ENGINEERING DESIGN REPORT

Final

I&J Waterway Site
Sediment Cleanup Unit 1
Bellingham, Washington

Project Number: 036-001

Prepared for:

Port of Bellingham and
Bornstein Seafoods, Inc.

November 14, 2023

Prepared by:

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List of Acronyms and Abbreviations

AO	Agreed Order
ASCE	American Society of Civil Engineers
BMC	City of Bellingham Municipal Code
BMP	Best Management Practice
Bornstein	Bornstein Seafoods, Inc
CAP	Cleanup Action Plan
CDF	controlled density fill
Cm	centimeter
CRC	Cultural Resource Consultants, Inc.
City	City of Bellingham
CMCRP	Compliance Monitoring and Contingency Response Plan
cPAH	carcinogenic Polycyclic Aromatic Hydrocarbon
CPT	Cone Penetrometer Testing
CQAP	Construction Quality Assurance Plan
CSL	Cleanup Screening Level
CWA	Clean Water Act
cy	cubic yard
DMMU	Dredged Material Management Unit
DO	dissolved oxygen
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
El.	elevation
ESA	Endangered Species Act
FEMA	Federal Emergency Management Act
ft/s	feet per second
GMD	Glacial Marine Drift
HASP	Health and Safety Plan
HTL	High Tide Line
HPA	Hydraulic Project Approval
JARPA	Joint Aquatic Resources Permit Application
MCE	maximum considered earthquake
MHHW	Mean Higher High Water
MLLW	Mean Lower Low Water
Mph	miles per hour
m/s	meters per second
MTCA	Model Toxics Control Act
ng/kg	nanogram per kilogram
No.	number
NOAA	National Oceanic and Atmospheric Administration

NPDES	National Pollutant Discharge Elimination System
OHWM	Ordinary High Water Mark
OSHA	Occupational Safety and Health Administration
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PGA	peak ground acceleration
PGF	post-glacial fluvial
Port	Port of Bellingham
PRDI	Pre-Remedial Design Investigation
RBCs	Risk Based Concentration
RCW	Revised Code of Washington
RI/FS	Remedial Investigation and Feasibility Study
RML	residuals management layer
s	second(s)
SCO	Sediment Cleanup Objective
SCU	Sediment Cleanup Unit
SEPA	State Environmental Policy Act
Site	I&J Waterway Site
SMS	Sediment Management Standards
SPT	Standard Penetration Tests
sq. ft.	square foot/feet
SQS	Sediment Quality Standard
SVOC	Semi-Volatile Organic Compound
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USCG	U.S. Coast Guard
UW CIG	University of Washington Climate Impacts Group
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WISHA	Washington Industrial Safety and Health Act
WQC	Water Quality Certification
WQMP	Water Quality Monitoring Plan

Professional Certification

Engineer Design Report
I&J Waterway SCU-1, Port of Bellingham – 1001 Hilton Ave., Bellingham, WA 98225

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1 Introduction

This Engineering Design Report (EDR) outlines the design criteria and describes the engineering design for certain portions of the cleanup action for the I&J Waterway site in Bellingham, Washington. The I&J Waterway site includes two Sediment Cleanup Units (SCUs), SCU-1 and SCU-2. This EDR addresses SCU-1. The EDR has been prepared to satisfy the requirements of Agreed Order No. DE 16186 (Agreed Order) and the Cleanup Action Plan (CAP) issued by Washington Department of Ecology (Ecology) in April 2019, including the required supporting plans. 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. Engineering design for SCU-2 will be initiated in conjunction with cleanup construction for SCU-1.

1.1 Site Location and Vicinity

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). 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 (Figure 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, 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 Hilton upland area and a property to its southwest that is currently leased to Bornstein. The federal government 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.

1.2 Purpose of Report

This EDR was developed to document the engineering design for the SCU-1 cleanup action defined in the CAP, which is Exhibit B of the Agreed Order. The CAP describes Ecology's selected cleanup action for the I&J Waterway site, consistent with Model Toxics Control Act (MTCA) and Sediment Management Standards (SMS) requirements.

In accordance with the Agreed Order requirements, the scope of work for this EDR includes Construction Quality Assurance Plan (CQAP), Compliance Monitoring and Contingency Response Plan (CMCRP), Water Quality Monitoring Plan (WQMP), proposed best management practices (BMPs), and permits and substantive requirements. This EDR will define specific performance standards for the cleanup action, including contingency response actions following completion of construction. An Inspection and Maintenance Plan

(IMP) was listed in a footnote to Exhibit C of the AO but an IMP is not relevant to the I&J Waterway SCU-1 cleanup since no engineered containment measures (e.g. caps) are being constructed.

1.3 Report Organization

This EDR is organized as follows:

- Section 2 summarizes the site background and design basis.
- Section 3 is an overview of the regulatory requirements which pertain to the cleanup project.
- Section 4 identifies the net environmental effects.
- Section 5 contains design considerations and details for the project components, including a discussion of the dredging plan design and dock replacement considerations.
- Section 6 contains the work sequence and dredge plan to complete the project.
- Section 7 presents the monitoring for the project and the contingency response actions.
- Section 8 lists references.

Key appendices include the following:

- Appendix A includes the results of the Pre-Remedial Design Investigation (PRDI) field results, competed in June 2020 and January 2021.
- Appendix B includes the Geotechnical Basis of Design Report
- Appendix C includes the Dock and Bulkhead Basis of Design
- Appendix D presents the Construction Quality Assurance Plan
- Appendix E presents the Compliance Monitoring and Contingency Response Plan
- Appendix F presents the Water Quality Monitoring Plan
- Appendix G includes the substantive requirements of procedurally exempt permits

2 Background and Design Basis

This section provides a summary of site conditions and the PRDI results. Detailed site history and environmental 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 (Ecology 2019). This section includes excerpts from the RI/FS and the CAP that are relevant to SCU-1.

2.1 Summary of Cleanup Action

The cleanup action for the I&J Waterway site is shown on Figure 3. The cleanup action for the SCU-1 area includes removal of contaminated sediment in the Dock, Floating Dock, Berthing Area, Notch 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.

As described in Appendix B, a stable dredge slope will be established between the SCU-1 footprint and adjacent areas, including the transition slope between SCU-1 and SCU-2 (Figures 3 and 4). Following dredging, a residuals management layer (RML) will be placed over the entire dredge footprint and dredge side slopes (except where shoreline armor material will be placed). The RML will in turn mix with the thin veneer of dredge residuals that may remain following dredging (see Section 5.2.3.3).

Removal of contaminated sediment from the Dock and Floating Dock units will require removal and 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. Within the Notch Area, recent sediment deposits will be removed based on field observations during the cleanup.

2.2 Other Cleanup Sites

A portion (Unit 9) of the Phase 2 area of the Whatcom Waterway site overlaps the I&J Waterway site. The primary contaminants at the Whatcom Waterway site are mercury and dioxins/furans, 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.

The Central Waterfront site is located adjacent to the I&J Waterway site, as shown in Figure 2. Petroleum hydrocarbons, metals and polycyclic aromatic hydrocarbons (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 2022.

2.3 PRDI Summary and Results

In June 2020 and January 2021 additional design data was collected to address data gaps identified in the PRDI Work Plan (CRETE 2020). Appendix A includes the results of the PRDI field investigations including sediment logs and laboratory reports. Data collected during the PRDI field activities included the following:

- Base Map – in order to develop a complete project base map additional surveys were completed. Surveys included bathymetric survey, upland topographic survey, and utility mapping. This information has been incorporated into the project base map for the remedial design drawings.
- Geotechnical Data – additional geotechnical data was collected to complete a dredgeability review, inform the bulkhead and dock design, to assess post-cleanup slope stability, and to determine safe offsets from the USCG facilities. This information has been folded into the project drawings and is summarized in the Geotechnical Report (included as Appendix B of this EDR) and the Basis of Design for the Dock and Bulkhead (included in Appendix C of this EDR). Sample investigation locations are shown on Figure 4.
- Dredge Extent – to aid in defining the dredge prism, the presence and depth of the Glacial Marine Drift (GMD) was documented using multiple complimentary methods. Subsurface chemistry was evaluated at select locations throughout the dredge prism and locations that represent future dredge side slopes. In addition, the extent of carcinogenic polycyclic aromatic hydrocarbon (cPAHs) in surface sediment at the southwest corner of SCU-1 was evaluated. This information is summarized in the PRDI Field Results Technical Memorandum (included as Appendix A of this EDR). Sample investigation locations are shown on Figure 4.
- Implementation Issues – a combination of side scan sonar, multi-beam, and sub-bottom profiling was used to assess the presence of surface debris and shallow subsurface debris under soft unconsolidated sediment. This information is summarized in the PRDI Field Results Technical Memorandum (included as Appendix A of this EDR).

2.4 Current Conditions

This section presents an overview of the site conditions. Site conditions are presented in more detail in the RI/FS (Anchor QEA 2015) and the CAP (Ecology 2019). This section includes excerpts from the RI/FS and the CAP that are relevant to SCU-1.

2.4.1 Topography

The I&J Waterway site is located along Bellingham Bay to the northwest of Bellingham, Washington. The upland area is relatively flat ranging from approximately elevation 12 feet to 16 feet MLLW. In the navigation channel the existing mudline varies from elevation -3 feet MLLW in the northern corner to approximately elevation -16 feet MLLW in the center of the channel and elevation -18 MLLW feet in a localized area near the USCG dock.

2.4.2 Regional Geology

The Bellingham area has been shaped by glacial deposits with the advance and retreat of the Cordilleran Ice Sheet and by subsequent sedimentation and filling activities. The project site is in a beach and intertidal area along the Bellingham Bay shoreline that has been filled in the past. 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. In the area, the bedrock is from the Chuckanut Formation consisting of sandstone, siltstone, and shale. Bedrock was not encountered at the I&J Waterway site, but it was encountered at El. -26 feet at its shallowest at the Whatcom Waterway site just to the southeast of the I&J Waterway.

2.4.3 Regional Seismicity

Based on the regional tectonics, three types of seismic sources provide contributions to the seismic hazard. Deep earthquakes, which occur within the subducting Juan de Fuca plate, usually have a magnitude less than 7.5. The range of distances between the earthquake source and the site is similar to the depths. The shaking from deep earthquakes is typically weaker but felt over a wider area when compared to shallow earthquakes. The Nisqually Earthquake (M=6.8) in 2001 is the most recent example of a deep earthquake in this area. Subduction earthquakes occur at the interface of the subducting Juan de Fuca plate and the North American plate. Huge areas of slip may occur resulting in earthquakes with a magnitude of up to 9.1. The strong shaking could continue for several minutes and many aftershocks will occur. The most recent inter-plate event on the Cascadia Subduction Zone is believed to have occurred in 1700. This fault zone is over 60 miles from the site. Shallow earthquakes occur within the North American plate at depths typically less than 10 miles and magnitudes of 7.5 or less. The Birch Bay Fault is the closest fault to this project, which is more than 5 miles from the project site.

2.4.4 Site Geology

Figures 5 and 6 show the interpreted subsurface conditions along the bulkhead and across the waterway, respectively, including approximate contacts between the lithologic units. In the upland area near Bornstein Seafood the Fill is 8 to 18 feet thick, extending to El. 4 to El. -3 feet. The Fill is underlain by Post-Glacial Fluvial (PGF) deposits that are 5 to 12 feet thick and extend to El. -4 to El. -12 feet. The PGF deposits were underlain by GMD to the maximum depth explored (El. -57 feet). In the navigation channel, the Recent Sediments are underlain by the GMD. The Recent Sediments were observed to be 1.8 to 7.2 feet thick, but in most areas, they were 3 to 4 feet thick. The individual lithologic units are described in more detail below:

- **Glacial Marine Drift (GMD):** GMD is a fine-grained glacial sediment that was deposited in marine water. In the Bellingham area, the GMD contains unstratified silt and clay with varying amounts of sand, gravel, cobbles, and occasional boulders. This unit may contain small percentages of shells and wood. At the site, the GMD consists of soft to stiff, clay (CL) with varying amounts of sand and gravel. In testing completed for this project, the average value of the plasticity index (PI) in the GMD was 18, with PI values ranging from 13 to 29, indicating that the GMD is medium to highly plastic. Consolidation tests indicate that the top 10 to 15 feet of the GMD is lightly overconsolidated. In the upland areas the GMD was encountered between -4 to -12 feet MLLW. In SCU-1, the GMD was encountered at elevations ranging from -19 to -24 feet MLLW in the federal channel sloping upward beneath the docks to the bulkhead at about – 4.5 to -8 feet MLLW. The federal navigation channel and berthing areas were excavated out of the GMD layer and the most recent maintenance dredging occurred in 1966.
- **Post-Glacial Fluvial Deposits (PGF):** This unit consists of native fluvial sediments, primarily from Whatcom Creek, deposited prior to industrialization of the area. The PGF consist of loose to dense, slightly silty to silty sand with varying amounts of gravel. Shells and wood were observed in this deposit. Trace organics were also observed in this deposit. The bottom of this unit is about -4 to -12 feet MLLW, indicating that it was almost entirely removed from SCU-1 during waterway construction. PGF was encountered during the PRDI on the slope at the southwest corner of SCU-1 in vibracore IJW-SC-10.
- **Fill:** This unit consists of very loose to medium dense, or locally very dense, cohesionless fill and medium stiff cohesive fill. The fill was typically silty to very silty sand to silty to very silty gravel, but cohesive layers were locally observed. Wood, brick, shells, and charcoal were found in these deposits. This unit consists of soil characterized by their recent man-made placement and larger variability in soil properties.
- **Recent Deposits:** This unit consists of very soft to soft, organic silts, silts and clays with varying amount of silt and gravel with localized layers of loose, silty sands and sands. Fish bones, fish waste, and shells were observed in this unit.

2.5 Site Contaminants

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.

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.

2.5.1 Nature and Extent of Contamination

The nature and extent of sediment contamination at the I&J Waterway site has been delineated through a number of investigations as summarized in the CAP. 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 cPAHs above natural background, with only one sample concentration above the cPAH cleanup level that was developed in the CAP based on 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.

  The depth and thickness of the contaminated recent sediment layer varies with location but is generally between 4 and 8 feet in thickness. The vertical extent of contamination was delineated based on the presence of the native uncontaminated GMD 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. The slope from the bulkheads to the toe of the navigation channel is generally at or steeper than a 2H:1V slope. 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. 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 depth and thickness of the contaminated recent sediment layer varies with location but is generally between 2 and 6 feet in thickness.

2.5.2 Exposure Pathways and Receptors

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

- **Protection of Benthic Organisms**: The primary environmental receptors are sediment-dwelling organisms.
- **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 and are generally within the area above benthic biological criteria.

The exposure pathways will be addressed in SCU-1 by the removal of contaminated sediments down to the GMD. Phase 2 PRDI sampling of the dredge side slopes also indicated that there is limited risk associated with the subsurface sediments that will be exposed due to dredging.

3 Regulatory Requirements

This section presents applicable regulatory requirements for the cleanup action, cleanup standards for the Site based on these regulatory requirements, identifies the Site boundary, and summarizes applicable local, state, and federal laws.

3.1 Cleanup Standards and Site Boundary

This section discusses the development of cleanup standards and identifies the Site boundary, consistent with SMS. The following subjects are discussed:

- Statement of cleanup action objectives: These are narrative statements that describe the goals of cleanup.
- Summary of the exposure pathways, screening levels, and contaminants.
- Selection of cleanup standards for contaminants: Under SMS, the cleanup standards consist of a cleanup level (i.e., a concentration that must be met by the cleanup) and a depth or area of compliance (point of compliance) where that cleanup level must be met.
- Identification of Site boundary: The Site Boundary is the area of the Site that must be remediated in order to meet cleanup standards.

3.1.1 Cleanup Action Objectives

Based on the site conditions and current regulations, the following cleanup action objectives are applicable to SCU-1:

- Surface Sediment: Remove sediment to ensure compliance with Site cleanup levels in the bioactive zone of subtidal sediment.
- Subsurface Sediment: Where subsurface sediment has the potential to become exposed, remove sediment to ensure long-term compliance with Site cleanup levels in the bioactive zone.
- Applicable Laws: Ensure that implementation of the cleanup action complies with other applicable laws.

3.1.2 Cleanup Standards

Under SMS, the cleanup standards consist of a cleanup level (i.e., a concentration that must be met by the cleanup) and the depth or area of compliance where that cleanup level must be met. The SMS state that cleanup levels are initially set at the Sediment Cleanup Objective (SCO) but may be adjusted upward as high as the Cleanup Screening Level (CSL), based on site-specific evaluation of technical possibility and net adverse environmental impact. For the I&J Waterway site, it is technically possible to achieve the SCO for all retained contaminants in a reasonable restoration time frame. The cleanup standard for cPAHs reflects the two methods for calculating risk-based concentrations (RBCs).

Cleanup levels are applied at different vertical and horizontal spatial scales depending on the exposure pathway they were developed to protect. The site-wide cleanup level for total cPAHs was developed to protect human health from seafood consumption; therefore, the cleanup level must be met on an area weighted average basis in the upper 12 cm of sediment. The relevant exposure area depends on the species, which includes crab and fish (subtidal home range of approximately 10 square kilometers).

3.1.3 Site Boundary

The I&J Site boundary was established using the following point-based criteria:

- Based on protection of the benthic community, all contaminants (except cPAHs) with point concentrations above the SCO benthic chemical criteria were incorporated into the Site boundary.
- Based on protection of the benthic community, all SCO exceedances of benthic biological criteria were incorporated into the Site boundary.

The Site boundary developed to protect the benthic community also results in meeting the cPAH cleanup standards for protection of human health based on an area-weighted average.

3.2 Applicable Local, State, and Federal Laws

Cleanup actions must comply with applicable local, state, and federal laws. For certain cleanup actions, a permit is required. For other cleanup actions, Ecology will ensure that the cleanup action complies with the substantive requirements of the law but the action is exempt from the procedural requirements of the law (RCW 70A.305.090; WAC 173-340-710).

Additionally, persons conducting remedial actions have a continuing obligation to determine whether additional permits or approvals are required or whether additional substantive requirements for permits or approvals must be met.

3.2.1 Required Permits and Approvals

Cleanup actions at the Site are anticipated to require a permit for discharge of dredged, excavated or fill material to waters of the United States pursuant to Section 404 of the Clean Water Act. It is anticipated that the cleanup of the Site will be performed using a Federal 404 Individual permit or a Nationwide Permit 38, issued by the U.S. Army Corps of Engineers (USACE). Impacts of the cleanup action on the federal navigation channel will also be evaluated and authorized by the USACE pursuant to Section 408 of the Clean Water Act. The federal permitting process includes review of issues relating to wetlands, tribal treaty rights, threatened and endangered species, habitat impacts, and other factors, including impacts to the federal navigation channel.

The following describes the key permits and approvals:

- **United States Army Corps of Engineers Nationwide Permit 38 and Washington Department of Natural Resources Aquatic Land Use Authorization**: Section 404 of the Clean Water Act, 33 U.S.C. § 1344 requires a permit prior to discharging dredged or fill material into the waters of the United States, including special aquatic sites such as wetlands. The cleanup action will be conducted under the conditions and requirements of a Nationwide Permit 38 which covers the Cleanup of Hazardous and Toxic Waste that are performed, ordered, or sponsored by government agency with established legal or regulatory authority. The Nationwide Permit 38 will be applied for through a Joint Aquatic Resources Permit Application (JARPA). The Site area is potential habitat for threatened and/or endangered species; therefore, the cleanup action is subject to the Endangered Species Act (ESA) review as part of the Clean Water Act Section 404 process. Potential adverse effects to threatened and endangered species, as well as conservation measures intended to prevent them, are discussed in the ESA Section 7 Consultation Biological Assessment. Most of the cleanup action will occur on State-owned aquatic lands managed by the Department of Natural Resources (DNR). DNR's Aquatic Resources Program manages State-owned aquatic lands and will determine the type of authorization required (e.g. license, lease, easement etc.) for the cleanup action. The Aquatic Land Use Authorization for the cleanup action will be initiated through the JARPA process.
- **Water Quality Certification from the State of Washington pursuant to Section 401 of the Clean Water Act:** Ecology has issued a programmatic Section 401 Water Quality Certification decision for the U.S. Army Corps of Engineers Nationwide Permit Program. This programmatic Section 401 Certification decision applies to a Nationwide Permit 38, with conditions. The cleanup action must adhere to the State General Conditions and the conditions specific for a Nationwide Permit 38.
- **United States Army Corps of Engineers 408 Review:** Concurrent with the USACE 404 permitting process, the USACE will conduct a review under Section 408 of the Clean Water Act, 33 U.S.C. § 1344, to evaluate the impacts of the cleanup action on the federal navigation channel. This review will be initiated through a written request as part of the Clean Water Act Section 404 process.
- **NPDES Construction Stormwater General Permit:** The NPDES Construction Stormwater Permit requirements will not apply to this work due to the limited area of upland disturbance (< 1 acre) and potential stormwater impacts. However, the substantive requirements of the City of Bellingham's Stormwater Permit do apply given the lower "disturbed area" threshold of (> 500 sf). Accordingly, the specifications will include stormwater management requirements, consistent with both NPDES and City of Bellingham Permit requirements. Additionally, the specifications will require the contractor to capture all contact stormwater and construction process water for offsite disposal at an approved facility.

- **State Environmental Policy Act Integrated Compliance (RCW 43.21C.036 and WAC 197-11-250 through 259)**: Compliance with SEPA, Chapter 43.21C RCW, was achieved by conducting a State Environmental Policy Act (SEPA) review in accordance with applicable regulatory requirements, including WAC 197-11-268, and Ecology guidance as presented in Ecology Policy 130A (Ecology 2004). The SEPA review for the cleanup of the Site was completed and a determination of non-significance was made by Ecology on February 19, 2019.

The JARPA package will be submitted based on this draft EDR and the 30% design drawings. The time required to complete permitting and associated regulatory reviews is not certain, but all permits and approvals will be required prior to contractor bidding on the cleanup work.

3.2.2 Substantive Requirements

The cleanup action must also meet the substantive requirements of permits or approvals that are procedurally exempt under RCW 70A.305.090. The substantive requirements of the following permits, known at this time to be applicable to the cleanup action, will be followed:

- **Washington Department of Fish and Wildlife Hydraulic Project Approval:** Projects involving in-water construction activities typically require a Hydraulic Project Approval (HPA). HPAs are issued by Washington Department of Fish and Wildlife (WDFW) and define state requirements for construction activities that could adversely affect fisheries and water resources.
- **City of Bellingham Shoreline Substantial Development Permit (Bellingham Municipal Code Title 22):** Projects within the City Limits of Bellingham and within 200 feet of the ordinary high water mark of Bellingham Bay typically must obtain a Shoreline Management Substantial Development Permit (Shoreline Permit). Shoreline Permits are issued by the City and include requirements to protect the ecological function of shorelines. The substantive requirements include meeting the general conditions for a SMP, requirements and conditions of the Waterfront District – Recreational Uses shoreline designation, and applicable general regulations and use activity policies.
- **City of Bellingham Construction Stormwater Permit (BMC Title 15.42):** Pursuant to the City of Bellingham Stormwater Management ordinance (BMC 15.42), the cleanup action may need to meet the requirements of a City Stormwater Permit depending on the extent of upland disturbance required. The substantive requirements include preparation of a stormwater site plan, preparation of a construction stormwater pollution prevention plan, source control of pollution, preservation of natural drainage systems and outfalls, on-site stormwater management, run off treatment, flow control, and system operations and maintenance.

Appendix G includes the substantive requirements of procedurally exempt permits issued by the City of Bellingham and the Washington Department of Fish and Wildlife. City of Bellingham construction stormwater requirements will be addressed during public facilities construction application review for the stormwater outfall extension. These and any additional requirements resulting from ongoing consultation with permitting agencies will be incorporated into the final design documents.

3.3 Other Requirements to Be Considered

3.3.1 Washington Industrial Safety and Health Act

The Washington Industrial Safety and Health Act (WISHA; WAC 296-155) sets safety standards for construction. This code specifies health and safety standards for responding to releases or substantial threats of release of hazardous substances at hazardous waste sites. WISHA requirements are generally more stringent than OSHA requirements. All cleanup activities will adhere to WISHA standards. Detailed health and safety training requirements, and details on how the Contractor will comply with WISHA standards, will be included in the Construction HASP.

3.3.2 Solid Waste Disposal Regulations

Minimum Functional Standards for Solid Waste Handling (WAC 173-304) are applicable to non-hazardous waste management generated during remedial activities. Non-hazardous sediment will be handled and disposed in accordance with these requirements.

The cleanup will use existing permitted disposal and recycling facilities that are compliant with the solid waste disposal regulations and are permitted to accept impacted materials.

4 Net Environmental Effects

4.1 Cleanup and Source Control

Cleanup and source control (removal of creosote-treated wood structures) actions will remove contaminated sediment from the water, within the vicinity of an estuary that supports spawning populations of ESA-listed salmon. PAHs, semi-volatile organics [including bis(2-ethylhexyl)phthalate], nickel are present in surface and subsurface sediment above cleanup levels in SCU-1. Mercury, PCBs, and dioxins/furans are also present due to other sources in the Bay. Removal of these contaminants will help restore substrate to closer to natural conditions, which will support normal production of salmonid prey and primary productivity within intertidal and shallow subtidal areas. Cleanup actions will also reduce potential contaminant bioaccumulation within salmonids.

4.2 Creosote and Shoreline Debris Removal

The cleanup project will remove approximately 113 creosote-treated timber piles, 5,200 square feet of creosote-treated timber decking, and a large quantity of shoreline debris. Debris will include anthropogenic armoring beneath the dock such as bricks, derelict structural timber and steel members, and concrete chunks. The action will also remove approximately 350 linear feet of 15-foot high creosote-treated timber bulkhead from contact with the water by isolating it behind a new steel sheet pile bulkhead.

Removal of these items from the aquatic environment will result in improvements to aquatic habitat. Removal of creosote-treated piles, bulkhead, and decking will remove a potential source of PAH from the water and sediment.

4.3 Improving Nearshore Habitat along Salmonid Migration Corridors

The action will remove armoring along the shoreline of the bulkhead beneath the dock and replace it with rock, sized as small as possible based on engineering considerations, that will be topped with fish-mix habitat gravel.

Rock placement and fish-mix topping will result in a significant reduction in the grain size of surface rock at the toe of the bulkhead beneath the dock. Currently, rock consists of large (2 to 3 feet) concrete chunks, boulders, and bricks, with 3- to 4-inch rounded cobble and sand/silt intermixed sporadically. The resulting surface will be a smaller, rounded gravel/cobble graded mixture that will provide a substrate that more closely resembles natural cobble shoreline conditions.

4.4 Net Change in State Waters and Waters of the US

The action will result in a net fill of approximately 2,470 sq. feet of aquatic habitat between approximately 0 feet MLLW and the high tide line (HTL) elevation (currently assumed to be 9.8 feet MLLW). 1,420 sq. feet of this fill is due to the replacement of the existing bulkhead with a sheet pile wall in in front. The other 1,050 sq. feet to be filled is a highly degraded, approximately 50 feet long by 25 to 30 feet wide, notch in the vertical bulkhead immediately east of the docks to be replaced. The notch side slopes are supported by a rudimentary retaining wall surrounding degraded habitat with large riprap armoring, concrete, debris, derelict piling, and a stormwater outfall. Based on the highly degraded nature of this area, this will have negligible effect on habitat function of the I&J Waterway.

