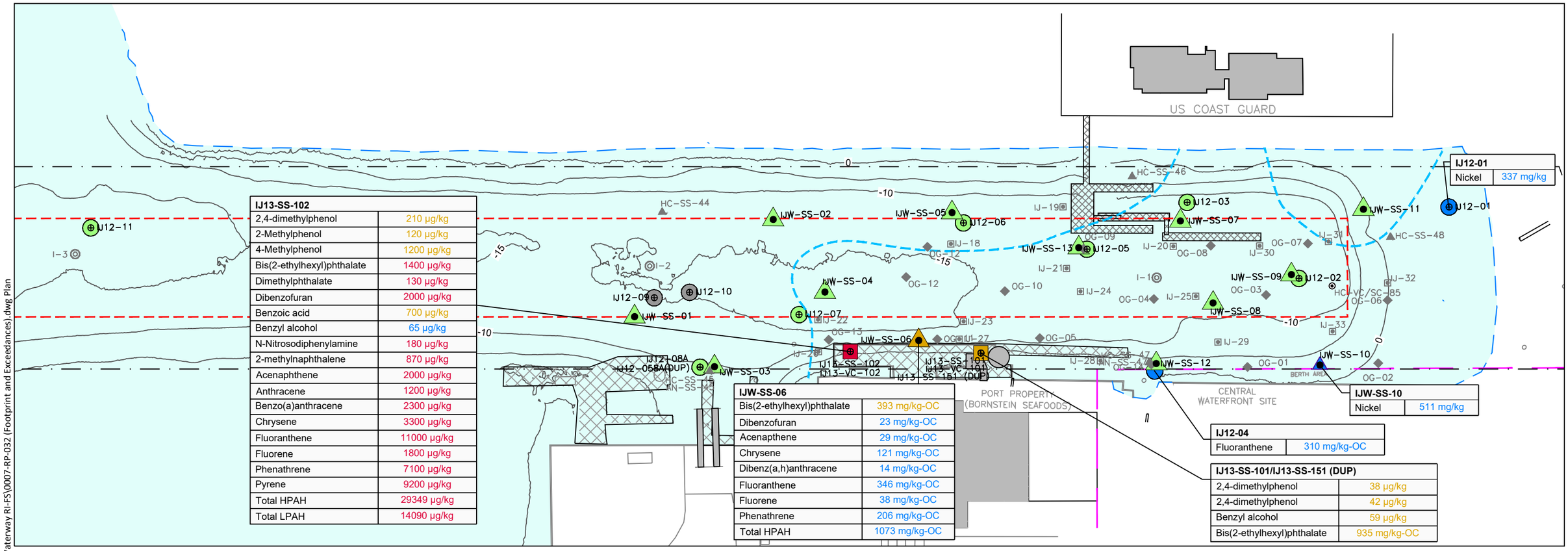
DEPARTMENT OF ECOLOGY
State of Washington

Figure 2-2
Conceptual Site Model - Part 2 of 2
Waterway Conceptual Cross Section and Southern Shoreline
Cleanup Action Plan
I & J Waterway Site
Port of Bellingham



IJ13-SS-102	
2,4-dimethylphenol	210 µg/kg
2-Methylphenol	120 µg/kg
4-Methylphenol	1200 µg/kg
Bis(2-ethylhexyl)phthalate	1400 µg/kg
Dimethylphthalate	130 µg/kg
Dibenzofuran	2000 µg/kg
Benzoic acid	700 µg/kg
Benzyl alcohol	65 µg/kg
N-Nitrosodiphenylamine	180 µg/kg
2-methylnaphthalene	870 µg/kg
Acenaphthene	2000 µg/kg
Anthracene	1200 µg/kg
Benzo(a)anthracene	2300 µg/kg
Chrysene	3300 µg/kg
Fluoranthene	11000 µg/kg
Fluorene	1800 µg/kg
Phenathrene	7100 µg/kg
Pyrene	9200 µg/kg
Total HPAH	29349 µg/kg
Total LPAH	14090 µg/kg

IJW-SS-06	
Bis(2-ethylhexyl)phthalate	393 mg/kg-OC
Dibenzofuran	23 mg/kg-OC
Acenapthene	29 mg/kg-OC
Chrysene	121 mg/kg-OC
Dibenz(a,h)anthracene	14 mg/kg-OC
Fluoranthene	346 mg/kg-OC
Fluorene	38 mg/kg-OC
Phenathrene	206 mg/kg-OC
Total HPAH	1073 mg/kg-OC

IJ12-01	
Nickel	337 mg/kg

IJW-SS-10	
Nickel	511 mg/kg

IJ12-04	
Fluoranthene	310 mg/kg-OC

IJ13-SS-101/IJ13-SS-151 (DUP)	
2,4-dimethylphenol	38 µg/kg
2,4-dimethylphenol	42 µg/kg
Benzyl alcohol	59 µg/kg
Bis(2-ethylhexyl)phthalate	935 mg/kg-OC

LEGEND:

- Docks or Piers (Over Water Structures)
- Existing Structures
- Existing Shoreline
- -10 Bathymetric Contour (5-foot interval)
- Central Waterfront Site Boundary
- I & J Waterway Boundary
- Federal Channel Boundary
- Area Above Benthic Biological Criteria (See Figure 2-4)

2012/2013 RI/FS and Historic Sediment Sampling Station

- HC-SS-47 Whatcom Waterway Sediment Grab Sample Location (Hart Crowser 1997)
- HC-VC/SC-85 Whatcom Waterway Sediment Core Location (Hart Crowser 1997)
- AN-SS-47 Bioassay Sample Location (Anchor 2000)
- OG-10 Surface Sediment Grab Sample Location (ThermoRetec 2001)
- IJ-28 Subsurface DMMP Composite Sample Location (RETEC 2006)
- IJW-SS-02 Surface Sample Location (RETEC 2006)
- I-2 Subsurface Sample Location (USACE 2011)
- IJ12-10 Surface Sediment Sample Location (Anchor QEA 2013)

Benthic Chemical Criteria

2005/2006	2012	2013	
			No Exceedances
			SCO Exceedances
			CSL Exceedances
			LAET Exceedances
			Archived

0 100
Scale in Feet

HORIZONTAL DATUM: Washington State Plane North, NAD83.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

NOTES:
1. CSL = Cleanup Screening Level.
2. LAET = Lowest Apparent Effect Threshold
3. SCO = Sediment Cleanup Objective.
4. cPAH concentrations are shown on Figure 2-5.
5. Bathymetric survey from eTrac dated April 5, 2012.

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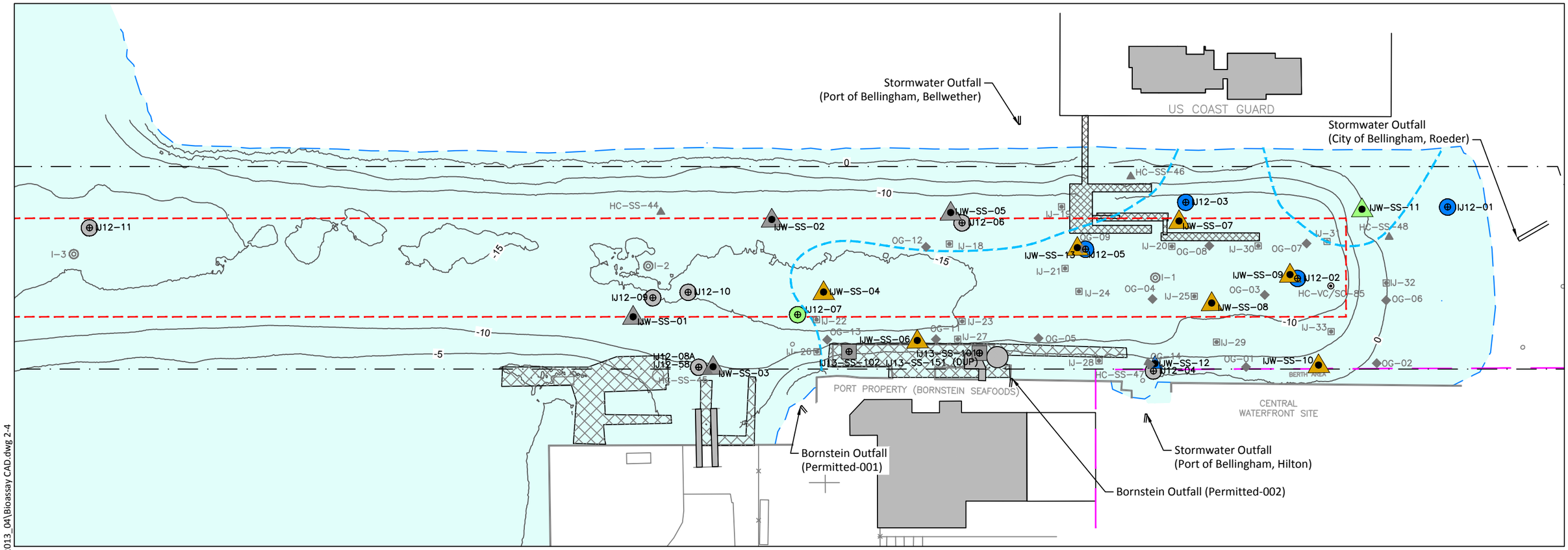
State of Washington

Figure 2-3
Surface Sediment Chemical Exceedances
Cleanup Action Plan
I&J Waterway Site
Port of Bellingham



LEGEND:

- Docks or Piers (Over Water Structures)
- Existing Structures
- Existing Shoreline
- -10 Bathymetric Contour (5-foot interval)
- Central Waterfront Site Boundary
- I&J Waterway Boundary
- Federal Channel Boundary
- Area Above Benthic Biological Criteria

RI/FS and Historic Sediment Sampling Station

- HC-SS-47 ▲ Whatcom Waterway Sediment Grab Sample Location (Hart Crowser 1997)
- HC-VC/SC-85 ⊙ Whatcom Waterway Sediment Core (Hart Crowser 1997)
- AN-SS-47 ▲ Bioassay Sample Location (Anchor 2000)
- OG-10 ◆ Surface Sediment Grab Sample Location (ThermoRetec 2001)
- IJ-28 ▣ Subsurface DMMP Composite Sample Location (RETEC 2006)
- IJW-SS-02 ● Surface Sample Location (RETEC 2006)
- I-2 ◎ Subsurface Sample Location (USACE 2011)
- IJ12-10 ⊕ Surface Sediment Sample Location (Anchor QEA 2013)

Biological Effects Criteria

2005/2006	2012	2013	
▲	●		No Exceedances
▲	●		SCO Exceedances
▲	●		CSL Exceedances
▲	●	■	Not Tested

0 100
Scale in Feet

HORIZONTAL DATUM: Washington State Plane North, NAD83.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

NOTES:
1. CSL = Cleanup Screening Level.
2. SCO = Sediment Cleanup Objective.
3. Samples were compared to Carr Inlet reference CR-023.
4. IJ12-08A is IJ12-08 alternative sample location.
5. Bathymetric survey from eTrac dated April 5, 2012.

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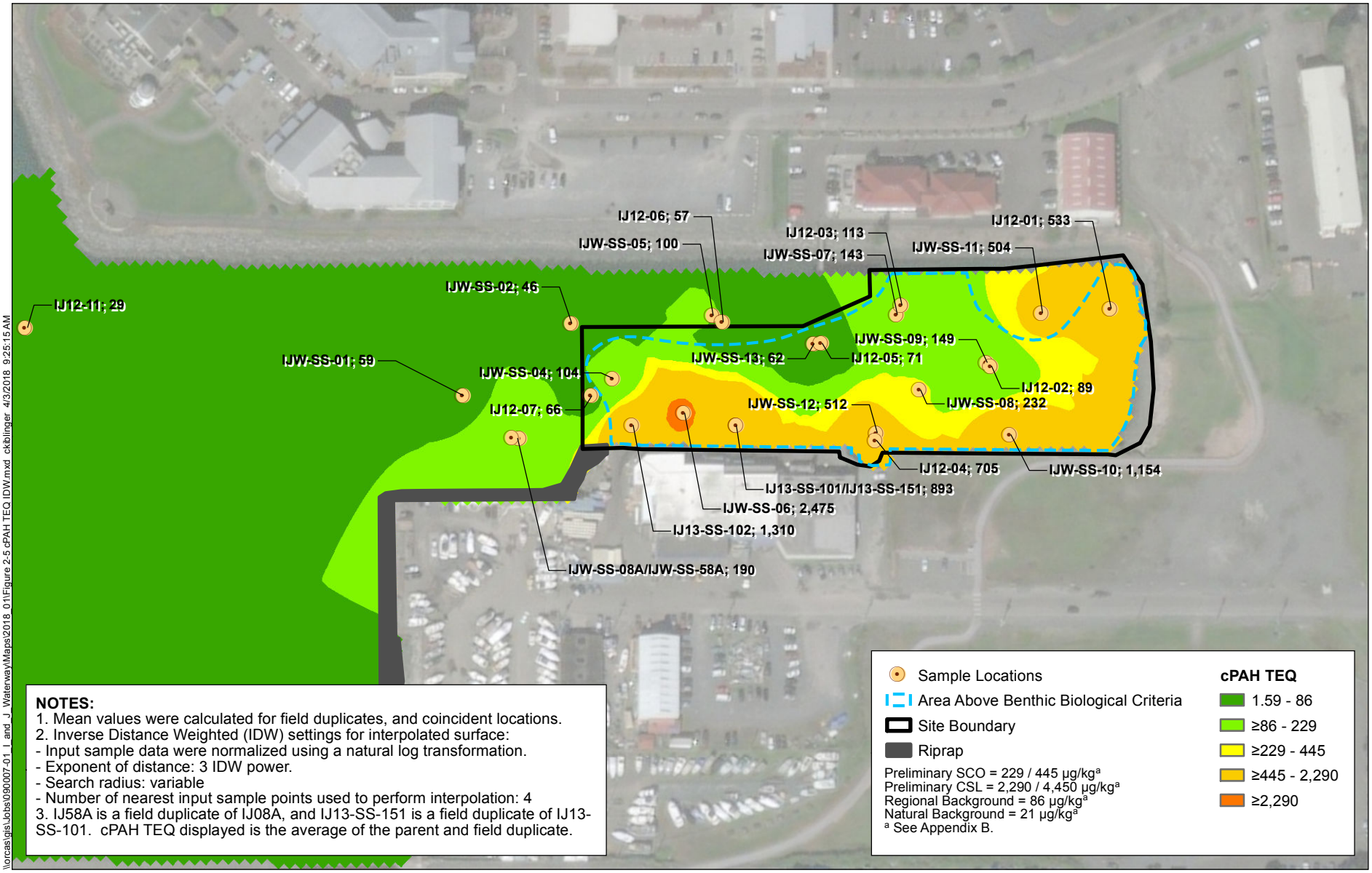
DEPARTMENT OF ECOLOGY
State of Washington

Figure 2-4
Surface Sediment Biological Exceedances
Cleanup Action Plan
I&J Waterway Site
Port of Bellingham



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State of Washington

Figure 2-5
Surface Sediment Human and Ecological Health Exceedances
Interpolated Surface Sediment cPAH TEQ Concentrations
Cleanup Action Plan
I&J Waterway Site
Port of Bellingham

Appendix B

Inadvertent Discovery Plan

Cultural Resource Consultants

MIDP 1908I-2

DATE: April 6, 2020

TO: Jamie Stevens
Crete Consulting

FROM: Margaret Berger, Principal Investigator

RE: Archaeological Monitoring and Inadvertent Discovery Plan for the I & J Waterway Cleanup Site Project, Bellingham, Whatcom County, Washington

DAHP Project: 2018-11-08882 ECY

The attached short report form constitutes our archaeological monitoring and inadvertent plan for the above referenced project. Preliminary background research did not identify any previously recorded archaeological sites within the project location but identified one historic dock determined not eligible for listing on historic registers. No further work is required for the dock. Please contact our office should you have any questions about our findings and/or recommendations.

PO BOX 4159, SEATTLE, WA 98194
PHONE 206 855-9020 - info@crcwa.com

CULTURAL RESOURCES REPORT COVER SHEET

Author: Sonja Kleinschmidt

Title of Report: Archaeological Monitoring and Inadvertent Discovery Plan for the I & J Waterway Cleanup Site Project, Bellingham, Whatcom County, Washington

Date of Report: April 6, 2020

County(ies): Whatcom Section: 25 Township: 38 N Range: 02 E

Quad: Bellingham North, WA Acres: 3.1

PDF of report submitted (REQUIRED) ☐ Yes

Historic Property Inventory Forms to be Approved Online? ☐ Yes ☒ No

Archaeological Site(s)/Isolate(s) Found or Amended? ☐ Yes ☒ No

TCP(s) found? ☐ Yes ☒ No

Replace a draft? ☐ Yes ☒ No

Satisfy a DAHP Archaeological Excavation Permit requirement? ☐ Yes # ☒ No

Were Human Remains Found? ☐ Yes DAHP Case # ☒ No

DAHP Archaeological Site #:

- Submission of PDFs is required.
- Please be sure that any PDF submitted to DAHP has its cover sheet, figures, graphics, appendices, attachments, correspondence, etc., compiled into one single PDF file.
- Please check that the PDF displays correctly when opened.

Archaeological Monitoring and Inadvertent Discovery Plan for the I & J Waterway Cleanup Site Project, Bellingham, Whatcom County, Washington

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Management Summary

This report describes the Archaeological Monitoring and Inadvertent Discovery Plan for the I & J Waterway Cleanup Site Project, Bellingham, Whatcom County, Washington. This project entails remedial in-water and upland soil borings which may be advanced to 60 feet below surface and dredging of 18,000 cubic yards of contaminated sediment at the I & J Waterway Cleanup Site. Cursory background research conducted by Cultural Resource Consultants, LLC (CRC) did not result in the identification of previously recorded archaeological sites within the project location. However, a dock (Property ID: 717568) has been recorded in the project location but was determined not eligible for listing on historic registers and requires no further work. Based on review of available project information, the proposed project actions have a low probability to encounter precontact deposits and a low probability to encounter significant (i.e. intact) historic era deposits. In addition, a majority of ground disturbing activities will be within fill material and marine sediments submerged in Bellingham Bay. An archaeological monitoring plan is outlined, and an WA Department of Ecology compliant inadvertent discovery protocol is provided.

1.0 Administrative Data

1.1 Overview

Report Title: Archaeological Monitoring and Inadvertent Discovery Plan for the I & J Waterway Cleanup Site Project, Bellingham, Whatcom County, Washington

Author (s): Sonja Kleinschmidt

Report Date: April 6, 2020

Location: This project is located in the I & J Waterway in Bellingham Bay, between Hilton Avenue and Bellwether Way, Whatcom County, Washington.

Legal Description: The legal description for the project is Section 25, Township 38 North, Range 02 East, W.M.

USGS 7.5' Topographic Map(s): Bellingham North, WA (Figure 1).

Total Area Involved: 3.1 acres.

1.2 Research Design

CRC's work was intended, in part, to assist in addressing state regulations pertaining to the identification and protection of cultural resources (e.g., RCW 27.44, RCW 27.53). The Archaeological Sites and Resources Act (RCW 27.53) prohibits knowingly disturbing archaeological sites without a permit from the Department of Archaeology and Historic Preservation (DAHP), the Indian Graves and Records Act (RCW 27.44) prohibits knowingly disturbing Native American or historic graves. This project is subject to permitting under the State Environmental Policy Act (SEPA), which requires that impacts to cultural resources be considered during the public environmental review process. Under SEPA, the DAHP is the sole agency with technical expertise in regard to cultural resources and provides formal opinions to

local governments and other state agencies on a site's significance and the impact of proposed projects upon such sites.

CRC's review consisted of available project information and correspondence provided by the project proponent, local environmental and cultural information, and historical maps. This assessment utilized a research design that considered previous studies, the magnitude and nature of the undertaking, the nature and extent of potential effects on historic properties, and the likely nature and location of historic properties within the project, as well as other applicable laws, standards, and guidelines (per 36CFR800.4 (b)(1)) (DAHP 2019a).