Dredging and shoreline armoring will result in a minor net deepening of nearshore habitat. Overall, approximately 3,800 sq. feet of intertidal habitat (above -4 feet MLLW) will be deepened to shallow-subtidal habitat (-4 to -10 feet MLLW), and approximately 1,300 sq. feet of shallow subtidal habitat will be deepened to deep subtidal habitat (below -10 feet MLLW). All intertidal and shallow subtidal habitat to be deepened is low-quality, under-pier habitat. These effects will be mitigated by placement of approximately 13,000 sq. feet of fish-friendly gravel/rock habitat substrate over all nearshore armoring.

5 Design Considerations and Details

The following sections provide an overview of the Site cleanup design data and assumptions. Detail is provided for the cleanup components of the project while more concise summaries are provided for the dock and bulkhead elements of the project. Additional details regarding the geotechnical and structural design elements of the dock and bulkhead are provided in Appendices C and D, respectively.

5.1 Site Specific Considerations

The following design considerations are generally applicable to all of the engineering design elements for the SCU-1 cleanup.

5.1.1 I&J Waterway Use Assumptions

Anticipated land and navigational uses for SCU-1 include the following:

- **Navigation Channel:** The I&J Waterway includes a federal navigation channel, with a width of 100 feet and an authorized depth of -18 feet MLLW. Berth areas adjacent to the federal channel include a mixture of state-owned and privately owned lands with varying water depth needs. Current navigation uses in the Waterway include commercial fishing vessels berthing at the Bornstein Seafoods processing facility and USCG vessels that dock at the USCG station on the east side of the Waterway. The outer portion of the I&J Waterway federal navigation channel has elevations around -15 feet MLLW and provides sufficient navigation access for vessels entering Squalicum Inner Harbor or visiting the Hilton Harbor facilities. The western portion of the navigation channel adjacent to the Bornstein Seafoods dock will retain the authorized depth of -18 feet MLLW.

- **Dock and Floating Dock Units:** The Bornstein Seafoods dock areas are expected to continue with navigation uses associated with Bornstein Seafoods. Periodic maintenance dredging of this area may be performed to maintain water depths, but deepening of this area (beyond environmental dredging depths) is not anticipated.

5.1.2 Meteorology and Physical Oceanography Conditions

5.1.2.1 Water Levels

Tidal datums in Bellingham are based on NOAA measurements in Bellingham between 1974 and 1975 (Station 9449211). Table 1 lists tidal datums and vertical datums for the site. Table 2 lists extreme still water levels for the site. Due to the short duration of measurement at the Bellingham tidal station, extreme water levels are reported from the Cherry Point station. The water levels reported include surge and other anomalies but not wave runup or setup. The 1% annual exceedance still water level is 12.1 feet, which is slightly less than the FEMA 1% base flood elevation of 12.48.

Table 1 Tidal Datums and Vertical Datums for Bellingham, WA

Description	Abbreviation	feet, MLLW	feet, NAVD88
Mean Higher High Water	MHHW	8.51	8.03
Mean High Water	MHW	7.79	7.31
Mean Tide Level	MTL	5.07	4.59
Mean Sea Level	MSL	4.59	4.47
National Geodetic Vertical Datum 1929	NGVD29	4.40	3.93
Mean Low Water	MLW	2.35	1.87
North American Vertical Datum 1988	NAVD88	0.48	0.00
Mean Lower Low Water	MLLW	0.00	-0.48

Table 2 Extreme Still Water Levels (Cherry Point, WA)

Annual Exceedance Probability Level	Elevation [feet MLLW]
1% (will be exceeded in only one year per century) High Water Level	12.1
10% (will be exceeded in ten years per century) High Water Level	11.5
10% (will be exceeded in ten years per century) Low Water Level	-4.7
1% (will be exceeded in all but one year per century) Low Water Level	-5.0

5.1.2.2 Sea Level Rise

A 2008 guidance from University of Washington Climate Impacts Group (UW CIG) and Ecology estimated 50 inches of sea level rise by 2100 for the Puget Sound region (Mote et al. 2008). The 50-inch estimate is the “very high” value and is currently being used for shoreline permitting in Bellingham. The Bellingham Shoreline Master Program states that the latest scientific studies/information should be used to guide shoreline development (BMC 22.02.020). The UW CIG’s research has been updated to incorporate the latest science, provide projections on a granular level, and provide exceedance statistics for various years and sea level change (Miller et al. 2018). The projections for Bellingham Harbor are shown in Figure 7. For the year 2100, the 1% exceedance curve estimates 4.7 feet of sea level rise, or 6 inches more conservative than the 2008 "very high" estimates. Nonetheless, the current I&J cleanup design has been preliminarily based on the City of Bellingham's stipulated sea level rise design criteria.

5.1.2.3 Wind

The wind rose for Bellingham International Airport is shown in Figure 8. The dominant winds are from the south, with a secondary peak from the north. During the winter months the winds are balanced between the north and the south. Along the waterfront, the southern winds will roughly orient with the offshore direction. Therefore, extreme winds at the site will be analyzed for the southern sector but can be assumed to come from the offshore direction – that is from the southwest. Extreme winds were analyzed using 49 years of data, spanning 1948-2004. The results of the extreme value analysis are shown in Table 3. The highest wind observed was 61 mph, measured in October 1962 (the Columbus Day Storm). This means that the Columbus Day Storm was greater than the 100-year storm according to the present analysis.

Table 3 Extreme Winds for Bellingham International Airport from the Southern Sector (SW-SE)

Return Period	Wind Speed (mph)
10-year	48.6
25-year	52.4
50-year	55.2
100-year	58.1

5.1.2.4 Wind Waves

Waves reaching the site are generated locally by winds blowing across Bellingham Bay. The predominant fetch (the straight-line distance over which wind and waves can travel without obstruction) was measured to be 8 miles from approximately 230° (from the southwest). The ASCE Wind adjustment and wave growth tool was used to estimate the offshore wave height for the extreme winds calculated in the previous section. These offshore waves would not occur near SCU-1, but approximately a mile offshore. Table 4 shows the calculated extreme waves undergo shoaling, refraction, and diffraction. In other words, the waves steepen, bend, and spread out due to the geometry of the waterway. Table 5 shows the estimated wave heights at the project site for design of shore protection. The 100-year wave (3.1 ft, 4.6 s) will be used for design of the riprap slope protection at southwest corner of the site.

Table 4 Extreme Offshore Wind Waves Near the Project Site

Return Period	Significant Wave Height, H_s (feet)	Peak Wave Period, T_p (s)
10-year	5.1	4.3
25-year	5.5	4.4
50-year	5.8	4.5
100-year	6.2	4.6

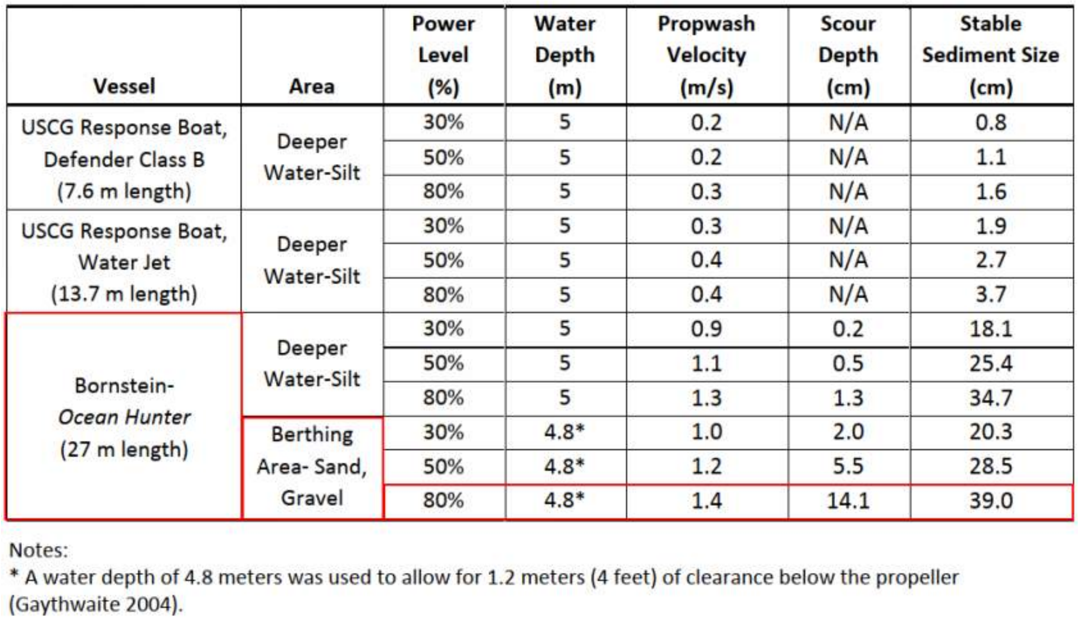
Table 5 Extreme Waves at the Project Site

Return Period	Significant Wave Height, H_s (feet)	Peak Wave Period, T_p (s)
10-year	2.4	4.3
25-year	2.6	4.4
50-year	2.7	4.5
100-year	3.1	4.6

5.1.2.5 Prop Wash

Prop wash analysis for the project was conducted for the 2015 Remedial Investigation and Feasibility Study Report (AnchorQEA 2015). The results of the analysis are shown in Table 6. The analysis did not specify the exact location for the calculated prop wash bed velocity and stable sediment. The estimate is likely a maximum measured directly where the propeller jet impacts the bed. The induced propeller velocity under the pier and near the proposed bulkhead is likely less. However, to be conservative, the propeller wash bed velocity of 1.4 meter/second (m/s; 4.6 feet/second [ft/s] or 3.1 miles per hour[mph]) will be used to design the cobble scour protection under the dock and along the proposed bulkhead. The stable sediment size associated with a maximum bed velocity of 1.4 m/s is 39.0 centimeter or 15.4 inches.

Table 6 Prop Wash Velocity, Average Scour Depth, and Stable Sediment Size (Port of Bellingham 2015)



Vessel	Area	Power Level (%)	Water Depth (m)	Propwash Velocity (m/s)	Scour Depth (cm)	Stable Sediment Size (cm)
USCG Response Boat, Defender Class B (7.6 m length)	Deeper Water-Silt	30%	5	0.2	N/A	0.8
		50%	5	0.2	N/A	1.1
		80%	5	0.3	N/A	1.6
USCG Response Boat, Water Jet (13.7 m length)	Deeper Water-Silt	30%	5	0.3	N/A	1.9
		50%	5	0.4	N/A	2.7
		80%	5	0.4	N/A	3.7
Bornstein-*Ocean Hunter* (27 m length)	Deeper Water-Silt	30%	5	0.9	0.2	18.1
		50%	5	1.1	0.5	25.4
		80%	5	1.3	1.3	34.7
	Berthing Area- Sand, Gravel	30%	4.8*	1.0	2.0	20.3
		50%	4.8*	1.2	5.5	28.5
		80%	4.8*	1.4	14.1	39.0

Notes:
* A water depth of 4.8 meters was used to allow for 1.2 meters (4 feet) of clearance below the propeller (Gaythwaite 2004).

5.1.3 Geotechnical Design Parameters

5.1.3.1 Engineering Properties for Soil/Sediment

The engineering properties for the soil/sediment units that are anticipated to be encountered in the project work are provided in Table 7. These properties are based on in situ testing, downhole seismic testing, laboratory testing, and our experience on local construction projects in similar soil deposits. Where a range of properties is provided, it represents the range of values observed or expected in the deposit.

Table 7 Engineering Properties of Sediment/Soil Units

Soil Unit	Unit Weight (pcf)	Effective Strength		Undrained Shear Strength (psf)
		º (deg)	c' (psf)	
Recent	115	26	20	250
Fill	125	32	20 to 50	NA
PGF	125	32	10 to 30	NA
GMD	130	30	20 to 50	550 to 700 at top of GMD increasing at 10 psf per foot to a GMD depth of 80 feet

Notes: NA=not applicable; Unit weights as saturated unit weights

5.1.3.2 Design Groundwater Elevations

Groundwater at the site varies with tidal fluctuations. Elevation 4.95 feet MLLW will be used as the design groundwater elevation for most analyses. Where fluctuations in the groundwater level will influence the results of the analysis, the high and low water cases equivalent to the MHHW (8.51 feet MLLW) and MLLW elevations will be used.

5.1.3.3 Seismic Design

Ground motion parameters for the project were developed using ASCE 7-16. The ASCE 7-16 seismic design parameters for the site are given in Appendix B.

5.1.3.4 Site Class

The shear wave velocity values measured in the seismic CPT test were used to determine the site class for the project. The average shear wave velocity for the top 100 feet was calculated in accordance with the procedure recommended in ASCE 7-16 as 755 feet/sec, which corresponds to Site Class D. The clay layers at the site do not meet the criteria that would correspond to Site Class E. The PGF deposits are susceptible to liquefaction, which would generally require the site to be considered Site Class F. However, since the structures at the site are not expected to have fundamental periods of greater than 0.5 sec, structures may be designed using Site Class D seismic parameters in accordance with ASCE 7-16.

5.1.3.5 Liquefaction Susceptibility

Liquefaction susceptibility was evaluated at each boring using empirical procedures from Idriss and Boulanger (2008). Fine-grained soils were considered susceptible to liquefaction if they met the criteria recommended in Bray and Sancio (2006). The PGAM, which is the PGA for the maximum considered earthquake (MCE) with a return period of 2475 years, is used for the liquefaction analysis, as recommended in ASCE 7-16. The mode earthquake from the de-aggregation of the hazard for the MCE, which was M=7.1, was used in the liquefaction analysis. Liquefaction is considered when the factor of safety for liquefaction triggering is less than 1.2. The top portion of the PGF deposits in IJW-SB-2 and all the PGF deposits IJW-SB-3 were found to be potentially liquefiable. The PGF deposits in IJW-SB-1 were not liquefiable. Based on this analysis, portions of the PGF limited in thickness and areal extent would be considered liquefiable.

5.1.4 In-water Work Window and Construction Work Hours

In-water construction activities will be performed consistent with allowable work windows established in coordination with state and federal resource agencies. Most in-water construction activities will be limited to the period between August 1 and February 15. Work may also be completed below the ordinary high water mark (OHWM) in the dry (i.e., during periods of low tide) between July 16 and July 31. Any work between February 16 and March 15 will be limited to placement of fill (residuals management layer, cobble fill, rock armor, and fish mix).

Based on the current land use classifications for the Site area (heavy industrial or marine industrial), there are currently no hours of work restriction, and construction activities are assumed to be allowed 24 hours per day, 7 days per week.

5.2 Dredge Design Details

Dredging will be performed using mechanical dredging equipment and dredged sediment and debris will be handled at a transload facility for disposal at an upland landfill. This section describes sediment properties, slope stability, dredge prism development, and the basis for equipment selection.

5.2.1 Sediment Properties

This section summarizes sediment chemistry and physical characteristics that are relevant to the dredge design. The following topics are addressed in this section:

- Sediment debris and density to determine dredgeability for the required depth of removal using suitable equipment.
- Cohesiveness of dredged material to assess the need for any special equipment or dredge/transload techniques.
- Drainage characteristics of dredged material to assess the potential amount of water in the haul barge and the time required for sediment to dewater on the barge.

The characterization of the sediment is provided by recent mud rotary borings, CPT borings, and vibracore explorations in addition to previous sediment grab and vibracore samples.

5.2.1.1 Debris

An analysis of visible debris combined information gathered from mobile light detection and ranging (LiDAR) imaging, multi-beam surveying, side scan sonar surveying of the channel bathymetry, and sub-bottom profiling using ground penetrating radar. Based on this information significant debris is not expected in the dredge removal area. The bank along the Bornstein facility is comprised of large pieces of material, such as concrete. These large items are expected to be removed with an excavator prior to demolition and dredging work and should not limit the ability of the dredging equipment.

5.2.1.2 Sediment Density

Sediment density was evaluated using *in situ* measurements (blow counts) recorded during boring (SPT-N values) and CPT readings (cone tip and frictional resistance) and from strength tests recorded from the sediment cores (torvane tests). These values indicate the presence of soft fine-grained sediment and loose to medium dense granular sediment that is dredgeable. The density increases significantly in the GMD layer and are reflective of a sandy silt to clayey silt (geotechnical sediment logs are included in Appendix B).

5.2.1.3 Sediment Cohesiveness

Sediment cohesiveness was evaluated based on soil classifications and Atterberg limit testing data (Summary of Material Properties, Appendix B). Recent sediment to be dredged is low to non-plastic while the GMD has moderate to high plasticity. These data suggest that no special measures, such as a dip tank or special washing measures to clean the dredge bucket are necessary for dredging recent sediment. A standard environmental bucket should be able to remove the recent sediment with minimal resuspension occurring from fine-grain sediment adhering to the outside of the bucket.

5.2.2 Slope Stability

The proposed dredge prism side slopes of 3H:1V on the north and south sides of the waterway channel meet the minimum factors of safety for both long-term static and seismic conditions. One-half the PGA from the ASCE 7-16 design response spectrum was used as the seismic coefficient in the seismic slope stability analysis. The slope stability results for these cases are shown in Appendix B.

5.2.3 Dredge Prism

As required by the Cleanup Action Plan (CAP; Ecology 2019), the dredge prism will extend down to the GMD unit throughout SCU-1, except that appropriate offsets and slopes will be incorporated near the Coast Guard docks to maintain structural stability. In a limited area in the southwest corner of SCU-1 and in the transition slope area outside the southwest corner of SCU-1, the base of the dredge prism may be defined by clean native past-glacial fluvial deposits (silty sand) rather than the GMD. Sediment will also be removed from the notch area. Following removal of sediment, the notch will be backfilled to match the surrounding upland grade. The following steps were used in developing the dredge prism:

1. Compiled elevation data for the surface of the GMD from PRDI locations (vibracores, cone penetrometer testing [CPTs], and upland boreholes), 2005/2006 Dredged Material Management Unit (DMMU) and 2013 vibracore logs, and upland monitoring well MW-4 on the Olivine property. These data are provided in Appendix A, PRDI Results Summary.
2. Checked GMD surface elevation data by comparing tide-based elevations collected during sampling versus elevations determined using bathymetric survey data at the sample location coordinates. Used the lowest GMD surface elevation data point for each location, with the exception of IJW-SC-1. Due to the large difference and the sample location near a steep slope, both data sets were used to confirm that both GMD surfaces would be captured by the dredge prism.
3. Added the 1966 post-dredge elevations from the USACE navigation channel dredging to the CAD file.
4. Used the 3:1 dredge prism side slope that would be stable in the long-term as discussed in Section 5.2.2.

5. Verified the location of the Coast Guard dock and piles and adjusted the dredge prism to maintain structural integrity.
6. Created a flat bottom dredge prism down to -22 feet MLLW that extends below the GMD surface throughout SCU-1, with the exception of two locations (IJW-SC-8/IJ-18 and IJW-SC-5/IJ-21/IJ-24), where the GMD interface appears to be below -22 feet MLLW.

At the two locations where the GMD surface is below -22 feet MLLW, dredging will be advanced until the GMD surface is encountered. The ultimate dredge depth will be determined in the field based on observed dredge bucket action (e.g. sediment strength) and visual observation of the dredged material on the dredge (consistency, color, etc.).

The bottom and side slopes of the dredge prism, and post-dredge fill locations are illustrated on Figure 9. Filling and armoring will be required at the west end of the sheet pile wall to stabilize the steep temporary dredge slope (1.5:1) that will be created (Figure 10). Other filling will occur along the toe of the new sheet pile wall to create intertidal habitat (Figure 11) and within the newly created upland area in the notch (Figure 12). Extending the sheet pile wall and backfilling the notch area will also stabilize the shoreline and adjacent upland, which is otherwise at risk of failure under seismic loading conditions, threatening the long-term performance of the cleanup action in this area (Appendix B). The total dredge volume amount is 17,100 cy, including an assumed 1-foot overdredge allowance.

Neatline elevations are specified for the dredge areas as shown in the figures. The Contractor will be provided with a maximum over-dredge allowance below the specified neatline depth that will be provided in the draft final EDR. The Contractor is expressly prohibited from dredging below the maximum over-dredge allowance.

To minimize water quality impacts, the Contractor will be required to make each dredge pass complete with the dredge buckets and will not be allowed to stockpile sediment in the water. The Contractor also will not be allowed to level the completed dredge surface by dragging a beam or the dredge bucket.

5.2.3.1 Equipment Selection

Dredging work will be conducted using a mechanical dredge. Dredging method selection for considered the following factors:

- Ability of mechanical dredging equipment to meet project requirements, including depth tolerances and compliance with applicable water quality criteria
- Ability of mechanical dredging to achieve higher solids loadings in the dredged materials, without necessitating costly and area-intensive dewatering methods
- Mechanical dredging produces lesser quantities of generated waters, minimizing both risks to receiving waters and the water treatment needs necessary to address those risks
- Improved availability of equipment and expertise within the Pacific Northwest for mechanical dredging as opposed to other dredging methods, such as hydraulic dredging

- Ability to use mechanical dredging equipment for other project activities (e.g., residuals management layer)

The selected Contractor will determine the specific pieces of mechanical dredging equipment required to perform the project work. It is assumed that the Contractor will use dredge derricks, barges, and tugs. The Contractor will be required to specify equipment choices and procedures in advance as part of the Construction Work Plan. Equipment selection choices will comply with environmental controls and permit requirements associated with water quality criteria. The WQMP (Appendix F) will be implemented during dredging as necessary to ensure protection of water quality.

5.2.3.2 Verifying Dredge Performance

In addition to completion of water quality monitoring, the completeness of dredging will be verified as described in the Construction Quality Assurance Plan (Appendix D) and in the Compliance Monitoring and Contingency Response Plan (Appendix E). Progress surveys will verify that design dredge elevations and stable side slopes have been met. In locations where adequate elevations and slopes have not been achieved the Contractor will be required to perform additional work.

5.2.3.3 Management of Dredging Residuals

A residuals management layer (RML) will be placed within the dredge prism footprint, including the bottom and side slopes within SCU-1 and the transition slope between SCU-1 and SCU-2 (Figure 9). The RML will be comprised of clean sand and gravel, placed to a minimum thickness of 4 inches. The purpose of the RML is to manage the thin veneer of potentially contaminated residuals that may be resuspended and redeposited during dredging. The RML material will mix with the thin veneer of residuals (if present) to produce a sediment surface condition that meets cleanup objectives. Placement of RML on the SCU-1/2 transition slope is also consistent with the selected remedial technologies for SCU-2, monitored and enhanced natural recovery. RML material will not be placed on side slopes to be covered with rock armor material.

As discussed in the CMCRP (Appendix E), following placement of RML, performance monitoring sediment samples will be collected at side slope locations where PRDI sample results exceeded the SCOs (IJW-SC-13 and IJW-SC-16). If elevated SCO concentrations remain in these locations following placement of the initial RML lift, an additional lift of RML will be placed within the designated contingency response area(s). This will increase the volume of material available for natural recovery processes. The coarser grained RML material will also provide added erosion protection in these areas, although the bathymetric data indicates that there is no discernable evidence of sediment bed erosion or prop wash scour in these locations (Figure 13). Additionally, following dredging and RML placement, final grades will be 2 to 4 feet below existing grades, further reducing potential vessel-related disturbances at these locations.

5.2.4Site Restoration

Site restoration includes the placement of rock armor, cobble fill, upland fill, and utilities. Figures 10 and 11 illustrate the placement rock armor at the southwest corner of SCU-1 and the cobble fill along the toe of the bulkhead to provide intertidal habitat and provide scour protection. Upland fill and utility sections will be added to the draft final EDR.

5.2.4.1 Slope Stability

The southwest corner of SCU-1 is close to an existing rubble-covered slope. In order to complete the dredging at the southwest corner of SCU-1, the rubble and some of the existing slope will need to be removed. Then riprap will have to be placed after dredging to stabilize the slope. The section modeled in these analyses is shown in Figure 10. The evaluation of the existing slope finds that it meets the minimum factor of safety for the long-term static condition but does not meet the typical minimum factor of safety for the seismic condition (Factor of Safety>1.1), as shown in Appendix B. The analysis of boring IJW-SB-1 which is adjacent to this area did not identify liquefiable deposits, so lateral spreading is not expected to be an issue in this location.

5.2.4.2Stone Sizing

Riprap Revetment

Riprap stone was sized using the Hudson Equation for Riprap (USACE 2011, VI-5-86):

$$W_{50} = \frac{\rho_r \left(H_{1/10}/D_H\right)^3}{K_D \Delta^3 \cot\theta}$$

Where,

$H_{1/10}$ is the average of the highest 10% of waves observed or approximately 1.27 H_s

K_D is the Hudson Damage Coefficient for the specific structure type.

D_H is the damage parameter. The value is 1 for 0-5% damage but can be increased to allow for more damage of the structure during the design event.

ρ_r is the density of the riprap stone

Δ is the relative density of the rock to the water less 100%

$\cot\theta$ is the slope of the structure or the "run" in run:rise of the structure slope.

W_{50} is the median stable stone size for design of the structure.

The inputs for Hudson equation used to design the riprap at the southwest corner of the site are shownbelowas well as the calculated stable median stone size.

Table 8 Inputs to the Riprap Stone Sizing Equation and Calculated Stable Median Stone Size

Variable	Value
$H_{1/10}$	3.9 feet
K_D	2.2
D_H	1 (0 - 5%)
ρ_r	165 pounds per cubic feet
Δ	1.62
$\cot\theta$	1.5
W_{50}	720 pounds
D_{50}	23”

The guidelines for riprap gradation are provided in the Coastal Engineering Manual, Part VI, Chapter 5 (USACE 2011). The selected gradation for the site is shown in Table 9. The armor layer thickness will be 3.3 feet.

Table 9 Design Riprap Gradation

% Passing		Dimension	Weight
100	Minimum	27 inches	1150 pounds
	Median	32 inches	2010 pounds
	Max	36 inches	2875 pounds
50	Minimum	21 inches	575 pounds
	Median	23 inches	720 pounds
	Max	24 inches	863 pounds
15	Minimum	14 inches	180 pounds
	Median	17 inches	310 pounds
	Max	19 inches	430 pounds

Cobble Habitat and Scour Protection

The stable sediment size for resisting prop wash will be used to design the cobble scour protection. The 2015 analysis of prop wash determined the maximum bed velocity to be 1.4 m/s and the stable sediment size to be 39.0 cm or 15.4 inches (Anchor QEA 2015). The interstitial spaces will be filled with rounded gravel/fish mix. To develop the gradation and stone weights (Table 10), a stone density of 165 pcf was assumed.

A typical section with cobble habitat and scour protection is provided on Figure 11.

Table 10 Design Scour Protection Gradation

% Passing		Dimension	Weight
100	Minimum	18 inches	350 pounds
	Median	22 inches	610 pounds
	Max	24 inches	875 pounds.
50	Minimum	14 inches	175 pounds
	Median	15 inches	220 pounds
	Max	16 inches	263 pounds
15	Minimum	9 inches	50 pounds
	Median	11 inches	90 pounds
	Max	13 inches	130 pounds

5.3 Dock and Bulkhead

The existing dock and timber bulkhead, originally constructed in 1946, modified and expanded in 1962, covers a portion of the dredge prism and will be removed to allow full access to the dredging area. A replacement bulkhead will be installed prior to dredging to provide support along the shoreline. The dock will be rebuilt after dredging is complete. Details regarding design of the dock and bulkhead are provided in Appendix C.

The existing dock is a 24-feet-wide by 180-feet-long timber structure with concrete-topped timber decking supported by timber stringers spanning to timber pile caps supported by timber piles. The existing bulkhead is timber lagging spanning to timber piles.