1.3 Project Description

The WA Department of Ecology has prepared a cleanup action plan to address contamination at the I & J Waterway. Pre-remedial work includes the advancement of soils borings to a depth of 60 feet below surface. The remediation plan includes:

- Dredging about 18,000 cubic yards of contaminated sediment with disposal at a permitted landfill. The sediment removal requires replacement of the existing dock and bulkhead.
- Capping a 0.7-acre area of contaminated sediment with clean material to isolate the sediment.
- Monitoring a 1.1-acre area where clean material from the Nooksack River is naturally capping contaminated sediment. This will verify that contaminant levels continue to decrease.
- Monitoring following construction to ensure that cleanup activities addressed the contamination.
- Restricting activities on about 2 acres to prevent disturbance of the capped areas.

For purposes of this assessment, the project location for cultural resources is considered to contain the locations of all project elements as described above and as shown in Figures 1 – 4.

1.4 Anticipated Project Impacts

As part of pre-remediation efforts, soil borings are anticipated to be advanced to a maximum depth of 60 feet below surface within the project location. Remediation ground disturbance is expected to include dredging 18,000 cubic yards of contaminated sediment in the waterway/berthing area. Expected depths of dredging have yet to be determined.

1.5 Project Context

The project is located along the shoreline of Bellingham Bay northwest of the downtown of the City of Bellingham. The project can be described as a developed industrial shoreline that has been historically modified. Much of the project is located at or below sea level while the surrounding upland is 4 to 5 meters above sea level. The project is owned by the Port of Bellingham and the State of Washington.

As summarized by the WA Department of Ecology (2019), the project contains contaminated marine sediments in the waterway as well as the nearby ship-berthing areas. The contamination in the project location has resulted from industrial shoreline activities. Historically, the project and vicinity had been used for lumber mill operations from the early 1900s through 1972, as a rock-crushing plant from 1963 to 1992, a frozen food processing plant from 1946 to 1959, and a seafood processing plant since 1959.

Mapped surface geology along the shoreline portions of the project consists of Pleistocene continental glacial drift (Qgd) (WA DNR 2019). This unit is described as Pleistocene till and outwash clay, silt, sand, gravel, cobbles, and boulders deposited by or originating from continental glaciers. Variations are present within this unit and could consist of modified land or artificial fills. Sediments mapped landward of the shoreline are composed of Urban Land (USA NRCS 2019) indicating that filling has occurred.

The cadastral survey from 1860 and the coast survey from 1887 depict the project as waterward of the historic shoreline (USCG 1887; USSG 1860; Figure 5). A cursory review of historic imagery available from 1972 shows that in this year the southeastern shoreline of the project was similar to present day with two docks present (NETR 2019). The northwestern shoreline was nonexistent at this time and was characterized by water and tideflats. By 1981, the northwestern shoreline had been constructed with fill material and had the same footprint as present day though no infrastructure was visible until the 1998 imagery. The southeast shoreline remained similar to 1972 and 1981 conditions in 1998. In the 2006 imagery, the dock on the northwest shoreline is visible. Imagery from 2006 to present shows the project in the same general condition with some changes in development to the surrounding upland.

A review of the DAHP WISAARD provided information regarding the presence and nature of cultural resources recorded within one mile of the project (DAHP 2019b). No cultural resources assessments have been conducted within the project location and archaeological sites have not been recorded within the project. The Bornstein Dock (Property ID: 717568) has been recorded in the project location but was determined not eligible for listing on historic registers and requires no further work. Numerous historic register listed properties and districts have been recorded within one mile of the project and dozens of historic structures have been inventoried in one mile of the project with many determined eligible, determined not eligible, or not formally evaluated for listing on historic registers. Due to the scope and nature of the proposed project, none of these resources are anticipated to be affected. Precontact and historic era archaeological sites are present along the shoreline of Bellingham Bay and are located to the southwest and northeast of the project with all at distances over 0.30 mile away. Recorded precontact sites are typically shell midden sites (e.g., 45HW740) located along the historic shoreline. Historic era archaeological sites include the remains of landfills (e.g., 45WH929), remains of maritime sites such as shipyards (e.g., 45WH757), or shoreline remains such as pilings (e.g., 45WH838).

1.6 Archaeological Expectations

1.6.1 Archaeological Predictive Model

The DAHP statewide predictive model uses environmental data about the locations of known archaeological sites to identify where previously unknown sites are more likely to be found. The model correlates locations of known archaeological data to environmental data "to determine the probability that, under a particular set of environmental conditions, another location would be expected to contain an archaeological site" (Kauhi and Markert 2009:2-3). Environmental data categories included in the model are elevation, slope, aspect, distance to water, geology, soils, and landforms. According to the model, the project location is ranked as "Survey Highly Advised: Very High Risk."

1.6.2 Archaeological Expectations

This assessment considers the implications of the predictive model coupled with an understanding of geomorphological context, local settlement patterns, and post-depositional processes to characterize the potential for archaeological deposits to be encountered. Historically, the project was located waterward of the existing shoreline. During the 1900s, successive fill episodes reclaimed the tidelands including the project location. Industrial development and later commercial development subsequently spread into the area. Historically the project was used for a variety of industrial uses from a lumber mill, a rock-crushing plant, a frozen food processing plant, and a seafood processing plant.

Recorded precontact sites in proximity to the project are located along the historic ca. 1860s shoreline, landward of the proposed project location. Archaeological deposits that may be present in the project location are anticipated to date to the historic period based on a review of locally recorded archaeological sites; however, it is not expected that significant (i.e. intact) historic deposits will be present within the project location. As discussed by previous researchers, the historic-era resources most likely to be found in the project location are types that were previously determined not to meet eligibility criteria for listing in the NRHP (Miss et al. 2010:75). These kinds of resources included:

- pilings, decking, trestle, ballast, and railroad track and ties, unless of clearly unusual construction;
- remains of infrastructure including abandoned utilities, portions of seawall, and brick or planked roadways, unless of clearly unusual construction;
- mass deposits of wood, lumber, coal, or cinders;
- loose bricks, mortar, or other architectural materials; and
- historic-period materials within unstratified dredge spoils or regraded fill that is not associated with a feature or stable surface.

Resources that could be considered to be significant would be those identified within intact strata and may consist of foundations and/or quantities of artifacts that could be linked with historic companies or individuals.

Based on review of the project location, excavation is expected to be within fill deposits of varying ages and marine sediments present below fill material. Historic materials could be identifiable within fill deposits or within the upper margins of marine sediments. Precontact materials could be present at the interface of fill and marine sediments or within the upper layers of marine sediments and would likely have been lost or discarded during resource procurement or could represent older deposits prior to the stabilization of modern sea levels. The project is anticipated to have a low potential to contain precontact deposits and a low potential to contain historic era deposits. As such, it is not anticipated that projects actions will have an impact on potentially significant (i.e. intact) archaeological deposits.

2.0 Archaeological Resources Monitoring Protocols

2.1 Archaeological Team Qualifications and Structure

The Project Archaeologist will oversee the implementation of the Monitoring and Inadvertent Discovery Plan (MIDP) and day-to-day operations of archaeological monitoring. Archaeological Monitors will be overseen by the Project Archaeologist who meets the National Park Service, Department of the Interior qualifications for professional archaeologists set forth in the Federal

Register (1983, Volume 48, No. 190:44739). All Archaeological Monitors will be capable of providing cultural resource orientation to construction personnel.

2.2 Health and Safety

The Port of Bellingham and WA Department of Ecology, or designee, will furnish a copy of the site Health and Safety Plan for review by the Project Archaeologist. All archaeological monitors will be furnished a copy of the HASP for review. Port of Bellingham and WA Department of Ecology, or its designee, will provide all necessary and appropriate orientation and training regarding site-specific safety procedures and hazards. Archaeological Monitors will abide by OSHA regulations and all additional site safety requirements at all times. Only HAZWOPER-certified archaeological staff will be permitted to work in areas where there is a probability for or verified the presence of hazardous waste. If archaeological resources are found in association with hazardous waste, HAZWOPER-certified archaeological staff will make a decision regarding the extent of examination feasible and warranted for evaluation of the resource. Safety concerns will take precedence at all times during the monitoring process.

2.3 Archaeological Monitoring

Archaeological monitoring will be conducted according to one of two approaches – On-Site or On-Call. Areas to be monitored will be verified on final construction plans by the Project Archaeologist. If new work elements are added to the project, these will be assessed for their potential for encountering cultural resources prior to implementation. Archaeological monitoring approaches may be revised during the duration of the project (see Section 2.3.3).

2.3.1 Approaches

On-Site Monitoring

On-Site monitoring requires the Archaeological Monitor to be physically present during construction ground disturbance. Construction ground disturbance may not occur in areas/depths identified for On-Site monitoring without an Archaeological Monitoring being present.

On-Call Monitoring

An Archaeological Monitor will be available on an On-Call basis in the event that possible archaeological resources are discovered during ground disturbing activities when an archaeologist is not present. The Project Archaeologist will attempt to evaluate the discovery using available information, including verbal descriptions and photos, before a site visit is conducted.

2.3.2 General Archaeological Monitoring Techniques

Archaeological monitoring will entail having an archaeologist present during ground-disturbing activities with the potential to expose native soils, such as excavation. The goal of monitoring is to observe subsurface conditions and identify any buried precontact or historic-era archaeological materials or human remains that may be encountered. Monitoring will be performed by or under the supervision of a "professional archaeologist" (RCW 27.53.030 (8)).

The Archaeological Monitor will observe ground-disturbing activities. The Archaeological Monitor would stand in close proximity to construction equipment in order to view subsurface deposits as they are exposed and would be in close communication with equipment operators to ensure adequate opportunity for observation and documentation. The archaeologist will be

provided the opportunity to screen excavated sediments and matrix samples when this is judged useful to the identification process and it is safe to do so. If cultural materials are observed in spoils piles, it is expected that these would be removed for examination and that the opportunity to screen spoil sediments would be available. It is assumed an approximately 10 by 10 foot area will be provided for the archaeologist to conduct screening as warranted. Monitoring of construction will proceed until the specified ground-disturbing work requiring archaeological monitoring is complete or until it is determined by the Project Archaeologist, WA Department of Ecology, and Port of Bellingham, that project activities have a low probability to encounter significant cultural resources. It is not expected that monitoring will occur within sediments that have been previously excavated and observed by the Archaeological Monitor.

Detailed protocols for treatment of archaeological or human remains discoveries are included below.

Archaeological Monitors will keep a log of monitoring activities and observations (Attachment B) for each day on which monitoring is conducted. Archaeological Monitors will wear appropriate personal protection equipment (PPE) at all times, and have appropriate archaeological equipment, including camera and phone (or smartphone), shovel and trowel, ¼-inch screen, flagging/pin flags, tarp, bags, ruler/tape measure, and monitoring logs. Archaeological Monitors will have a copy of the MIDP and site Health and Safety Plan while on site.

2.3.3 Revision of Monitoring Level of Effort

Based on monitoring results, the Project Archaeologist will reevaluate the level of monitoring and recommend to the Designated Project Manager any changes in level of monitoring effort for specific locations/layers; decreases in monitoring effort will require consensus between Project Archaeologist, Designated Project Manager, Port of Bellingham, and WA Department of Ecology.

3.0 Inadvertent Discoveries and Treatment of Archaeological Resources

A WA Department of Ecology inadvertent discovery plan has been prepared for this project and is provided in this document as Attachment A and will be used in the unlikely event of a discovery.

4.0 Communications and Reporting

The following discussion outlines communication procedures to address cultural resource matters that arise during project ground disturbance and complete DAHP compliant reporting.

4.1 Pre-Construction Meeting

The Project Archaeologist or Monitoring Archaeologist will attend a pre-construction meeting with representatives of Port of Bellingham, WA Department of Ecology, contractor project managers, and construction supervisors involved in ground disturbing activities. It is anticipated that this meeting will serve to 1) review construction plans, schedules, and areas where monitoring will take place; 2) describe the role of archaeological monitoring in the construction process; and 3) identify notification procedures.

4.2 Final Construction Plan Review

Prior to construction, the Project Archaeologist will review the final construction plans to verify construction activities requiring archaeological monitoring and identify any locations of particular concern or archaeological sensitivity. If changes are required, the Project Archaeologist will consult with the Designated Project Manager, the Port of Bellingham, and WA Department of Ecology,

4.3 Pre-Construction Orientation

The Project Archaeologist or Archaeological Monitor will conduct a pre-construction cultural resources orientation for Port of Bellingham construction managers and retained subcontractor construction managers and personnel. The purpose of the orientation will be to discuss cultural resources protocols set forth in the monitoring and inadvertent discovery protocol and to establish working communications between project personnel.

4.4 On-Going Communication

The Project Archaeologist will remain in regular communication with the Designated Project Manager and construction personnel during the monitoring process in person or by email and phone. The Designated Project Manager (or designee) will provide current project schedules and plans to the Project Archaeologist as they are updated. When on-site, Archaeological Monitors will communicate with the Designated Project Manager to make general requests about equipment movement, placement of spoils for examination, access to exposures, and temporary halts in excavation to examine potential archaeological resources.

4.5 Weekly Progress Summaries

The Project Archaeologist will email a progress summary of monitoring activities to the Designated Project Manager and all consulting parties each week monitoring occurs. The summary will be based upon the daily log of activities and finds submitted by Archaeological Monitors.

4.6 Monitoring Report

Daily archaeological monitoring logs will be completed each day monitoring is provided. Logs will include the date, name of archaeological monitor, weather/visibility conditions, components of the project monitored, a survey narrative, and figures and tables describing the observed sediments and, if identified, cultural materials or deposits. Upon completion of the project, monitoring results will be summarized in a report and provided to the Project Prime. Following review, the report will be submitted to the Port of Bellingham and WA Department of Ecology, who will submit the report to DAHP. The report will provide a summary of the results of monitoring, illustrated with maps, drawings, and photographs as appropriate with the daily logs appearing as an appendix. The Designated Project Manager will provide due dates for the draft and final technical memorandums, inclusive of one round of consolidated comments.

4.7 Dissemination of Communications

The Designated Project Manager will keep all other consulting parties informed, as appropriate. Consultation among the Port of Bellingham, WA Department of Ecology, State Historic Preservation Officer (SHPO), Tribal Governments, and other entities will be initiated under the circumstances previously noted concerning the discovery of burials or sites that are potentially eligible for inclusion in the NRHP. All consultation will be accomplished in a manner consistent

with the guidance in 36 CFR Part 800. The Project Archaeologist will be informed of decisions made during the consulting process.

5.0 Archaeological Resources Collection and Curation

Archaeological resources (i.e., artifacts, features, and environmental indicators of cultural presence) encountered during monitoring will be recorded on field forms. Artifacts, feature samples, and environmental samples will be collected and retained at the construction site in a secure on-site location (e.g., locking file cabinet). At the completion of monitoring, resources considered not eligible for listing on the NRHP will be disposed on-site by the Project Archaeologist. The disposition, including curation, of resources that are eligible or potentially eligible for listing on the NRHP will be determined by WA Department of Ecology in consultation with DAHP and other consulting parties.

6.0 Limitations of this Assessment

No cultural resources study can wholly eliminate uncertainty regarding the potential for prehistoric sites, historic properties or traditional cultural properties to be associated with a project. The information presented in this report is based on professional opinions derived from our analysis and interpretation of available documents, records, literature, and information identified in this report, and on our field investigation and observations as described herein. Conclusions and recommendations presented apply to project conditions existing at the time of our study and those reasonably foreseeable. The data, conclusions, and interpretations in this report should not be construed as a warranty of subsurface conditions described in this report. They cannot necessarily apply to site changes of which CRC is not aware and has not had the opportunity to evaluate.

7.0 References

Kauhi, T. C., and J. Markert
2009 Washington Statewide Archaeology Predictive Model. GeoEngineers. Submitted to DAHP, Olympia.

Miss, C. J., L. Hudson, S. A. Boswell, and R. M. Weaver
2010 SR 99: Alaskan Way Viaduct Moving Forward Projects Archaeological Treatment Plan: South Holgate Street to South King Street. Prepared for Washington State Department of Transportation, Olympia, WA. Prepared by Northwest Archaeological Associates, Inc., and Environmental History Company, Seattle, WA

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2019 Historic Aerials. Electronic Resource, http://www.historicaerials.com/?javascript, accessed September 9, 2019.

United States Coast Geodetic Survey
1887 Sheet No. 9 Topography of Rosario Strait W. T. Part of Bellingham Bay. Register No. 1798.

United States Department of Agriculture Natural Resources Conservation Service (USDA NRCS)
2019 Web Soil Survey, Washington. Electronic resource, http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx, accessed September 9, 2019.

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1860 General Land Office Cadastral Survey Plat Map, Township 38 North, Range 02 East, Willamette Meridian.

Washington State Department of Archaeology and Historic Preservation (DAHP)
2019a Washington State Standards for Cultural Resources Reporting 2018. On file at DAHP, Olympia.
2019b Washington Information System for Architectural and Archaeological Records Data (WISAARD) database. Electronic resource, https://secureaccess.wa.gov/dahp/wisaard/, accessed September 9, 2019.

Washington State (WA) Department of Ecology
2019 I & J Waterway. Electronic document, https://apps.ecology.wa.gov/gsp/Sitepage.aspx?csid=2012, accessed September 9, 2019.

Washington State Department of Natural Resources (WA DNR)
2019 Washington Interactive Geologic Map. Division of Geology and Earth Resources – Washington's Geological Survey. Electronic resource, https://geologyportal.dnr.wa.gov/, accessed September 9, 2019.

8.0 Figures and Tables

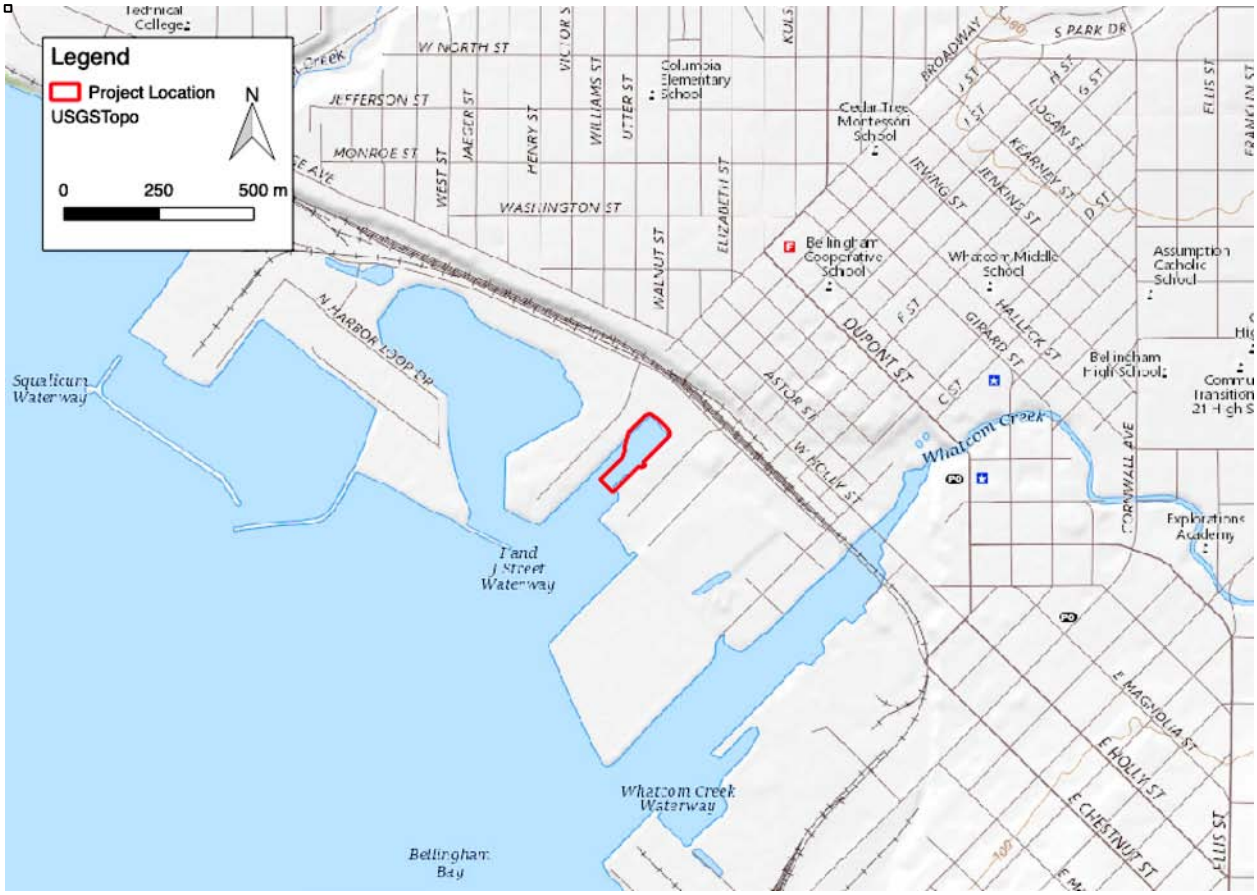

Figure 1. USGS Bellingham North, WA 7.5-minute quadrangle annotated with the location of the project in red.

Figure 2. Satellite imagery annotated with the project location in red.

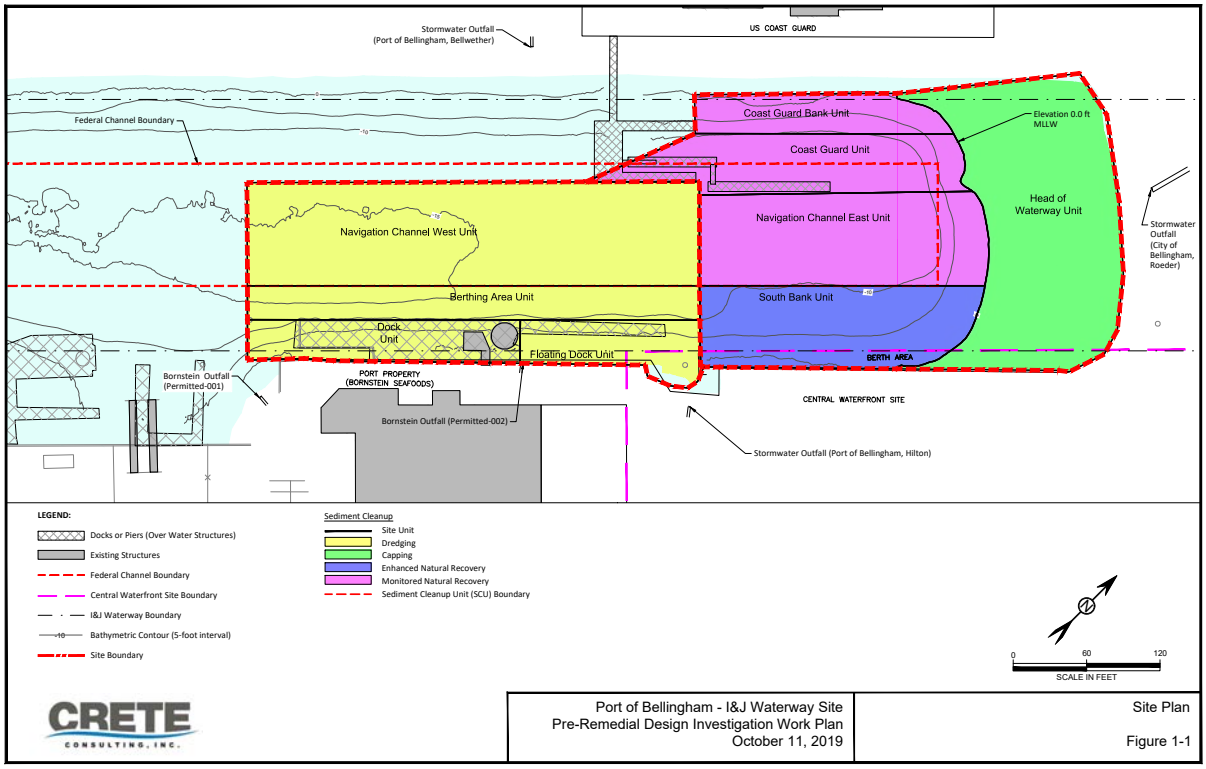

Figure 3. Project plans provided by Crete Consulting, Inc. depicting the types and extents of sediment cleanup. As shown on the plans, dredging will occur in the deepest portion of the project.

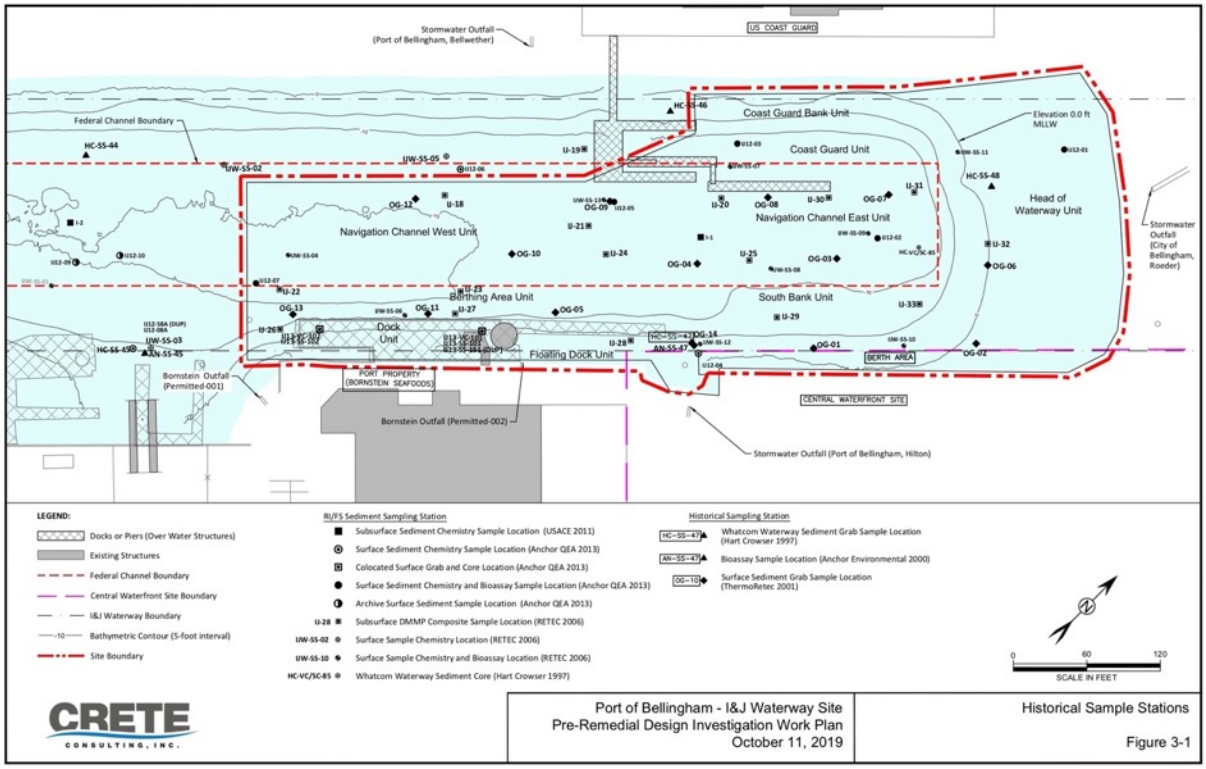

Figure 4. Project plans provided by Crete Consulting, Inc. depicting the locations of the proposed borings.

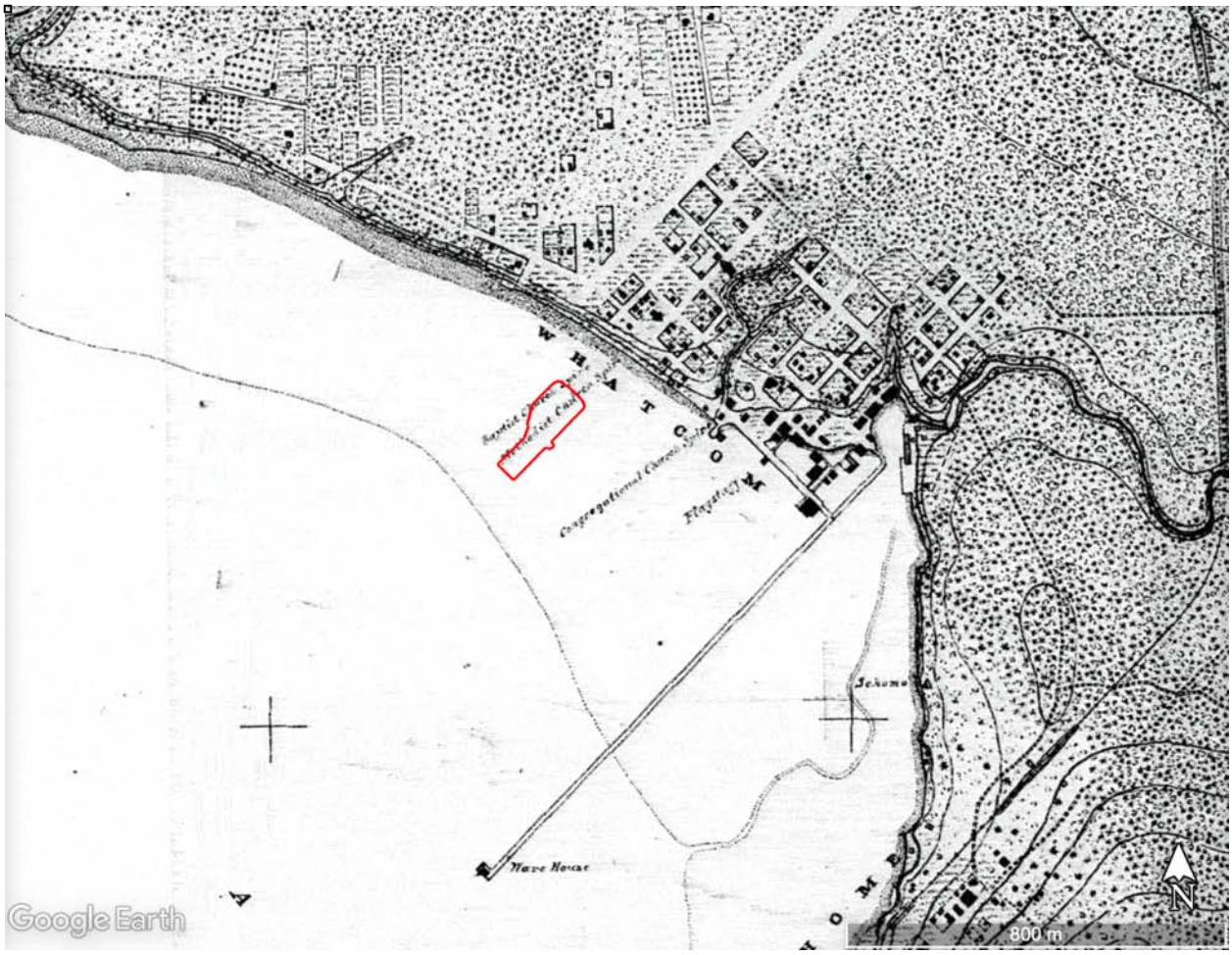

Figure 5. U.S. Coast Geodetic Survey map from 1887 depicting the project in Bellingham Bay.

Attachment A. Inadvertent Discovery Protocol.

PLAN AND PROCEDURES FOR THE UNANTICIPATED DISCOVERY OF CULTURAL RESOURCES AND HUMAN SKELETAL REMAINS[1]

PROJECT TITLE: I & J Waterway Cleanup Site

COUNTY WASHINGTON: Bellingham, Whatcom County, WA

Section, Township, Range: S 25, T 38 N, R 02 E

1. INTRODUCTION

The following Inadvertent Discovery Plan (IDP) outlines procedures to perform in the event of discovering archaeological materials or human remains, in accordance with state and federal laws.

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.

When in doubt, assume the material is a cultural resource.

3. ON-SITE RESPONSIBILITIES

STEP 1: *Stop Work*. If any employee, contractor or subcontractor believes that he or she has uncovered a cultural resource at any point in the project, all work must stop immediately. Notify the appropriate party(s). Leave the surrounding area untouched, and provide a demarcation adequate to provide the total security, protection, and integrity of the discovery. The discovery location must be secured at all times by a temporary fence or other onsite security.

STEP 2: *Notify Archaeological Monitor or Licensed Archaeologist*. If there is an Archaeological Monitor for the project, notify that person. If there is a monitoring plan in place, the monitor will follow the outlined procedure.

STEP 3: *Notify the Project Manager* of this project and contact the Ecology Staff Project Manager, or other applicable contacts:

Project Manager: Crete Consulting Name: Jamie Stevens, PE Phone: 206-799-2744 Email: jamie.stevens@creteconsulting.com	Ecology Staff Project Manager Name: Lucy McInerney Phone:425-649-7272 Email:lucy.mcinerney@ecy.wa.gov

Assigned Alternates:

Assigned Project Manager Alternate: Name: Phone: Email:	Ecology Cultural Resource Specialist (Alternate): Name: Phone: email:

The Project Manager or applicable staff will make all calls and necessary notifications. **If human 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 unless directed to do so by DAHP. See Section 5.**

4. FURTHER CONTACTS AND CONSULTATION

A. **Project Manager's Responsibilities**:

- *Protect Find*: The Project Manager is responsible for taking appropriate steps to protect the discovery site. All work will stop immediately in a surrounding area adequate to provide for the complete security of location, protection, and integrity of the resource. Vehicles, equipment, and unauthorized personnel will not be permitted to traverse the discovery site. Work in the immediate area will not resume until treatment of the discovery has been completed following provisions for treating archaeological/cultural material as set forth in this document.
- *Direct Construction Elsewhere on-Site*: The Project Manager may direct construction away from cultural resources to work in other areas prior to contacting the concerned parties.
- *Contact Senior Staff*: If the Senior Staff person has not yet been contacted, the Project Manager must do so.

B. **Senior Staff Responsibilities**:

- *Identify Find*: The Senior Staff (or a delegated Cultural Resource Specialist), will ensure that a qualified professional archaeologist examines the area to determine if there is an archaeological find.
    - If it is determined not to be of archaeological, historical, or human remains, work may proceed with no further delay.
    - If it is determined to be an archaeological find, the Senior Staff or Cultural Resource Specialist will continue with all notifications.

- If the find may be human remains or funerary objects, the Senior Staff or Cultural Resource Specialist will ensure that a qualified physical anthropologist examines the find. **If it is determined to be human remains, the procedure described in Section 5 will be followed.**

- *Notify DAHP*: The Senior Staff (or a delegated Cultural Resource Specialist) will contact the involved federal agencies (if any) and the Washington Department of Archaeology and Historic Preservation (DAHP).

- *Notify Tribes*: If the discovery may be of interest to Native American Tribes, the DAHP and Ecology Supervisor or Coordinator will coordinate with the interested and/or affected tribes.

General Contacts

Federal Agencies:	**State Agencies**:
Agency: Name Title Number Email	Agency: Name Title Number Email

Department of Archaeology and Historic Preservation:

Dr. Allyson Brooks State Historic Preservation Officer 360-586-3066 Assigned Alternate:	Rob Whitlam, Ph.D. Staff Archaeologist 360-586-3080 Assigned Alternate:

The DAHP or appropriate Ecology Staff will contact the interested and affected Tribes for a specific project.

Tribes consulted on this project are:

Lummi Nation	Upper Skagit Tribe
Lena Tso	Scott Schuyler
THPO	Cultural Resources
360-312-2257	360-854-7009
lenat@lummi-nsn.gov	sschuyler@upperskagit.com
Swinomish Indian Tribal Community	Nooksack Tribe
Larry Campbell	Trevor Delgado
THPO	THPO
360-466-7314	360-592-5176 ext. 3234

lcampbell@swinomish.nsn.us	tdelgado@nooksack-nsn.gov

Further Activities

- Archaeological discoveries will be documented as described in Section 6.
- Construction in the discovery area may resume as described in Section 7.

5. SPECIAL PROCEDURES FOR THE DISCOVERY OF HUMAN SKELETAL MATERIAL

Any human skeletal remains, regardless of antiquity or ethnic origin, will at all times be treated with dignity and respect. Do not take photographs by any means, unless you are pre-approved to do so.
If the project occurs on federal lands or receives federal funding (e.g., national forest or park, military reservation) the provisions of the Native American Graves Protection and Repatriation Act of 1990 apply, and the responsible federal agency will follow its provisions. Note that state highways that cross federal lands are on an easement and are not owned by the state.

If the project occurs on non-federal lands, the Project Manager will comply with applicable state and federal laws, and the following procedure:

A. **In all cases you must notify a law enforcement agency or Medical Examiner/Coroner's Office**:

In addition to the actions described in Sections 3 and 4, the Project Manager will immediately notify the local law enforcement agency or medical examiner/coroner's office.

The Medical Examiner/Coroner (with assistance of law enforcement personnel) will determine if the remains are human, whether the discovery site constitutes a crime scene, and will then notify DAHP.

Enter contact information below:

Chief David Doll, Bellingham Police Department
360-778-8800

B. **Participate in Consultation**:

Per RCW 27.44.055, RCW 68.50, and RCW 68.60, DAHP will have jurisdiction over non-forensic human remains. Ecology staff will participate in consultation.

C. **Further Activities**:

- Documentation of human skeletal remains and funerary objects will be agreed upon through the consultation process described in RCW 27.44.055, RCW 68.50, and RCW 68.60.

- When consultation and documentation activities are complete, construction in the discovery area may resume as described in Section 7.

6. DOCUMENTATION OF ARCHAEOLOGICAL MATERIALS

Archaeological deposits discovered during construction will be assumed eligible for inclusion in the National Register of Historic Places under Criterion D until a formal Determination of Eligibility is made.

Project staff will ensure the proper documentation and field assessment will be made of any discovered cultural resources in cooperation with all parties: the federal agencies (if any), DAHP, Ecology, affected tribes, and a contracted consultant (if any).

All prehistoric and historic cultural material discovered during project construction will be recorded by a professional archaeologist on a cultural resource site or isolate form 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.

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 ¼-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 the federal agencies (if any), DAHP, Ecology and the affected tribes.

Within 90 days of concluding fieldwork, a technical report describing any and all monitoring and resultant archaeological excavations will be provided to the Project Manager, who will forward the report for review and delivery to Ecology, the federal agencies (if any), DAHP, and the affected tribe(s).

If assessment activity exposes human remains (burials, isolated teeth, or bones), the process described in Section 5 will be followed.

7. PROCEEDING WITH WORK

Work outside the discovery location may continue while documentation and assessment of the cultural resources proceed. A professional archaeologist must determine the boundaries of the discovery location. In consultation with Ecology, DAHP and any affected tribes, the Project Manager will determine the appropriate level of documentation and treatment of the resource. If there is a federal nexus, Section 106 consultation and associated federal laws will make the final determinations about treatment and documentation.

Work may continue at the discovery location only after the process outlined in this plan is followed and the Project Manager, DAHP, any affected tribes, Ecology (and the federal agencies, if any) determine that compliance with state and federal law is complete.

8. RECIPIENT/PROJECT PARTNER RESPONSIBILITY

The Project Recipient/Project Partner is responsible for developing an IDP. The IDP must be immediately available onsite, be implemented to address any discovery, and be available by request by any party. The Project Manager and staff will review the IDP during a project kickoff or pre-construction meeting.

We recommend that you print images in color for accuracy.

Implement the IDP / UDP if …

You see chipped stone artifacts.

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

1

Implement the IDP / UDP 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 / UDP if …

You see bone or shell artifacts.

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

Implement the IDP / UDP if …

You see bone or shell artifacts.

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

Implement the IDP / UDP if …

You see fiber or wood artifacts.

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

Implement the IDP / UDP if …

You see historic period artifacts.

Implement the IDP / UDP 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)

Implement the IDP / UDP 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)

Implement the IDP / UDP 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

Implement the IDP / UDP if …

You see historic foundations or buried structures.

10

Attachment B. Archaeological Monitoring Form.

DAILY ARCHAEOLOGICAL MONITORING LOG
I & J WATERWAY CLEANUP SITE PROJECT
CRC PROJECT NO. 1908I

TIME AND DATE:

MONITOR:

PROJECT COMPONENT MONITORED:

GENERAL FIELD CONDITIONS:

ARCHAEOLOGY OBSERVED:

NARRATIVE:

Figure 1. Satellite imagery annotated with the testing locations.

Figure 2. Overview photograph.

Figures 3-4. Representative sediments observed.

Table 1. Depositional context observed.