The new dock will be constructed over the same footprint as the existing demolished dock and will consist of concrete-topped precast concrete deck panels spanning to precast concrete pile caps supported by driven steel pipe piles. The new bulkhead wall will be constructed in-front (waterside) of the existing timber bulkhead wall and will extend across the notch at the southeast corner of SCU-1 and will be integrated with the bulkhead at the adjoining property. The existing bulkhead wall will be abandoned in-place and the space between the existing and new wall will be filled with controlled density fill (CDF).

Obstructions encountered by the sheet piles during driving could affect sheet pile penetration. Concrete and wood debris were observed near the existing bulkhead at low tide. The likelihood of encountering obstructions is expected to decrease once the sheet piles penetrate the GMD. Obstructions may need to pushed aside or removed using a large excavator. The Contractor will provide a plan for removing obstructions and keeping sheet piles in alignment.

To limit the impact of vibrations on nearby structures, use of a variable frequency vibratory pile driver may be used for sheet pile installation. The use of a variable frequency vibratory pile driver can minimize ground vibration amplification by avoiding the resonant frequency of the soil stratum.

5.4 Stormwater Improvements

An existing stormwater outfall discharges into the I&J Waterway in the southeast corner of SCU-1, in a small notch along the shoreline (Figure 3). As part of the bulkhead construction, the new bulkhead wall will extend across the notch and will be integrated with the bulkhead at the adjoining property. Sediment currently located in the notch will be removed. Data presented in the RI/FS indicates that the sediment may be contaminated with fluoranthene (at sample locations IJW-SS-12/IJ12-04) and nickel (at sample locations IJW-SS-12) above SCO. Samples were collected between the surface and 0.4 feet below the mud line. Recent sediment deposits will be removed within the Notch Area based on known chemistry and observations during construction, and disposed of at an approved off-site disposal facility.

After sediment removal is completed, the stormwater outfall currently located in this notch will be extended through the bulkhead and the area will be backfilled to match the surrounding upland grade.

6 Work Sequence

Construction sequencing will begin with the demolition of the existing dock and extraction of timber piles. The Bornstein Seafood floating dock will be removed and stored off-site at a location to be determined for future reinstallation. All demolition will be completed per the project specifications. After completion of demolition, the new bulkhead wall and tie backs will be installed in front of the existing timber bulkhead while dredging operations commence away from the existing bulkhead face. Once the wall is complete and stable, dredging adjacent to the sheet pile face can be completed. With the completion of dredging, riprap slope protection will be placed followed by construction of the new dock.

Bornstein Seafood is an active facility, but Bornstein operations throughout construction will be limited to inside and immediately around the building. No dock access will be needed by Bornstein. All dredging, bulkhead replacement, and dock construction will be completed in one in-water work window (mid-August to mid-February). Select work that is determined to be acceptable may occur between mid-February through March 15. Work completed after the in-water work window expiration date will be limited to work above the HTL elevation currently assumed to be 9.8 feet MLLW.

The overall sequence for the project will be refined after the Contractor is selected. The general construction schedule includes Contractor mobilization in early summer 2023, pending receipt of all permits and approvals. Shoring and upland site preparation will occur with in water work starting August 1, 2023. Work will continue through the end of the 2023/2024 fish window with upland completion extending to May 2024.

The following sections provide additional detail on the dredging element of the project. The construction work associated with the bulkhead and dock replacement will occur in conjunction with the dredging.

6.1 Dredge and Excavation Plan

The Contractor will prepare a dredge plan that documents the approaches, equipment, and means and methods of accomplishing the dredging, handling, transloading, and disposal of materials. The dredge plan will also include any proposed modifications to the design dredge surface that may better accommodate the Contractor's proposed equipment and approach and that clearly demonstrates complete and accurate removal to or below the design dredge surface. The Contractor's plan will specify the construction approaches for removal of debris within the dredging area, dredging of sediments, dewatering, and transloading. The plan will describe specific dewatering controls, such as turbidity controls on dewatering barges, and include product data on proposed dewatering filter media to achieve water quality requirements outlined in the Water Quality Monitoring Plan. The transloading facility location, design, and operation will also be identified in the transportation and disposal plan, including confirmation that the facility is permitted to receive dredge material. The plan will show bucket placement and overlap for approval prior to initiation of dredging. The plan will provide for horizontal positioning accuracy that allows a 6-inch overlap for each bucket fill.

The dredge cut elevation will be monitored in real time by a dredge operator who understands the difference in the dredgeability of loose, fine unconsolidated sediment and stiff, dense sediment. The operator will also understand the potential problems created by the presence of debris.

The dredging will be accomplished generally in two passes with the goal to limit the production of dredging residuals on the final surface remaining after dredging. The first pass will remove impacted sediment, including debris, to within one foot above the elevation on the excavation plan. This pass will leave a thin residual layer above the underlying clean sediment. The second pass will remove the final thin lift of the contaminated sediment and a minor volume of clean material. While the second pass will also result in development of dredge residuals, this approach will best achieve a post-dredge surface suitable for confirmation sampling.

The dredge will work the intertidal and shallow subtidal areas at higher tides as needed to provide the required draft for the dredge and material barge(s). The dredge will load a material barge that will transport the wet sediment from the site to a transload facility. Some dewatering of the sediment by decanting may occur prior to the transfer barge leaving the dredge area.

The progress of the dredging will be monitored by the Contractor in the daily progress surveys and reports. The Contractor will be required to correct any dredge cuts that have not met the required elevation. Final acceptance surveys will be completed by an independent, third-party, licensed surveyor experienced in hydrographic surveying.

6.1.1 Dredge Operation and Production

A range of dredge production rates was estimated based on the following assumptions:

- an average 5-cy bucket grab at 1.0 to 1.5-minute intervals
- 50% and 60% bucket fill factors
- 60% and 70% effective time (time actually dredging)
- a 16-hour work day (2 active 8-hour shifts)
- 6-day work week with maintenance performed on Sunday.

Using the above range of assumptions, the average dredging rate is expected to be between 900 and 1,400 cy/day. The lower production rate will likely occur if dredging is slowed due to water quality issues related to resuspension of sediments, and to a lesser degree, encountering debris. Dredging rates will also be reflective of the general geometry of SCU-1 being rather long and narrow which will result in a fair amount of repositioning of equipment. Work to be completed during the window includes dredging, in-water demolition/timber pile removal, backfilling, confirmation sampling (at two locations per the CMCRP), and replacement of the dock, pilings and bulkhead.

Within the range of rates presented above, dredging of the 17,100 cy of sediment is estimated to take between 13 and 19 working days. Additional time will be needed to place residual management layers, place slope protection, and perform the confirmation survey. The Contractor is responsible for supplying an anticipated schedule and for completing the work within the work window. The Contractor is also responsible for determining contingent actions that could be employed to speed up the work if it is anticipated that the schedule would not be met. Contingent actions could include an extension of working hours (more hours per day or adding Sundays and holidays) or the use of different equipment. Planned contingent actions must be accepted by the Port and Ecology prior to implementation.

6.1.2 Dredge Operational Controls

Operational controls will be used to limit water quality impacts, recontamination, and dredge residuals to the extent practicable. These controls include BMPs, water quality monitoring, and operational adjustments as described below.

6.1.3 Best Management Practices

The overall goal of the environmental dredging is to remove impacted sediment, while minimizing the dispersion of contaminated sediments and development of dredge-related residuals. The use of appropriate BMPs will be required in the Specifications and will be addressed during development and review of the Contractor's Dredge Plan. In addition to the equipment specification and the dredge plan described above, the Contractor will be required to follow BMPs. The following BMPs will be required and additional BMPs may be required by permits:

- The work will limit migrating salmonid exposure to turbidity by allowing dredging to only occur within the I&J Waterway work window (August 1, 2022 to February 15, 2023, with limited work allowed between February 16 to March 15, 2023).
- Maneuvering of tugs and barges will be kept to the minimum necessary for safe and efficient operation of the dredging and transloading activities to avoid resuspension of sediments due to prop wash.
- Water quality will be monitored during dredging to ensure compliance with the WQC. 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.
- The grounding of barges will be prohibited.
- Scour will be minimized by controlling minimal depths for vessel draft and movement.

- Glory holing will not be allowed.
- Dredge buckets will not be overfilled.
- No bottom stockpiling will be allowed.
- Leveling of the dredge surface by dragging/sweeping the bucket will not be allowed.
- The loaded bucket will be retrieved from the bed at a slow and continuous rate, anticipated not to exceed 2 feet per second.
- The bucket will have a closed/open sensor.
- The loaded bucket will pause after it breaks the water surface if the bucket sensor indicates it is closed.
- The passage of the bucket over open water prior to release of sediment from the bucket into the haul barge will be minimized.
- Once the bucket is above the water line it can only be opened on the barge.
- Planned contingent actions must be accepted by the Port and Ecology prior to implementation
- Barges will not be overloaded; sediment will not spill over the edges of the barges.
- Subsurface release of partially full or full dredge buckets will not be allowed; i.e., once a bucket is closed underwater, it may not be opened until it is positioned over the barge, even if the operator believes it is empty.
- Dredging will occur from higher to lower elevations to reduce the potential for sloughing.
- Stable cut slopes will be maintained during dredging to reduce the potential for sloughing.
- Multiple bites with the dredge bucket will not be allowed.
- An environmental bucket will be used to the extent practicable to reduce the potential for suspension of contaminated sediment during dredging. A sub-foot geographical positioning system will be used for accurate bucket positioning.
- Dredged material will be placed on a barge immediately after removal from the I&J Waterway for dewatering. Prior to release to the I&J Waterway, all water will be filtered through a medium placed across the barge scuppers. The scuppers will be plugged prior to the barge leaving the dredge removal area for transload. Water quality effects from dewatering will be strictly monitored according to the WQMP.

- A Transportation and Disposal Plan including appropriate BMPs for material handling will be developed by the Contractor for regulatory approval in accordance with the specifications.
- Backfill shall be sand (with less than 5% fines content), as described in the CQAP and the specifications and its placement will be monitored according to the WQMP; it is expected that backfill placement will not result in exceedances of the water quality criteria.

Additional BMPs will be implemented during the dock and bulkhead replacement work, which are specified on the project Drawings and Specifications, and will include items such as:

- During piling removal and disposal, BMPs will be implemented in accordance with Ecology's Sediment Cleanup User's Manual (SCUM), Section 16.3.2 (Ecology 2021), including, but not limited to, requirements for site assessments and removal documentation, removal methods and equipment, turbidity and debris management, and disposal.
- During dock demolition, provide a platform or other suitable positive means of capturing debris from demolition operations to prevent debris from entering the waterway.
- During placement of control density fill between existing bulkhead and new sheet pile system, any displaced seawater must be collected and properly disposed.

6.2 Water Quality Monitoring

Dredging will result in short-term turbidity in the water column. Excessive turbidity can be caused by inadequate operator knowledge and control of the bucket during dredging or debris removal, bank or side slope sloughing, scour of sediment that sticks to or is captured on the outside of the bucket, and/or release of sediment due to debris preventing tight closure of the bucket. Additionally, water quality impacts may occur during placement of the RML and shoreline armor materials. The WQMP (Appendix F) includes the required water quality monitoring for these construction activities.

The purpose of the water quality monitoring is to provide ongoing assessment of the water quality impacts of dredging of site sediment. General requirements of the monitoring program for open- water dredge and fill areas are as follows:

- Assess dissolved oxygen compared to prescribed minimums.
- Assess turbidity compared to prescribed maximums (compliance with turbidity criteria also ensures protection from dredging-related contaminant releases).
- Allow for appropriate adjustment of construction activities in a manner to protect human health and the environment.
- Document the results of the water quality performance monitoring.

Water quality monitoring will include background water quality monitoring. Ongoing dredging activities require rapid feedback from the monitoring program to support implementation of corrective actions in a timely manner. The WQMP specifies the appropriate balance between rapid turn-around results and maintenance of an appropriate level of quality control. If water quality criteria exceedances are measured, the following operational changes can be made to reduce sediment resuspension:

- Reducing the speed of bucket ascension
- Placing a tarp/barrier between the dredge and haul barge where the loaded bucket is moved above the water surface
- Reducing the number of bucket penetrations, which can cause sediment to be expelled from the vents in the bucket or cause sediment to become piled on top of the bucket, which then erodes during bucket retrieval
- Reducing the rate of bucket movement at impact with sediment; however reducing the bucket velocity just before impact may result in reduced penetration (resulting in additional passes).
- A change in the method of operating the dredge or the timing of dredging, based on changing site conditions such as tides, waves, currents, and wind, can occur.
- Controlled placement of fill materials to minimize generation of turbidity plumes, including slow bottom placement of initial fill lifts as necessary to establish a stable base for subsequent lifts.
- Work could be temporarily suspended.

6.3 Notch Sediment Removal

Recent sediment deposits withing the Notch Area will be removed based on field observations during construction. Removal will be accomplished using either barge or land-based excavation equipment, depending on the contractor’s sequencing of the work. Sediment from the notch will be disposed at a Subtitle D landfill.

Following removal of sediment from the notch, the existing stormwater outfall will be extended and the notch will be backfilled to match the surrounding upland grade.

6.4 Sediment and Debris Transit, Transload, and Disposal

It is anticipated that dredged material will be placed on haul barges and transported to an approved sediment transload facility for barge offloading. Any water from the barge and sediment stockpiles at the facility will be managed by the transload operation in compliance with all appropriate rules and regulations.

BMPs to ensure the clean and safe transfer of materials at the transloading facility will be required prior to any handling of sediment. The goals of the BMPs include:

- No discharge of contaminated material into surface water during transit or at the transload facility
- No tracking of contaminated material off site or into any area where it may contact water that would be uncontrolled by containment
- Control runoff so that contaminated water does not enter the waterways
- Prevent material spilling from the truck or train during transport from the transfer facility to the disposal facility.
- All vessels will be seaworthy

Dredged material will be disposed of at an approved Subtitle D landfill. Transport to the landfill from the transload facility will include truck or rail transportation.

6.5 Site Restoration

Site dredging will remove armoring along the shoreline of the bulkhead beneath the dock. Restoration will include placement of rounded rock, sized as small as possible based on engineering considerations, to protect the toe of the bulkhead and provide intertidal sediment and grades to provide suitable aquatic habitat. The cobble fill will be topped with habitat-mix gravel. The cobble has been sized to provide protection against potential boat scour and will have a maximum rounded rock size of 18 inches.

The southwest corner of SCU-1 is close to an existing rubble-covered slope. In order to complete the dredging at the southwest corner of SCU-1, the rubble and some of the existing slope will need to be removed. After dredging, riprap will be placed to stabilize the slope. The riprap layer will be about 3.3 feet thick and will have a maximum rock size of 36 inches.

Dock construction will occur after dredging has been completed. The in-water portion of dock construction is expected to occur immediately following dredging, in the same in-water work window, followed by work above the HTL elevation with upland completion extending to May 2023.

7 Monitoring and Contingency Response Actions

Compliance monitoring and contingency responses (as needed) will be implemented in accordance with WAC 173-340-410, Compliance Monitoring Requirements. Detailed requirements are described in the Construction Quality Assurance Plan (CQAP, included as Appendix D), Compliance Monitoring and Contingency Response Plan (CMCRP, included as Appendix E), and Water Quality Monitoring Plan (WQMP, included as Appendix F). The objective of the first two plans is to confirm that the goals of the cleanup action have been achieved, and to confirm the long-term effectiveness of cleanup actions.

The objective of the WQMP is to provide quality assurance that the Contractor's operations are in compliance with water quality criteria and the WQC. The WQMP outlines the duration and frequency of monitoring, the trigger for contingency response actions, and the rationale for terminating monitoring.

Water quality will be monitored during dredging of sediments and placement of RML and shoreline armor materials, following procedures detailed in the WQMP and summarized in Section 6.2. Water quality samples will be obtained and analyzed to monitor and control short- term water quality impacts from dredging activities, and to invoke corrective actions or modify dredging procedures, if necessary, to bring construction activities into compliance with water quality criteria.

7.1 Sediment Monitoring

The CMCRP (Appendix E) includes performance monitoring to be conducted during dredging. Dredging in SCU-1 is designed to achieve full removal of contaminated sediments from the bottom of the dredge prism to the existing sediment surface. Dredging will be complete when bathymetric survey data and sediment profile imaging (SPI) confirm that impacted sediment has been removed to the GMD.

Dredge residuals are anticipated within the dredge prism at the completion of removal activities. It is possible that these residuals could contaminate the post-dredge surface sediment. Post-dredge residual management will include placement of a RML consisting predominantly of clean sand to reduce possible contaminant concentrations. Subsequent to the placement of the RML, grab sampling will be performed to measure baseline chemical concentrations for long-term compliance monitoring as described in the CMCRP. The CMRP also describes performance monitoring samples that will be collected to assess post-excavation soil conditions within the Notch Area and to monitor stormwater solids that may accumulate outside of the Notch Area following extension of the outfall in this area.

Compliance monitoring will take place during Years 1, 3, and 5 following completion of construction in SCU-1. Additional monitoring may be required by Ecology based on prior monitoring results. Compliance monitoring may be integrated into monitoring for SCU-2, if appropriate, as determined by Ecology. Sample locations and analyses are provided in the CMCRP (Appendix E).

7.2 Contingency Response Actions

Detailed contingency response actions are described in the CMCRP (Appendix E) and WQMP (Appendix F). The objective of these plans is to confirm that cleanup standards have been achieved, to confirm the long-term effectiveness of cleanup actions at the Site, and to provide quality assurance that the Contractor's operations are in compliance with water quality criteria.

The WQMP provides details on response actions required for the project, including changes to BMPs and stop work orders. Modification or addition of BMPs will occur when turbidity or dissolved oxygen (DO) measurements do not satisfy water quality criteria. Changes to BMPs may include:

- Operational BMPs:
    - Slowing the speed of the dredge bucket through the water column
    - Avoiding overfilling of the bucket
    - Allowing water to drain from the bucket at the surface
    - Not overfilling the dredge scow
    - Avoiding critical tidal or current conditions
- Structural BMPs:
    - Modification of equipment to better control sediment resuspension
    - Installation of a sediment barrier such as a silt curtain

The following conditions will trigger a stop work response:

- Evidence of a significant oil sheen
- Evidence of distressed or dying fish
- Confirmed exceedance of water quality criteria at the 150-foot compliance boundary.

8 References

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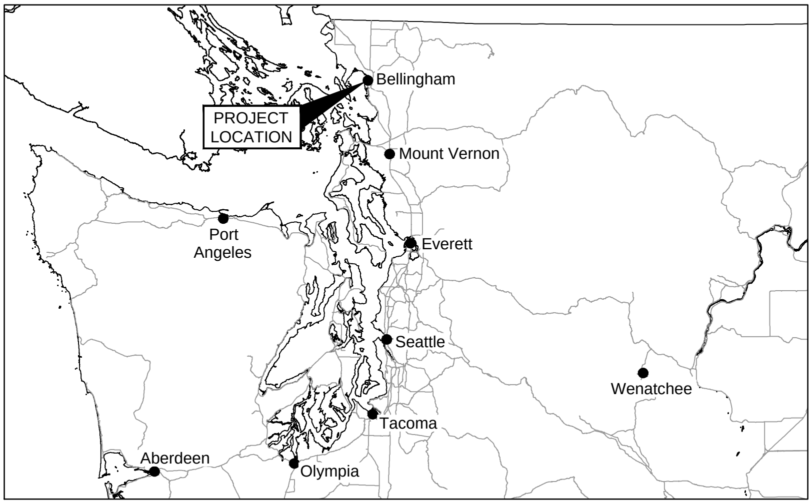
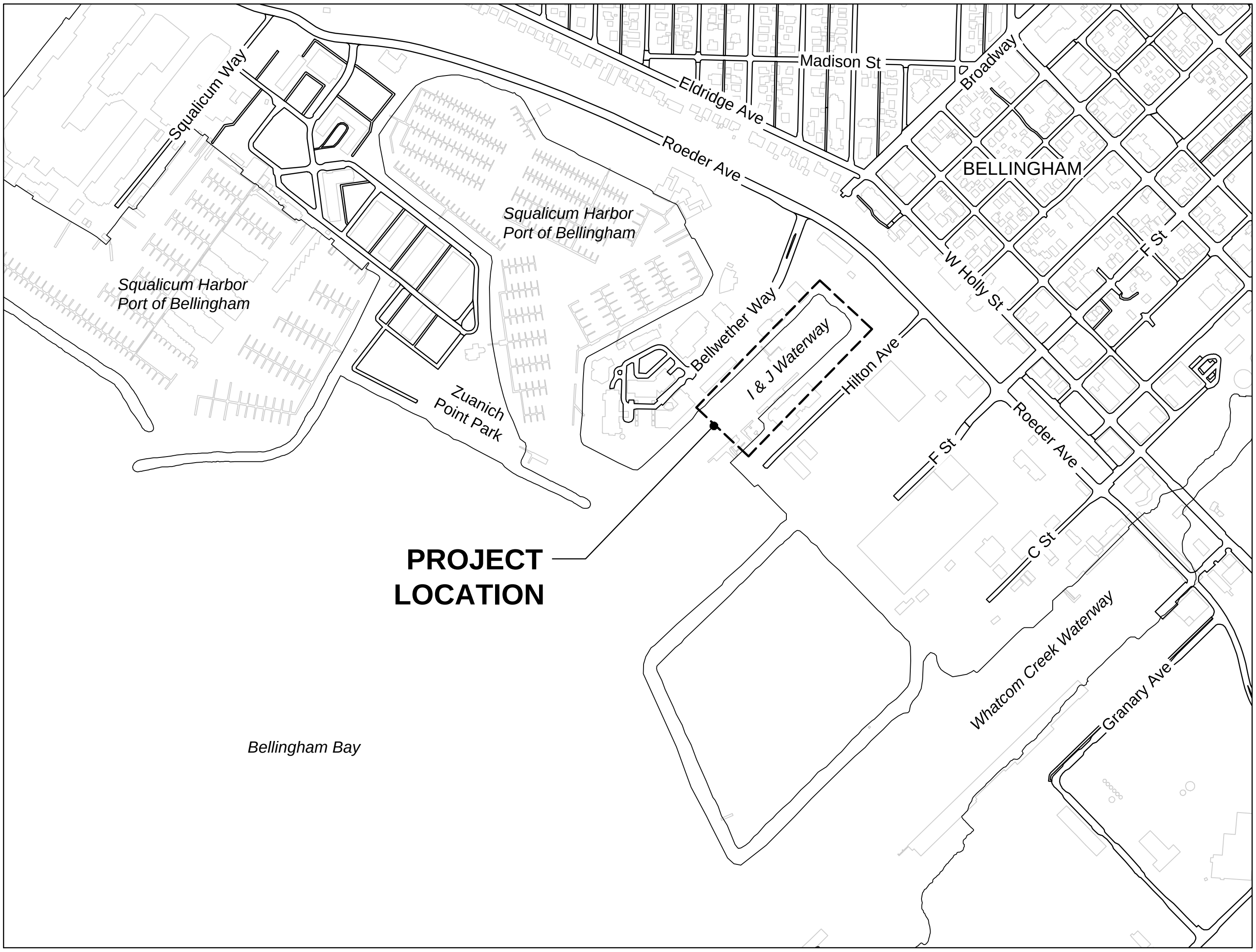
Figures



WASHINGTON LOCATION MAP



VICINITY MAP

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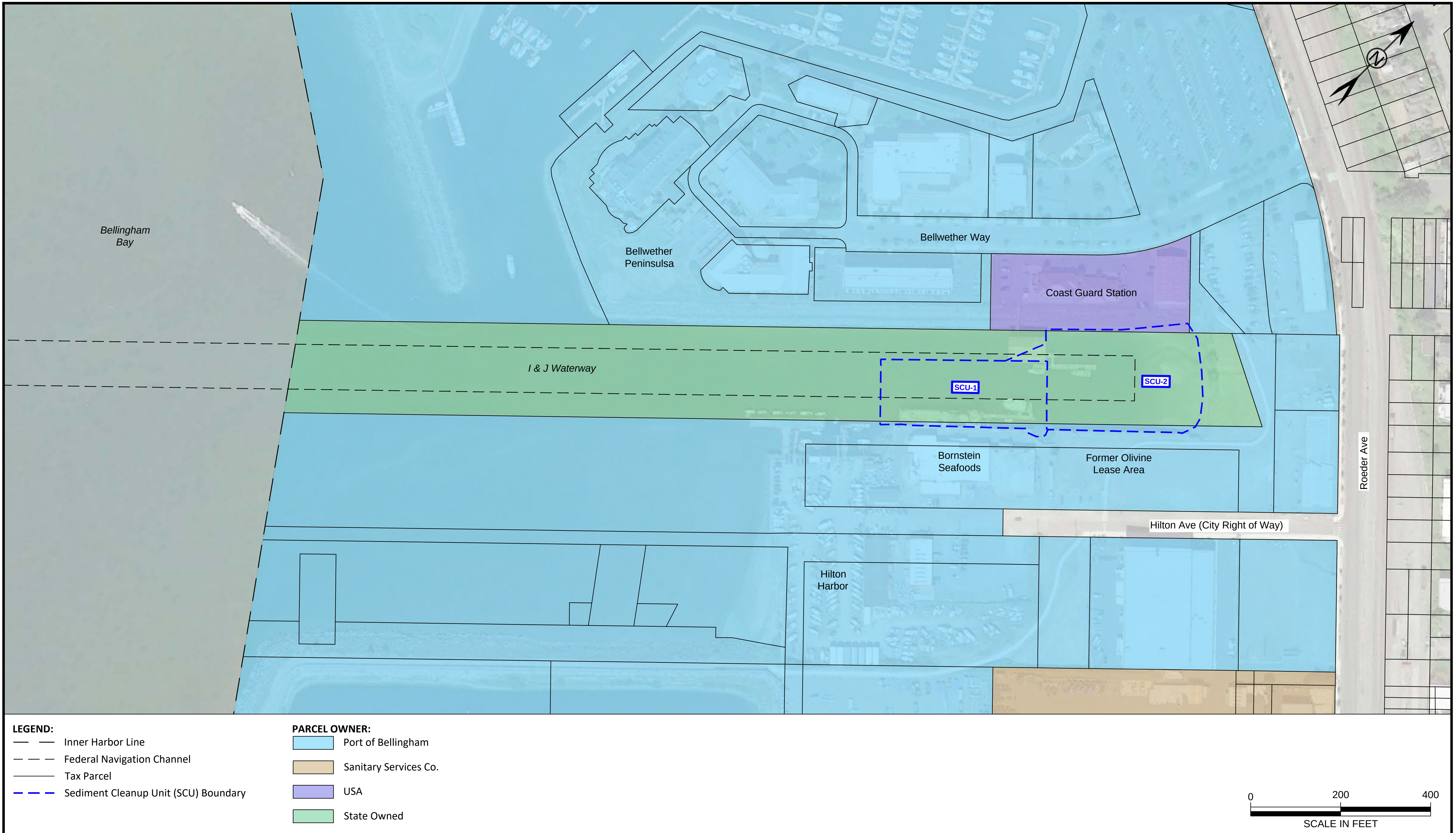
I&J Waterway Site, Sediment Cleanup Unit 1
Engineering Design Report

Vicinity Map

Figure 1



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Notes
1. Parcel data from City of Bellingham GIS.