Project Element	Approximate Area Involved	Location (WGS84 Zone 10 UTM coordinates, +/- 3 meters)	Stratigraphic Description (depths are feet below surface)	Archaeological Material Found

Appendix C

Quality Assurance Project Plan

Pre-Remedial Design Investigation Work Plan
Appendix C: Quality Assurance Project Plan

I&J Waterway Sediment Cleanup Site

Project Number: 036-001

Prepared for:
Port of Bellingham and
Bornstein Seafoods, Inc.

April 8, 2020

Prepared by:

CRETE
CONSULTING, INC.

Table of Contents

List of Tables

1 Introduction

This Pre-Remedial Design Investigation (PRDI) Quality Assurance Project Plan (QAPP) presents the project organization, objectives, activities, and quality assurance (QA) procedures to be implemented during data collection activities to support remedial design for the cleanup action proposed by the Washington State Department of Ecology (Ecology) for sediment cleanup unit 1 (SCU-1) at the I&J Waterway Site (Site) in Bellingham, Washington. The specific data collection activities are detailed in the PRDI Work Plan (Work Plan).

The QAPP was prepared following Ecology Guidance for Quality Assurance Project Plans (Lombard and Kirchmer 2004) and Ecology's Sediment Sampling and Analysis Plan Appendix (SAPA) guidance document (Ecology 2008). Analytical quality assurance/quality control (QA/QC) procedures were also developed based on the analytical protocols and quality assurance guidance of the Puget Sound Estuary Program (PSEP 1986; PSEP 1997a, b, and c), U.S. Environmental Protection Agency's (EPA's) Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods, 3rd Edition (EPA 1986), and the U.S. EPA Contract Laboratory Program National Functional Guidelines for Data Review (EPA 1999; EPA 2004).

1.1 Project Overview

A detailed project overview and project figure is provided in the PRDI Work Plan (CRETE 2020).

1.2 Document Organization

The remainder of this QAPP is organized into the following sections:

- Section 2 – Project Management
- Section 3 – Data Generation and Acquisition
- Section 4 – Assessments and Oversite
- Section 5 – Data Validation and Usability
- Section 6 – References

A Sampling Analysis Plan (SAP) detailing the sample collection procedures is provided in Section 4 of the PRDI Work Plan.

2 Project Management

This section identifies key project personnel, describes the rationale for conducting the monitoring studies, identifies the studies to be performed and their respective schedules, outlines project data quality objectives and criteria, lists training and certification requirements for sampling personnel, and describes documentation and record-keeping procedures.

2.1 Project Organization

This project is being led by the Port and Bornstein, under the oversight of Ecology. This QAPP includes activities conducted for the I&J Sediment Cleanup Project.

The Port Project Manager is Ben Howard and the Bornstein Project Manager is Jay Bornstein. The primary role of the Project Managers is to ensure compliance with the Agreed Order and other Ecology requirements. The Ecology Project Manager is Lucy McInerney.

The CRETE Consulting LLC (CRETE) Project Manager is Grant Hainsworth who is the direct line of communication between CRETE and the Port and Bornstein, and is responsible for implementing activities described in this QAPP. Grant will also be responsible for production of work plans, producing all project deliverables, and performing the administrative tasks needed to ensure timely and successful completion of these studies.

The organizational structure for the additional data collection activities will consist of the following key members: a Project Manager, Field Manager, Site Safety Officer, Quality Assurance Officer, and Data Validator. Additional members of the project team include, but are not limited to the laboratories, design team sub-consultants, and subcontractors. The responsibilities of project personnel are described in Table 1. In some cases one person may assume more than one role.

2.2 Project Definition and Background

The PRDI Work Plan (CRETE 2019) identified several data gaps such as base map, survey data, and geotechnical data for the I&J Sediment Cleanup project. The objectives and background information to address these needs are provided in the PRDI Work Plan.

2.3 Project Description and Schedule

Sampling activities described in the SAP will be initiated following Ecology's approval of this QAPP and as outlined in the Agreed Order. This QAPP includes work associated with the following field activities:

- Collection of Sediment Chemistry Samples
- Collection of Physical Geotechnical Samples.

2.4 Data Quality Objectives and Criteria

The overall data quality objective (DQO) for this project is to develop and implement procedures that will ensure the collection of representative data of known, acceptable, and defensible quality. The DQOs identified in this QAPP are identical to the DQOs identified in the 2003 QAPP.

2.4.1 Precision

Field precision is estimated by collecting field duplicate samples at a frequency specified in this QAPP for each matrix collected and measured. Laboratory precision and accuracy can be measured through the analysis of matrix spike/matrix spike duplicate (MS/MSD) samples, laboratory duplicate samples and/or laboratory control samples/duplicates (LCS/ LCSD). The laboratory will perform the analysis of one set of MS/MSD, LCS/LCSD and/or duplicate field samples per matrix measured at a frequency of one sample per 20 samples. Field and analytical precision will be evaluated by the relative percent difference (RPD) between field duplicate samples, laboratory duplicate samples; laboratory accuracy and precision will be determined by the spike recoveries and the RPDs of the MS/MSD and LCS/LCSD samples, respectively.

$$RPD = \frac{ABS(R1-R2)}{(R1+R2)/2} \times 100$$

Where:
R1 = Sample result or recovery for spiked compound
R2 = Duplicate sample result or recovery for spiked compound duplicate

Field chemistry duplicate precision will be screened against a RPD of 50 percent for sediment samples and 35 percent for water samples. However, no data will be qualified based solely on field homogenization duplicate precision.

2.4.2 Accuracy

Accuracy is an expression of the degree to which a measured or computed value represents the true value. Accuracy may be expressed as a percentage of the true or reference value for reference material, or as a percent recovery in those analyses where reference materials are not available and spiked samples are analyzed. The equations used to express accuracy are as follows.

1. For reference materials:

   Percent of true value = (measured value/true value) x 100

2. For spiked samples:

   Percent recovery = (SQ - NQ)/(S) x 100

SQ = quantity of spike or surrogate found in sample
NQ = quantity found in native (unspiked) sample
S = quantity of spike or surrogate added to native sample

Laboratory method reporting limits (MRL) are listed on Table 2.

2.4.3 Representativeness

Representativeness is the degree to which data from the project accurately represent a particular characteristic of the environmental matrix which is being tested. Representativeness of samples is ensured by adherence to standard field sampling protocols and standard laboratory protocols. The design of the sampling scheme and number of samples should provide a representativeness of each matrix or product of the chemical processes being sampled.

2.4.4 Comparability

Comparability expresses the confidence with which one data set can be evaluated in relation to another data set. For this investigation, comparability of data will be established through the use of program-defined general methods and reporting formats and the use of common, traceable calibration and reference materials from the National Institute of Standards and Technology or other established sources.

2.4.5 Completeness

Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected. Completeness will be calculated as follows:

Completeness =
(number of valid measurements/ total number of data points planned) x 100

Completeness will be calculated per matrix. The DQO for completeness for all components of this project is 90%. Data that have been qualified as estimated because the QC criteria were not met will be considered valid for the purpose of assessing completeness. Data that have been qualified as rejected will not be considered valid for the purpose of assessing completeness. The sediment chemical and physical testing will adhere to the most recent PSEP QA/QC procedures (PSEP 1997b) and PSEP analysis protocols.

2.5 Special Training/Certifications

Specific training requirements for performing fieldwork, which may bring employees in contact with hazardous materials, are as follows:

- All field personnel assigned to the site must have successfully completed 40 hours of training for hazardous site work in accordance with Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120(e)(3) and be current with their 8-hour refresher training in accordance with OSHA 29 CFR

1910.120(e)(8). Documentation of OSHA training is required prior to personnel being permitted to work on site.

- Personnel managing or supervising work on site will also have successfully completed 8-hours of manager/supervisor training meeting the requirements of OSHA 29 CFR1910.120(e)(4).
- Personnel assigned to the site must be enrolled in a medical surveillance program meeting the requirements of OSHA 29 CFR 1910.120(f). Personnel must have successfully passed an occupational physical during the past 12 months and be medically cleared to work on a hazardous waste site and capable of wearing appropriate personal protective equipment (PPE) and respiratory protection as may be required.
- Personnel performing the sampling work must have extensive knowledge, skill, and demonstrated experience in the execution of the sampling methods.

2.6 Documentation and Records

Field investigators (including subcontractors) will maintain field notes in a bound notebook and all documents, records, and data collected will be kept in a case file in a secure records filing area. All Laboratory deliverables (both hard copy and electronic) with verifiable supporting documentation shall be submitted by the lab to the QA Officer. The following documents will be archived at the Laboratory: 1) signed hard copies of sampling and chain-of-custody records; and 2) electronic and hard copy of analytical data including extraction and sample preparation bench sheets, raw data and reduced analytical data. The laboratory will store all laboratory documentation for sample receipt, sample login, sample extraction, cleanup and analysis and instrument output documentation per laboratory's Standard Operating Procedure (SOP) or QA Manual.

Copies of all analytical reports will be retained in the laboratory files, and at the discretion of the QA Officer, the data will be stored on computer disks for a minimum of 1 year. After one year, or whenever the data become inactive, the files will be transferred to archives in accordance with standard laboratory procedure. Data may be retrieved from archives upon request.

Copies of all sub-consultant field notes, field logs, sample collection logs, and field photographs will be sent to the Field Manager within 2 weeks of completion of the field task.

Field quality control requirement

Field quality control samples are useful in identifying problems resulting from sample collection or sample processing in the field related to analytical samples. The field QC samples to be collected include field duplicates and sampling equipment rinsate blanks.

A minimum of one duplicate sample will be collected from the material homogenized from one field sample and submitted for the same analyses as the field samples to evaluate heterogeneity attributable to sample handling. A minimum of one field duplicate will be submitted per 20 samples. The RPD for homogenate duplicate samples will be within 75% for soil/sediment and within 50% for water.

At least one equipment rinsate sample will be collected after decontamination for every 20 soil and/or sediment samples collected. Equipment rinsate blanks will be collected for each type of sampling equipment that comes into contact with sample material. Duplicate and equipment rinsate samples will be analyzed for the same constituents as the environmental samples.

3 Data Generation and Acquisition

3.1 Sample Process Design

The rationale for the sampling design and assumptions for locating and selecting environmental samples is detailed in the SAP. The methods and procedures for collection of field samples are also provided in the SAP. All sampling will be conducted following standard procedures documented in the SAP.

3.2 Analytical Sampling Methods, Handling and Custody

3.2.1 Sediment Samples

All sediment samples will be submitted for analysis described in Table 2. Select samples will also be submitted for physical testing, based on visual classification. Cores will be removed from the boat and placed in an on-site trailer for detailed core logging, which includes bulk density, moisture content, pocket penetrometer and Torvane readings, and digital photographs. All samples from these cores will be archived.

Collected samples for chemistry will be thoroughly homogenized and distributed to sample containers. Organisms and debris will be removed prior to distribution to sample containers; removed materials will be noted in the field logbooks.

All sample containers will be labeled on the outside in indelible ink with the sample identification number, date and time collected, and analysis to be performed. Data quality indicators for sediment analysis are shown on Table 3.

3.2.2 Sampling Handling

Soil (from upland borings) and sediment sampling containers will be filled to minimize head space, and will be appropriately labeled and stored prior to shipment or delivery to the laboratory. Reusable sampling equipment such as stainless steel spoons and bowls shall be decontaminated between sample locations.

Samples must be packed to prevent damage to the sample container and labeled to allow sample identification. All samples must be packaged so that they do not leak, break, vaporize or cause cross-contamination of other samples. Each individual sample must be properly labeled and identified. A chain-of-custody record must accompany each shipping container (see Section 3.2.3). When refrigeration is required for sample preservation, samples must be kept cool during the time between collection and final packaging.

All samples must be clearly identified immediately upon collection. Each sample bottle will be labelled and will include the following information:

- Client and project name

- A unique sample description
- Sample collection date and time.

Additionally, the sample bottle label may include:

- Sampler's name or initials
- Indication of addition of preservative, if applicable
- Analyses to be performed.

After collection, the samples will be maintained under chain-of-custody procedures as described below.

3.2.3 Chain of Custody

Chain-of-custody procedures are intended to document sample possession from the time of collection to disposal. Chain-of-custody forms must document transfers of sample custody. A sample is considered to be under custody if it is in one's possession, view, or in a designated secure area. The chain-of-custody record will include, at a minimum, the following information:

- Client and project name
- Sample collector's name
- Company's mailing address and telephone number
- Designated recipient of data (name and telephone number)
- Analytical laboratory's name and city
- Description of each sample (i.e., unique identifier and matrix)
- Date and time of collection
- Quantity of each sample or number of containers
- Type of analysis required
- Addition of preservative, if applicable
- Requested turn-around times
- Date and method of shipment.

When transferring custody, both the individual(s) relinquishing custody of samples and the individual(s) receiving custody of samples will sign, date, and note the time on the form. If samples are to leave the collector's possession for shipment to the laboratory, the subsequent packaging procedures will be followed. If an on-site lab is being used, a chain-of-custody must be completed but the following packing procedures do not apply. All samples will be stored appropriately by the laboratory.

3.3 Analytical Quality Control

Laboratory Quality Control Requirements

Internal quality control procedures are designed to ensure the consistency and continuity of data. A routine QC protocol is an essential part of the analytical process. The minimum requirements for each analytical run follow. Additional description of laboratory QA/QC procedures can be found in the laboratory's QA Manual. A project narrative detailing analytical results must accompany all data packages submitted by the laboratory.

- **Initial and continuing calibration:** A calibration standard will be analyzed each time an instrument is calibrated. The instruments used to perform the various analyses will be calibrated and the calibrations verified as required by the respective EPA methodologies. For example, a standard five-point initial calibration will be utilized to determine the linearity of response with the gas chromatograph/electron capture detection. Once calibrated, the system must be verified every 12 hours. All relative response factors, as specified by the analytical method, must be greater than or equal to 0.05. All relative standard deviations, as specified by the analytical method, must be less than or equal to 30 percent for the initial calibration and less than or equal to 25 percent for the continuing calibration.
- **Laboratory control sample:** The laboratory control sample (LCS) will consist of a portion of analyte-free water or solid phase sample that is spiked with target analytes of known concentration. The LCS will be processed through the entire method procedure and the results examined for target analyte recovery (accuracy). Precision evaluations will be generated using a laboratory control sample duplicate (LCSD). The LCS and LCSD results will be used as a fall-back position by the laboratory in cases where the matrix spike has failed to achieve acceptable recovery and/or precision. Inability to obtain acceptable LCS results will be directly related to an inability to generate acceptable results for any sample. One LCS/LCSD pair will be analyzed for each extraction batch.
- **Method blank analysis:** The method blank is utilized to rule out laboratory-introduced contamination by reagents or method preparation. Compounds detected in the blank will be compared in concentration to those found in the samples. Any concentration of common laboratory contaminants (i.e., phthalates, acetone, methylene chloride, or 2-butanone) in a sample at less than 10 times that found in the blank will be considered a laboratory contaminant. For other contaminants, any compounds detected at less than five times that found in the blank will be considered laboratory contamination (EPA, 1994). Values reported for the method blanks are expected to be below the detection limits for all compounds, except the common laboratory contaminants. Deviations from this must be explained in the laboratory project narrative(s). One method blank will be analyzed for each extraction/digestion batch

- **Matrix spike analysis:** A matrix spike (MS) is the addition of a known amount of target analyte to a sample. Analysis of the sample that has been spiked and comparison with the results from unspiked sample (background) will give information about the ability of the test procedure to generate a correct result from the sample (accuracy). Precision evaluations will be generated using a matrix spike duplicate (MSD). One matrix spike and matrix duplicate will be analyzed per sample delivery group (SDG) or per 20 samples. A SDG is defined as no more than 20 samples or a group of samples received at the laboratory within a two-week period
- **Surrogate evaluations (organic analyses):** Surrogate recovery is a quality control measure limited to use in organics analysis. Surrogates are compounds added to every sample at the beginning of the sample preparation to monitor the success of the sample preparation on an individual sample basis (accuracy). Although some methods have established surrogate recovery acceptance criteria that are part of the method or contract compliance, for the most part, acceptable surrogate recoveries need to be determined by the laboratory. Recoveries of surrogates will be calculated for all samples, blanks and quality control samples. Acceptance limits will be listed for each surrogate and sample type and will be compared against the actual result
- **Laboratory management review:** The QA Officer(s) will review all analytical results prior to final external distribution (preliminary results will be reported before this review). If the QA Officer(s) finds the data meet project quality requirements, the data will be released as “final” information. Data which are not acceptable will be held until the problems are resolved, or the data will be flagged appropriately.

3.4 Instrument/Equipment Testing, Inspection and Maintenance

The primary objective of an instrument/equipment testing, inspection, and maintenance program is to help ensure the timely and effective completion of a measurement effort by minimizing the downtime of crucial sampling and/or analytical equipment due to expected or unexpected component failure.

Testing, inspection, and maintenance will be carried out on all field and laboratory equipment in accordance with manufacturer’s recommendations and professional judgment. Analytical laboratory equipment preventative testing, inspection, and maintenance will be addressed in the laboratories’ QA manual, which will be kept on file at the contracted laboratory.

As appropriate, schedules and records of calibration and maintenance of field equipment will be maintained in the field notebook. Equipment that is out of calibration or is malfunctioning will be removed from operation until it is recalibrated or repaired.

3.5 Instrument/Equipment Calibration and Frequency

Measuring and test equipment used during environmental data collection activities will be subject to calibration requirements. These requirements are summarized below:

- Identification. Either the manufacturer's serial number or the calibration system identification number will be used to uniquely identify measuring and test equipment. This identification, along with a label indicating when the next calibration is due, will be attached to the equipment. If this is not possible, records traceable to the equipment will be readily available for reference.
- Standards. Measuring and test equipment will be calibrated, whenever possible, against reference standards having known valid relationships to nationally recognized standards (e.g., National Institute of Standards and Technology) or accepted values of natural physical constraints. If national standards do not exist, the basis for calibration will be described and documented.
- Frequency. Measuring and test equipment will be calibrated at prescribed intervals and/or prior to use. Frequency will be based on the type of equipment, inherent stability, manufacturers' recommendations, intended use, and experience. All sensitive equipment to be used at the project site or in the laboratory will be calibrated or checked prior to use.
- Records. Calibration records (certifications, logs, etc.) will be maintained for all measuring and test equipment used on the project.

If measuring and test equipment are found to be out of calibration, an evaluation will be made and documented to determine the validity of previous measurements and/or corrective action will be implemented. The QA officer will lead the evaluation process.

All laboratory calibration requirements must be met before sample analysis can begin. The laboratory will follow the calibration procedures found in the analytical methods listed in this QAPP or in the laboratory's SOPs. If calibration non-conformances are noted, samples will be reanalyzed under compliant calibration conditions within method-specified holding times.

3.6 Inspection/Acceptance of Supplies and Consumables

The Field Manager will be responsible for material procurement and control. The Field Manager will verify upon receipt that materials meet the required specifications and that,

as applicable, material or standard certification documents are provided and maintained. The Field Manager will also verify that material storage is properly maintained and contamination of materials is not allowed.

Laboratories contracted for this project must have procedures that are documented and followed that cover the following:

- Checking purity standards, reagent grade water, and other chemicals as appropriate versus intended use
- Preparation and storage of chemicals
- Requirements for disposable glassware (grade and handling).

For this project, the Field Manager or designee will be responsible for procuring and shipping the appropriate sample containers and preservatives to the sampling site. The containers will be pre-cleaned and certified by lot. Reagents provided will be of the appropriate grade for the analysis. Records of these certifications and grades of material will be maintained on file at the laboratory.

3.7 Non-Direct Measurements

Existing chemical data from previous site characterization efforts have been reviewed to assist in identifying proposed sampling locations, discussed in the Work Plan. All historical data were previously reviewed for quality assurance.

3.8 Data Management

All hard copies of project field documentation, analytical results, and reports will be filed and stored at the consultant's library.

Analytical laboratories are expected to submit data in both electronic and hard copy.
The Laboratory Project Manager should contact the Project QA/QC Coordinator prior to data delivery to discuss specific format requirements. A library of routines will be used to translate typical electronic output from laboratory analytical systems and to generate data analysis reports. The use of automated routines ensures that all data are consistently converted into the desired data structures and that operator time is kept to a minimum. In addition, routines and methods for quality checks will be used to ensure such translations are correctly applied.

Written documentation will be used to clarify how field and laboratory duplicates and QA/QC samples were recorded in the data tables and to provide explanations of other issues that may arise. The data management task will include keeping accurate records of field and laboratory QA/QC samples so that project team members who use the data will have appropriate documentation.