Horizontal Datum: Washington State Plane North, NAD83, U.S. Feet
Vertical Datum: Mean Lower Low Level (MLLW)

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Property Ownership and Land Use

Figure 2

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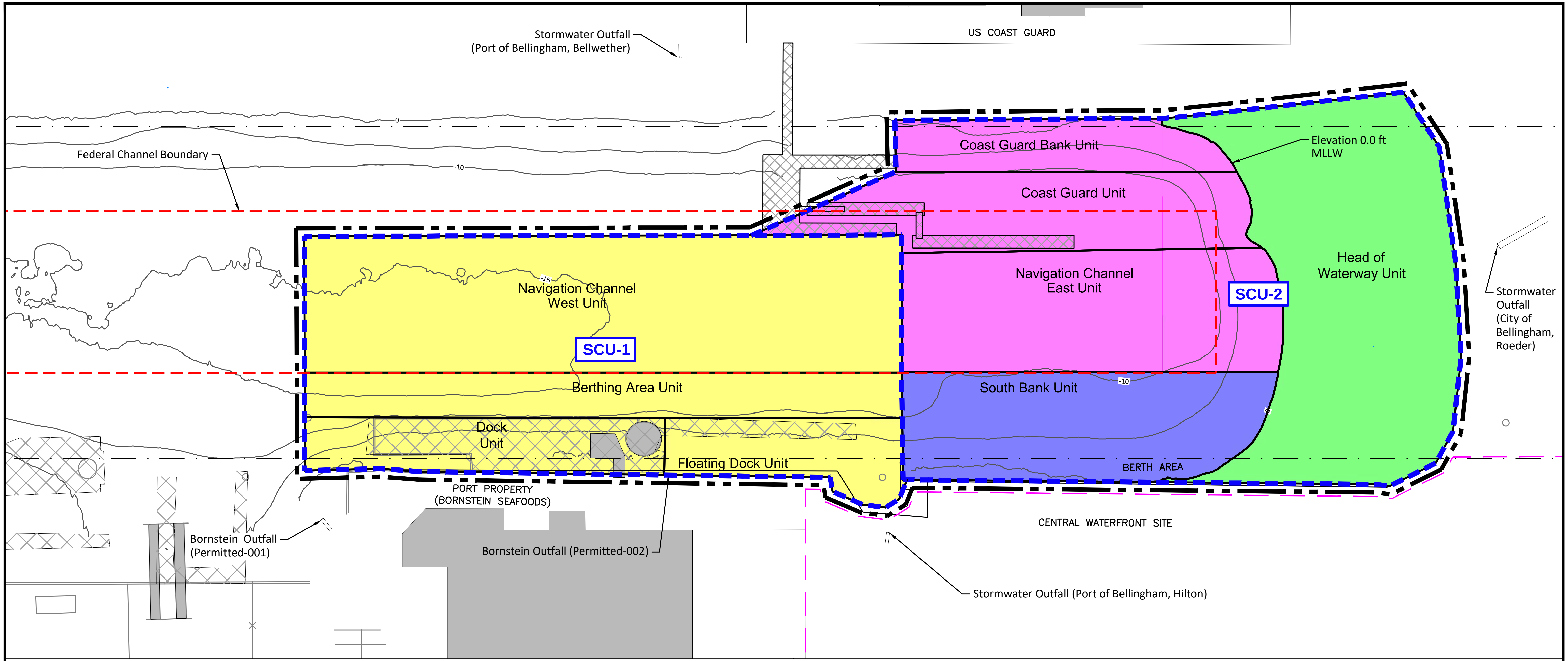

LEGEND:

▨ 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

0 60 120
SCALE IN FEET

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Cleanup Action

Figure 3

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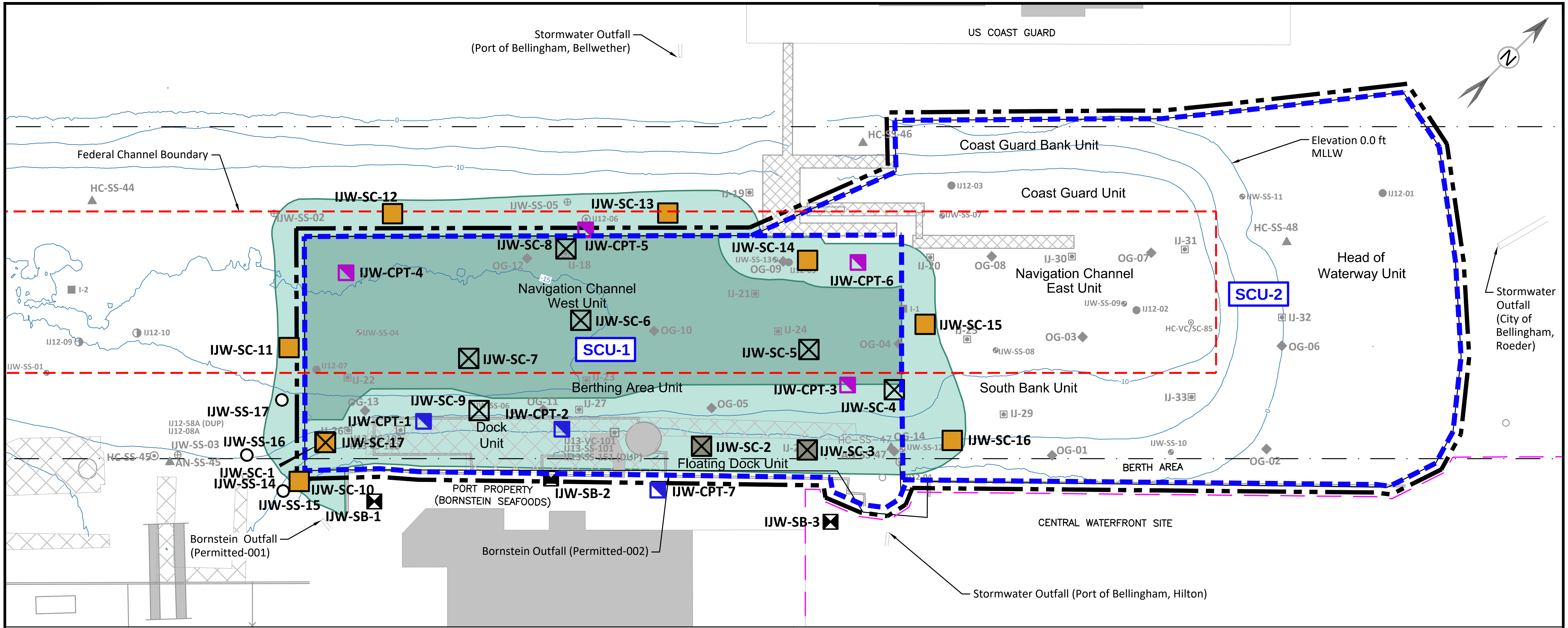

LEGEND:

▨ 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

🟩 Proposed Dredge Surface

🟩 Proposed Dredge Surface Side Slope Area

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)

Completed Pre-Remedial Design Sampling Station

🟪 CPT - Coast Guard Setback, Sediment Properties, GMD (Crete 2020)

🟦 CPT - Bulkhead and Dock, GMD (Crete 2020)

☒ Mud Rotary - Bulkhead and Dock, GMD (Crete 2020)

☒ Vibracore - Dredge Prism, Subsurface Chemistry, GMD (Crete 2020)

☒ Vibracore - Dredge Prism, GMD (Crete 2020)

○ Surface Grab - Dredge Prism, Chemistry (Crete 2020)

🟧 Vibracore - Dredge Prism Side Slope,
Collected during Phase 2 of Sampling Activities (Crete, 2021)

☒ Vibracore - Dredge Prism, GMD,
Collected during Phase 2 of Sampling Activities (Crete, 2021)

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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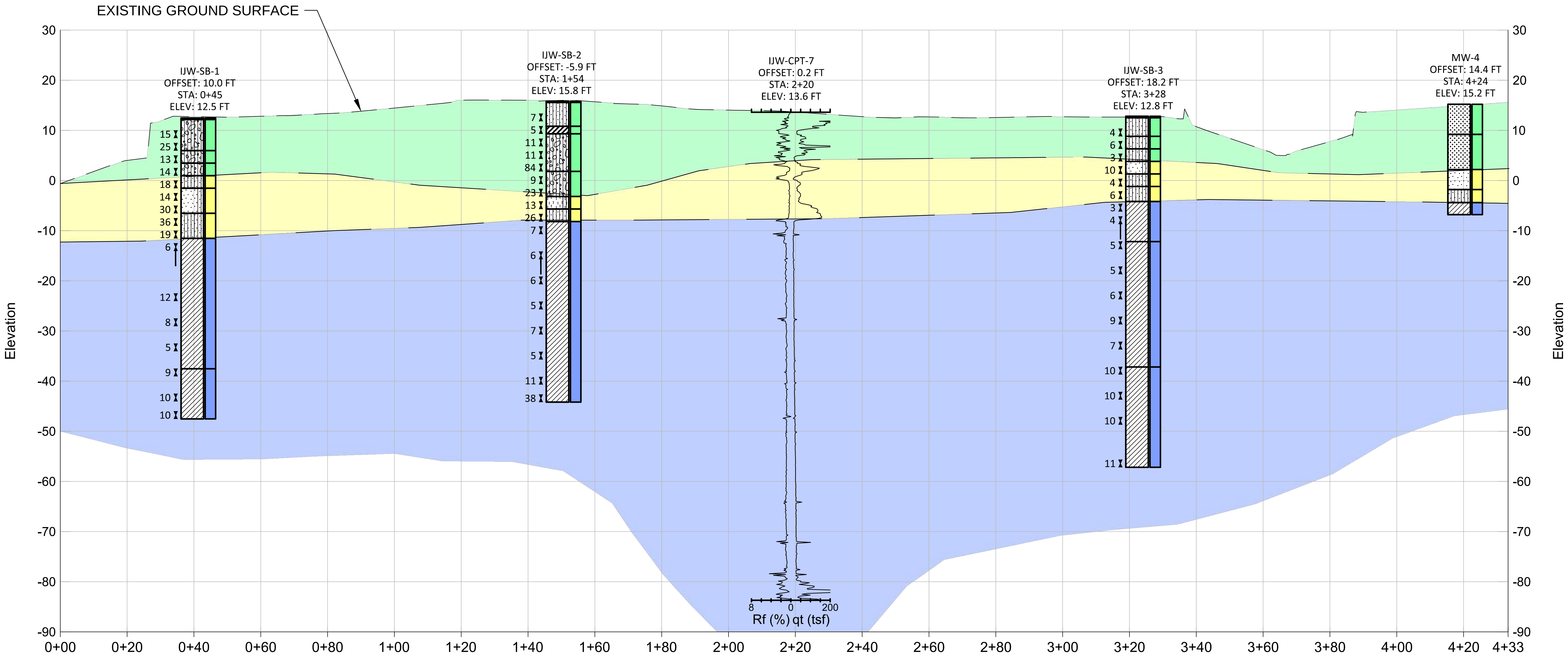
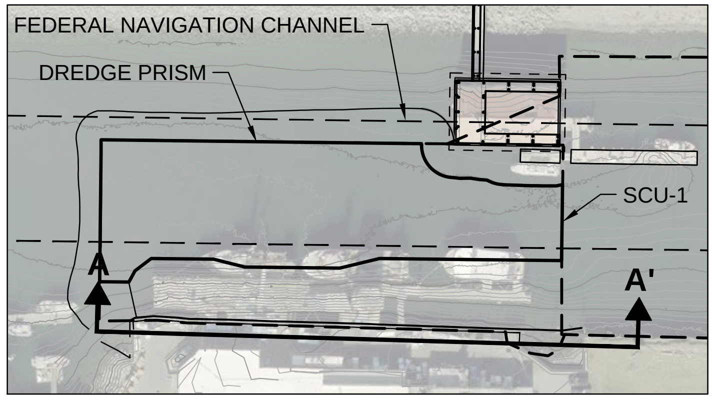
Engineering Design Report

Sample Locations

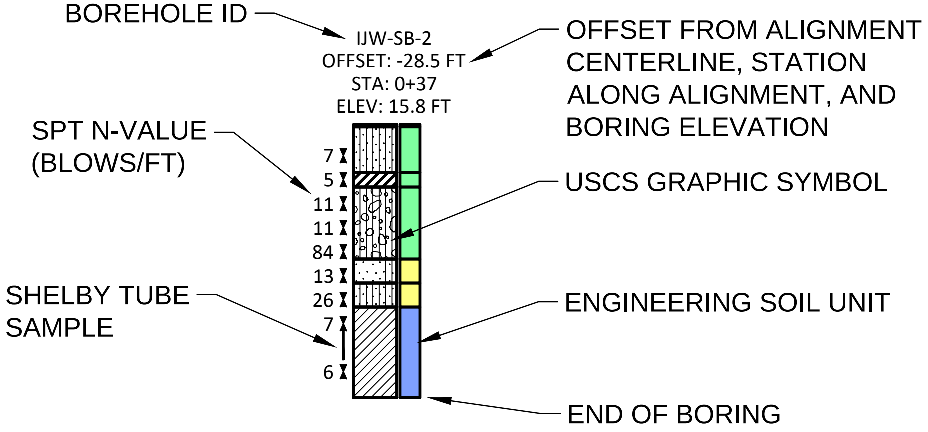
Figure 4



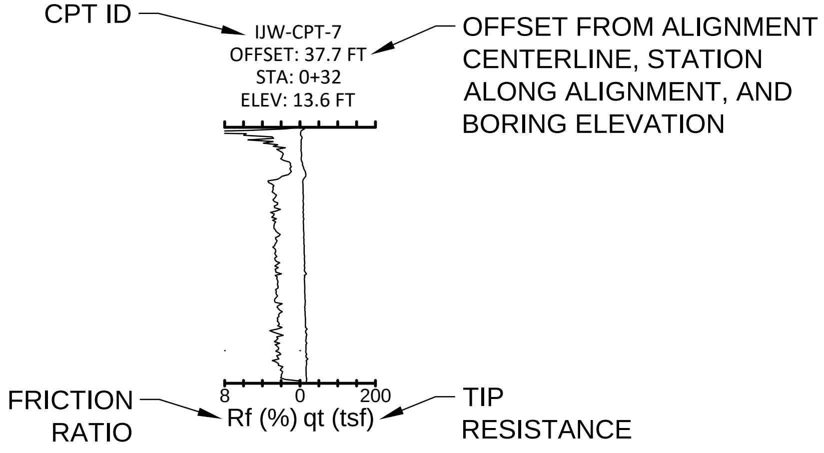


KEY MAP

BORING LEGEND

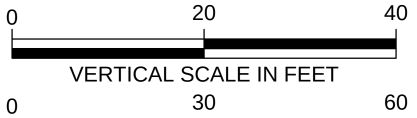


CPT LEGEND



SOIL LEGEND

- ▨ RECENT SEDIMENTS
- 🟩 FILL
- 🟨 POST-GLACIAL FLUVIAL DEPOSITS
- 🟦 GLACIAL MARINE DRIFT



VERTICAL EXAGGERATION = 1.5X

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I&J Waterway Site, Sediment Cleanup Unit 1
Engineering Design Report

Geologic Section A-A'

Figure 5

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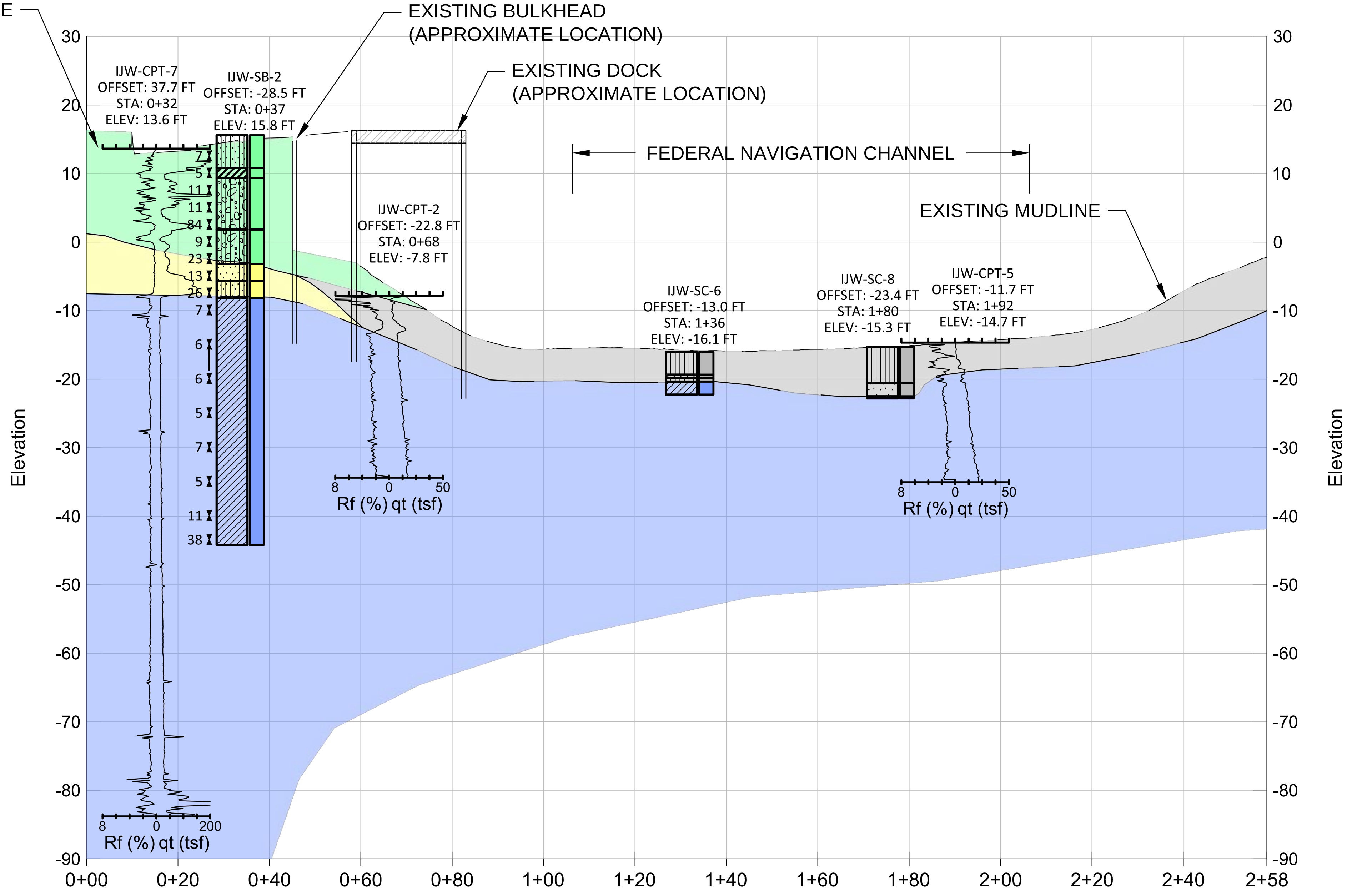
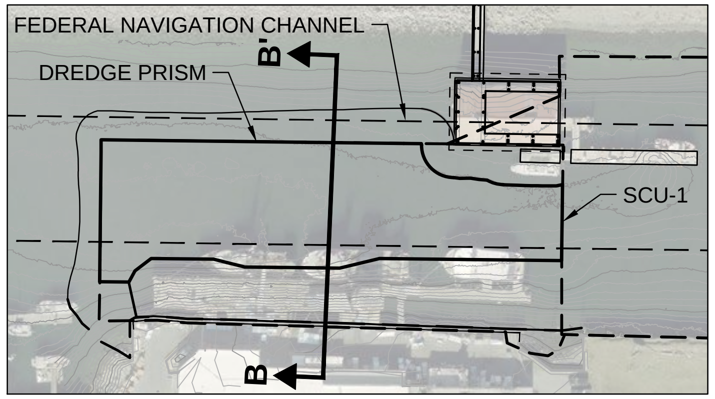
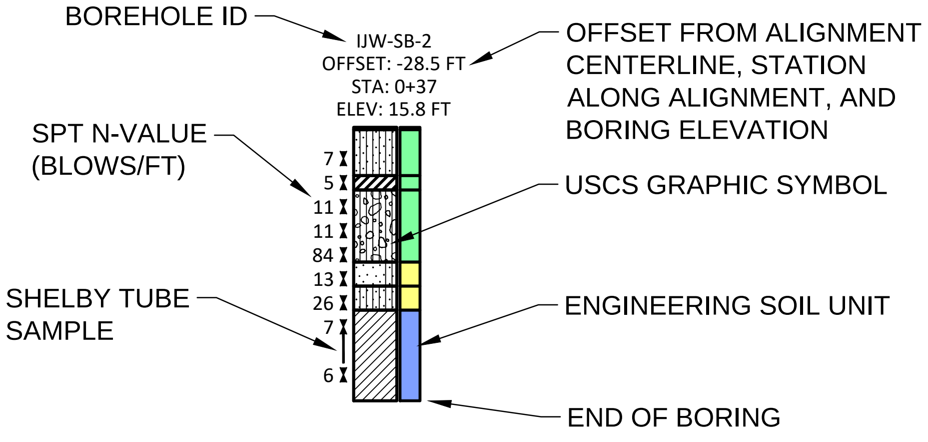


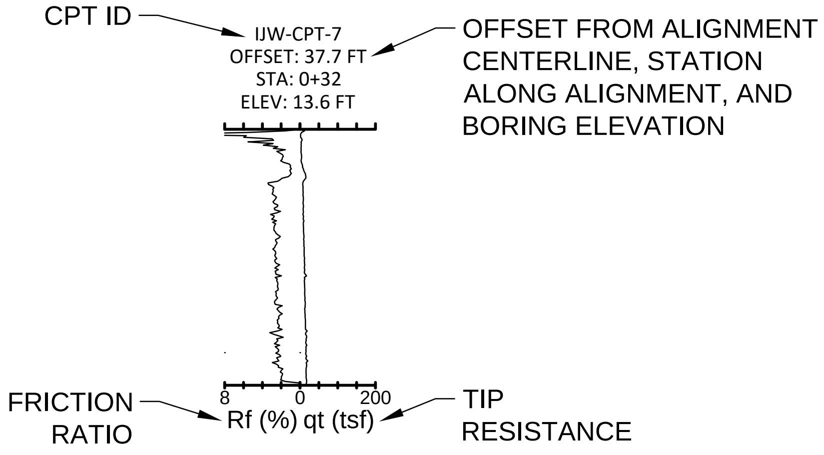


KEY MAP

BORING LEGEND

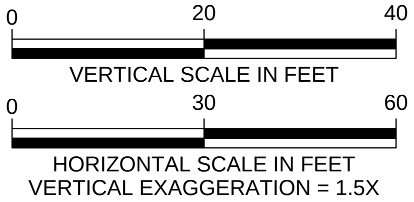


CPT LEGEND



SOIL LEGEND

- ▨ RECENT SEDIMENTS
- 🟩 FILL
- 🟨 POST-GLACIAL FLUVIAL DEPOSITS
- 🟦 GLACIAL MARINE DRIFT



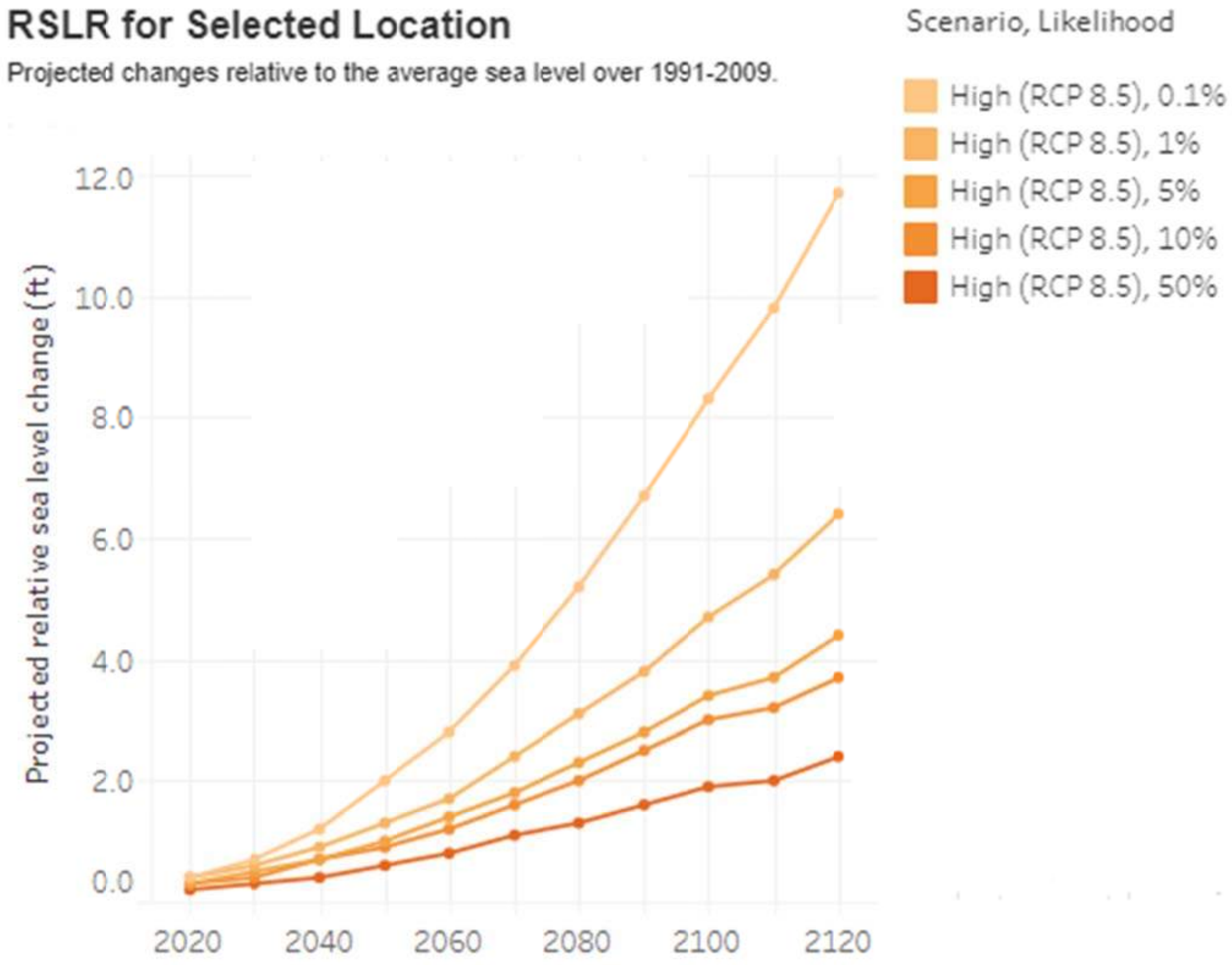
File: D:_Projects\Crete\PRD\BHIJ Dredge.dwg Date: 10/19/2021 | Cabryn

CRETE
CONSULTING, INC.

Port of Bellingham
I&J Waterway Site, Sediment Cleanup Unit 1
Engineering Design Report

Geologic Section B-B'

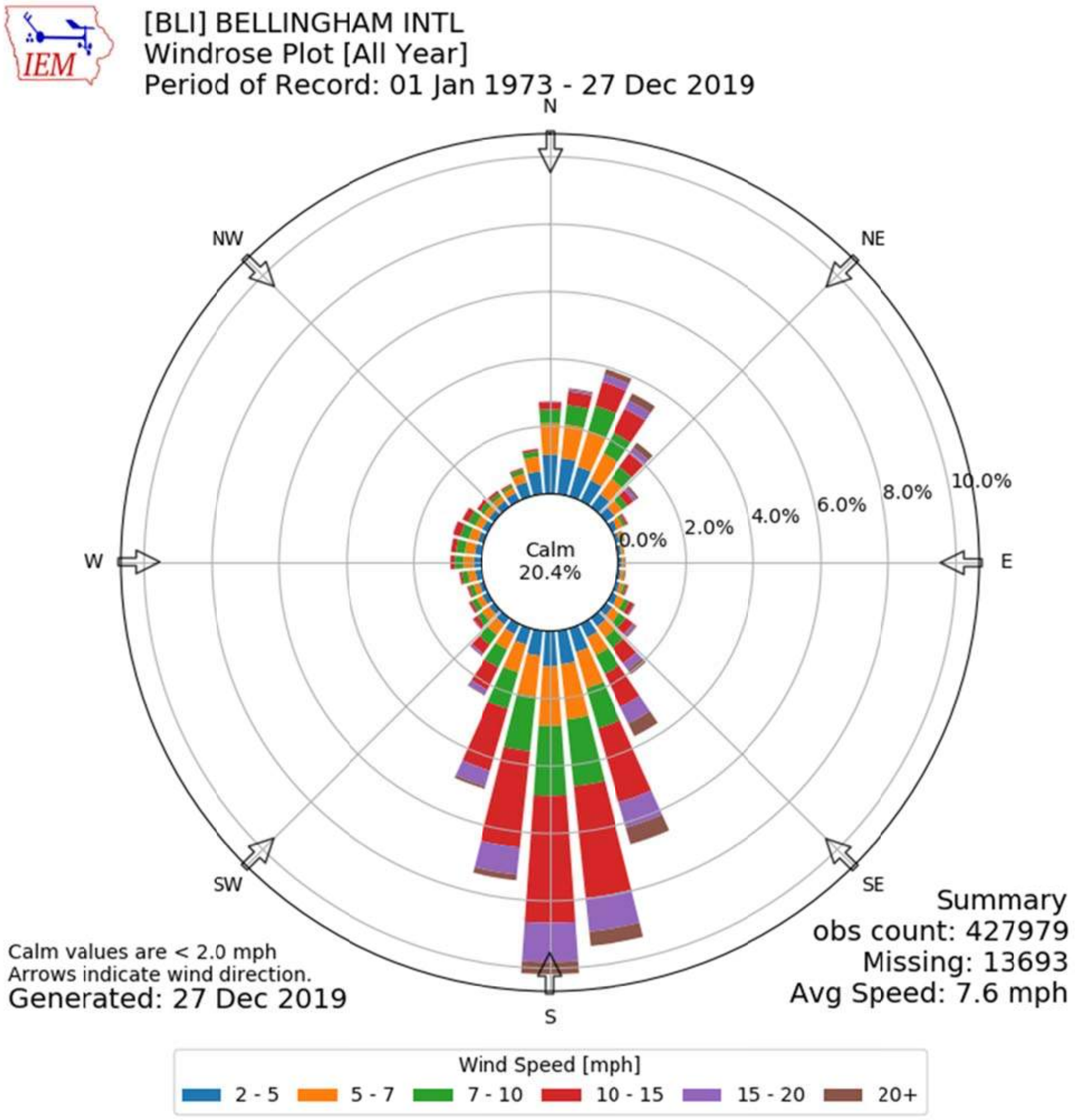
Figure 6



CRETE
CONSULTING, INC.

Port of Bellingham
I&J Waterway Site, Sediment Cleanup Unit 1
Engineering Design Report

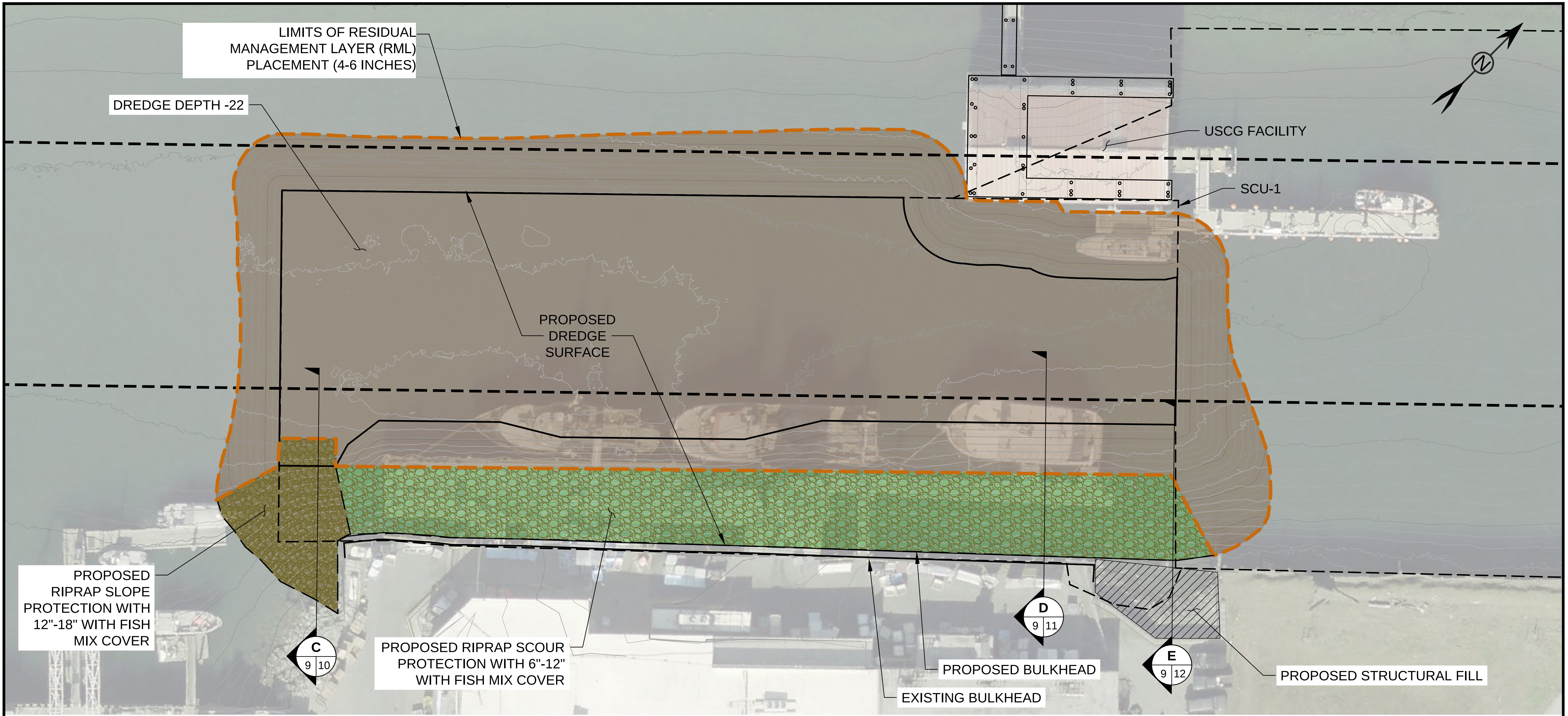
Sea Level Rise Projections
for the Bellingham Segment
of Whatcom County
Figure 7



CRETE
CONSULTING, INC.

Port of Bellingham
I&J Waterway Site, Sediment Cleanup Unit 1
Engineering Design Report

Wind Rose for Bellingham
Airport, 1948 - 2018
Figure 8



LEGEND

- PROPOSED RIPRAP SLOPE PROTECTION WITH FISH MIX COVER
- PROPOSED RIPRAP SCOUR PROTECTION WITH FISH MIX COVER
- ▨ PROPOSED STRUCTURAL FILL
- RESIDUAL MANAGEMENT LAYER (RML) PLACEMENT

NOTES:
1. EXISTING SURVEY:
   BATHYMETRY BY NW HYDRO; UPLAND TOPO BY WILSON ENGINEERING (JUNE 2020)
2. AERIAL: WHATCOM COUNTY (2019)

0 40 80
SCALE IN FEET

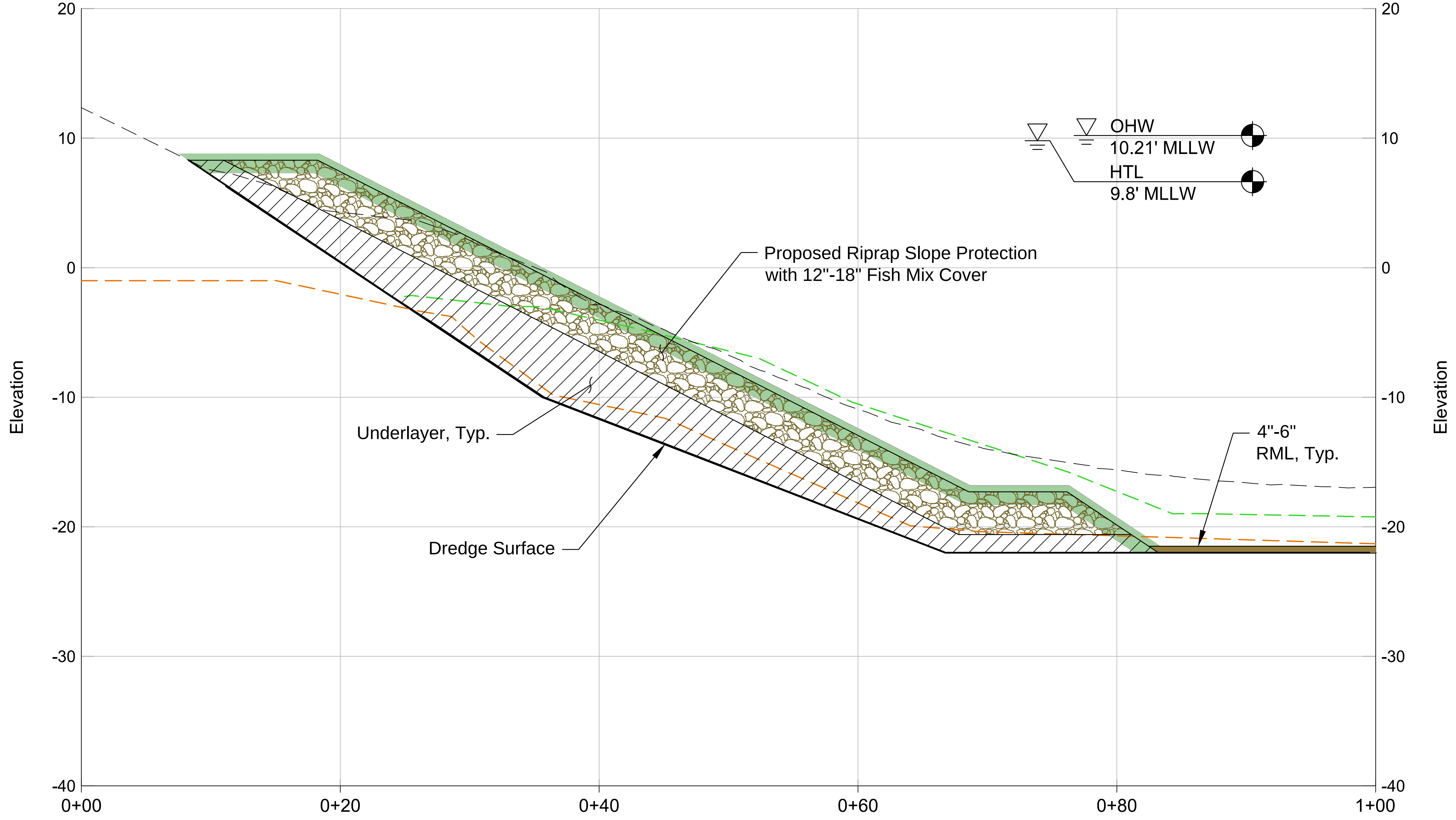
CRETE
CONSULTING, INC.

Port of Bellingham
I&J Waterway Site, Sediment Cleanup Unit 1
Engineering Design Report

Dredge Plan

Figure 9

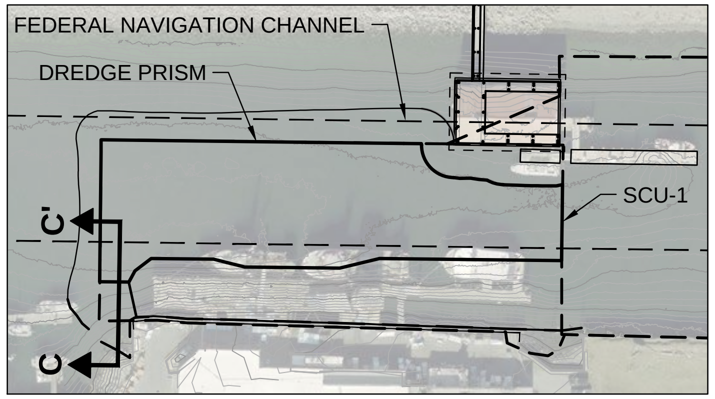
File: D:_Projects\Crete\PRD\BHIJ Dredge.dwg Date: 10/19/2021 | Cabryn



C
9 | 10

SECTION - SLOPE PROTECTION

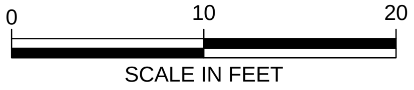
SCALE: 1" = 10'



KEY MAP

LEGEND

- — — ESTIMATED GMD SURFACE
- — — 1966 USACE SOUNDINGS
- — — 2020 SURVEY
- —— PROPOSED DREDGE SURFACE



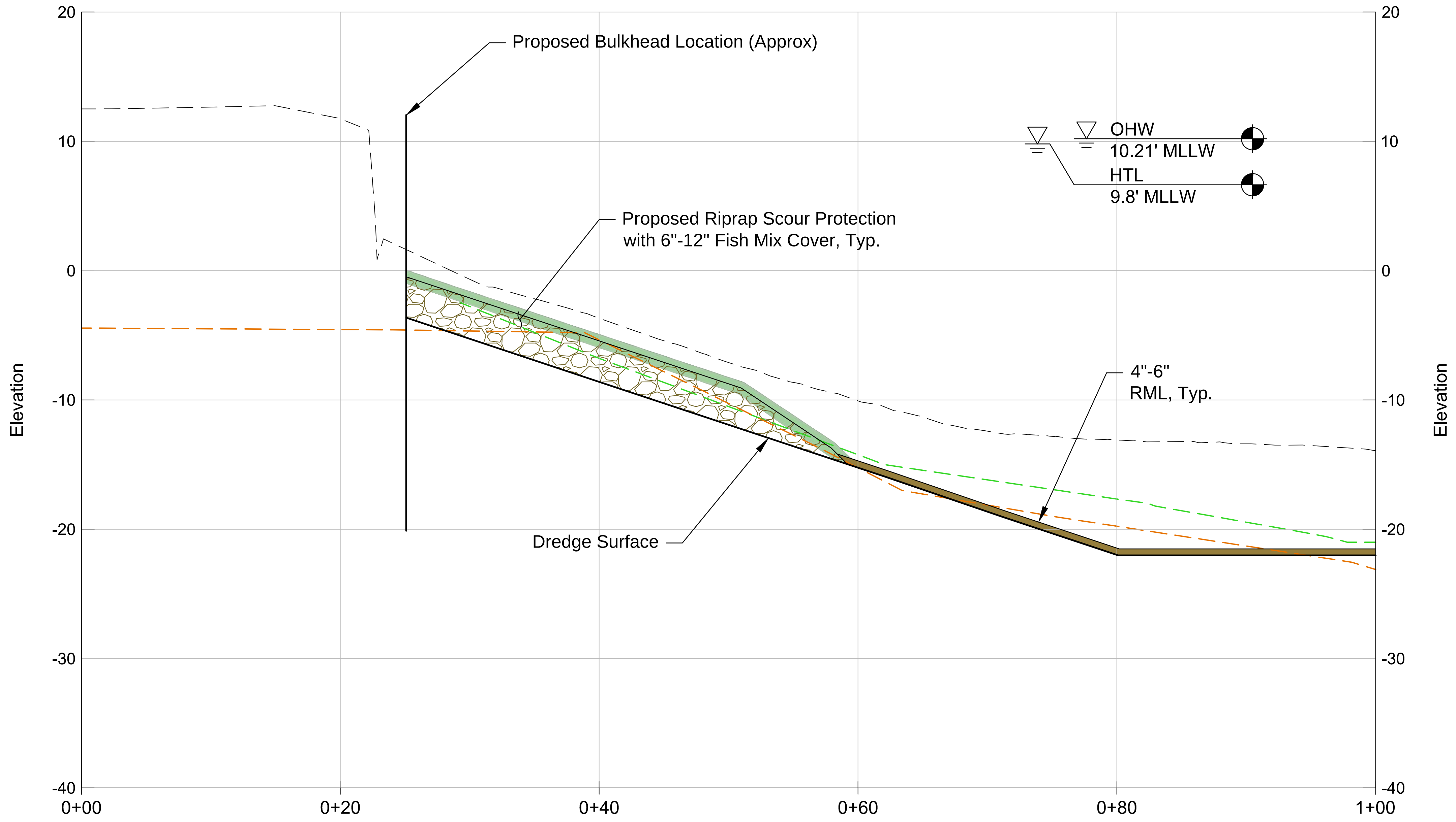
File: D:_Projects\Crete\PRD\BHIJ Dredge.dwg Date: 10/19/2021 | Cabryn

CRETE
CONSULTING, INC.

Port of Bellingham
I&J Waterway Site, Sediment Cleanup Unit 1
Engineering Design Report

Dredge Section C-C'

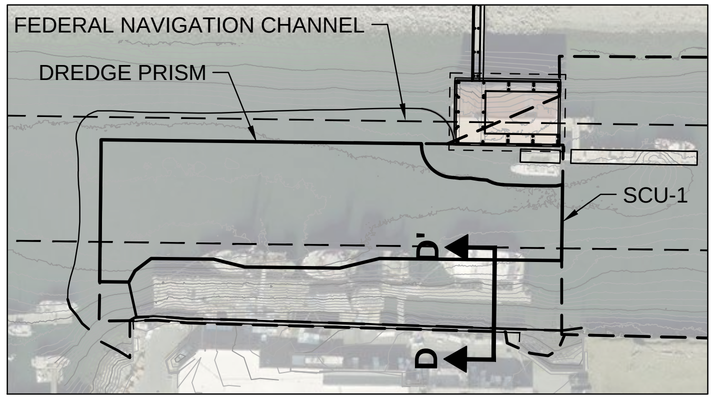
Figure 10



SECTION - SLOPE PROTECTION

D 9 | 11

SCALE: 1" = 10'



KEY MAP

LEGEND

– – – ESTIMATED GMD SURFACE

– – – 1966 USACE SOUNDINGS

– – – 2020 SURVEY

—— PROPOSED DREDGE SURFACE

0 10 20

SCALE IN FEET

CRETE
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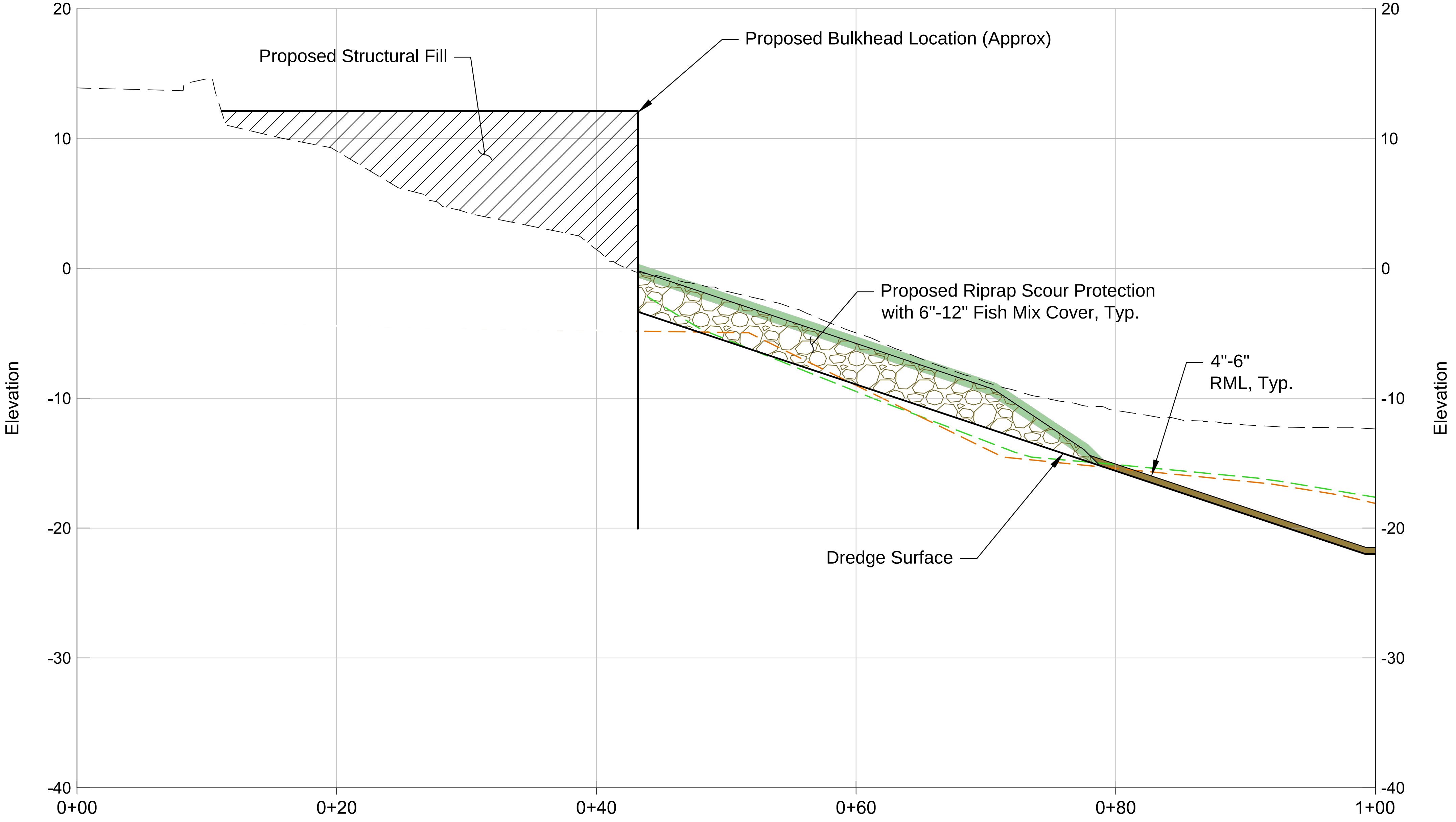
Port of Bellingham
I&J Waterway Site, Sediment Cleanup Unit 1
Engineering Design Report

Dredge Section D-D'

Figure 11

File: D:_Projects\Crete\PRD\BHIJ Dredge.dwg Date: 10/19/2021 | Cabryn



E
9 | 12

SECTION - SLOPE PROTECTION

SCALE: 1" = 10'

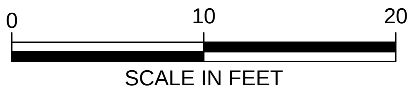
LEGEND

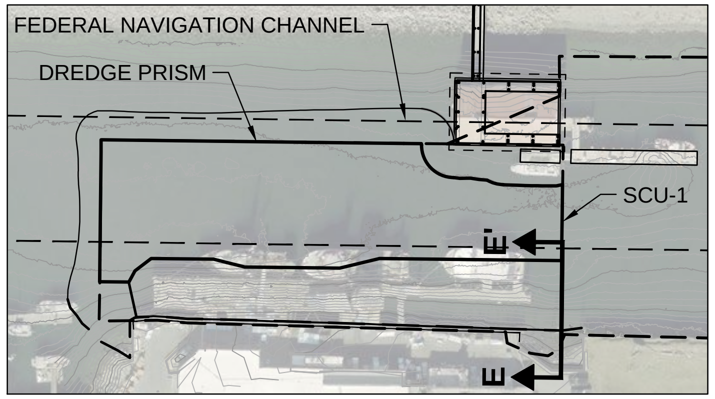
— — — ESTIMATED GMD SURFACE

— — — 1966 USACE SOUNDINGS

— — — 2020 SURVEY

——— PROPOSED DREDGE SURFACE





KEY MAP

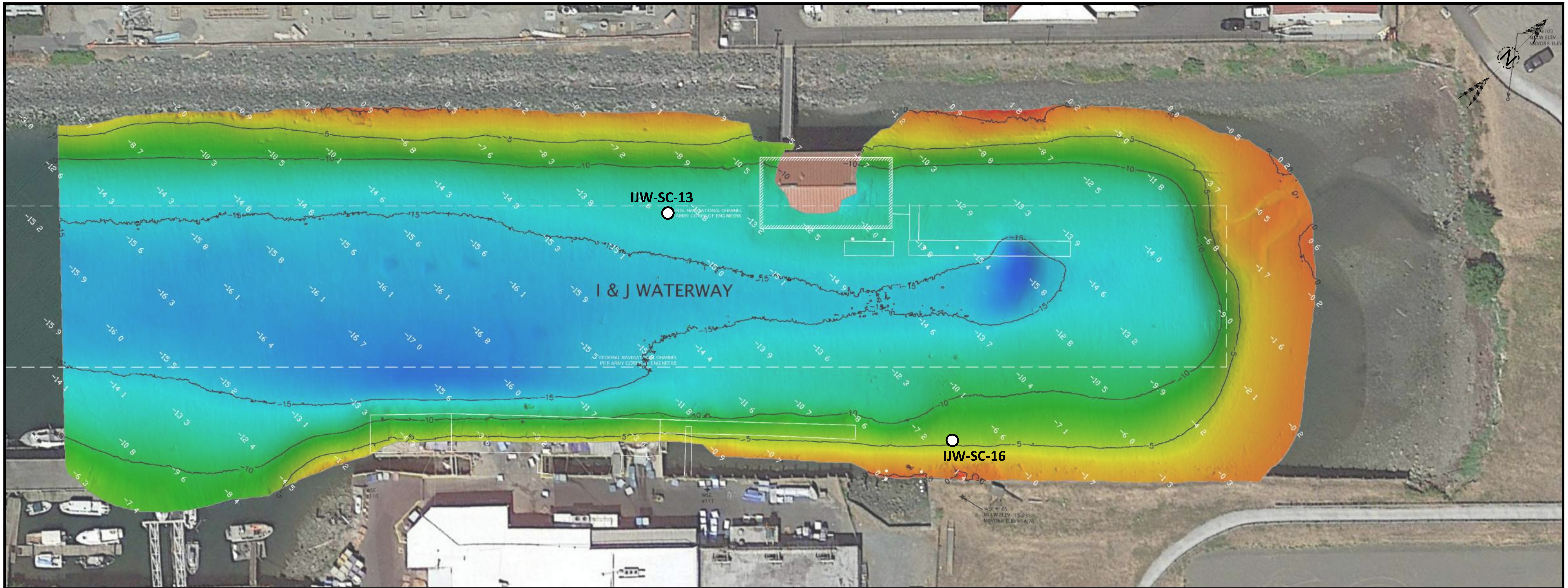
CRETE
CONSULTING, INC.