4 Assessment and Oversight

4.1 Assessment and Response Actions

Assessment of field sample collection methods will be evaluated using the sampling equipment rinsate blank results. If there is a detectable level of the compound of interest in the equipment rinsate blank, samples will be qualified based on possible contamination.

Assessment of the field and laboratory methods will be evaluated using the field duplicate results. A significant variation between the original sample and the field duplicate may be caused by laboratory error or due to field sampling conditions. This variation will be identified during data validation with results compared to both the laboratory reports and field notes.

Nonconforming items and activities are those which do not meet the project requirements or approved work procedures. Non-conformance may be detected and identified by any of the following groups:

- Project Staff: During the performance of field activities and testing, supervision of subcontractors, performance of audits, and verification of numerical analyses
- Laboratory Staff: During the preparation for and performance of laboratory testing, calibration of equipment, and QC activities
- QA Staff: During the performance of audits.

If possible, action will be taken in the field to correct any nonconformance observed during field activities. If necessary and appropriate, corrective action may consist of re-sampling. If implementation of corrective action in the field is not possible, the nonconformance and its potential impact on data quality will be discussed in the report.

Corrective action to be taken as a result of nonconformance during field activities will be situation-dependent. The laboratory will be contacted regarding any deviations from the QAPP, will be asked to provide written justification for such deviations, and in some instances, will be asked to reanalyze the sample(s) in question. An example of a laboratory nonconformance that would require corrective action is if holding times were exceeded prior to analysis. All corrective actions must be documented. The person identifying the nonconformance will be responsible for its documentation.

Documentation will include the following information:

- Name(s) of the individual(s) identifying or originating the nonconformance
- Description of the nonconformance
- Any required approval signatures
- Method(s) for correcting the nonconformance or description of the variance granted.

Documentation will be made available to project, laboratory, and/or QA management. Appropriate personnel will be notified by the management of any significant nonconformance detected by the project, laboratory, or QA staff. Implementation of corrective actions will be the responsibility of the PM or the QA Officer. Any significant recurring nonconformance will be evaluated by project or laboratory personnel to determine its cause. Appropriate changes will then be instituted in project requirements and procedures to prevent future recurrence. When such an evaluation is performed, the results will be documented. If there are unavoidable deviations from this QAPP, the Project Manager will document the alteration and track the change in the subsequent deliverables.

4.2 Reports to Management

Deliverables from this project include:

- Laboratory hardcopy results and EDDs
- Data validation reports
- Boring logs
- Reports discussing the results.

5 Data Validation and Usability

5.1 Data Review, Verification, and Validation

EPA method control limits (or WA State method control limits for NWTPH methods) for surrogate and matrix spike recoveries will be used for the determination of data quality. If surrogate or matrix spike recoveries are not within their method-specific control limits, then the analysis must be repeated. If the re-analyzed values are within required limits and holding times, they will be reported as true values. If, in the repeated analysis, the values are still outside required limits, the data will be identified and the Data Validator will verify the representativeness of the data following EPA guidelines. Laboratory analysts are responsible for reviewing calibration integrity, sample holding times, method compliance, and completeness of tests, forms, and logbooks.

Analytes detected at concentrations between the MRL and the method detection limit (MDL) will be reported with a J qualifier to indicate that the value is an estimate (i.e., the analyte concentration is below the calibration range). Non-detects will be reported at the MRL. The MRL will be adjusted by the laboratory as necessary to reflect sample dilution or matrix interference.

Verification of completeness and method compliance, as well as raw data entry and calculations by analysts will be reviewed by a laboratory supervisor or the Laboratory Coordinator. The Laboratory Coordinator will be responsible for checking each group or test data package for precision, accuracy, method compliance, compliance to special client requirements, and completeness. The Laboratory Coordinator will also be responsible certifying that hardcopy and EDD data are identical prior to release from the laboratory.

Data validation will be completed by the Data Validator. Data validation will be completed within three weeks after receipt of the complete laboratory data package. A detailed report of the data validation results will be submitted to the Quality Assurance Officer and included in the final deliverable.

The analytical laboratories will generate a Level 4 CLP-like fully validatable data package (EPA, 1991).

5.2 Reconciliation with User Requirements

The QA Officer will review the field notebooks, laboratory report, and results of the data validation to determine if the data quality objectives have been met. Instances where the data quality objectives were not met will be documented. The usability of the data will depend on the magnitude of the data quality objective exceedance. Data that has been rejected will be flagged as “R” and maintained in the database but will not be used in any decision making.

6 References

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Tables

Table 1 Roles and Responsibilities

Role	Contact	Roles and Responsibilities
Project Manager	Grant Hainsworth (CRETE)	• Primary point of contact. • Strategy development with project team. • Establishment of a project record-keeping system. • Monitoring all aspects of the project to verify that all work is being completed in accordance with this QAPP. • Review all technical documents associated with the project for technical accuracy and feasibility. • Budget and schedule control.
Field Manager	Paul Bianco (CRETE)	• Maintaining a log for all work completed on site. • Coordinating the sampling operations to verify that the sampling team members adhere to this QAPP. • Preparing the field investigation data and information for reports. • Working with the subcontractors and analytical laboratories to ensure that all field activities are conducted appropriately and that field activities are properly documented. • Reviewing subcontractors' work and invoices. • Ensuring that the integrity of the samples are maintained throughout sample collection and shipment to the laboratory.
Site Safety Officer (SSO)	Paul Bianco (CRETE)	• Verifying that project personnel adhere to the site safety requirements outlined in the pre-design health and safety plan (HASP). • Conducting the health and safety training for project personnel as appropriate. • Monitor compliance with the approved HASP. • Ensuring that proper health and safety equipment is available for the project. • Modifying health and safety equipment or procedure requirements and amend the approved HASP based on data gathered during the site work. • Interface with the Project Manager as required in matters of health and safety. • Authority to stop any operation that threatens the health or safety of the work team, surrounding populace, or the environment. • The daily health and safety activities may be conducted by the SSO or a designated replacement.
Quality Assurance (QA) Officer	Jamie Stevens (CRETE)	• Reviewing laboratory analytical data. • Providing the Data Validator with the laboratory analytical data and sampling field notes. • Serving as liaison between the laboratory and Field Manager and/or subcontractors. • Ensuring that the integrity of the samples and analyses are maintained at the laboratory. • Providing necessary documentation needed to support goals of the project and ensure that laboratory meets project data quality objectives, analytical concentration goals and other technical specifications for chemical analysis specified in this QAPP. • Notifying the laboratory of specific laboratory

Table 1 Roles and Responsibilities (Continued)

Role	Contact	Roles and Responsibilities
		nonconformances and changes. • Maintaining a complete set of laboratory data. • Verifying that data reported is correct. • Releasing testing data and results to the Project Manager in a timely manner.
Data Validator	Jamie Stevens (CRETE)	• Evaluation of the conformance of the analyses with the specifications of this QAPP. • Verification of the reported results with the raw data. • Ensure the Electronic Data Deliverables (EDDs) of analytical data match the hard copies
Laboratory Manager	Eric Young (Friedman & Bruya)	• Oversee all laboratory operations associated with the receipt of the environmental samples, chemical/physical analyses, and laboratory report preparation for this project • Prepare laboratory validation report and QAQC testing.
Sub-consultants and Subcontractors	Field Manager	The Field Manager will coordinate all field activities and oversee all sub-consultants and subcontractors at the site. Key sub-consultants are listed below: • McMillen Jacobs Associates – Geotechnical analysis

Table 2 Sediment Laboratory Testing Program

Analytes	CUL - dwt	Analytical Method	RL	MDL	Sample Size	Container	Units	Preser-vative	Holding Times
Conventional Parameters (pct)									
Total organic carbon	---	EPA 9060	--	--	50 g	4-oz glass	mg/kg dry wt	Cool/4o C	14 days
Metals (mg/kg)									
Nickel (See Note 1)	211	6020	200	44	50 g	4-oz glass	ug/kg dry wt	Cool/4o C	6 months
Mercury	0.59	7471A	0.05	0.14	50 g	4-oz glass	ug/kg dry wt	Cool/4o C	28 days
Polycyclic Aromatic Hydrocarbons (µg/kg)									
cPAH TEQ - surface sediment	229/ 445	8270D/E	--	--	150 g	8-oz glass	ug/kg dry wt	Cool/4o C	14 days until extraction, 40 days to analyze
cPAH TEQ - intertidal areas	450/ 800	8270D/E	--	--					
2-Methylnaphthalene	670	8270D/E	2	0.33					
Acenaphthene	500	8270D/E	2	0.37					
Anthracene	960	8270D/E	2	0.46					
Benzo(a)anthracene	1300	8270D/E	2	0.43					
Benzo(a)pyrene	--	8270D/E	2	0.48					
Benzofluoranthenes (b,k)	--	8270D/E	4	0.98					
Chrysene	1400	8270D/E	2	0.53					
Dibenzo(a,h)anthracene	230	8270D/E	2	0.91					
Fluoranthene	1700	8270D/E	2	0.53					
Fluorene	540	8270D/E	2	0.37					
Indeno(1,2,3-c,d)pyrene	--	8270D/E	2	0.56					
Phenanthrene	1500	8270D/E	2	0.59					
Pyrene	2600	8270D/E	2	0.37					
Total HPAH (SMS) (U = 0)	12000	8270D/E							
Total LPAH (SMS) (U = 0)	5200	8270D/E							
bis(2-Ethylhexyl)phthalate*	1300	8270D/E	160	2.3					

Table 2 Sediment Laboratory Testing Program (Continued)

Analytes	CUL - dwt	Analytical Method	RL	MDL	Sample Size	Container	Units	Preser-vative	Holding Times
Dibenzofuran	540	8270D/E	10	0.76					
Dimethyl phthalate	71	8270D/E	50	5.5					
n-Nitrosodiphenylamine	28	8270D/E	10	3.6					
Semivolatile Organics (µg/kg)									
2,4-Dimethylphenol	29	8270D/E	29	24	150 g	8-oz glass	ug/kg dry wt	Cool/4° C	14 days until extraction, 40 days to analyze
2-Methylphenol (o-Cresol)	63	8270D/E	50	8.2					
3- & 4-Methylphenol (m, p-Cresol)	670	8270D/E	200	8.3					
Benzoic acid	650	8270D/E	500	81					
Benzyl alcohol	57	8270D/E	50	9.1					
Dioxin/Furans									
Dioxins					150 g	8-oz glass	ng/kg dry wt	Freeze - 10°C	1 year to extraction
2,3,7,8-TCDD	See Note 2								
1,2,3,7,8-PeCDD		1613B	2.5	2.5					
1,2,3,4,7,8-HxCDD		1613B	2.5	2.5					
1,2,3,6,7,8-HxCDD		1613B	2.5	2.5					
1,2,3,7,8,9-HxCDD		1613B	2.5	2.5					
1,2,3,4,6,7,8-HpCDD		1613B	2.5	2.5					
OCDD		1613B	5	5					
Furans									
2,3,7,8-TCDF	See Note 2	1613B	0.5	0.5					
1,2,3,7,8-PeCDF		1613B	2.5	2.5					
2,3,4,7,8,-PeCDF		1613B	2.5	2.5					
1,2,3,4,7,8-HxCDF		1613B	2.5	2.5					
1,2,3,6,7,8-HxCDF		1613B	2.5	2.5					
1,2,3,7,8,9-HxCDF		1613B	2.5	2.5					
2,3,4,6,7,8-HxCDF		1613B	2.5	2.5					
1,2,3,4,6,7,8-HpCDF		1613B	2.5	2.5					

Table 2 Sediment Laboratory Testing Program (Continued)

Analytes	CUL - dwt	Analytical Method	RL	MDL	Sample Size	Container	Units	Preser-vative	Holding Times
1,2,3,4,7,8,9-HpCDF		1613B	2.5	2.5					
OCDF		1613B	5	5					
Dioxin-like PCB Congeners (see Note 3)									
3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	See Note 4	1613B	366	900	150 g	8-oz amber glass	ng/kg dry wt	Freeze -6°C	1 year to extraction
3,4,4',5-Tetrachlorobiphenyl (PCB 81)		1613B	535	1250					
2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)		1613B	197	585					
2,3,4,4',5-Pentachlorobiphenyl (PCB 114)		1613B	359	900					
2,3',4,4',5-Pentachlorobiphenyl (PCB 118)		1613B	209	585					
2',3,4,4',5-Pentachlorobiphenyl (PCB 123)		1613B	371	900					
3,3',4,4',5-Pentachlorobiphenyl (PCB 126)		1613B	206	585					
2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)		1613B	207	585					
2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)		1613B	363	900					
2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)		1613B	369	900					
3,3',4,4',5,5'-		1613B	217	585					

Table 2 Sediment Laboratory Testing Program (Continued)

Analytes	CUL - dwt	Analytical Method	RL	MDL	Sample Size	Container	Units	Preser-vative	Holding Times
Hexachlorobiphenyl (PCB 169)									
2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)		1613B	204	585					
3,3',4,4'-Tetrachlorobiphenyl (PCB 77)		1613B	0.2	14					
3,4,4',5-Tetrachlorobiphenyl (PCB 81)		1613B	0.19	14					
2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)		1613B	0.2	26					
2,3,4,4',5-Pentachlorobiphenyl (PCB 114)		1613B	0.2	14					
2,3',4,4',5-Pentachlorobiphenyl (PCB 118)		1613B	0.28	55					
2',3,4,4',5-Pentachlorobiphenyl (PCB 123)		1613B	0.2	14					
3,3',4,4',5-Pentachlorobiphenyl (PCB 126)		1613B	0.24	14					
2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)		1613B	0.25	27					
2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)		1613B	0.24	25					
2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)		1613B	0.23	14					

Table 2 Sediment Laboratory Testing Program (Continued)

Analytes	CUL - dwt	Analytical Method	RL	MDL	Sample Size	Container	Units	Preser-vative	Holding Times
3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)		1613B	0.19	15					
2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)		1613B	0.18	14					
Physical Samples									
Grainsize (GS)	na	ASTM D-422 with hydrometer	300 g	16-oz HDPE	na	na	---	Cool/4° C	6 months
total solids	na	SM2540B (MOD)	50 g	From GS	0.5	0.1	wt%		
Specific Gravity	na	ASTM D-5057-10	100 g	From GS	na	na	---		
Moisture Content	na	ASTM D-2216	50 g	From GS	0.5	0.1	wt%		
Atterberg Limits	na	ASTM D-4318	300 g	16-oz HDPE	---	---	---		
Soil Description and Classification	na	ASTM D-2488/D-2487		From GS	---	---	---		
Bulk Density	na	ASTM D-5057-10	50 g	From GS	na	na	g/ml		

Notes:
na - not applicable
SVOC - semi-volatile organic compound
g – grams
oz – ounce
GS – Grain Size
ug/kg dry wt – microgram per kilogram dry weight
ng/kg dry wt – nanogram per kilogram dry weight
RL – reporting limit
TEF – toxic equivalence

1. The SCO for nickel has been established at 211 mg/kg based on a site-specific adverse effects threshold. See Appendix A of the CAP.
2. The PQL-based SCO for dioxin/furan is 5 ng TEQ/kg DW. See Table 11-1 of the Sediment Cleanup User's Manual, dated December 2019, prepared by the Washington State Department of Ecology (SCUM). The regional background-based CSL is 15 ng TEQ/kg DW. See Table 6 of the Bellingham Bay Regional Background Sediment Characterization report dated February 2015, prepared for the Washington State Department of Ecology.
3. The RL and MDL are the average MDL and PQL, respectively, listed in Table D-1 of the SCUM.
4. The PQL-based SCO for dioxin-like PCB congeners is 0.7 TEQ ng/kg (ppt) DW. See Table 11-1 of the SCUM.

Table 3 Data Quality Objectives

Parameter	Precision	Accuracy	Completeness
Grain size	+/- 20% RPD	NA	95%
Total solids/total volatile solids	+/- 20% RPD	NA	95%
Total metals	+/- 20% RPD	75-125% R	95%
Total organic carbon	+/- 20% RPD	75-125% R	95%
Semivolatile organic compounds	+/- 35% RPD	50-150% R	95%
Dioxins/Furans	+/- 35% RPD	50-150% R	95%
Dioxin-like PCB congeners	+/- 35% RPD	50-150% R	95%

Notes:

RPD = Relative percent difference

R = Recovery

Appendix D

Health and Safety Plan

Pre-Remedial Design Investigation Work Plan

APPENDIX D. HEALTH AND SAFETY PLAN

I&J Waterway Sediment Cleanup Site

Nearest Address: Bornstein Seafoods

1001 Hilton Ave, Bellingham Washington

Project Number: 036-001

Prepared for:

Port of Bellingham and
Bornstein Seafoods, Inc.

April 8, 2020

Prepared by:

CRETE CONSULTING, INC.

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Acronyms and Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists
APR	air purifying respirator
BEHP	bis(2-ethylhexyl)phthalate
CRETE	CRETE Consulting, Inc.
CRZ	contaminant reduction zone
EPA	United States Environmental Protection Agency
HASP	Health and Safety Plan
HEPA	high-efficiency particulate air
IDHL	immediately dangerous to health and life
JHA	job hazard analysis
kV	kilovolt
MSDS	material safety data sheet
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyl
PCE	perchloroethene (tetrachloroethene)
PEL	permissible exposure limit
PID	photoionization detector
PGG	Pacific Groundwater Group
PPE	personal protective equipment
REL	reasonable exposure limit
PRID	Pre Remedial Investigation Design
Site	I&J Waterway
STEL	short-term exposure limit
SVOC	semivolatile organic compound
TCE	trichloroethene
TPH	total petroleum hydrocarbons
TLV	threshold limit value
TWA	time weighted average
UST	underground storage tank
VOC	volatile organic compound
WAC	Washington Administrative Code

1 Introduction

The Pre-Remedial Design Investigation (PRDI) Work Plan describes the investigation components to perform the remedial design for the cleanup action proposed by the Washington State Department of Ecology (Ecology) for the cleanup of contamination at the I&J Waterway Site (Site) in Bellingham, Washington. This Health and Safety Plan (HASP) describes the health and safety protocols to be used during the Site Investigation.

The Contractors, such as drillers, involved in this work will follow their own HASPs. CRETE Consulting, Inc. (CRETE) and McMillen Jacobs Associates will oversee the soil borings, Cone Penetrometer Tests, in-water vibracores, and surveying at the Site. This plan was written by CRETE, who has subcontracted the drillers, surveyors, CPT installer, and vibracores operators to perform work on the site. However, at least one CRETE or McMillen Jacobs Associates staff (or both), will be onsite during all PRDI work. Any further mention of CRETE in this HASP refers to field work performed by CRETE or McMillen Jacobs Associates during the PRDI. This HASP is unique to activities to be performed by CRETE staff/field managers. General site information is summarized in Table 1-1. Background information pertaining to site history and general hazards is listed in Table 1-2.

In addition to the requirements set forth in this HASP, Crete personnel shall comply with the HASPs and related protocols of all onsite Contractors and any health and safety protocols required by Borstein Seafoods and or the Port of Bellingham.

1.1 Site Safety Plan Acknowledgment and Acceptance

The Field Manager (the CRETE or McMillen Jacobs Associates field staff onsite leading field activities) shall be responsible for informing all individuals assigned to work on the site, or who visit the site within the exclusion or contaminant reduction zones, of the contents of this HASP and for ensuring that each person signs the Site Safety Plan Acknowledgment Form (Appendix A). By signing the Site Safety Plan Acknowledgment Form, individuals recognize the site health and safety hazards, known or suspected, and will adhere to the protocols required to minimize exposure to such hazards. Subcontractors will also adhere to their own HASPs related to the work they are performing, e.g., safe drill operation.

1.2 Site Health and Safety Meetings

A pre-work meeting addressing site-specific health and safety issues shall be held on the first day of mobilization to the site and prior to the commencement of any work activities. Mandatory attendance is required for all personnel assigned to the particular tasks for which the equipment was mobilized. For example, a work meeting with the air-knife operators will occur at a different time than the meetings with the drillers, as these activities will be performed on different days and each have their own mobilization events. The intent of these meetings is to discuss the site-specific health and safety issues (such as

known or suspected contaminants), not to discuss activity-specific (such as well installation) health and safety issues.

At the conclusion of the meeting, personnel are to sign the Site Safety Plan Acknowledgment Form in Appendix A, indicating their attendance and understanding of the health and safety protocols. As additional personnel are assigned to the site, it is the responsibility of the Field Manager to ensure that new personnel are briefed on site-specific health and safety information and that they also have signed the Site Safety Plan Acknowledgment Form (Appendix A).

Daily tailgate meetings will be held by the Field Manager or field staff in charge of the day's activities, and attendance will be documented in the tailgate meeting form (Appendix C).

1.3 Training Requirements

All personnel assigned to work on this site beyond the support zone must have successfully completed 40 hours of Training for Hazardous Waste Site Work, in accordance with Occupational Safety Health Act (OSHA) 29 CFR 1910.120(e)(3), and must be current with their 8-hour Refresher Training, in accordance with OSHA 29 CFR 1910.120(e)(8).

Personnel managing or supervising work on site must also have successfully completed 8 hours of Manager/Supervisor Training, meeting the requirements of 29 CFR 1910.120(e)(4). Documentation of CRETE staff training is maintained in each company's respective databases. Each contractor must maintain documentation of OSHA training for personnel working on site.

Any exceptions to the training requirements will be explicitly specified either in this HASP or through a HASP amendment.

1.4 Medical Monitoring Requirements

All personnel, including subcontractors, assigned to work on this site beyond the support zone must be enrolled in a medical surveillance program meeting the requirements of OSHA 29 CFR 1910.120(f). Personnel must have successfully passed an occupational physical within the past 12 months, be medically cleared to work on hazardous waste sites, and be capable of wearing appropriate personal protective equipment (PPE), including any respiratory protection.

Any exceptions to the medical monitoring requirements will be explicitly specified either in this HASP or through a HASP amendment.

1.5 Fit Testing Requirements

All CRETE personnel assigned to work on this site beyond the support zone must be familiar with the requirements in the OSHA respiratory standard (29 CFR 1910.134). All personnel who are required to wear respiratory protection must have successfully passed a respirator fit test within the past 12 months. Personnel who do not have a current fit test are prohibited from working in areas where any potential exists for exceeding OSHA Permissible Exposure Limits. Documentation of a successful respirator fit test for the appropriate type of respirator needed for this work (half-face) must be maintained by each contractor performing onsite work. The Field Manager will check that the respirator being worn by personnel is the same size, make, and model as that specified on any respirator fit test records from the past 12-month period.

1.6 Project Staff Responsibilities

The Field Manager is responsible for overall project administration and for coordinating health and safety protocols and procedures for all onsite CRETE personnel at all times. All applicable United States Environmental Protection Agency (EPA), OSHA, state, and local health and safety requirements shall be followed throughout the course of the project. This HASP covers only CRETE personnel onsite. Any person who observes health and safety problems or infractions should immediately report the problem or infraction to appropriate personnel.

1.7 Access to Employee Exposure and Medical Records

OSHA provides employees and their designated representatives a right-of-access to relevant exposure and medical records (29 CFR 1910.20). The “Notification of Access to Employee Exposure and Medical Records” (Appendix D) is to be made accessible to all employees involved with these field operations.

1.8 Hazard Communication

The Field Manager will advise all CRETE personnel assigned to this site of the hazards associated with working onsite and of the methods to mitigate those hazards and prevent exposures. This information will be presented to personnel prior to initiation of any field activities. The following information regarding site contaminants or any chemicals brought to the site to conduct the work will be presented to site personnel prior to conducting any field work:

- Material Safety Data Sheets (MSDS; Appendix E)
- Chemical/physical hazards
- Appropriate PPE for protection from exposure
- Labeling.

Table 1-1 General Information

Client: Port of Bellingham and Bornstein Seafoods	
Site Name: I&J Waterway	
Site Location: 1001 Hilton Ave, Bellingham, WA 98225 (nearest address)	
Description of Field Activities: • Mobilization to the site and driving on the site; • Geotechnical borings; • CPTs and vibracore sampling to collect soil data; and • Subsurface mapping	
Dates of Field Activities: Q1 2020	
Project Manager: Grant Hainsworth, CRETE	**Project Manager Telephone Number: 253-797-6323**
QA Officer: Jamie Stevens, CRETE	**Office: Seattle**
Field Manager: Paul Bianco, CRETE	
The following requirements have been fulfilled for each employee to work onsite: ☒**Completed OSHA 40-Hour HAZWOPER Training** ☒**Current OSHA 8-Hour HAZWOPER Refresher (within last 12 months)** ☒**Current Medical Surveillance Examination (within last 12 months)** ☒**Current Respirator Fit-test (within last 12 months)** ☒**Current First Aid and CPR Training (within last 2 years)** **Note:** CRETE employees may not enter a site beyond the support zone unless the training/qualifications listed above are current.	

Table 1-2 Site Background

Overall Hazard Is:			
High: ☐	**Low:** ☐	**Moderate:** ☒	**Unknown:** ☐
Facility Description: This project is inside the I&J Street Waterway. The Site includes areas of contaminated marine sediments in the federally authorized I&J Waterway navigation channel and adjacent berthing areas, primarily located on state-owned aquatic land. The dock is located on property leased to Bornstein Seafoods, who's operations include a seafood processing and distribution center.			
Status: The federally authorized navigation channel has a current authorized channel depth of 18 feet below mean lower low water (MLLW) and is tidally influenced. The Port of Bellingham (Port) owns the berthing areas on the south side of the Site and the surrounding uplands, including the sloped beach area at the head of the Waterway. The upland areas near the Site include the former Olivine Corporation lease area and a property to its southwest that is currently leased to Bornstein Seafoods. The U.S. Coast Guard (USCG) owns the property north of the Site and berths vessels within the Waterway and northern berth areas.			
Unusual Features (containers, dikes, buildings, power lines, terrain, etc.): Close proximity to waterways, buried debris, site actively used.			
Site History (worker injury, complaints, regulatory agency action): Under Agreed Order with Department of Ecology.			
Potential Waste Types: sludges and liquids may be encountered in during investigation and sediment removal activities. Debris will be encountered along shorelines.			
Liquid: ☒	**Solid:** ☒	**Sludge:** ☒	**Debris:** ☒
Characteristics:			
Corrosive: ☒	**Ignitable:** ☐	**Volatile:** ☒	**Toxic:** ☒
Reactive: ☐	**Unknown:** ☒	**Radioactive:** ☐	**Other (name):** ☐
Hazards posed by site activities (Job Hazard Analysis in Appendix F): Potential exposure to contaminants including metals, SVOCs, PCBs, metals, dioxin and furans, and cold stress; work in steep, potentially unstable areas, work over water (drowning)			
Unusual Hazards: Proximity to water.			

2 Health & Safety Risk Analysis

This section identifies the specific hazards associated with the remedial investigation work and presents an analysis of documented or potential chemical hazards at the site. Every effort must be made to reduce or eliminate exposure to these hazards. Hazards that cannot be eliminated must be abated by use of engineering controls and/or PPE.

2.1 Hazard Analysis Requirements

2.1.1 Job Hazard Analysis

A Job Hazard Analysis (JHA) Form (Appendix F) is a basic tool that allows personnel to think through the steps involved in each job and discuss how to complete the job safely prior to mobilizing to the field. Each JHA accomplishes the following:

- Breaks a job down into individual steps
- Lists the safety hazards in each step
- Lists appropriate precautions to be followed for each hazard and safety resources (PPE, equipment, permits, etc.) to be obtained and coordinated.

Completion of a JHA requires thoroughness and attention to detail, as well as input of all those who participate in the job. As part of this HASP and prior to commencement of work, initial JHA forms (Appendix F) for soil sample collection and well installation have been completed and reviewed by the QA Officer. Each JHA will be modified if job scope or conditions change. If additional tasks are added to the scope of work in the field, a new JHA will be completed and approved by the QA Officer prior to the commencement of those additional tasks.

2.2 Precautions When Working Around Heavy Equipment

The following precautions will be taken to minimize heavy equipment hazards:

- All equipment must have back-up alarms.
- Personnel must make eye contact with the operator before approaching the equipment and remain safely outside the swing radius of the equipment.
- Personnel must wear orange visibility vests in addition to standard Level D PPE.
- Personnel must never stand on track-hoe tracks to communicate with the operator.
- Operators must be aware of personnel in the area and use proper hand signals before maneuvering.
- Operators must wear hard hats when operating machines and when going to and from their equipment.
- Operators must use spotters and be cautious when maneuvering equipment within 15 feet of overhead power lines and utility pole guy wires, and maintain safe distances at all times (greater than 10 feet).

- Provisions will be made to prevent the unauthorized start-up of equipment when personnel leave the site at the end of the shift, such as battery ignition locks.

2.3 General Site Hazards

2.3.1 Docks/Shoreline/Waterway

Project activities including work on the Bornstein Seafood company's dock and bulkhead, working on and around the I&J Waterway, and working along the shoreline. The I&J Waterway is tidally influenced, and water levels along the shoreline can vary widely throughout the day.

Sampling and surveying from barges or other vessels present a potential drowning hazard. All personnel working on or near (within 6') the water must wear a properly fastened (e.g. zipped and clipped) U.S. Coast Guard approved personal flotation device (PFD). Ring buoys with 70 feet of attached polypropylene line shall be maintained aboard the floating equipment. Man overboard drills shall be conducted by the crews prior to commencing work and periodically thereafter. The "buddy system" shall be mandatory for all crew members working on, over, or near the water.

2.3.2 Lighting

Work areas must have adequate lighting for employees to see to work and identify hazards (5-foot candles minimum, comparable to a single 75- to 100-watt bulb). Personnel should have flashlights available in all indoor or dimly lighted areas for use in the event of a power failure, or if working outdoors after daylight hours. Applicable OSHA standards for lighting (29 CFR 1910.120(m)) shall apply. All Remedial Investigation work is expected to occur outside during daylight hours.

2.3.3 Electrical Power and Lockout/Tagout

All electrical power must have a ground fault circuit interrupter as part of the circuit, including generators. All equipment must be suitable and approved for the class of hazardous atmosphere in which it is being used. Applicable OSHA standards for electric power (29 CFR 1910 Subpart S) shall apply.

2.3.4 Fall Protection

Work site slip, trip, and fall accidents can result in serious injuries or fatalities. Procedures to help prevent these types of incidents will be implemented. Elevated work (above 4 feet) where a fall potential exists will be performed using appropriate ladders and/or fall protection (i.e., body harness, lifeline, etc.) Applicable OSHA standards for fall protection (29 CFR 1910.21 through 29 CFR 1910.32) shall apply. No work is expected to be performed on ladders. However, debris exploration will occur on or near steep riverbank slopes.

2.3.5 Drum Handling

The movement, opening, handling, and storage of drums will be conducted in accordance with 29 CFR 1910.120(j). See Section 9 for more details.

2.3.6 Cold Stress

When the temperature falls below 40°F, cold stress protocols shall be followed. Employees must be supplied with adequate clothing to maintain core temperature. Cold stress is discussed in detail in Appendix H.

2.3.7 Eye Wash Protection

All operations involving the potential for eye injury, splash, etc., must have approved eye wash units locally available as per 29 CFR 1910.151(c).

2.3.8 Hearing Protection

When the noise level of any operation exceeds the 8-hour Time Weighted Average (TWA) of 85 decibels (dB), a hearing protection program meeting the requirements of 29 CFR 1910.95 will be implemented.

2.3.9 Fire Prevention

Operations involving the potential for fire hazards shall be conducted in a manner that minimizes the risk. Non-sparking tools and fire extinguishers shall be used or available as required. Sources of ignition shall be removed. When necessary, explosion-proof instruments and/or bonding and grounding will be used to prevent explosion and/or fire.

2.3.10 Utilities

All underground utility hazards shall be identified and/or inspected prior to conducting operations involving potential contact. Some work will occur where numerous current and historical utilities exist, and special caution should be exercised in all ground disturbing work.

2.3.11 Overhead Utilities and Power Lines

Any time work is performed in the vicinity of overhead utilities, including power lines, a spotter will be assigned to help operators maneuver equipment in and around the wires. The following distances will always be maintained around high-tension wires:

- For lines rated 50 kilovolts (kV) or below, minimum clearance between the lines and any part of the crane or load shall be 10 feet.
- For lines rated over 50 kV, minimum clearance between the lines and any part of the crane or load shall be 10 feet plus 0.4 inch for each 1 kV over 50 kV, or twice the length of the line insulator, but never less than 10 feet.
- In transit with no load and boom lowered, the equipment clearance shall be a minimum of 4 feet for voltages less than 50 kV, 10 feet for voltages over 50 kV, up to and including 345 kV, and 16 feet for voltages up to and including 750 kV.

In addition, all utility pole "guy-wire" support cables will be identified, marked, and/or barricaded prior to work. Unintended equipment or vehicle contact with these guy wires may result in utility poles or power lines falling on personnel or equipment.

2.3.12 Severe Weather and Lightning

The Field Manager will monitor local media resources to identify possible severe weather situations at the project site. Site work may be delayed, postponed, or cancelled due to severe weather based on the Field Manager's discretion. In the event of a weather emergency, the site will be evacuated in accordance with Section 7 of this document.

Lightning can strike up to a distance of 10 miles, but thunder can only be heard at a distance of 8 miles. Therefore, if site personnel working outdoors hear thunder and/or see lightning, work will be stopped and personnel will move to an indoor location. If indoor facilities are not available, personnel will move inside of passenger vehicles such as cars and pickups. During a thunderstorm with thunder/lightning, avoid trees/poles, standing water, high areas, and metal structures (fences, scaffolding, etc.). Work will resume 30 minutes following the final observance of thunder and/or lightning.

2.4 Chemical Hazards

This section discusses the hazards associated with the contaminants remaining on site. Employees may inhale contaminated dusts or come into direct contact with contaminated media while performing excavations or otherwise handling the soil, sediment, or groundwater (stockpiling, characterizing, or transporting soils) on this project.

Polychlorinated Biphenyls

Polychlorinated biphenyls (PCBs) are mixtures of up to 209 individual chlorinated compounds (known as congeners). There are no known natural sources of PCBs. PCBs are either oily liquids or solids that are colorless to light yellow. Some PCBs can exist as a vapor in air. PCBs have no known smell or taste. Many commercial PCB mixtures are known in the U.S. by the trade name Aroclor.

PCBs have been used as coolants and lubricants in transformers, capacitors, and other electrical equipment because they don't burn easily and are good insulators. The manufacture of PCBs was stopped in the U.S. in 1977 because of evidence they build up in the environment and can cause harmful health effects. Products made before 1977 that may contain PCBs include old fluorescent lighting fixtures and electrical devices containing PCB capacitors, and old microscope and hydraulic oils.

The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage. PCB exposures in the general population are not likely to result in skin and liver effects. Most of the studies of health

effects of PCBs in the general population examined children of mothers who were exposed to PCBs.

Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

Polycyclic Aromatic Hydrocarbons
Polycyclic aromatic hydrocarbons are a group of chemicals that occur naturally in coal, crude oil, and gasoline. PAHs are also present in products made from fossil fuels, such as coal-tar pitch, creosote, and asphalt. When coal is converted to natural gas, PAHs can be released. Therefore, some coal-gasification sites may have elevated levels of PAHs. PAHs also can be released into the air during the burning of fossil fuels, garbage, or other organic substances. The less efficient the burning process, the more PAHs are given off. Forest fires and volcanoes produce PAHs naturally.
It is not clear that PAHs cause short-term health effects. Other compounds commonly found with PAHs may be the cause of short-term symptoms such as eye irritation, nausea, vomiting, diarrhea, and confusion.
Long-term health effects of exposure to PAHs may include cataracts, kidney and liver damage, and jaundice. Repeated skin contact to the PAH naphthalene can result in redness and inflammation of the skin. Breathing or swallowing large amounts of naphthalene can cause the breakdown of red blood cells.

Long-term exposure to low levels of some PAHs have caused cancer in laboratory animals. Benzo(a)pyrene is the most common PAH to cause cancer in animals. Studies of workers exposed to mixtures of PAHs and other compounds have noted an increased risk of skin, lung, bladder, and gastrointestinal cancers. The information provided by these studies is limited because the workers were exposed to other potential cancer-causing chemicals besides PAHs. Although animal studies have shown adverse reproductive and developmental effects from PAH exposure, these effects have generally not been seen in humans.

Semivolatile Organics Compounds and Dioxins and Furans

Semivolatile organic compounds (SVOCs) are a subgroup of VOCs that tend to have a higher molecular weight and higher boiling point temperature than other VOCs.

The health effects of a specific SVOC depend on its chemical nature and on the degree of exposure, which can occur through a combination of ingestion, respiration, and skin absorption. Individual susceptibility factors can also be important, and much attention has been focused on the developing fetus. Some SVOCs are known to be toxic, such as dioxins

and pentachlorophenol; some are no longer used because of demonstrated or suspected health effects, such as polybrominated biphenyls; and concerns are emerging about potential health effects of others. Health effects now associated with specific SVOCs include allergic symptoms, retarded reproductive development, and altered semen quality with phthalates, and lower birth weight with perfluorooctane sulfonate and perfluorooctanoate. A broad and growing concern is about SVOCs with chemical structures that may mimic human hormones and increase or decrease endocrine activity.

Metals

Site sediments main contain elevated levels of metals that include mercury and nickel. Mercury is a neurotoxin. Possible symptoms of exposure or may include: loss of peripheral vision; "pins and needles" feelings, usually in the hands, feet, and around the mouth; lack of coordination of movements; impairment of speech, hearing, walking; and muscle weakness.

Nickel is a naturally occurring metal but exposure to high concentrations can result in health problems. The most serious harmful health effects from exposure to nickel, such as chronic bronchitis, reduced lung function, and cancer of the lung and nasal sinus, have occurred in people who have breathed dust containing certain nickel compounds while working in nickel refineries or nickel-processing plants.

Other Chemical Hazards

Other hazards may be posed by chemicals brought on site by CRETE or their subcontractors. In accordance with DOSH requirements for hazard communication, Material Safety Data Sheets (MSDS) are available for all products brought on site. In order to facilitate the accessibility by site workers, all MSDS will be maintained in a separate binder and kept on site.

- CRETE employees and subcontractors will bring on site only those materials required to perform work on site. The following procedures will be followed to optimize use of the MSDSs.
- All CRETE employees will be briefed on materials safety procedures, use of MSDSs for employee health information, and use of MSDSs for mishap response during safety meetings.
- Selected MSDSs will be reviewed as a normal part of the safety briefing.

In the event of a spill or other emergency event involving a material brought on site by CRETE employees, the MSDS binder will be brought to the mishap location for use by the SSO, Project Manager, and any other response personnel.

2.5 Biological Hazards

Project personnel should be provided with the information and training necessary to avoid accidental injury or illness that can result from exposure to biological hazards. This includes ensuring that the site is carefully assessed when personnel are on site so that the hazards associated with biological entities are recognized and eliminated or controlled. Potential biological hazards associated with the project site include animals, such as raccoons and rats; stinging insects, such as bees and yellow jackets; and plants, such as blackberries.

3 Personal Protective Equipment

The proposed work areas for this project are well characterized with regard to chemical contaminants in soil, sediment, and groundwater. In addition, based on the levels of contaminants identified in environmental media on the site and the types of activities proposed, the potential for airborne chemicals of concern above occupational exposure limits is low. If there is any indication that workers may be exposed to airborne contaminants in unacceptable concentrations, work will stop and this plan will be revised to address that hazard.

The following levels of personal protective equipment are prescribed, in compliance with WAC 296-843.

Workers conducting work in areas of identified contamination, and therefore required to enter exclusion zones, will be required to wear modified Level D personal protective equipment (PPE), which consists of the following.

- Personal Floatation Device (PFD) for work over water;
- Chemical-resistant clothing or rubber rain gear;
- Hard hat (if necessary, as determined by the SSO);
- Safety glasses with side shields;
- High visibility (Hi-vis) clothing;
- Work boots;
- Viton gloves (if necessary, as determined by the SSO);
- Hearing protection (if necessary, as determined by the SSO)

PPE required for work within the exclusion zone will be upgraded to Level C. Also, if the concentration of airborne PCBs, vapors, or metals (as determined by air monitoring) exceed specified action levels at any time, the requirements for work inside the exclusion zone may (at the discretion of the SSO), be upgraded to Level C PPE. Level C consists of all of the equipment specified for modified Level D above plus:

- Half-face air-purifying respirator with combined organic vapor/particulate cartridge.