Port of Bellingham
I&J Waterway Site, Sediment Cleanup Unit 1
Engineering Design Report

Dredge Section E-E'

Figure 12

File: D:_Projects\Crete\PRD\BHIJ Dredge.dwg Date: 10/19/2021 | Cabryn



NOTES:

1. HORIZONTAL DATUM: NAD 83(1998) STATE PLANE COORDINATES, WASHINGTON NORTH ZONE. COORDINATES BASED ON PROJECT CONTROL PROVIDED BY WILSON ENGINEERING. SEE SURVEY CONTROL TABLE
2. UNITS: U.S SURVEY FEET
3. VERTICAL DATUM: MEAN LOWER LOW WATER (MLLW) AS DEVELOPED BY WILSON ENGINEERING FOR THIS SEDIMENT CLEANUP PROJECT. VERTICAL DATUM WAS DEVELOPED BY WILSON ENGINEERING HOLDING THE PUBLISHED ELEVATION FOR CITY OF BELLINGHAM CONTROL POINT #1332 (BRASS MONUMENT AT THE CENTERLINE OF BELLWETHER WAY). PUBLISHED ELEVATION: MLLW = 18.56 FEET. SEE CONTROL TABLE FOR WILSON ENGINEERING PROJECT MONUMENTS USED FOR THIS MAPPING.
4. CONTOUR INTERVAL: 1 FOOT. CONTOURS WERE DEVELOPED FROM A GRIDDED 1 FT X 1FT DATASET USING AN INVERSED WEIGHTED AVERAGE OF ALL SOUNDINGS.
5. ALL HORIZONTAL POSITIONING AND VESSEL ATTITUDE WAS PROVIDED IN REAL TIME USING AN APPLANIX POS-MV RTK GPS AIDED INERTIAL SENSOR. RTK CORRECTIONS WERE RECEIVED FROM A TRIMBLE R8 RTK BASE STATION OCCUPYING KPFF MONUMENT #1.
6. SOUNDINGS WERE COLLECTED USING A R2SONIC 2022 MULTIBEAM SONAR SYSTEM AND DATA PROCESSING WAS COMPLETED USING HYPACK HYSWEEP SOFTWARE.
7. THIS BATHYMETRIC SURVEY IS REPRESENTATIVE OF THE GENERAL CONDITION OF THE RIVERBED AT THE TIME OF THE SURVEY. THE CONDITION OF THE BOTTOM MAY CHANGE AT ANY TIME AFTER THE DATE OF THIS SURVEY.
8. ALL BATHYMETRIC DATA WAS COLLECTED IN ACCORDANCE WITH THE U.S ARMY CORPS OF ENGINEERS HYDROGRAPHIC SURVEY MANUAL EM-1110-02-1003 (NOVEMBER 2013).

Design Sampling Station

○ Performance Monitoring Sample - Sediment Chemical Analysis (See Appendix E)

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SCALE IN FEET

CRETE
CONSULTING, INC.

Port of Bellingham
I&J Waterway Site, Sediment Cleanup Unit 1
Engineering Design Report

Bathymetric Survey (June 2020)

Figure 13

File: D:_Projects\Crete\PRDI\PRDI Sonar Map.dwg Date: 9/29/2022 | Cabryn

Appendix A

PRDI Results Summary

TO: Ben Howard – Port of Bellingham and Jay Bornstein – Bornstein Seafoods

FROM: Rusty Jones, Jamie Stevens, P.E. – CRETE Consulting Inc.

PROJECT: I&J Waterway Site

SUBJECT: Pre-Remedial Design Investigation Field Results

DATE: June 7, 2021

CC: File

This memorandum describes the investigation activities related to the Pre-Remedial Design Investigation Work Plan for the I&J Waterway Site (CRETE 2020). The Pre-Remedial Design Investigation (PRDI) Work Plan described 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. The PRDI Work Plan and this document address SCU-1. These documents have been prepared to satisfy the requirements of Agreed Order No. DE 16186 (Agreed Order). 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.

The 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 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). 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. The federally authorized navigation channel has an authorized channel depth of 18 feet below mean lower low water (MLLW).

The PRDI Work Plan identified data gaps relating to design of the cleanup action for SCU-1. The data gap analysis was based on a review of available documentation and results from previous investigation efforts completed at the site. PRDI field activities included collection of data to inform the identified data gaps. Data collection during the PRDI field activities included the following items:

- Base Map – in order to develop a complete project base map additional surveys were completed. Surveys included bathymetric survey, upland topographic survey, and utility mapping. This information has been folded into project basemaps and Drawings presented in Appendix B of this EDR.
- Geotechnical Data – additional geotechnical data was collected to complete a dredgeability review, inform the bulkhead and dock design, to assess post-cleanup slope stability, and to determine safe offsets from USCG facilities. This information has been folded into the project Drawings (Appendix B of this EDR) and is summarized in the Geotechnical Report (included as Appendix C of this EDR) and the Dock design (included in Appendix D of this EDR).
- Dredge Extent – to aid in defining the dredge prism, the presence and depth of the GMD was documented using multiple complimentary methods. Subsurface chemistry was evaluated at select locations throughout the dredge prism. In addition, the extent of carcinogenic polycyclic aromatic hydrocarbon (cPAHs) in surface sediment at the southwest corner of SCU-1 was

evaluated. This information is discussed in this memorandum and has been folded into the project Drawings (Appendix B of this EDR). Supplemental geotechnical data was collected in dredge extent sampling locations, geotechnical data results from these locations are discussed in this memorandum.

- Implementation Issues – During surveying a debris survey was completed. The results are discussed in this memorandum.

PRDI field work was completed per the PRDI Work Plan. Data results related to the dredge extent are discussed below.

Dredge Extent Investigation Activities

Additional sediment samples were needed to refine the understanding of the GMD and the chemical distribution in sediments at select areas. Sediments were collected in two separate events. Phase 1 included surface samples at the southwest corner of the dredge footprint and subsurface samples within the dredge footprint. Phase 2 included subsurface samples around the perimeter of the dredge footprint and representing surface sediment on the post-dredge side slopes. Figure 1 shows the Phase 1 and Phase 2 sediment sampling locations, Table 1 reviews the rationale for each sediment sampling location and outlines the laboratory testing assignment.

Attachment 1 includes a photographic log from the sediment sampling events, Attachment 2 includes field logs and Attachment 3 includes laboratory reports from the sampling events.

Phase 1 Surface Samples

Four surface grab samples were collected at the locations shown on Figure 1. Surface sediment samples collected for nature and extent testing were collected from the 0- to 12-cm biologically active zone at each location. Table 1 presents a summary of the surface sediment location and sampling scheme details including chemical testing analyses. Samples were collected using a hydraulic Van Veen sampling device using the methods outlined in the PRDI Work Plan.

Field activities for the surface sediment grab samples were conducted on June 18, 2020 by Gravity Marine and Crete. Samples were submitted to the Friedman & Bruya, Inc laboratory on June 18, 2020. Coordinates for surface grab sample locations are listed on Table 1 and the sample locations are shown on Figure 1.

Surface samples were compared to Sediment Cleanup Objective (SCO), results are included on Table 2. Only cPAHs were analyzed for the surface grab samples. Total cPAHs concentrations at IJW-SS-14 and its duplicate were detected at concentrations of 0.259 mg/kg and 0.299 mg/kg, respectively, exceeding the SCO of 0.229 mg/kg. No other cPAHs detections were above the SCO for surface samples collected during Phase 1.

Phase 1 Subsurface Samples

Subsurface sediment sample cores (for chemistry and physical testing) were collected by vibracore technology using the methods outlined in the PRDI Work Plan. Sediment core sampling was completed at the locations shown on Figure 1, and includes locations IJW-SC-1 through IJW-SC-9. Coordinates for these sample locations are listed on Table 1.

Field activities for the Phase 1 subsurface sediment sample collection and processing were conducted on June 16 and 17, 2020. Samples were submitted to Friedman & Bruya, Inc. laboratory on June 18, 2020. As per the PRDI, initially two samples (from locations IJW-SC-2 and 3) were submitted for chemical analysis. All other samples (from locations IJW-SC-1, 4, 5, 6, 7, 8, and 9) were archived. A photographic log is included Attachment 1, sediment logs for all nine subsurface sample locations in Phase 1 are included in Attachment 2 and laboratory analytical results are included in Attachment 3.

Subsurface sediment samples were submitted for chemical analysis for total organic carbon (TOC) and indicator hazardous substances (IHSs); consisting of PAHs, SVOCs [including bis(2-ethylhexyl)phthalate], and nickel. Based on the results of the IHS analysis, mercury, dioxins/furan, and dioxin-like polychlorinated biphenyls (PCBs) congeners assignments were not needed. Analysis from locations IJW-SC-2 and 3 were completed and based on the results from these initial analyses, additional analyses were not completed on the archived samples.

Table 2 summarizes analytical chemistry performed for the Phase 1 sediment sample locations. Sediment sample interval depths varied for all sample stations and are listed on Table 2. Below is a summary of the detections above the SCOs:

- Total cPAH concentrations of 0.263 mg/kg at duplicate sample IJW-SC-100 exceeded the SCO of 0.229 mg/kg. The parent sample cPAH detection was below the SCO (IJW-SC-2 at 0.101 mg/kg). The averaged concentration of the total cPAH of the normal sample and duplicate sample is 0.182 mg/kg, below the SCO of 0.229 mg/kg.

- No other dry-weight or TOC-normalized concentrations exceed SCOs in the Phase 1 IHS sediment results.

Phase 1 Supplemental Geotechnical Data

Supplemental geotechnical data was collected during the Phase 1 sediment core sampling activities. Select sediment samples were assigned physical testing for grain size distribution and hydrometer analysis by ASTM-D422 by Fremont Analytical in Seattle, WA. These samples were selected based on visual classification to represent the major sediment units found in the core and spaced to throughout the dredge prism to provide representative data. The physical tests were conducted on sediment samples from the following sediment cores:

- IJW-SC-3 intervals 1 (0 to 1.8 feet below the mud line [bml]) and 3 (1.8 to 3.8 feet bml),
- IJW-SC-4 intervals 2 (0 to 1.7 feet bml) and 3 (3.7 to 5.7 feet bml),
- IJW-SC-8 intervals 2 (3.2 to 5.2 ft bml) and 1 (5.2 to 7.2 ft bml), and
- IJW-SC-9 Intervals 2 (2.2 to 4.2 feet bml) and 3 (6.2 to 8.2 ft bml).

Based on the grain size and hydrometer results from the select Phase 1 sediment samples, the Glacial Marine Drift materials from IJW-SC-3 and IJW-SC-4 are a clayey sand with the clay content ranging from 20 to 23% and the total sand contents ranging from 53 to 56%, with silts, colloids and gravel comprising the remaining percentages. The sediments above the GMD at IJW-SC-3 are predominantly sands (56%) with 14% clay composition. The shallow interval 2 (0 to 1.7 feet bml) sediment sample from IJW-SC-4 is predominantly gravels/shells/barnacles with minor coarse sand. The sediments above the GMD at IJW-SC-8 are predominantly sands or variable content (56 to 70% total sand content) with 30 to 59 % of this fine sand. The sediments above the GMD at IJW-SC-9 are gravelly sands (53% sand). The grain size analysis of the sample of GMD material from IJW-SC-9 indicates a gravel with minor sands. The sediment log from this location indicates that minor rounded gravel was present, but the GMD was predominantly a silty clay similar to what was observed at IJW-SC-3 and IJW-SC-4. It is likely the sample submitted to the lab may have included more gravel than what was representative of the entire unit.

Phase 2 Subsurface Samples

A second sediment core sampling event was conducted after the preliminary dredge prism was developed. Phase 2 included 8 subsurface sample locations representing post-dredge side slope surface sediment or prism perimeter locations. The Phase 2 sediment coring locations are shown on Figure 1, and include locations IJW-SC-10 through IJW-SC-17. Coordinates for these sampling locations are listed on Table 1. Samples were collected at the same interval as Phase 1 and followed the vibracore sample collection methods outlined in the PRDI Work Plan.

Field activities for the Phase 2 subsurface sediment sample collection and processing were conducted on January 26 through 28, 2021. Samples were submitted to Friedman & Bruya, Inc. laboratory on January 27 and 29, 2021. Samples were collected for chemical analysis, as described in Table 1. A photographic log is included Attachment 1, sediment logs are included in Attachment 2 and laboratory analytical results are included in Attachment 3.

Samples were submitted for analysis for the TOC and IHSs analysis. Select intervals were submitted for archiving. A summary of Phase 2 subsurface sediment results are provided in Table 3. Below is a summary of the detections above the SCO:

- Nickel was detected in sediment from IJW-SC-16 at a concentration of 235 mg/kg, exceeding the SCO of 211 mg/kg.

- Bis(2-ethylhexyl)phthalate was detected in sediment from IJW-SC-13 at a concentration of 2.1 mg/kg, exceeding the SCO of 1.3 mg/kg. The TOC-normalized result for this sample is 67 mg/kg, which exceeds the carbon-normalized SCO of 47 mg/kg.

- No other dry-weight or TOC-normalized concentrations exceeded SCOs in the Phase 2 IHS sediment results.

Subsurface Debris Survey

The PRDI work plan identified the need for additional information to map the extent of debris on-top and within the sediment. During the PRDI field events a high quality side scan sonar geo-referenced to high density multi-beam data was completed to provide additional 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. Survey efforts did not suggest that high levels of debris are present in the sediment. The survey was unable to provide information on the relative density of the sediments, but this information was collected with the geotechnical work that was also completed at the project (results of the geotechnical field work are included in Appendix C of the EDR).

References

CRETE 2020. Pre-Remedial Design Investigation Work Plan dated April 8, 2020.

Ecology 2019. Agreed Order DE 16186. February 11, 2019.

Attachments

Tables
Figures
Attachment 1 Photographic Log
Attachment 2 Sediment Core Logs
Attachment 3 Laboratory Analytical Data

Table 1
I and J Waterway
Summary of Sample Locations

Sample ID	Northing [3]	Easting [3]	Purpose	Geotechnical or Physical Testing	Design of Bulkheads/Pil	Refine Dredge Prism	Depth of Boring/Sampling	Chemistry Analyses	Installation Methods
IJW-SS-14	644206.915	1239853.126	Assess horizontal extent of cPAHs in surface sediment to refine dredge prism			x	0-12 cm	cPAHs	Surface grab
IJW-SS-15	644167.090	1239855.781	Assess horizontal extent of cPAHs in surface sediment to refine dredge prism			x			
IJW-SS-16	644167.343	1239824.042	Assess horizontal extent of cPAHs in surface sediment to refine dredge prism			x			
IJW-SS-17	644206.951	1239815.808	Assess horizontal extent of cPAHs in surface sediment to refine dredge prism			x			
IJW-SC-1	644207.000	1239853.000	Stratigraphy and in-situ soil properties of the sediment, determine GMD contact, and refine slope stability, assess vertical assessment of contamination	x		x	Refusal at 9.5 ft bml	IHS [2]	
IJW-SC-2	644367.693	1240022.180	Stratigraphy and in-situ soil properties of the sediment, determine GMD contact, refine slope stability, assess vertical assessment of contamination	x		x	Refusal at 6.3 ft bml	IHS [2], TOC	
IJW-SC-3	644411.724	1240070.742	Stratigraphy and in-situ soil properties for design of bulkhead, slopes, and piles determine GMD contact, assess vertical assessment of contamination		x	x	Refusal at 6.5 ft bml		
IJW-SC-4	644475.999	1240083.400	Stratigraphy and in-situ soil properties of the sediment, determine GMD contact, and refine slope stability, assess vertical assessment of contamination			x	Refusal at 6.7 ft bml	IHS [2]	
IJW-SC-5	644456.987	1240028.115	Stratigraphy and in-situ soil properties of the sediment and determine GMD contact, assess vertical assessment of contamination			x	Refusal at 10.7 ft bml		
IJW-SC-6	644371.455	1239914.228	Stratigraphy and in-situ soil properties of the sediment and determine GMD contact, assess vertical assessment of contamination			x	Refusal at 6.4 ft bml		
IJW-SC-7	644306.168	1239880.843	Stratigraphy and in-situ soil properties of the sediment, determine GMD contact, and refine slope stability, assess vertical assessment of contamination			x	Refusal at 5.5 ft bml		

Table 1
I and J Waterway
Summary of Sample Locations

Sample ID	Northing[3]	Easting[3]	Purpose	Geotechnical or Physical Testing	Design of Bulkheads/Pil	Refine Dredge Prism	Depth of Boring/Sampling	Chemistry Analyses	Installation Methods
IJW-SC-8	644396.757	1239876.792	Stratigraphy and in-situ soil properties of the sediment, determine GMD contact, refine slope stability, assess vertical assessment of contamination	x		x	Refusal at 8.8 ft bml		Vibracore - continuous core collected, visual and physical samples collected
IJW-SC-9	644287.423	1239907.996	Stratigraphy and in-situ soil properties of the sediment, determine GMD contact, refine slope stability, assess vertical assessment of contamination (co located with IJW-CPT-5 and historical vibracore IJ-18)	x		x	Refusal at 9.3 ft bml		
IJW-SC-10	644178.35	1239858.70	Stratigraphy and in-situ soil properties of the sediment, determine GMD contact, refine slope stability and extent of dredge prism; located in close proximity to Bornstein outfall in southwest corner of SCU-1			x	Refusal at 6 ft bml	IHS[2], TOC	
IJW-SC-11	644233.35	1239796.39	Stratigraphy and in-situ soil properties of the sediment, determine GMD contact, refine slope stability and extent of dredge prism			x	GMD at 4.4 ft bml		
IJW-SC-12	644337.48	1239784.60	Stratigraphy and in-situ soil properties of the sediment, determine GMD contact, refine slope stability and extent of dredge prism			x	GMD at 6.6 ft bml		
IJW-SC-13	644456.66	1239906.57	Stratigraphy and in-situ soil properties of the sediment, refine slope stability and extent of dredge prism			x	Maximum penetration depth 5 ft bml		
IJW-SC-14	644496.00	1239989.04	Stratigraphy and in-situ soil properties of the sediment, refine slope stability and extent of dredge prism; located adjacent to the Coast Guard docks where dredge prism does not extend to edge of SCU-1			x	Maximum penetration depth 5 ft bml		
IJW-SC-15	644518.45	1240068.83	Stratigraphy and in-situ soil properties of the sediment, refine slope stability, and refine extent of dredge prism; located close to 2011 core location I-1 (elevated VOCs at 4.6-6.4 ft bgs)			x	Maximum penetration depth 5 ft bml		
IJW-SC-16	644478.55	1240131.01	Stratigraphy and in-situ soil properties of the sediment, determine GMD contact, refine slope stability and extent of dredge prism; located in close proximity to Port outfall in southeast corner of SCU-1			x	GMD at 6.9 ft bml		

Table 1
I and J Waterway
Summary of Sample Locations

Sample ID	**Northing** ^{3}	**Easting** ^{3}	**Purpose**	**Geotechnical or Physical Testing**	**Design of Bulkheads/Pil**	**Refine Dredge Prism**	**Depth of Boring/Sampling**	**Chemistry Analyses**	**Installation Methods**
IJW-SC-17	644206.98	1239853.59	Stratigraphy and in-situ soil properties and to determine GMD contact for design of bulkhead, piles, and refine slope stability		x		Refusal at 7.4 ft bml		

Notes:

1. See *I&J Waterway Site, Sediment Cleanup Unit 1, Geotechnical Engineering Report* by McMillan-Jacobs Associates for sample and result details.
2. Indicator Hazardous Substance (IHS) analysis includes: PAHs, SVOCs, and nickel. Archived samples collected for (but not analyzed): mercury, dioxin/furans, and dioxin-like PCB congeners.
3. Horizontal Datum - Washington State Plane Coordinates, North (NAD 83), US Survey feet.

GMD – Glacial Marine Drift
cPAH – carcinogenic polycyclic aromatic hydrocarbon
PAH – polycyclic aromatic hydrocarbon
SVOC - semi-volatile organic compound
TOC - total organic carbon
PCB - poly-chlorinated biphenyls
cm - centimeter
ft bml - feet below mudline
ft bgs - feet below ground surface

Table 2
I and J Waterway
Summary Phase 1 Sediment Analytical Data

All Results in mg/kg

	Vibracore Samples				Surface Grab Samples						TOC Normalized Data									
SAMPLE ID	IJW-SC-2-1	IJW-SC-100	Average (SC-2-1 and SC-100)	IJW-SC-3-1	IJW-SS-14	IJW-SS-14-200	Average (SS-14 and SS-14-200)	IJW-SS-15	IJW-SS-16	IJW-SS-17	SC-2-1	SC-100	SC-3-1	Carbon Normalized Screening Level			Dry-weight Screening Level			**Cleanup Level[a]**
Sample depth (adjusted depth per estimated compaction/fluff) (ft bml)	1.7 to 3.5	1.7 to 3.5		0 to 1.7	---	---		---	---	---	1.7 to 3.5	1.7 to 3.5	0 to 1.7							
Sample Date	6/17/20	6/17/20		6/17/20	6/18/20	6/18/20		6/18/20	6/18/20	6/18/20	6/17/20	6/17/20	6/17/20	---	---	---	---	---	---	
	---	Duplicate		---	---	Duplicate		---	---	---				SCO	CSL	Unit	SCO	CSL	Unit	
TOC % dry weight	**3.26**	**3.13**	---	**0.929**	---	---	---	---	---	---	3.26	3.13	0.929	---		---	---		---	---
Nickel	**26.3**	**29.1**	---	**65.8**	---	---	---	---	---	---				n/a	n/a	n/a	211[b]	No value	mg/kg	SCO
Mercury	0.1 U	0.1 U	---	0.1 U	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Benz(a)anthracene	**0.058**	**0.18**	**0.119**	**0.055**	**0.2**	**0.26**	**0.23**	**0.092**	**0.15**	**0.16**	1.78	5.75	5.92	110	270	mg/kg OC	1.30	1.60	mg/kg	SCO
Chrysene	**0.14**	**0.4**	**0.27**	**0.16**	**0.7**	**0.87**	**0.785**	**0.14**	**0.26**	**0.29**	4.29	0.01	17.22	110	460	mg/kg OC	1.40	2.80	mg/kg	SCO
Benzo(a)pyrene	**0.071**	**0.18**	**0.1255**	**0.077**	**0.18**	**0.19**	**0.185**	**0.076**	0.1 U	0.1 U	---	---	---	---	---	---	---	---	---	---
Benzo(b)fluoranthene	**0.14**	**0.36**	**0.25**	**0.19**	**0.29**	**0.45**	**0.37**	**0.13**	**0.19**	**0.2**	---	---	---	---	---	---	---	---	---	---
Benzo(k)fluoranthene	**0.047**	**0.14**	**0.0935**	**0.072**	**0.12**	**0.17**	**0.145**	0.05 U	0.1 U	0.1 U	---	---	---	---	---	---	---	---	---	---
Indeno(1,2,3-cd)pyrene	**0.033**	**0.09**	**0.0615**	**0.035**	**0.088**	**0.093**	**0.0905**	0.05 U	0.1 U	0.1 U	---	---	---	---	---	---	---	---	---	---
Dibenz(a,h)anthracene	0.01 U	**0.023**	**0.014**	0.01 U	0.05 U	0.05 U	0.025	0.05 U	0.1 U	0.1 U	0.15	0.73	0.54	12	33	mg/kg OC	0.23	0.23	mg/kg	SCO
Total cPAH TEQ	**0.101**	**0.263**	**0.182**	**0.115**	**0.262**	**0.301**	**0.279**	**0.115**	**0.167**	**0.169**	---	---	---	n/a	n/a	n/a	0.450/0.800[c]	4.500/8.00	mg/kg	SCO
Total HPAH (green shade, U=1/2)	**0.67**	**1.93**	---	**0.68**	NA	NA	NA	NA	NA	NA	21	62	74	960	5,300	mg/kg OC	12	17	mg/kg	SCO
Total LPAH (blue shade, U=1/2)	**0.108**	**0.199**	---	**0.103**	NA	NA	NA	NA	NA	NA	3	6	11	370	780	mg/kg OC	5	5	mg/kg	SCO
1,2,4-Trichlorobenzene	0.05 U	0.05 U	---	0.05 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
1,2-Dichlorobenzene	0.05 U	0.05 U	---	0.05 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
1,3-Dichlorobenzene	0.05 U	0.05 U	---	0.05 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
1,4-Dichlorobenzene	0.05 U	0.05 U	---	0.05 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
1-Methylnaphthalene	0.01 U	0.01 U	---	0.01 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
2,2'-Oxybis(1-chloropropane)	0.05 U	0.05 U	---	0.05 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
2,4,5-Trichlorophenol	0.5 U	0.5 U	---	0.5 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
2,4,6-Trichlorophenol	0.5 U	0.5 U	---	0.5 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
2,4-Dichlorophenol	0.5 U	0.5 U	---	0.5 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
2,4-Dimethylphenol[d]	0.04 U	0.04 U	---	0.04 U	NA	NA	NA	NA	NA	NA	---	---	---	n/a	n/a	n/a	0.029	0.029	mg/kg	SCO
2,4-Dinitrophenol	1.5 U	1.5 U	---	1.5 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
2,4-Dinitrotoluene	0.25 U	0.25 U	---	0.25 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
2,6-Dinitrotoluene	0.25 U	0.25 U	---	0.25 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
2-Chloronaphthalene	0.05 U	0.05 U	---	0.05 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
2-Chlorophenol	0.5 U	0.5 U	---	0.5 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
2-Methylnaphthalene	0.01 U	**0.013**	---	0.01 U	NA	NA	NA	NA	NA	NA	0.15	0.42	0.54	38	64	mg/kg OC	0.67	0.67	mg/kg	SCO
2-Methylphenol	0.05 U	0.05 U	---	0.05 U	NA	NA	NA	NA	NA	NA	---	---	---	n/a	n/a	n/a	0.063	0.063	mg/kg	SCO
2-Nitroaniline	0.25 U	0.25 U	---	0.25 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
2-Nitrophenol	0.5 U	0.5 U	---	0.5 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
3-Methylphenol + 4-Methylphenol	0.1 U	0.1 U	---	0.1 U	NA	NA	NA	NA	NA	NA	---	---	---	n/a	n/a	n/a	0.67	0.67	mg/kg	SCO
3-Nitroaniline	5 U	5 U	---	5 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
4,6-Dinitro-2-methylphenol	1.5 U	1.5 U	---	1.5 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
4-Bromophenyl phenyl ether	0.05 U	0.05 U	---	0.05 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
4-Chloro-3-methylphenol	0.5 U	0.5 U	---	0.5 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
4-Chloroaniline	5 U	5 U	---	5 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
4-Chlorophenyl phenyl ether	0.05 U	0.05 U	---	0.05 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
4-Nitroaniline	5 U	5 U	---	5 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
4-Nitrophenol	1.5 U	1.5 U	---	1.5 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
Acenaphthene	0.01 U	**0.011**	---	0.01 U	NA	NA	NA	NA	NA	NA	0.15	0.35	0.54	16	57	mg/kg OC	0.5	0.5	mg/kg	SCO
Acenaphthylene	0.01 U	**0.012**	---	0.01 U	NA	NA	NA	NA	NA	NA	---	---	---	---		---	---	---	---	---
Anthracene	**0.018**	**0.036**	---	**0.015**	NA	NA	NA	NA	NA	NA	0.55	1.15	1.61	220	1,200	mg/kg OC	0.96	0.96	mg/kg	SCO
Benzo(g,h,i)perylene	**0.028**	**0.072**	---	**0.029**	NA	NA	NA	NA	NA	NA	0.86	2.30	3.12	---	---	---	---		---	---
Benzoic acid	0.2 U	0.2 U	---	0.2 U	NA	NA	NA	NA	NA	NA	---	---	---	n/a	n/a	n/a	0.65	0.65	mg/kg	SCO
Benzyl alcohol[d]	0.15 U	0.15 U	---	0.15 U	NA	NA	NA	NA	NA	NA	---	---	---	n/a	n/a	n/a	0.057	0.073	mg/kg	SCO
Benzyl butyl phthalate	0.05 U	0.05 U	---	0.05 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---