All employees working in the contamination reduction zone, support zones, and areas of the site without documented contamination will be required to wear the following modified Level D PPE. Modified Level D consists of the following:

- Personal Floatation Device (PFD) for work over water (PFDs will be appropriately secured at all times. No personnel will be allowed over water with a PFD that is unbuckled, unzipped, etc);
- Standard construction clothing;
- Hard hat (if necessary, as determined by the SSO);

- Safety glasses with side shields;
- High visibility (Hi-vis) clothing;
- Work boots;
- Hearing protection (if necessary, as determined by the SSO) - If foam earplugs are used, they should only be applied with clean hands (e.g. while gloves are removed) to avoid exposing the worker to site contaminants, or earmuffs should be used.

3.1 Engineering Controls

To minimize potential exposure to contaminants present in soil, sediment, and groundwater on site, every effort will be made to minimize dust levels or migration of contaminants off site. In accordance with Puget Sound Clean Air Agency (PSCAA) Regulation 1, Section 9.15, no visible dust will be permitted during site activities.
The following procedures will be implemented during soil test pitting, drilling, stockpiling, and transport of contaminated soils or sediment to control fugitive dust emissions.

Dust control measures are to be used for the duration of the project.

Water or wetting agents shall be used to control dust at the excavation sites, as needed. Each stockpile shall be covered to minimize the potential for dust generation from the material placed in the piles and from water intrusion.

The following additional engineering controls will be practiced on site to minimize the migration of contaminants off site.

- Exclusion zones shall be clearly marked with cones or barrier tape to avoid accidental entry.
- Contamination reduction zones will be marked and equipped with buckets and brushes for decontamination. Disposable contaminated clothing will be disposed of as solid waste and re-usable clothing (i.e. hard hats, rubber rain gear and etc.) will be washed and reused.
- Decontamination areas (contamination reduction zones) shall be established at all entrances and exits to/from exclusion zones.
- All barricades and tapes shall be maintained daily prior to commencement of operations.

3.2 Work Practices

- Eating, drinking, smoking, chewing gum or tobacco, or applying of cosmetics is only permitted in support zones.

- No facial hair that would interfere with respirator fit will be permitted on employees who are required to wear respirators.
- Employees are to report to the SSO any symptoms of exposure they might experience and all accidents/incidents.
- Inspect all vehicles prior to leaving the site.
- Workers shall use proper decontamination procedures in the contaminant reduction zone.
- At the end of every workday on site, a heavy-duty plastic sheet shall be placed over the top of any stockpiled soils to minimize erosion and fugitive dust.
- All excavation and earthwork will take place using motorized excavation equipment such as track hoes, etc. Operators shall remain in their closed cabs with the ventilation on recirculate.

4 Air Monitoring and Action Levels

According to 29 CFR 1910.120(h) and Washington Administrative Code (WAC), air monitoring shall be used to identify and quantify airborne levels of hazardous substances and health hazards in order to determine the appropriate level of employee protection required for personnel working on site.

4.1 Real Time Air Monitoring Requirements

Real time air monitoring is required for sites where the chemical hazards listed in Table 4-1 may be present. However, drilling and sample collection is not expected to create a hazardous atmosphere. All work will be performed outside, and personnel will be in close proximity to small volumes of soil and groundwater during sample collection. Although some of the chemical listed in Table 4-1 are present at the Site, monitoring with a photoionization detector (Table 4-2) will be the only air monitoring conducted at the Site.

Table 4-1 Chemicals Requiring Initial Determination Air Monitoring

Chemical	OSHA and WA DOSH Standard for Respiratory Protection
Acrylonitrile	1910.1045 WAC 296-62-07340
Arsenic, inorganic	1910.1018
Asbestos	1910.1001 – General Industry 1926.1101 – Construction Sites
Benzene	1910.1028 WAC 296-62-07523
1,3-Butadiene	1910.1051 WAC 296-62-07460
Cadmium	1910.1027 1926.1127 WAC 296-62-074
Coal Tar Pitch Volatiles • Acenaphthene • Benzo(a)pyrene • Chrysene • Phenanthrene • Pyrene	1910.1029
1,2-dibromo-3-chloropropane	1910.1044 WAC 296-62-07342
Formaldehyde	1910.1048 WAC 296-62-07540
Hexavalent Chromium	WAC 296-62-08003
Lead	1910.1025 – General Industry

	1926.62 – Construction WAC 296-62-07521
Methylene chloride	1910.1052
Methylenedianiline	1910.1050 – General Industry 1926.60 – Construction WAC 296-62-076
Vinyl chloride	1910.1017 WAC 296-62-07316

Air monitoring is conducted at the following times or as specified by the Field Manager:

- Upon initial entry to rule out oxygen deficient, flammable, and/or IDLH conditions. At this site there is no “entry”, as no work in to be completed in excavations, trenches, or small spaces.
- When the possibility of an oxygen deficient, flammable, and/or IDLH condition or flammable atmosphere has developed
- As an on-going check of the levels of contaminants in the breathing zone
- When work is initiated on a different portion of the site
- When contaminants other than those previously identified are encountered
- When a different operation is initiated
- When work involves the handling of leaking drums, containers, or when working in areas with obvious liquid contamination
- During confined space entry
- At the perimeter of the site as required
- Outside the site perimeter as required (e.g., adjacent buildings).

If deemed necessary, per the conditions noted above, real time air monitoring with direct reading instruments will conform to, at a minimum, the criteria listed in Table 4-2. All air monitoring data will be recorded in the daily field logs. All air monitoring equipment calibration data is to be recorded in the daily field logs. Air monitoring instruments will be calibrated and maintained in accordance with the manufacturer's specifications.

Table 4-2 Air Monitoring/Instrumentation

X	**Photoionization Detector** Please Check Bulb Size:		
	9.5eV: ☐	**10.2eV:** ☒	**11.7eV:** ☐
Use:	Detection of Organic Gases and Vapors		
Action Level:	PID reading >15 ppm at point of operations for more than 1 minute → **Establish 25-ft diameter exclusion zone around work area**, monitor worker's breathing zone. PID reading >15 ppm in worker's breathing zone for more than 1 minute→ **Evacuate area or upgrade to Level C-half face respirator with organic vapor/HEPA cartridge**, establish contamination reduction zone with waste containers and decontamination fluids provided for personal decontamination. PID reading >75 ppm in worker's breathing zone for more than 1 minute→ **Evacuate area and move upwind** to allow vapors to dissipate, may resume work after vapors dissipate. PID reading >100 ppm in worker's breathing zone for more than 1 minute OR >300 ppm instantaneous →**Evacuate area and move upwind.** If elevated levels persist, cover boring and cuttings and notify Field Manager.		
Frequency:	Sample the breathing space and work area periodically throughout field activities.		

4.2 Respirator Cartridge Change Out

In the event of the use of respiratory protection, cartridges will be replaced daily during field work. For organic cartridges, these conditions may dictate that the cartridges be replaced more frequently:

- If the organic chemical's boiling point is <70°F and the concentration is greater than 200 ppm, contact the Field Manager to discuss cartridge replacement and options for respiratory protection.
- If physical work rate exceeds a moderate level, replace cartridges every 4 hours of work.
- If relative humidity exceeds 85%, replace cartridges every 4 hours of work.

5 Site Control

5.1 Work Zones

Work zones will be delineated by CRETE personnel. The primary purpose for site controls is to establish the hazardous area perimeter, to reduce migration of contaminants into clean areas, and to prevent access or exposure to hazardous materials by personnel or visitors. At the end of each workday, the work should be completed such that there are no open boreholes or excavations remaining. A new activity will not be started toward the end of the workday, such that an unfinished condition is left overnight. All equipment will be removed from the site or locked out such that it cannot be accessed at the end of each workday. During active working conditions, site work zones will include:

- Clean Zone/Support Zone. This uncontaminated zone will be the area outside the Exclusion Zone and Contamination Reduction Zone (CRZ) and within the geographic perimeters of the Site, but not within actively used portions of the Site, such as tenant parking areas. This area is used for staging of materials, parking of investigation personnel vehicles, and receipt of deliveries. Personnel entering this zone may include delivery personnel, visitors, security guards, etc., who will not necessarily be permitted in the exclusion zone.

  All personnel arriving in the support zone will report to the Field Manager and sign the Visitor Sign-In Log.

  - If investigation work is to occur in actively used portions of the site, such as if a UST investigation overlaps commonly used tenant parking areas, then prior communications/arrangements will be made between the Port and the tenants to utilize another part of the Site during that workday.
- The CRZ will provide a location for removal and final decontamination of contaminated PPE. A separate decontamination area will be established for heavy equipment. All personnel and equipment must exit the Exclusion Zone via the CRZ.
- Exclusion Zone/Hot Zone. The exclusion zone will be the "hot zone" or contaminated area inside the site perimeter. Entry to and exit from this zone will be made through a designated point within the CRZ. Appropriate warning signs to identify the exclusion zone should be posted (*e.g.,* **DANGER**, **AUTHORIZED PERSONNEL ONLY**, **PROTECTIVE EQUIPMENT BEYOND THIS POINT**). Personnel and equipment decontamination must occur upon exiting from the exclusion zone.

In most cases, these work zones will not be formally demarcated. Sample collection will occur at each of the locations on Figure 5 of the RIWP, and work zones will move to accommodate these locations. The area around any heavy equipment, such as a drill rig, and the area where samples are processed/logged will become informal exclusion zones. Where investigation locations may overlap frequently used areas of

the property, arrangements between the Port and the tenants will be made beforehand to ensure the area is accessible for RI activities and that tenants do not wander into the area.

5.2 General Site Control Safety Procedures

- Whenever possible, avoid contact with contaminated (or potentially contaminated) surfaces. Walk around (not through) puddles and discolored surfaces. Do not kneel or set equipment on the ground. Stay away from waste drums unless it is necessary to sample or handle the drums. Protect equipment from contamination by bagging.
- Eating, drinking, and/or smoking are only permitted in designated areas in the support zone.
- Hands and face must be thoroughly washed upon leaving the CRZ.
- Beards and/or other facial hair that interferes with respirator fit will preclude admission to the exclusion zone.
- All equipment must be decontaminated or properly discarded upon exit from the exclusion zone as determined by the Field Manager.
- All personnel exiting the exclusion zone must go through the decontamination procedures as described in this HASP.
- PPE as described in this HASP will be required for all field personnel working on site.
- Contact lenses may be worn on the site provided safety glasses or goggles are also worn. Any exceptions to wearing of contact lenses will be specified in this HASP or through a HASP amendment.

6 Decontamination

In general, everything that enters the exclusion zone must either be decontaminated or properly discarded upon exit from the exclusion zone. All personnel, including any visitors, must enter and exit the exclusion zone through the CRZ.

Contaminated equipment will be decontaminated and inspected by the equipment operator (a subcontractor). Material that is generated by decontamination procedures will be drummed and properly disposed of.

6.1 Personnel Decontamination

Personnel may become contaminated in a number of ways including, not limited to:

- Contacting vapors, gases, mists, or particulates in the air
- Being splashed by materials during sampling
- Walking through puddles or on contaminated soil
- Using contaminated instruments or equipment.

Even with safeguards, personnel contamination may occur. Harmful materials can be transferred into the clean area, exposing unprotected personnel. In removing contaminated clothing, personnel may contact contaminants on clothing or inhale them. To prevent such occurrences, decontamination procedures must be developed and established before anyone enters the site and must continue throughout site operations.

Personnel decontamination procedures will be based on the contaminants of concern and the level of protection being worn by site personnel.

6.2 Sampling Equipment

Sampling devices, when used onsite, require special cleaning procedures (Table 6-1).

6.3 Equipment Decontamination

Heavy equipment will be decontaminated by the operator/subcontractor.

6.4 Disposal of Contaminated Materials

All materials and equipment used for decontamination must be disposed of properly (Table 6-1).

6.5 Emergency Decontamination

Personnel with medical problems or injuries may also require decontamination. There is the possibility that the decontamination may aggravate or cause more serious health effects. If prompt lifesaving, first aid, and medical treatment are required, decontamination procedures will be omitted. In either case, a member of

the site management team will accompany contaminated personnel to the medical facility to advise on matters involving decontamination.

6.6 Sanitizing of Personal Protective Equipment

Respirators, reusable protective clothing, and other personal articles not only must be decontaminated before being reused, but also sanitized. The insides of masks and clothing become soiled due to exhalation, body oils, and perspiration. Manufacturer's instructions should be used to sanitize the respirator masks. If practical, reusable protective clothing should be machine-washed after a thorough decontamination; otherwise, it must be cleaned by hand.

Table 6-1 Decontamination Procedures

☒	**Level C:** Segregated equipment drop, boot cover and glove wash, boot cover and glove rinse, boot cover removal, outer glove removal, suit/safety boot wash, suit/safety boot rinse, (canister or mask change), safety boot removal, splash suit removal, inner glove wash, face piece removal, inner glove removal, inner clothing removal, field wash, re-dress. **Modifications**:
☒	**Level D:** Segregated equipment drop, boot and glove wash, boot and glove rinse, or dispose of gloves. **Modifications:** Personal Floatation Device (PFD) for work over water
☐	**Sampling Equipment:**
☐	**Heavy Equipment Decontamination:**
☐	**Decontamination Disposal Procedures:**
☐	**Emergency Decontamination Equipment Procedures:**

7 Emergency Response/Contingency Plan

The SSO is responsible for emergency contingency planning and as such, is responsible for:
Posting emergency telephone numbers and route to the hospital in the field

- Conducting a weekly inventory of site emergency equipment, spill response and supplies
- Familiarizing themselves with emergency procedures for personnel injury or suspected overexposures, fires, explosions or releases
- Identifying the names of all personnel on site who are certified in CPR and first aid
- Briefing new employees on the emergency response plan before they perform fieldwork.

7.1 Emergency Equipment and Supplies

The following emergency equipment and supplies will be available on site during days with field sampling:

- Fire extinguishers;
- Industrial first aid kit; and
- Eye wash.

7.2 Emergency Recognition and Prevention

Prevention of emergencies will be aided by the effective implementation of the health and safety procedures specified in this Site-Specific Health and Safety Plan. The following hazards which could lead to emergency situations have been identified as being potentially present during the course of field activities:

- Drowning or other water accidents when working from barges or vessels;
- Traumatic injury from heavy equipment accidents, rusty or sharp demolition debris, and/or falling into holes or trenches; and
- Exposure to harmful chemical dusts and vapors.

7.3 Emergency Medical Treatment and First Aid

Prevent further injury, perform appropriate decontamination and notify the SSO.

Depending upon the type and severity of the injury, the SSO will call 911 for an ambulance.

Notify CRETE personnel.

Prepare an incident report.

7.4 Emergency Decontamination

Personnel will be decontaminated to the extent feasible but life saving and first aid procedures take priority over decontamination efforts. Workers shall grossly decontaminate the injured person.

7.5 Evacuation Routes and Procedures

In case of emergencies, evacuation routes will be designated. Personnel will exit the site and assemble at the designated point in the support zone. The SSO will account for personnel at the on site assembly point and notify local emergency responders. The SSO will assess the need for site evacuation based on the degree of hazard posed to personnel in the support zone.

Evacuation routes will be determined on a site-by-site basis. Elements that will be considered in the selection of the route include: wind direction, obstructions, topography, and type of emergency. Assembly Points will be determined, as needed.

7.6 Critique of Response and Follow-up

The Project Manager or their designee will evaluate the effectiveness of the emergency response and recommend procedures for improving emergency response to the Project CIH. Follow-up activities include notification of the CRETE Project Manager within 24 hours of the injury, investigation of cause and implementation of measures to prevent reoccurrence.

8 Emergency Contacts

The initial contact by CRETE field personnel will be to the SSO. The Project Manager will provide subsequent notification to the parties listed below. If the SSO or Project Manager must be absent from the site, an assigned alternate will be responsible for establishing communications. CRETE will first notify the Seattle Police and Fire Departments by calling 911. In the event of a spill, notification will proceed in the following order:

1.	Department of Ecology	Spill Response 24 hr Emergency Line (206) 649-7130
2.	EPA Region X HQ	(206) 553-1200

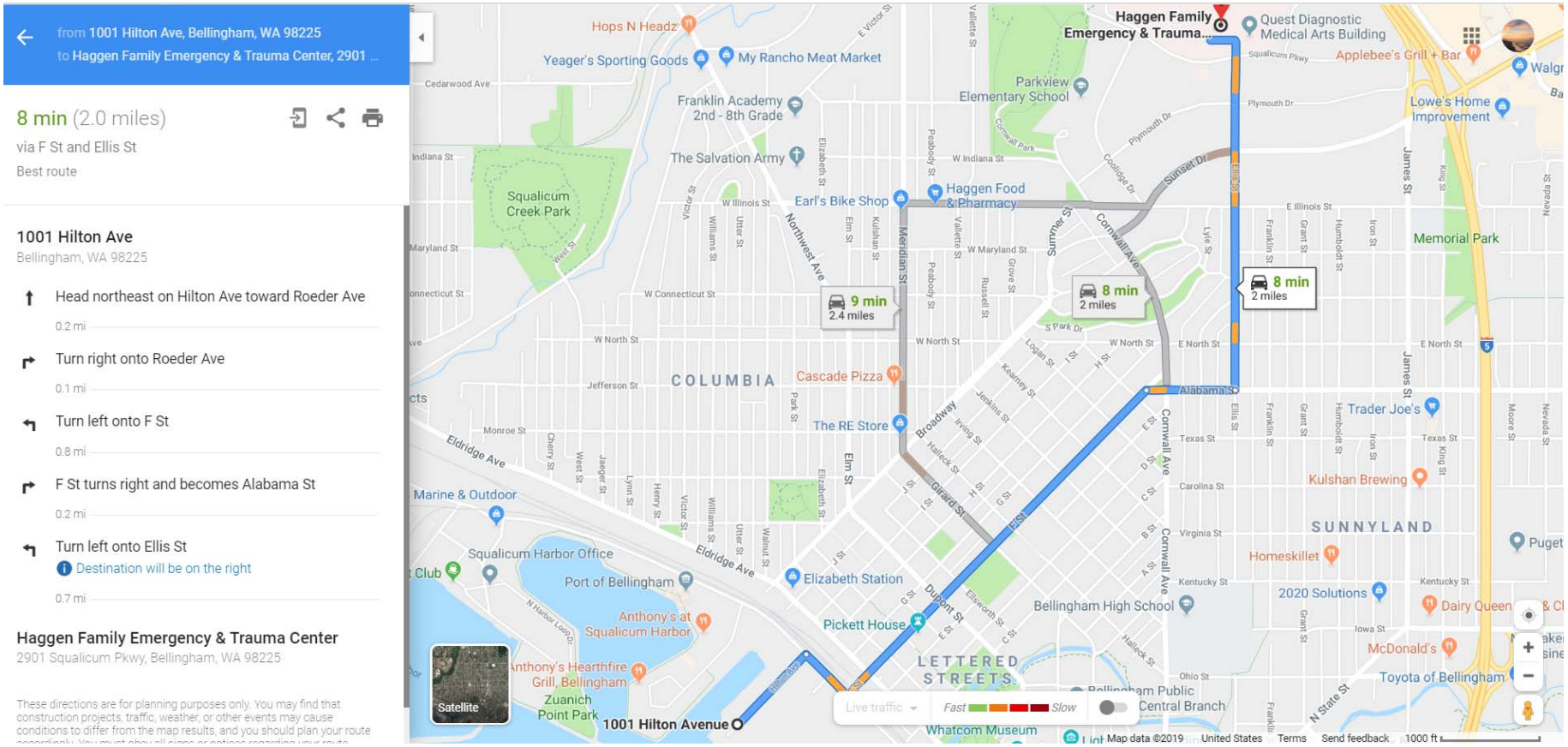
Emergency medical services are available at the following locations:

Haggen Family Emergency & Trauma Center
2901 Squalicum Pkwy
Bellingham, Washington
360.734.5100
(See Figure 1)

The following records shall be kept on site during activities on site:

- This plan with a complete signature sheet as of that day
- Material Safety Data Sheets
- Medical approval to wear respirator and respirator fit tests
- Air monitoring data
- Daily sign-in and out log
- Copies of workers' 40-Hour or 8-Hour Refresher Hazardous Waste Site Training Certificates
- Attendance list for Site Safety Briefings

Figure 1 Route to Hospital



Haggen Family Emergency & Trauma Center - 2901 Squalicum Pkwy, Bellingham, Washington
360.734.5100

9 Drum Handling

Will this project require the handling of drummed materials?