Table 2
I and J Waterway
Summary Phase 1 Sediment Analytical Data

All Results in mg/kg

	Vibracore Samples				Surface Grab Samples						TOC Normalized Data									
SAMPLE ID	IJW-SC-2-1	IJW-SC-100	Average (SC-2-1 and SC-100)	IJW-SC-3-1	IJW-SS-14	IJW-SS-14-200	Average (SS-14 and SS-14-200)	IJW-SS-15	IJW-SS-16	IJW-SS-17	SC-2-1	SC-100	SC-3-1	Carbon Normalized Screening Level			Dry-weight Screening Level			**Cleanup Level[a]**
Sample depth (adjusted depth per estimated compaction/fluff) (ft bml)	1.7 to 3.5	1.7 to 3.5		0 to 1.7	---	---		---	---	---	1.7 to 3.5	1.7 to 3.5	0 to 1.7							
Sample Date	6/17/20	6/17/20		6/17/20	6/18/20	6/18/20		6/18/20	6/18/20	6/18/20	6/17/20	6/17/20	6/17/20	---	---	---	---	---	---	
	---	Duplicate		---	---	Duplicate		---	---	---				SCO	CSL	Unit	SCO	CSL	Unit	
Bis(2-chloroethoxy)methane	0.05 U	0.05 U	---	0.05 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
Bis(2-chloroethyl) ether	0.8 U	**1.8**	---	**1.2**	NA	NA	NA	NA	NA	NA	0.12	57.51	129.17	---	---	---	---	---	---	---
Bis(2-ethylhexyl) phthalate	0.5 U	0.5 U	---	0.5 U	NA	NA	NA	NA	NA	NA	1.53	1.60	5.38	47	78	mg/kg OC	1.3	3.1	mg/kg	SCO
Carbazole	0.05 U	0.05 U	---	0.05 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
Dibenzofuran	0.05 U	0.05 U	---	0.05 U	NA	NA	NA	NA	NA	NA	0.77	0.80	2.69	15	58	mg/kg OC	0.54	0.54	mg/kg	SCO
Diethyl phthalate	0.5 U	0.5 U	---	0.5 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
Dimethyl phthalate	0.05 U	0.05 U	---	0.05 U	NA	NA	NA	NA	NA	NA	0.77	0.80	2.69	53	53	mg/kg OC	0.071	0.16	mg/kg	SCO
Di-n-butyl phthalate	0.5 U	0.5 U	---	0.5 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
Di-n-octyl phthalate	0.5 U	0.5 U	---	0.5 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
Fluoranthene	**0.19**	**0.69**	---	**0.18**	NA	NA	NA	NA	NA	NA	5.83	22.04	19.38	160	1,200	mg/kg OC	1.7	2.5	mg/kg	SCO
Fluorene	**0.011**	**0.018**	---	0.01 U	NA	NA	NA	NA	NA	NA	0.34	0.58	0.54	23	79	mg/kg OC	0.54	0.54	mg/kg	SCO
Hexachlorobenzene	0.05 U	0.05 U	---	0.05 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
Hexachlorobutadiene	0.05 U	0.05 U	---	0.05 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
Hexachlorocyclopentadiene	0.15 U	0.15 U	---	0.15 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
Hexachloroethane	0.05 U	0.05 U	---	0.05 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
Isophorone	0.05 U	0.05 U	---	0.05 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
Naphthalene	**0.018**	**0.024**	---	0.01 U	NA	NA	NA	NA	NA	NA	0.55	0.77	5.38	---	---	---	---	---	---	---
Nitrobenzene	0.05 U	0.05 U	---	0.05 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
N-Nitrosodimethylamine	0.02 U	0.02 U	---	0.02 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
N-Nitroso-di-n-propylamine	0.05 U	0.05 U	---	0.05 U	NA	NA	NA	NA	NA	NA	---	---	---	---	---	---	---	---	---	---
N-Nitrosodiphenylamine[d]	0.05 U	0.05 U	---	0.05 U	NA	NA	NA	NA	NA	NA	0.77	0.80	2.69	11	11	mg/kg OC	0.028	0.04	mg/kg	SCO
Pentachlorophenol	0.25 U	0.25 U	---	0.25 U	NA	NA	NA	NA	NA	NA	---	---	---	---		---	---	---	---	---
Phenanthrene	**0.051**	**0.098**	---	**0.068**	NA	NA	NA	NA	NA	NA	1.56	3.13	7.32	100	480	mg/kg OC	1.5	1.5	mg/kg	SCO
Phenol	0.5 U	0.5 U	---	0.5 U	NA	NA	NA	NA	NA	NA	---	---	---	---		---	---	---	---	---
Pyrene	**0.35**	**0.9**	---	**0.36**	NA	NA	NA	NA	NA	NA	10.74	28.75	38.75	1,000	1,400	mg/kg OC	2.6	3.3	mg/kg	SCO

Notes:

Grey = detection exceeds SCO

For ND, 1/2 reporting limit used to determine sums or TEQ.

a. The SCO is the carbon normalized value when total organic carbon is within the range of 0.5% to 3.5%.

b. See Appendix A of the Cleanup Action Plan for the derivation of this value.

c. These are preliminary screening levels. See Appendix B of the Cleanup Action Plan for the derivation of these values.

d. The reporting limit for 2,4-dimethylphenol, benzyl alcohol, and n-nitrosodiphenylamine exceeded the SCO

mg/kg: milligram per kilogram

cPAH: carcinogenic polycyclic aromatic hydrocarbon

HPAH: high-molecular-weight polycyclic aromatic hydrocarbon

LPAH: low-molecular-weight polycyclic aromatic hydrocarbon

mg/kg: milligram per kilogram

mg/kg-OC: milligram per kilogram organic carbon normalized

n/a: not applicable

SCO: Sediment Cleanup Objective

TEQ: toxic equivalent quotient

Table 3
I and J Waterway
Summary Phase 2 Analytical Sediment Data

All Results in mg/kg

	Dry Weight Concentrations (mg/kg)							TOC Normalized Concentrations (mg/kg OC)					Cleanup Levels						
SAMPLE ID	IJW-SC-10-3.7	IJW-SC-11-3.4	IJW-SC-12-3	IJW-SC-13-4.1	IJW-SC-14-4.4	IJW-SC-15-3.6	IJW-SC-16-2.2	IJW-SC-11-3.4	IJW-SC-12-3	IJW-SC-13-4.1	IJW-SC-14-4.4	IJW-SC-15-3.6	Carbon Normalized			Dry-weight			**Cleanup Level[a]**
Sample depth (adjusted depth per estimated compaction/fluff) (ft bml)	4.5 to 5.5	1.8 to 2.8	3.3 to 4.4	3.2 to 4.4	2.9 to 3.9	2.7 to 3.8	1.2 to 2.2	1.8 to 2.8	3.3 to 4.4	3.2 to 4.4	2.9 to 3.9	2.7 to 3.8							
Sample Date	1/28/21	1/26/21	1/26/21	1/26/21	1/26/21	1/26/21	1/26/21	1/26/21	1/26/21	1/26/21	1/26/21	1/26/21	SCO	CSL	Unit	SCO	CSL	Unit	
TOC % dry weight	**0.150 U**	**1.74**	**1.65**	**2.78**	**2.25**	**1.63**	**12.1**	---	---	---	---	---	---		---	---		---	---
Nickel	**10.4**	**66.3**	**74.3**	**61.6**	**70.5**	**72.7**	**235**	---	---	---	---	---	---		---	211[b]	No value	mg/kg	SCO
Benz(a)anthracene	0.002 U	**0.053**	**0.037**	**0.077**[e]	**0.079**	**0.15**	**0.22**	2.7	1.9	2.6	4.0	7.5	110	270	mg/kg OC	1.30	1.60	mg/kg	SCO
Chrysene	0.002 U	**0.11**	**0.057**	**0.13**	**0.17**	**0.21**	**0.25**	5.5	2.9	4.3	8.5	10.5	110	460	mg/kg OC	1.40	2.80	mg/kg	SCO
Benzo(a)pyrene	0.002 U	**0.063**	**0.044**	**0.10**	**0.084**	**0.16**	**0.16**	---	---	---	---	---	---		---	---		---	---
Benzo(b)fluoranthene	0.002 U	**0.13**	**0.080**	**0.17**	**0.18**	**0.26**	**0.25**	---	---	---	---	---	---		---	---		---	---
Benzo(k)fluoranthene	0.002 U	**0.048**	**0.027**	**0.067**	**0.063**	**0.11**	**0.099**	---	---	---	---	---	---		---	---		---	---
Indeno(1,2,3-cd)pyrene	0.002 U	**0.038**	**0.026**	**0.051**	**0.043**	**0.059**	**0.062**	---	---	---	---	---	---		---	---		---	---
Dibenz(a,h)anthracene	0.002 U	**0.0083**	**0.0058**	**0.011**	**0.0092**	**0.014**	**0.016**	0.42	0.29	0.37	0.46	0.70	12	33	mg/kg OC	0.23	0.23	mg/kg	SCO
Total cPAH TEQ (U = 1/2)	0.002	**0.092**	**0.062**	**0.138**	**0.123**	**0.221**	**0.226**	---	---	---	---	---	---		---	0.229/0.445[c]	2.290/4.450[c]	mg/kg	SCO
Total cPAH TEQ	0.003	**0.092**	**0.063**	**0.139**	**0.123**	**0.221**	**0.227**	---	---	---	---	---	---		---	0.450/0.800[c]	4.500/8.000[c]	mg/kg	SCO
Total HPAH (green shade, U=1/2)	0.005	**0.399**	**0.276**	**0.668**	**0.588**	**0.997**	**2.68**	19.9	13.8	22.3	29.4	49.8	960	5,300	mg/kg OC	12	17	mg/kg	SCO
Total LPAH (blue shade, U=1/2)	0.006	**0.097**	**0.072**	**0.168**	**0.137**	**0.260**	**0.575**	4.9	3.6	5.6	6.8	13.0	370	780	mg/kg OC	5	5	mg/kg	SCO
1,2,4-Trichlorobenzene	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	---	---	---	---	---	---		---	---		---	---
1,2-Dichlorobenzene	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	---	---	---	---	---	---		---	---		---	---
1,3-Dichlorobenzene	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	---	---	---	---	---	---		---	---		---	---
1,4-Dichlorobenzene	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	---	---	---	---	---	---		---	---		---	---
1-Methylnaphthalene	0.002 U	**0.0061**	**0.0044**	**0.0095**	**0.0081**	**0.011**	**0.012**	---	---	---	---	---	---		---	---		---	---
2,2'-Oxybis(1-chloropropane)	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	---	---	---	---	---	---		---	---		---	---
2,4,5-Trichlorophenol	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	---	---	---	---	---	---		---	---		---	---
2,4,6-Trichlorophenol	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	---	---	---	---	---	---		---	---		---	---
2,4-Dichlorophenol	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	---	---	---	---	---	---		---	---		---	---
2,4-Dimethylphenol[d]	0.029 U	0.029 U	0.029 U	0.029 U	0.029 U	0.029 U	0.15 U	---	---	---	---	---	---		---	0.029	0.029	mg/kg	SCO
2,4-Dinitrophenol	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.5 U	---	---	---	---	---	---		---	---		---	---
2,4-Dinitrotoluene	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.25 U	---	---	---	---	---	---		---	---		---	---
2,6-Dinitrotoluene	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.25 U	---	---	---	---	---	---		---	---		---	---
2-Chloronaphthalene	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	---	---	---	---	---	---		---	---		---	---
2-Chlorophenol	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	---	---	---	---	---	---		---	---		---	---
2-Methylnaphthalene	0.002 U	**0.014**	**0.0098**	**0.018**[e]	**0.021**	**0.027**	**0.022**	0.70	0.49	0.60	1.05	1.35	38	64	mg/kg OC	0.67	0.67	mg/kg	SCO
2-Methylphenol[d]	0.063 U	0.063 U	0.063 U	0.063 U	0.063 U	0.063 U	0.32 U	---	---	---	---	---	---		---	0.063	0.063	mg/kg	SCO
2-Nitroaniline	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.25 U	---	---	---	---	---	---		---	---		---	---
2-Nitrophenol	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	---	---	---	---	---	---		---	---		---	---
3-Methylphenol + 4-Methylphenol[d]	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	1 U	---	---	---	---	---	---		---	0.67	0.67	mg/kg	SCO
3-Nitroaniline	1 U	1 U	1 U	1 U	1 U	1 U	5 U	---	---	---	---	---	---		---	---		---	---
4,6-Dinitro-2-methylphenol	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.5 U	---	---	---	---	---	---		---	---		---	---
4-Bromophenyl phenyl ether	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	---	---	---	---	---	---		---	---		---	---
4-Chloro-3-methylphenol	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	---	---	---	---	---	---		---	---		---	---
4-Chloroaniline	1 U	1 U	1 U	1 U	1 U	1 U	5 U	---	---	---	---	---	---		---	---		---	---
4-Chlorophenyl phenyl ether	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	---	---	---	---	---	---		---	---		---	---
4-Nitroaniline	1 U	1 U	1 U	1 U	1 U	1 U	5 U	---	---	---	---	---	---		---	---		---	---
4-Nitrophenol	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1.5 U	---	---	---	---	---	---		---	---		---	---
Acenaphthene	0.002 U	**0.0061**	**0.0042**	**0.010**	**0.0088**	**0.016**	**0.034**	0.31	0.21	0.33	0.44	0.80	16	57	mg/kg OC	0.5	0.5	mg/kg	SCO
Acenaphthylene	0.002 U	0.002 U	**0.0027**	**0.0069**	**0.0050**	**0.0071**	**0.015**	---	---	---	---	---	---		---	---		---	---
Anthracene	0.002 U	**0.020**	**0.013**	**0.029**	**0.028**	**0.066**	**0.24**	1.0	0.7	1.0	1.4	3.3	220	1,200	mg/kg OC	0.96	0.96	mg/kg	SCO
Benzo(g,h,i)perylene	0.002 U	**0.030**	**0.022**	**0.040**	**0.035**	**0.046**	**0.049**	---	---	---	---	---	---		---	---		---	---
Benzoic acid[d]	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.5 U	---	---	---	---	---	---		---	0.65	0.65	mg/kg	SCO
Benzyl alcohol[d]	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	0.29 U	---	---	---	---	---	---		---	0.057	0.073	mg/kg	SCO
Benzyl butyl phthalate	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	---	---	---	---	---	---		---	---		---	---
Bis(2-chloroethoxy)methane	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	---	---	---	---	---	---		---	---		---	---
Bis(2-chloroethyl) ether	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	---	---	---	---	---	---		---	---		---	---
Bis(2-ethylhexyl) phthalate	0.16 U	0.16 U	0.16 U	**2.1**	**0.25**	**0.19**	0.8 U	4.0	4.0	**67**	12.5	9.5	47	78	mg/kg OC	1.3	3.1	mg/kg	SCO
Carbazole	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	**0.011**	0.05 U	---	---	---	---	---	---		---	---		---	---
Dibenzofuran	0.01 U	**0.013**	0.01 U	**0.020**	**0.021**	**0.030**	0.05 U	0.65	0.25	0.67	1.05	1.50	15	58	mg/kg OC	0.54	0.54	mg/kg	SCO
Diethyl phthalate	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	---	---	---	---	---	---		---	---		---	---
Dimethyl phthalate[d]	0.071 U	0.071 U	0.071 U	0.071 U	0.071 U	0.071 U	0.36 U	2.0	2.2	1.3	1.6	2.2	53	53	mg/kg OC	0.071	0.16	mg/kg	SCO
Di-n-butyl phthalate	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	---	---	---	---	---	---		---	---		---	---
Di-n-octyl phthalate	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	---	---	---	---	---	---		---	---		---	---
Fluoranthene	0.002 U	**0.097**	**0.072**	**0.16**	**0.14**	**0.29**	**1.2**	4.9	3.6	5.3	7.0	14.5	160	1,200	mg/kg OC	1.7	2.5	mg/kg	SCO

Table 3
I and J Waterway
Summary Phase 2 Analytical Sediment Data

All Results in mg/kg

	Dry Weight Concentrations (mg/kg)							TOC Normalized Concentrations (mg/kg OC)					Cleanup Levels						
SAMPLE ID	IJW-SC-10-3.7	IJW-SC-11-3.4	IJW-SC-12-3	IJW-SC-13-4.1	IJW-SC-14-4.4	IJW-SC-15-3.6	IJW-SC-16-2.2	IJW-SC-11-3.4	IJW-SC-12-3	IJW-SC-13-4.1	IJW-SC-14-4.4	IJW-SC-15-3.6	Carbon Normalized			Dry-weight			**Cleanup Level[a]**
Sample depth (adjusted depth per estimated compaction/fluff) (ft bml)	4.5 to 5.5	1.8 to 2.8	3.3 to 4.4	3.2 to 4.4	2.9 to 3.9	2.7 to 3.8	1.2 to 2.2	1.8 to 2.8	3.3 to 4.4	3.2 to 4.4	2.9 to 3.9	2.7 to 3.8							
Sample Date	1/28/21	1/26/21	1/26/21	1/26/21	1/26/21	1/26/21	1/26/21	1/26/21	1/26/21	1/26/21	1/26/21	1/26/21	SCO	CSL	Unit	SCO	CSL	Unit	
Fluorene	0.002 U	**0.011**	**0.0089**	**0.018**[e]	**0.018**	**0.031**	**0.081**	0.55	0.45	0.60	0.90	1.55	23	79	mg/kg OC	0.54	0.54	mg/kg	SCO
Hexachlorobenzene	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	---	---	---	---	---	---		---	---		---	---
Hexachlorobutadiene	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	---	---	---	---	---	---		---	---		---	---
Hexachlorocyclopentadiene	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.15 U	---	---	---	---	---	---		---	---		---	---
Hexachloroethane	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	---	---	---	---	---	---		---	---		---	---
Isophorone	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	---	---	---	---	---	---		---	---		---	---
Naphthalene	0.002 U	**0.014**	**0.011**	**0.026**	**0.019**	**0.030**	**0.025**	---	---	---	---	---	---		---	---		---	---
Nitrobenzene	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	---	---	---	---	---	---		---	---		---	---
N-Nitrosodimethylamine	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	---	---	---	---	---	---		---	---		---	---
N-Nitroso-di-n-propylamine	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	---	---	---	---	---	---		---	---		---	---
N-Nitrosodiphenylamine[d]	0.01 U	0.01 U	0.01 U	0.05 U	0.01 U	0.01 U	0.05 U	1.3	1.3	0.8	1.3	1.3	11	11	mg/kg OC	0.028	0.04	mg/kg	SCO
Pentachlorophenol	0.05 U	0.05 U	0.05 U	**0.051**	0.05 U	0.05 U	0.25 U	---	---	---	---	---	---		---	0.36	0.69	mg/kg	SCO
Phenanthrene	0.002 U	**0.045**	0.032	**0.078**	**0.058**	**0.11**	**0.18**	2.3	1.6	2.6	2.9	5.5	100	480	mg/kg OC	1.5	1.5	mg/kg	SCO
Phenol	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	---	---	---	---	---	---		---	---		---	---
Pyrene	0.002 U	**0.18**	**0.12**	**0.33**[e]	**0.29**	**0.44**	**1.2**	9.0	6.0	11.0	14.5	22.0	1,000	1,400	mg/kg OC	2.6	3.3	mg/kg	SCO

Notes:

Bold = detection

Grey = detection exceeds SCO

Screening level added due to detection

For ND, 1/2 reporting limit used to determine sums or TEQ, unless noted otherwise.

a. The SCO is the carbon normalized value when total organic carbon is within the range of 0.5% to 3.5%. Carbon normalized results were not calculated for IJW-SC-10-3.7 and IJW-SC-16-2.2.

b. See Appendix A of the Cleanup Action Plan for the derivation of this value.

c. These are preliminary screening levels. See Appendix B of the Cleanup Action Plan for the derivation of these values.

d. The reporting limits for IJW-SC-16 2.2 exceeded the SCO for 2,4-dimethylphenol, 2-methylphenol, 3-Methylphenol + 4-Methylphenol, benzoic acid, benzyl alcohol, dimethyl phthalate, and n-nitrosodiphenylamine. For IJW-SC-13-4.1, the reporting limit for n-nitrosodiphenylamine exceeded the SCO.

e. Value is the result from the 1/5 dilution.

cPAH: carcinogenic polycyclic aromatic hydrocarbon

HPAH: high-molecular-weight polycyclic aromatic hydrocarbon

LPAH: low-molecular-weight polycyclic aromatic hydrocarbon

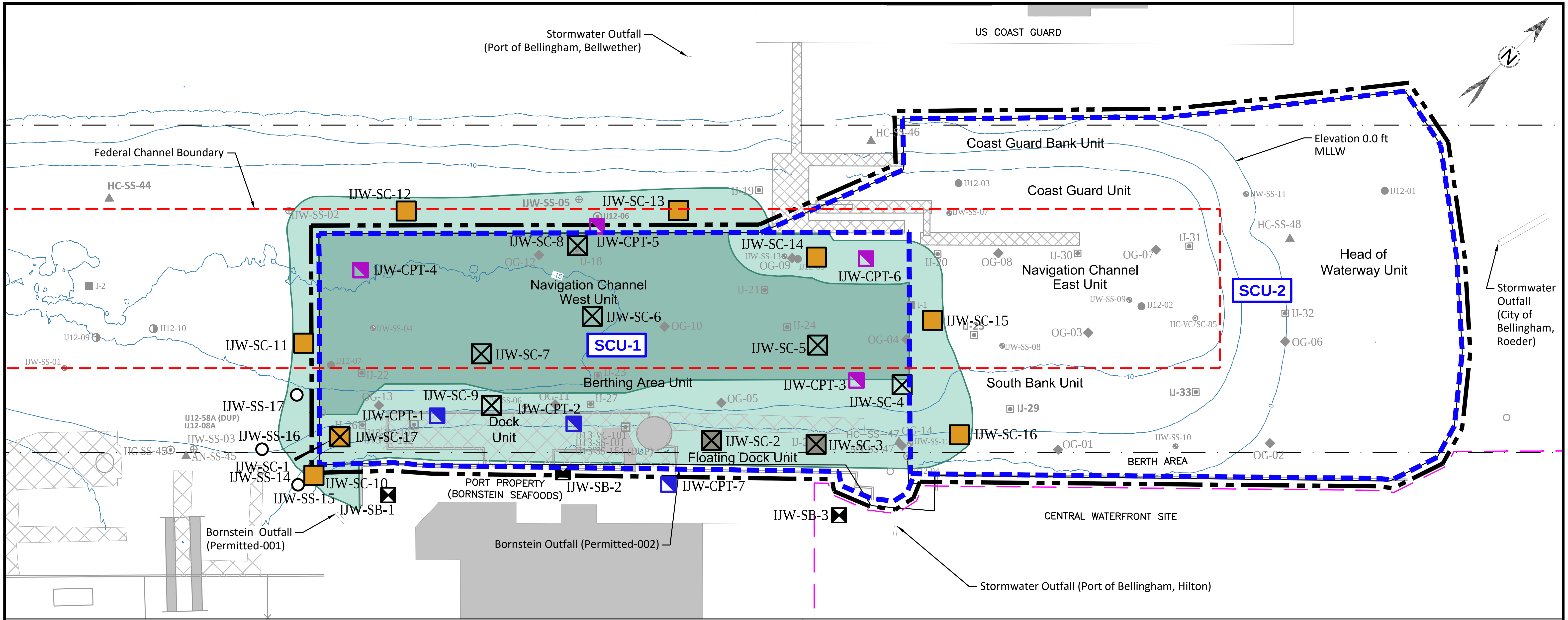
mg/kg: milligram per kilogram

mg/kg-OC: milligram per kilogram organic carbon normalized

SCO: Sediment Cleanup Objective

TEQ: toxic equivalent quotient

ft bml: feet below mudline



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

🟩 Proposed Dredge Surface

🟩 Proposed Dredge Surface Side Slope Area

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)

Completed Pre-Remedial Design Sampling Station

◪ CPT - Coast Guard Setback, Sediment Properties, GMD (Crete 2020)

◪ CPT - Bulkhead and Dock, GMD (Crete 2020)

☒ Mud Rotary - Bulkhead and Dock, GMD (Crete 2020)

☒ Vibracore - Dredge Prism, Subsurface Chemistry, GMD (Crete 2020)

☒ Vibracore - Dredge Prism, GMD (Crete 2020)

○ Surface Grab - Dredge Prism, Chemistry (Crete 2020)

■ Vibracore - Dredge Prism Side Slope,
Collected during Phase 2 of Sampling Activities (Crete 2021)

☒ Vibracore - Dredge Prism, GMD,
Collected during Phase 2 of Sampling Activities (Crete 2021)

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
SCALE IN FEET

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CONSULTING, INC.

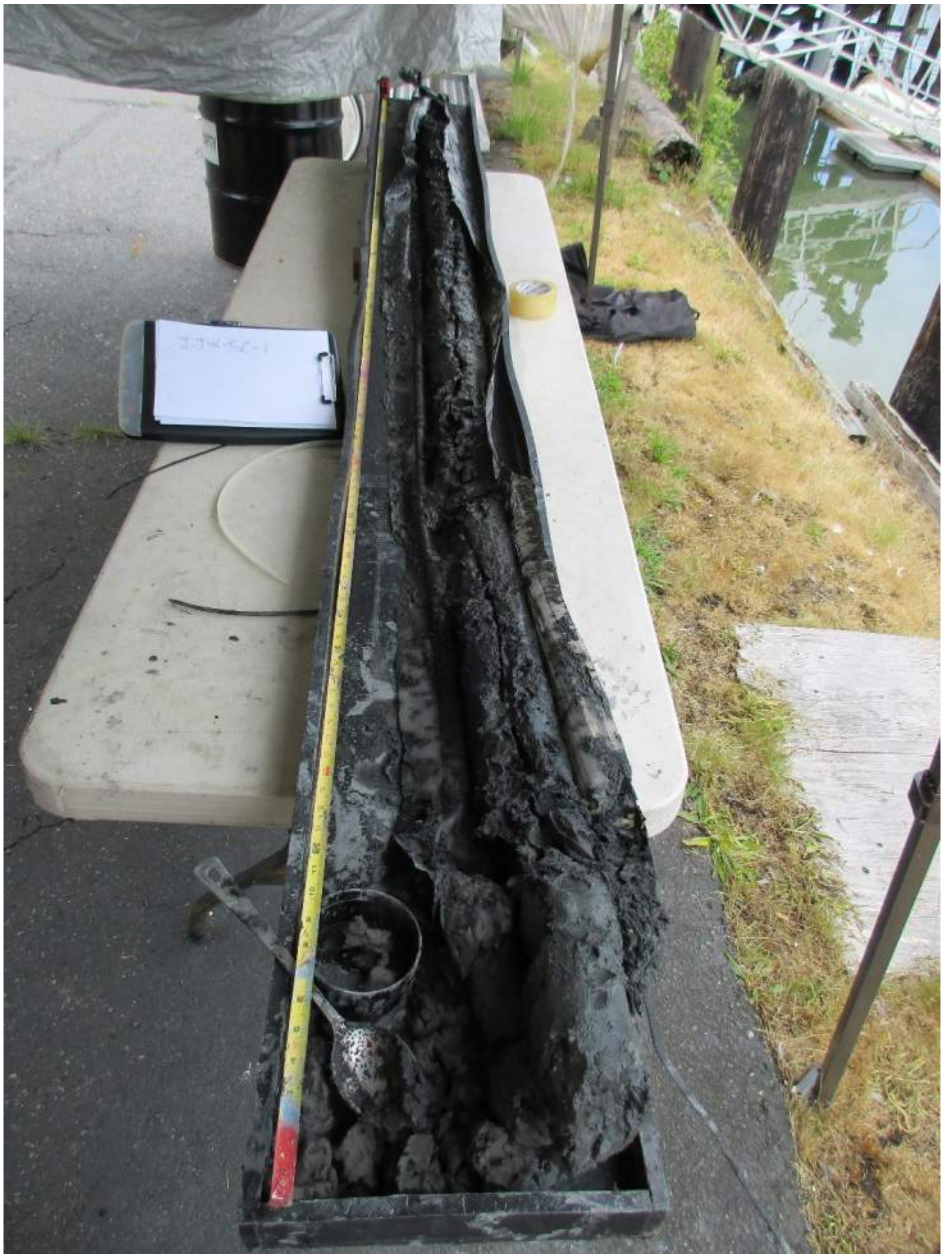
Port of Bellingham - I&J Waterway Site
Engineering Design Report
March 26, 2021

Sediment Cleanup Unit 1
Sample Locations
Figure 1

Attachment

Attachment 1 Photographic Log
Attachment 2 Sediment Core Logs
Attachment 3 Laboratory Analytical Data

ATTACHMENT 1
PHOTOGRAPHIC LOG



Photograph No. 1 – Sediment core IJW-SC-1, 0 to 9.5 feet bml.
Photograph taken on 6/16/2020.