No: ☐	**Yes:** ☒

Soil cuttings, well purge/development water, and decontamination water will be drummed.

Accidents may occur during handling of drums and other investigation derived waste containers. Hazards include vapor generation and/or physical injury resulting from moving heavy containers by hand and working around drums and heavy equipment. OSHA regulations (29 CFR Parts 1910 and 1926) include general requirements and standards for storing, containing, and handling chemicals and containers, and for maintaining equipment used for handling materials. U.S. EPA regulations 40 CFR Part 265 stipulate requirements for types of containers, maintenance of containers and containment structures, and design and maintenance of storage areas. Department of Transportation (DOT) regulations (49 CFR Parts 171 through 178) also stipulate requirements for containers and procedures for shipment of hazardous waste.

- Have a dry chemical fire extinguisher on hand to control small fires.
- Check for labels, markings, etc., and note conditions of containers. Are the drums bulging, deteriorated, or leaking?
- Before moving any drum or container, determine the most appropriate sequence in which the various containers should be moved.
- Exercise extreme caution in handling drums that are not intact or tightly sealed.
- Use the following types of equipment to move drums and/or containers: 1) drum grappler attached to a hydraulic excavator, 2) small front-end loader with a bucket sling, 3) rough terrain fork lift, or 4) drum cart.
- Train personnel in proper lifting and moving techniques to prevent back injuries.
- Have over packs ready before any attempt is made to move drums.
- Pressurized drums are extremely hazardous. If possible, do not move drums that may be under internal pressure as evidenced by bulging or swelling. This is not expected because the only drums to be handled during the Remedial Investigation are those storing investigation derived waste (soil cuttings, purged groundwater, decontamination fluid).
- If a drum containing liquid cannot be moved without rupture, immediately transfer its contents to a sound drum using a pump designed for transferring the liquid.
- DO NOT use picks, chisels, or firearms to open drums.
- If pressure must be released manually, place a barrier such as explosion-resistant plastic sheeting between the worker and bung to deflect any gas, liquid, or solid that may be expelled as the bung is loosened.

- Reseal open bungs and drill holes with new bungs or plugs to avoid explosions and/or vapor generation. If an open drum cannot be resealed, place the drum into an over pack. Plug any opening in pressurizing drums with pressure venting caps set for 5 psi.
- Cover drum tops with plastic sheeting or other suitable non-chlorinated material to avoid excessive contact with drum tops.
- Never stand on drum tops.

10 Drilling Safety

Will this project require the use of a drill or direct push equipment rig for well installation and/or subsurface sampling?

No: ☐	**Yes:** ☒

Accidents may occur during drilling activities. Hazards include subsurface and overhead utilities, heavy machinery, heavy falling objects, slip/trip/fall, and potential flying debris. Prior to mobilization, the Project Manager should receive confirmation from the contractors that all personnel meet the following requirements:

- Personnel are 40-Hour OSHA trained.
- Personnel are current with 8-Hour Annual Refresher Training.
- Personnel are enrolled in a medical monitoring program.
- Personnel have been successfully fit-tested within the last 12 months.
- Personnel are trained in drill rig safe operating practices.
- Personnel are trained in First Aid/CPR.

Every drill crew should have a designated safety supervisor who has authority to enforce safety on the drilling site.

The drilling operator is responsible for making sure the drilling activities are conducted in a safe manner and that the operators are wearing appropriate PPE, are familiar with the Site and with emergency procedures, and are cognizant of safe operating methods for their equipment.

Appendix A

Site Safety Plan Acknowledgment Form

Site Safety Plan
Acknowledgment Form

I have been informed, understand, and will abide by all the procedures and protocols set forth in this Site Health and Safety Plan for the _____ site.

Name (Print)	Signature Affiliation		Date

Appendix B

Visitor Sign-In Log

Visitor Sign-In Log

Client:_____ **Project Name**:_____

Location:_____ **Field Activity:**_____

Project Mgr.:_____ **Field Manager**:_____

Date	Name	Affiliation	Purpose of Visit	Site EHS Training		Do you have Level D PPE?		Time In	Time Out
				Yes	No	Yes	No		

Appendix C

Site Safety/Tailgate Meeting Form

Our behavior-based safety process is the key to our success!

Site Safety/Tailgate Meeting Form

Project Name:_____ **Location**:_____
Date:_____ **Time**:_____
Project Number:_____ **Instructor**:_____

Safety Topics Presented

JHA:_____

Lessons Learned:_____

General Safety Topics:_____

Name Attend	ee's Signature

Appendix D
Notification of Access to Employee Exposure and Medical Records

Notice

To All Em ployees: This Notice Is to Provide Information for Compliance with 29 CFR Part 1910 Subpart C - General Safety and Health Provisions - Paragraph 1910.1020, Access to Employee Exposure and Medical Records.

(i) The existence, location, and availability of any records covered by this section is as follows:

CRETE Consulting, Inc.

100 South King Street, Suite 240
Seattle, WA
PH: (253) 797-6323

Attn: Grant Hainsworth

Grant.hainsworth@creteconsulting.com

(ii) The person responsible for maintaining and providing access to these records is CRETE's Environmental Health and Safety Manager.

(iii) Each employee has the right to access these records.

Appendix E

Material Safety Data Sheets

Appendix F

Job Hazard Analysis Forms

Appendix G

Cold Stress Indicators

Cold Stress

These Threshold Limit Values (TLVs) are intended to protect workers from the severe effects of cold stress (hypothermia) and cold injury and to describe exposures to cold working conditions under which it is believed that nearly all workers can be repeatedly exposed without adverse health effects. The TLV objective is to prevent the deep body core temperature from falling below 36ºC and to prevent cold injury to body extremities. Deep body temperature is the core temperature of the body as determined by rectal temperature measurements. For a single, occasional exposure to a cold environment, a drop in core temperature to no lower than 35ºC should be permitted. In addition to provisions for total body protection, TLV objective is to protect all parts of the body, with emphasis on hands, feet, and head, from cold injury.

Introduction

Fatal exposures to cold among workers have almost always resulted from accidental exposures involving failure to escape from low environmental air temperatures or from immersion in low temperature water. The single most important aspect of life-threatening hypothermia is the fall in the deep core temperature of the body. The clinical presentations of victims of hypothermia are shown in Table 1 (taken from Dembert in AFP, January 1982). Workmen should be protected from exposure to cold so that the deep core temperature does not fall below 36ºC (96.8ºF); lower body temperatures will very likely result in reduced mental alertness, reduction in rational decision-making, or loss of consciousness with the threat of fatal consequences.

Pain in the extremities may be the first early warning of danger to cold stress. During exposure to cold, maximum severe shivering develops when the body temperature has fallen to 35ºC (95ºF). This must be taken as a sign of danger to the workers and exposure to cold should be immediately terminated for any workers when severe shivering becomes evident. Useful physical or mental work is limited when severe shivering occurs.

Since prolonged exposure to cold air or to immersion in cold water in temperatures well above freezing can lead to dangerous hypothermia, whole body protection must be provided.

1. Adequate insulating clothing to maintain core temperatures above 36ºC must be provided to workers if work is performed in air temperatures below 4ºC (40ºF). Wind chill factor[1] or the cooling power of the air is a critical factor. An equivalent chill temperature chart relating the actual dry bulb air temperature and the wind velocity is presented in Table 2. The equivalent chill temperatures on exposed skin are determined by estimating the combined cooling effect of wind and low air temperatures.

2. Unless there are unusual or extenuating circumstances, cold injury to other than hands, feet, and head is not likely to occur without the development of the initial signs of hypothermia. Older workers or workers with circulatory problems require special precautionary protection against cold injury. The use of extra insulating

[1] Wind chill factor is a unit of heat loss from a body defined in watts per meter squared per hour being a function of the air temperature and wind velocity upon the exposed body.

clothing and/or a reduction in the duration of the exposure period are among the special precautions, which should be considered. The precautionary action to be taken will depend upon the physical condition of the worker and should be determined with the advice of a physician with knowledge of the cold stress factors and the medical condition of the worker.

Evaluation and Control

For exposed skin, continuous exposure should not be permitted when the air speed and temperature result in an equivalent chill temperature of -32ºC (-25ºF). Superficial or deep local tissue freezing will occur only at temperatures below -1ºC regardless of wind speed.

At air temperatures of 2ºC (35.6ºF) or less, it is imperative that workers who become immersed in water or whose clothing becomes wet be immediately provided a change of clothing and be treated for hypothermia.

Table 1 Progress Clinical Presentations of Hypothermia[2]

Core Temperature		Clinical Signs
ºC	ºF	
37.6	99.6	"Normal" rectal temperature
37.0	98.6	"Normal" oral temperature
36.0	96.8	Metabolic rate increases in an attempt to compensate for heat loss
35.0	95.0	Maximum shivering
34.0	93.2	Victim conscious and responsive, with normal blood
33.0	91.4	Severe hypothermia below this temperature
32.0 31.0	89.6 87.8	Consciousness clouded; blood pressure becomes difficult to obtain; pupils dilated but react to light; shivering ceases
30.0 29.0	86.0 84.2	Progressive loss of consciousness; muscular rigidity increases; pulse and blood pressure difficult to obtain; respiratory rate decreases
28.0	82.4	Ventricular fibrillation possible with myocardial irritability
27.0	80.6	Voluntary motion ceases; pupils non-reactive to light; deep tendon and superficial reflexes absent
26.0	78.8	Victim seldom conscious
25.0	77.0	Ventricular fibrillation may occur spontaneously
24.0	75.2	Pulmonary edema
22.0 21.0	71.6 69.8	Maximum risk of ventricular fibrillation
20.0	68.0	Cardiac standstill
18.0	64.4	Lowest accidental hypothermia victim to recover
17.0	62.6	Isoelectric electroencephalogram
9.0	48.2	Lowest artificially cooled hypothermia patient to recover

[2] Presentations approximately related to core temperature. Reprinted from the January 1982 issue of American Family Physician published by the American Academy of Fandly Physicians.

Table 2 Cooling Power of Wind on Exposed Flesh Expressed as Equivalent Temperature (under calm conditions)

Est. Wind Speed (mph)	Actual Temperature Reading (ºF)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (ºF)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-131
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect).	**Little Danger** In < 1 hr. with dry skin. Maximum danger of false sense of security.				**Increasing Danger** Danger from freezing of exposed flesh within one minute.			**Greater Danger** Flesh may freeze within 30 seconds.				
	Trench foot and immersion foot may occur at any point on this chart.											

Note:
Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.

Recommended limits for properly clothed workers for periods of work at temperatures below freezing are shown in Table 3. Special protection of the hands is required to maintain manual dexterity for the prevention of accidents:

1. If fine work is to be performed with bare hands for more than 10 to 20 minutes in an environment below 16ºC (60ºF), special provisions should be established for keeping the workers' hands warm. For this purpose, warm air jets, radiant heaters (fuel burner or electric radiator), or contact warm plates may be utilized. Metal handles of tools and control bars shall be covered by thermal insulating material at temperatures below -1ºC (30ºF).

To prevent contact frostbite, the workers should wear anti-contact gloves.

1. When cold surfaces below -7ºC (20ºF) are within reach, a warning should be given to each worker by his supervisor to prevent inadvertent contact by skin.

2. If the air temperature is -17.5ºC (9ºF) or less, the hands should be protected by mittens. Machine controls and tools for use in cold conditions should be designed so that they can be handled without removing the mittens.

Provisions for additional total body protection are required if work is performed in an environment at or below 4ºC (40ºF). The workers shall wear cold protective clothing appropriate for the level of cold and physical activity:

1. If the air velocity at the job site is increased by wind, draft, or artificial ventilating equipment, the cooling effect of the wind shall be reduced by shielding the work area, or by wearing an easily removable outer windbreak layer garment. Wind chill cooling rates are illustrated in Table 4.

2. If only light work is involved and if the clothing on the worker may become wet on the job site, the outer layer of the clothing used may be of a type impermeable to water. With more severe work under such conditions, the outer layer should be water repellent and the outerwear should be changed as it becomes wet. The outer garments must include provisions for easy ventilation in order to prevent wetting of inner layers by sweat. If work is done at normal temperatures or in a hot environment before entering the cold area, and the clothing is wet, the employee shall change into dry clothes before entering the cold area. The workers shall change socks and any removable felt insoles at regular daily intervals or use vapor barrier boots. The optimal frequency of change shall be determined empirically and will vary individually and according to the type shoe worn and how much the individual's feet sweat.

3. If extremities (ears, toes, and nose) cannot be protected sufficiently to prevent sensation of excessive cold or frostbite by handwear, footwear, and facemasks, these protective items shall be supplied in auxiliary heated versions.

4. If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work shall be modified or suspended until adequate clothing is made available or until weather conditions improve.

5. Workers handling evaporative liquid (gasoline, alcohol, or cleaning fluids) at air temperature below 4ºC (40ºF) shall take special precautions to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling. Special note should be taken of the particularly acute effects of splashes of "cryogenic fluids" or those liquids with a boiling point only just above ambient temperatures.

Table 3 Threshold Limit Values Work/Warm-up Schedule for Four-Hour Shift

Air Temp – Sunny Sky		Non-Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
ºC ºF		**Max. Work Period (min.)**	**No. of Breaks**	**Max. Work Period (min.)**	**No. of Breaks**	**Max. Work Period (min.)**	**No. of Breaks**	**Max. Work Period (min.)**	**No. of Breaks**	**Max. Work Period (min.)**	**No. of Breaks**
-26º to -28º	-15º to -1º	Normal Breaks		Normal Breaks		75	2	55	3	40	4
-29º to -31º	-20º to -24º	Normal Breaks		75	2	55	3	40	4	30	5
-32º to -34º	-25º to -29º	75	2	55	3	40	4	30	5	Non-emergency work should cease	
-35º to -37º	-30º to -34º	55	3	40	4	30	5	Non-emergency work should cease			
-38º to -39º	-35º to -39º	40	4	30	5	Non-emergency work should cease					
-40º to -42º	-40º to -44º	30	5	Non-emergency work should cease							
-43º & below	-45º & below	Non-emergency work should cease									

Notes:

1. Schedule applies to moderate-to-heavy work activity with warm-up breaks of ten (10) minutes in a warm location. For light-to-moderate work (limited physical movement): apply the schedule one step lower. For example, at 30ºF with no noticeable wind (Step 4), a worker at a job with little physical movement should have a maximum work period of 40 minutes with 4 breaks in a 4-hour period (5).

2. The following is suggested as a guide for estimating wind velocity if accurate information is not available: 5 mph - light flag moves; 10 mph - light flag fully extended; 15 mph - raises newspaper sheet; 20 mph - blowing and drifting snow.

3. If only the wind chill cooling rate is available, a rough rule of thumb for applying it rather than the temperature and wind velocity factors given above would be:
   (1) special warm-up breaks should be initiated at a wind chill of about 1720 Wm/2
   (2) all non-emergency work should have ceased at or before a wind chill of 2250 W/m2.

   In general, the warm-up schedule provided above slightly under-compensates for the wind at the warmer temperatures, assuming acclimatization and clothing appropriate for winter work. On the other hand, the chart slightly over-compensates for the actual temperatures in the colder ranges, since windy conditions rarely prevail at extremely low temperatures.

   Adapted from Occupational Health & Safety Division, Saskatchewan Department of Labor.

Table 4 Wind Chill Cooling Rate Effects*

Wind Chill Rates (Watts/m^3)	Comments/Effects
700	Conditions considered comfortable when dressed skiing.
1200	Conditions no longer pleasant for outdoor activities on overcast days.
1400	Conditions no longer pleasant for outdoor activities on sunny days.
1600	Freezing of exposed skin begins for most people depending on the degree of activity and the amount of sunshine.
2300	Conditions for outdoor travel such as walking become dangerous. Exposed areas of the face freeze in less than 1 minute for the average person.
2700	Exposed flesh will freeze within half a minute for the average person.

**Adapted from Canadian Department of the Environment, Atmospheric Environment Service.*

Work-Warming Regimen

If work is performed continuously in the cold at an equivalent chill temperature (ECT) or below -7ºC (20ºF), heated warming shelters (tents, cabins, rest rooms, etc.) shall be made available nearby and the workers should be encouraged to use these shelters at regular intervals, the frequency depending on the severity of the environmental exposure. The onset of heavy shivering, frostbite, the feeling of excessive fatigue, drowsiness, irritability, or euphoria are indications for the immediate return to the shelter. When entering the heated shelter, the outer layer of clothing shall be removed and the remainder of the clothing loosened to permit sweat evaporation. Also, a change of dry work clothing may be provided. A change of dry work clothing shall be provided as necessary to prevent workers from returning to their work with wet clothing. Dehydration, or the loss of body fluids, occurs insidiously in the cold environment and may increase the susceptibility of the worker to cold injury due to a significant change in blood flow to the extremities. Warm sweet drinks and soups should be provided at the work site to provide caloric intake and fluid volume. The intake of coffee should be limited because of the diuretic and circulatory effects.

For work practices at or below -12ºC (10ºF) ECT, the following shall apply:

1. The worker shall be under constant protective observation (buddy system or supervision).

2. The work rate should not be so high as to cause heavy sweating that will result in wet clothing; if heavy work must be done, rest periods must be taken in heated shelters and opportunity for changing into dry clothing shall be provided.

3. New employees shall not be required to work full time in cold in the first days until they become accustomed to the working conditions and required protective clothing.

4. The weight and bulkiness of clothing shall be included in estimating the required work performance and weights to be lifted by the worker.

5. The work shall be arranged in such a way that sitting still or standing still for long periods is minimized. Unprotected metal chair seats shall not be used. The worker should be protected from drafts to the greatest extent possible.

6. The workers shall be instructed in safety and health procedures. The training program shall include, at a minimum, instruction in:

    a) Proper re-warming procedures and appropriate first aid treatment

    b) Proper clothing practices

    c) Proper eating and drinking habits

    d) Recognition of impending frostbite

    e) Recognition of signs and symptoms of impending hypothermia or excessive cooling of body even when shivering does not occur

    f) Safe work practices

Special Workplace Recommendations

Special design requirements for refrigerator rooms include the following:

1. In refrigerator rooms, the air velocity should be minimized as much as possible and should not exceed 1 meter per second (200 fpm) at the job site. This can be achieved by properly designed air distribution systems.

2. Special wind-protective clothing shall be provided based upon existing air velocities to which workers are exposed.

Special caution shall be exercised when working with toxic substances and when workers are exposed to vibration. Cold exposure may require reduced exposure limits.

Eye protection for workers employed outdoors in a snow and/or ice-covered terrain shall be supplied. Special safety goggles to protect against ultraviolet light and glare (which can produce temporary conjunctivitis and/or temporary loss of vision) and blowing ice crystals are required when there is an expanse of snow coverage causing a potential eye exposure hazard.

Workplace Monitoring is Required as Follows:

1. Suitable thermometry should be arranged at any workplace where the environmental temperature is below 16ºC (60ºF) to enable overall compliance with the requirements of the TLV to be maintained.

2. Whenever the air temperature at a workplace falls below -1ºC (30ºF), the dry bulb temperature should be measured and recorded at least every 4 hours.

3. In an indoor workplace, the wind speed should also be recorded at least every 2 hours whenever the rate of air movement exceeds 2 meters per second (5 miles per hour).

4. In an outdoor work situation, the wind speed should be measured and recorded together with the air temperature whenever the air temperature is below -1ºC (30ºF).

5. The equivalent chill temperature shall be recorded with the other data whenever the equivalent chill temperature is below -7ºC (20ºF).

Employees shall be excluded from work in cold at -1ºC (30ºF) or below if they are suffering from diseases or taking medication, which interferes with normal body temperature regulation or reduces tolerance to work in cold environments. Workers who are routinely exposed to temperatures below -24ºC (-10ºF) with wind speeds less than 5 miles per hour should be medically certified as suitable for such exposures.

Trauma sustained in freezing or subzero conditions requires special attention because an injured worker is predisposed to secondary cold injury. Special provisions must be made to prevent hypothermia and secondary freezing of damaged tissues, in addition to providing first aid treatment.