ATTACHMENT 1
PHOTOGRAPHIC LOG

Photograph No. 2 – Sediment core IJW-SC-2, 0 to 6.3 feet bml.
Photograph taken on 6/17/2020.

ATTACHMENT 1
PHOTOGRAPHIC LOG

Photograph No. 3 – Sediment core IJW-SC-3, 0 to 6.5 feet bml.
Photograph taken on 6/17/2020.

ATTACHMENT 1
PHOTOGRAPHIC LOG

Photograph No. 4 – Sediment core IJW-SC-4, 0 to 6.7 feet bml.
Photograph taken on 6/17/2020.

ATTACHMENT 1
PHOTOGRAPHIC LOG

Photograph No. 5 – Sediment core IJW-SC-5, 0 to 10.7 feet bml.
Photograph taken on 6/16/2020.

ATTACHMENT 1
PHOTOGRAPHIC LOG

Photograph No. 6 – Sediment core IJW-SC-6, 0 to 6.4 feet bml.
Photograph taken on 6/17/2020.

ATTACHMENT 1
PHOTOGRAPHIC LOG

Photograph No. 7 – Sediment core IJW-SC-7, 0 to 5.5 feet bml.
Photograph taken on 6/17/2020.

ATTACHMENT 1
PHOTOGRAPHIC LOG

Photograph No. 8 – Mid-section of sediment core IJW-SC-8, approximately 2 to 4 feet bml.
Photograph taken on 6/17/2020.

ATTACHMENT 1
PHOTOGRAPHIC LOG

Photograph No. 9 – Lower section of sediment core IJW-SC-8, approximately 5 to 8.8 feet bml. GMD tagged at 8.8 feet bml. Photograph taken on 6/17/2020.

ATTACHMENT 1
PHOTOGRAPHIC LOG

Photograph No. 10 – Upper section of sediment core IJW-SC-9, approximately 0 to 3 feet bml. Photograph taken on 6/16/2020.

ATTACHMENT 1
PHOTOGRAPHIC LOG

Photograph No. 11 – Lower section of sediment core IJW-SC-9, approximately 5.5 to 9.3 feet bml. View of GMD contact at approximately 6.2 feet bml. Photograph taken on 6/16/2020.

ATTACHMENT 1
PHOTOGRAPHIC LOG

Photograph No. 12 – Surface sediment sampler at IJW-SS-15.
Photograph taken on 6/18/2020.

Photograph No. 13 – Recovery from Van Veen sampling device at IJW-SS-15.
Photograph taken on 6/18/2020.

ATTACHMENT 1
PHOTOGRAPHIC LOG

**Photograph No. 14 – Sediment core IJW-SC-10, approximately 3 to 6 feet bml.
Photograph taken on 1/28/2021.**

ATTACHMENT 1
PHOTOGRAPHIC LOG

Photograph No. 15 – Sediment core IJW-SC-11, approximately 2.5 to 4 feet bml. Photograph taken on 1/26/2021.

ATTACHMENT 1
PHOTOGRAPHIC LOG

Photograph No. 16 – Sediment core IJW-SC-12, approximately 1 to 4 feet bml. Photograph taken on 1/26/2021.

ATTACHMENT 1
PHOTOGRAPHIC LOG

**Photograph No. 17 – Sediment core IJW-SC-13, approximately 2 to 5 feet bml.
Photograph taken on 1/26/2021.**

ATTACHMENT 1
PHOTOGRAPHIC LOG

Photograph No. 18 – Sediment core IJW-SC-14, 0 to 5 feet bml.
Photograph taken on 1/26/2021.

ATTACHMENT 1
PHOTOGRAPHIC LOG

**Photograph No. 19 – Sediment core IJW-SC-15, approximately 2.5 to 4.5 feet bml.
Photograph taken on 1/26/2021.**

ATTACHMENT 1
PHOTOGRAPHIC LOG

**Photograph No. 20 – Sediment core IJW-SC-16, approximately 0 to 3 feet bml.
Photograph taken on 1/27/2021.**

ATTACHMENT 1
PHOTOGRAPHIC LOG

Photograph No. 21 – Sediment core IJW-SC-16, approximately 5.5 to 8 feet bml. View of GMD contact at approximately 7 feet bml. Photograph taken on 1/27/2021.

Photograph No. 22 – Sediment core IJW-SC-17 sediment material, approximately 3.5 to 5.5 feet bml. No GMD encountered. Photograph taken on 1/28/2021.

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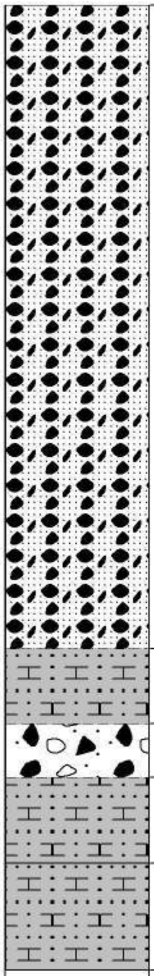
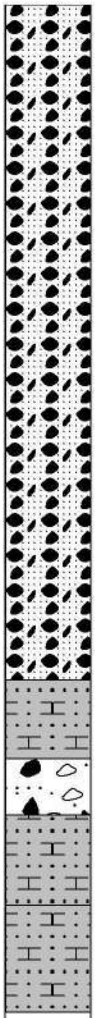
Seattle, WA 98104

SEDIMENT LOG

BORING ID	**IJW-SC-1**
TOTAL DEPTH:	**9.5-Feet**

PROJECT INFORMATION	
PROJECT:	**I&J Waterway PRDI**
SITE LOCATION:	**1001 Hilton Ave** **Bellingham, WA**
LOGGED BY:	**Rusty Jones**
PROJECT MANAGER:	**Mike Byers, P.E.**
DATES CORED/PROCESSED:	**6/16/2020**
LATITUDE	**48.7541418° N**
LONGITUDE	**122.4938651° W**

DRILLING INFORMATION			
DRILLING CO.	**Gravity Marine**		
DRILLING METHOD	**VibraCore Technology**		
EQUIPMENT TYPE	**OI RIC-5500**		
SAMPLING METHOD	**Open Cores** **4-inch OD Lexan Tubes**		
PENETRATION DEPTH	**9.5-Feet**		
CORE LENGTH	**9-Feet**	EST. COMPACTION	**5%**
WATER DEPTH	**15.3-Feet**	TIDE HEIGHT	**2.7-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		GC	GRAVELLY FINES (mud) with abundant FISH WASTE, subround to round gravel, loose, saturated, mostly black, minor to some SHELLS (fragmented and intact), trace plastic pieces. 2-ft: BRICK fragments 3.5-ft: WOOD pices, trace SHELLS 4.5-ft: Small BRICK pieces, some spiny FISH BONES					0
5				IJW-SC-1-2	4 to 6 ft	1.7		5
		CL	SILTY CLAY,soft to medium consistency, gray to dark gray. Distubed interface - Glacial Marine Drift sediment with overlying mixed sediments	IJW-SC-1-1	6 to 8 ft	0.9		
			Pocket of BRICK fragments, SHELLS, organic fines, very fine-grained SAND					
		CL	SILTY CLAY,soft to medium consistency, gray to dark gray. Distubed interface - Glacial Marine Drift sediment with overlying mixed sediments					
		CL	SILTY CLAY, soft to medium consistency, low to moderate plasticity, wet, gray, minor round to subround GRAVEL. Refusal. Undisturbed Glacial Marine Drift (GMD).	IJW-SC-1-3	8 to 9 ft	0.9		
10								10

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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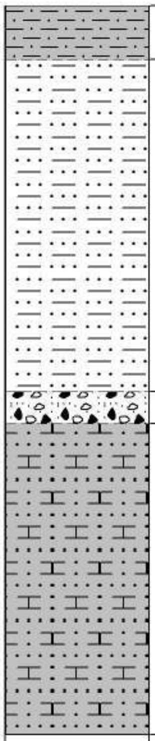
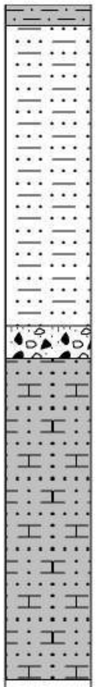
Seattle, WA 98104

SEDIMENT LOG

BORING ID **IJW-SC-2**
TOTAL DEPTH: **6.3-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Mike Byers, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**6/17/2020**	PENETRATION DEPTH	**6.3-Feet**
LATITUDE	**48.75459212° N**	CORE LENGTH **6.8-Feet**	EST. COMPACTION **7% Fluff**
LONGITUDE	**122.4931784° W**	WATER DEPTH **5.3-Feet**	TIDE HEIGHT **2.4-Feet**





DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0			FINES/MUD, very looose, saturated, very dark gray.					0
		SM	SILTS and SANDS, very fine-grained to medium-grained, loose, little to no cohesivity, saturated, very dark gray to black, with minor GRAVEL (up to 1.5-inch), some FISH BONES and FISH SCALES, some WOOD chips.	IJW-SC-2-2	0 to 1.8 ft	1.5		
				IJW-SC-2-1	1.8 to 3.8 ft	1.4		
		GP	COBBLE seam, large (up to 3-4-inch), subround to subangular.					
5		CL	SILTY CLAY, medium to stiff, moderate plasticity, wet, gray to dark gray, minor pockets of fine-grained SAND, trace subround GRAVEL and COBBLES. Glacial Marine Drift.	IJW-SC-2-3	3.8 to 5.8 ft	2.0		5
			Refusal.	IJW-SC-2-4	5.8 to 6.8 ft	2.1		
10								10

NOTES: `*Depicted depths are adjusted for estimated fluff.`

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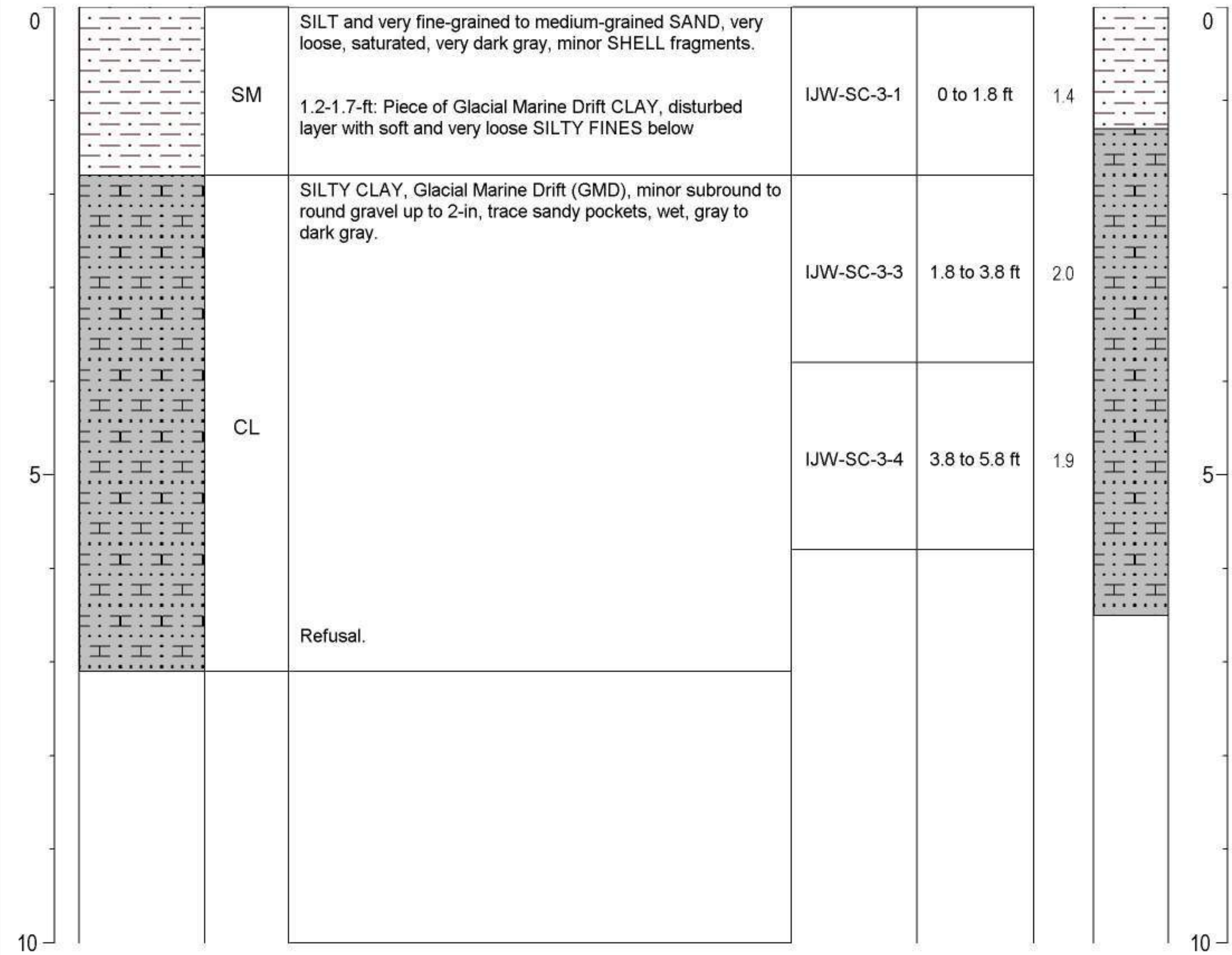
SEDIMENT LOG

BORING ID	**IJW-SC-3**
TOTAL DEPTH:	**6.5-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Mike Byers, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**6/17/2020**	PENETRATION DEPTH	**6.5-Feet**
LATITUDE	**48.75471564° N**	CORE LENGTH **7.1-Feet**	EST. COMPACTION **7% Fluff**
LONGITUDE	**122.4929811° W**	WATER DEPTH **5.1-Feet**	TIDE HEIGHT **1.6-Feet**



DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		SM	SILT and very fine-grained to medium-grained SAND, very loose, saturated, very dark gray, minor SHELL fragments. 1.2-1.7-ft: Piece of Glacial Marine Drift CLAY, disturbed layer with soft and very loose SILTY FINES below	IJW-SC-3-1	0 to 1.8 ft	1.4		0
		CL	SILTY CLAY, Glacial Marine Drift (GMD), minor subround to round gravel up to 2-in, trace sandy pockets, wet, gray to dark gray.	IJW-SC-3-3	1.8 to 3.8 ft	2.0		
5				IJW-SC-3-4	3.8 to 5.8 ft	1.9		5
			Refusal.					
10								10

NOTES: `*Depicted depths are adjusted for estimated fluff.`

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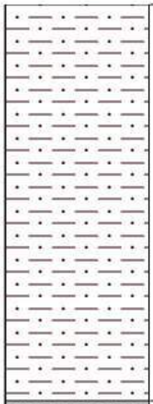
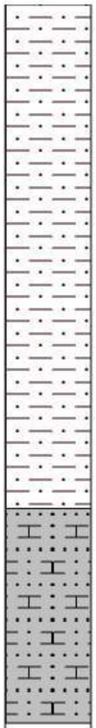
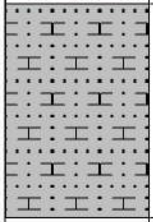
SEDIMENT LOG

BORING ID	**IJW-SC-4**
TOTAL DEPTH:	**6.7-Feet**

PROJECT INFORMATION		DRILLING INFORMATION			
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**		
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**		
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**		
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**		
PROJECT MANAGER:	**Mike Byers, P.E.**		**4-inch OD Lexan Tubes**		
DATES CORED/PROCESSED:	**6/17/2020**	PENETRATION DEPTH	**6.7-Feet**		
LATITUDE	**48.75489251° N**	CORE LENGTH	**5.7-Feet**	EST. COMPACTION	**15%**
LONGITUDE	**122.4929344° W**	WATER DEPTH	**12.5-Feet**	TIDE HEIGHT	**0.7-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		SM	SANDY SILT, loose to very loose, saturated, black, minor to some SHELLS and FISH BONES. 1.1-ft: Increasing very fine-grained to fine-grained SAND, loose, large SHELLS and BARNACLES. 2-3.7-ft: Very loose to soupy consistency.	IJW-SC-4-2 IJW-SC-4-1	0 to 1.7 ft 1.7 to 3.7 ft	1.4 1.7		0
5		CL	SILTY CLAY, Glacial Marine Drift (GMD), medium-stiff to stiff, moderate to high plasticity, minor subround to round gravel up to 1-inch, wet, gray. Refusal.	IJW-SC-4-3	3.7 to 5.7 ft	1.6		5
10								10

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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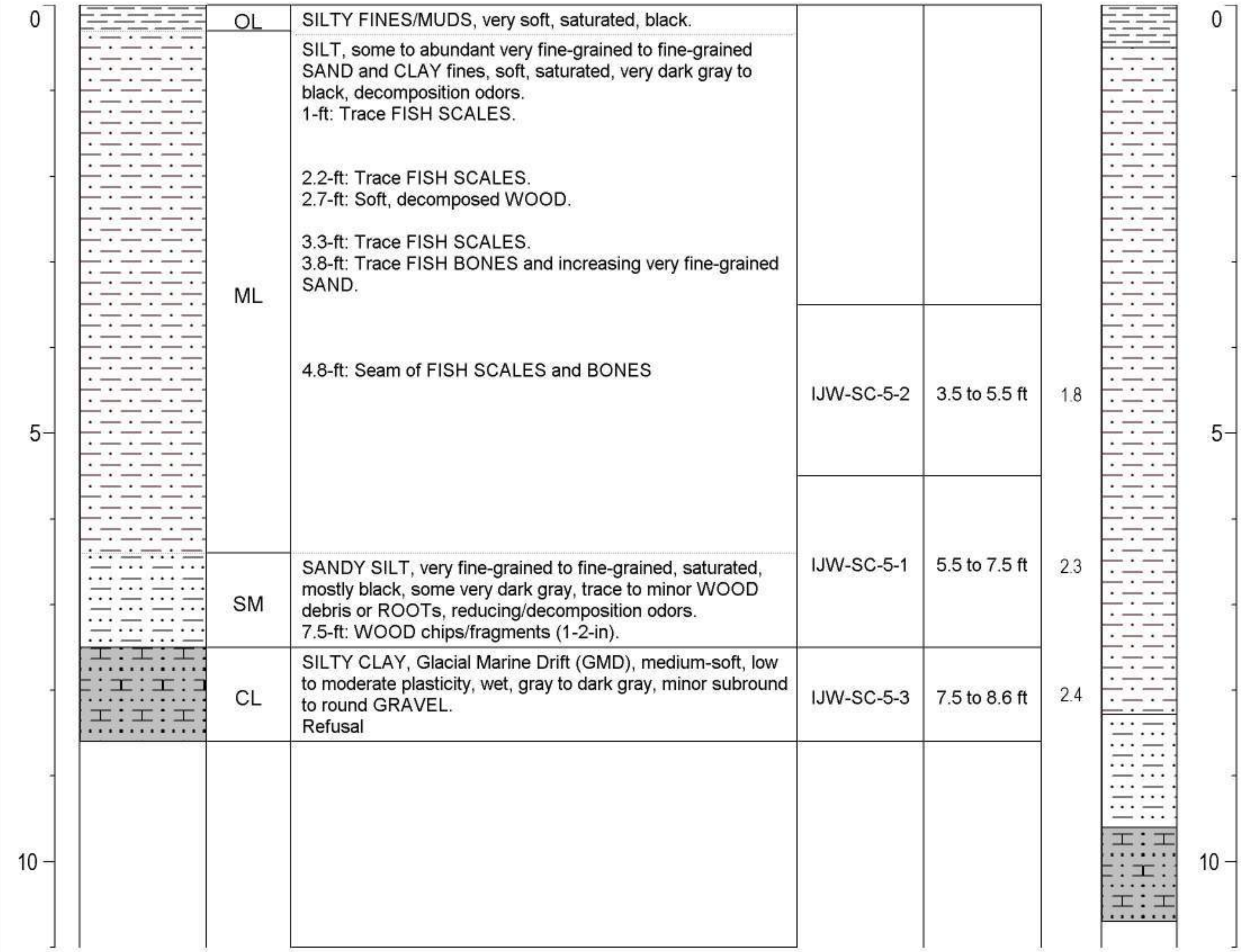
SEDIMENT LOG

BORING ID	**IJW-SC-5**
TOTAL DEPTH:	**10.7-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Mike Byers, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**6/16/2020**	PENETRATION DEPTH	**10.7-Feet**
LATITUDE	**48.75483715° N**	CORE LENGTH **8.6-Feet**	EST. COMPACTION **20%**
LONGITUDE	**122.4931618° W**	WATER DEPTH **19.1-Feet**	TIDE HEIGHT **5.9-Feet**



DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
		OL	SILTY FINES/MUDS, very soft, saturated, black.					
		ML	SILT, some to abundant very fine-grained to fine-grained SAND and CLAY fines, soft, saturated, very dark gray to black, decomposition odors. 1-ft: Trace FISH SCALES. 2.2-ft: Trace FISH SCALES. 2.7-ft: Soft, decomposed WOOD. 3.3-ft: Trace FISH SCALES. 3.8-ft: Trace FISH BONES and increasing very fine-grained SAND.					
			4.8-ft: Seam of FISH SCALES and BONES	IJW-SC-5-2	3.5 to 5.5 ft	1.8		
		SM	SANDY SILT, very fine-grained to fine-grained, saturated, mostly black, some very dark gray, trace to minor WOOD debris or ROOTs, reducing/decomposition odors. 7.5-ft: WOOD chips/fragments (1-2-in).	IJW-SC-5-1	5.5 to 7.5 ft	2.3		
		CL	SILTY CLAY, Glacial Marine Drift (GMD), medium-soft, low to moderate plasticity, wet, gray to dark gray, minor subround to round GRAVEL. Refusal	IJW-SC-5-3	7.5 to 8.6 ft	2.4		

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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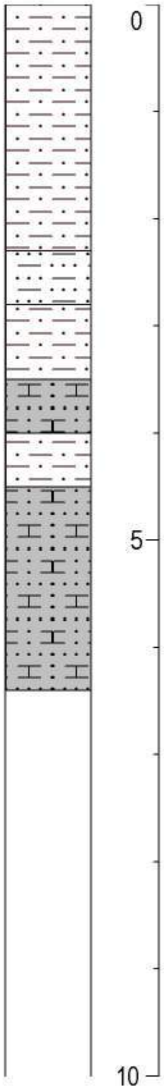
SEDIMENT LOG

BORING ID: **IJW-SC-6**
TOTAL DEPTH: **6.4-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Mike Byers, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**6/17/2020**	PENETRATION DEPTH	**6.4-Feet**
LATITUDE	**48.75459605° N**	CORE LENGTH **6.2-Feet**	EST. COMPACTION **1.5%**
LONGITUDE	**122.4936261° W**	WATER DEPTH **21.1-Feet**	TIDE HEIGHT **5.2-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm
0		ML	SILTY MUD fines, some very fine-grained SAND, minor subround to round GRAVEL, very loose, sticky, saturated, black, some SHELL fragments, some FISH SCALES, trace FISH BONES.	IJW-SC-6-2	0.3 to 2.3 ft	1.2
		ML	SANDY SILT, some mud FINES, saturated, black, some FISH SCALES.	IJW-SC-6-1	2.3 to 4.3 ft	2.1
		ML	SILTY MUD fines, soft, cohesive, sticky, saturated, black.			
		CL	SILTY CLAY, with round GRAVEL, wet, gray. Disturbed piece of Glacial Marine Drift.			
		ML	SILTY MUD fines, sticky, saturated, black.			
5		CL	SILTY CLAY, Glacial Marine Drift (GMD), medium-stiff, moderate to high plasticity, wet, gray, with subround to round GRAVEL. Refusal.	IJW-SC-6-3	4.3 to 6.2 ft	2.7
10						

*LOG / *EST. DEPTH



NOTES: `*Depicted depths are adjusted for estimated compaction.`

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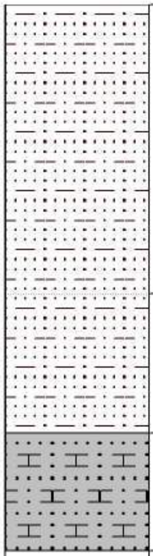
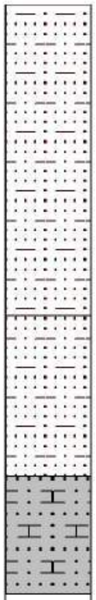
SEDIMENT LOG

BORING ID	**IJW-SC-7**
TOTAL DEPTH:	**5.5-Feet**

PROJECT INFORMATION		DRILLING INFORMATION			
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**		
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**		
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**		
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**		
PROJECT MANAGER:	**Mike Byers, P.E.**		**4-inch OD Lexan Tubes**		
DATES CORED/PROCESSED:	**6/17/2020**	PENETRATION DEPTH	**5.5-Feet**		
LATITUDE	**48.75441518° N**	CORE LENGTH	**5.1-Feet**	EST. COMPACTION	**7%**
LONGITUDE	**122.4937586° W**	WATER DEPTH	**17.3-Feet**	TIDE HEIGHT	**1.1-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		SM	SANDY SILT, very fine-grained to fine-grained sand, loose, saturated, black, trace FISH BONES. 1.1-ft: Abundant FISH SCALES, some FISH BONES. More FISH WASTE than SILT. Saturated, black.	IJW-SC-7-2	0 to 2 ft	1.4		0
		SM	SILTY SAND, saturated, black, minor to some FISH SCALES and FISH BONES. 4-ft: Some to abundant FISH WASTE at interface.	IJW-SC-7-1	2 to 4 ft	1.5		
5		CL	SILTY CLAY, Glacial Marine Drift (GMD), medium-stiff, low to moderate plasticity, minor very fine-grained SAND, wet, gray. Refusal.	IJW-SC-7-3	4 to 5.1 ft	1.4		5
10								10

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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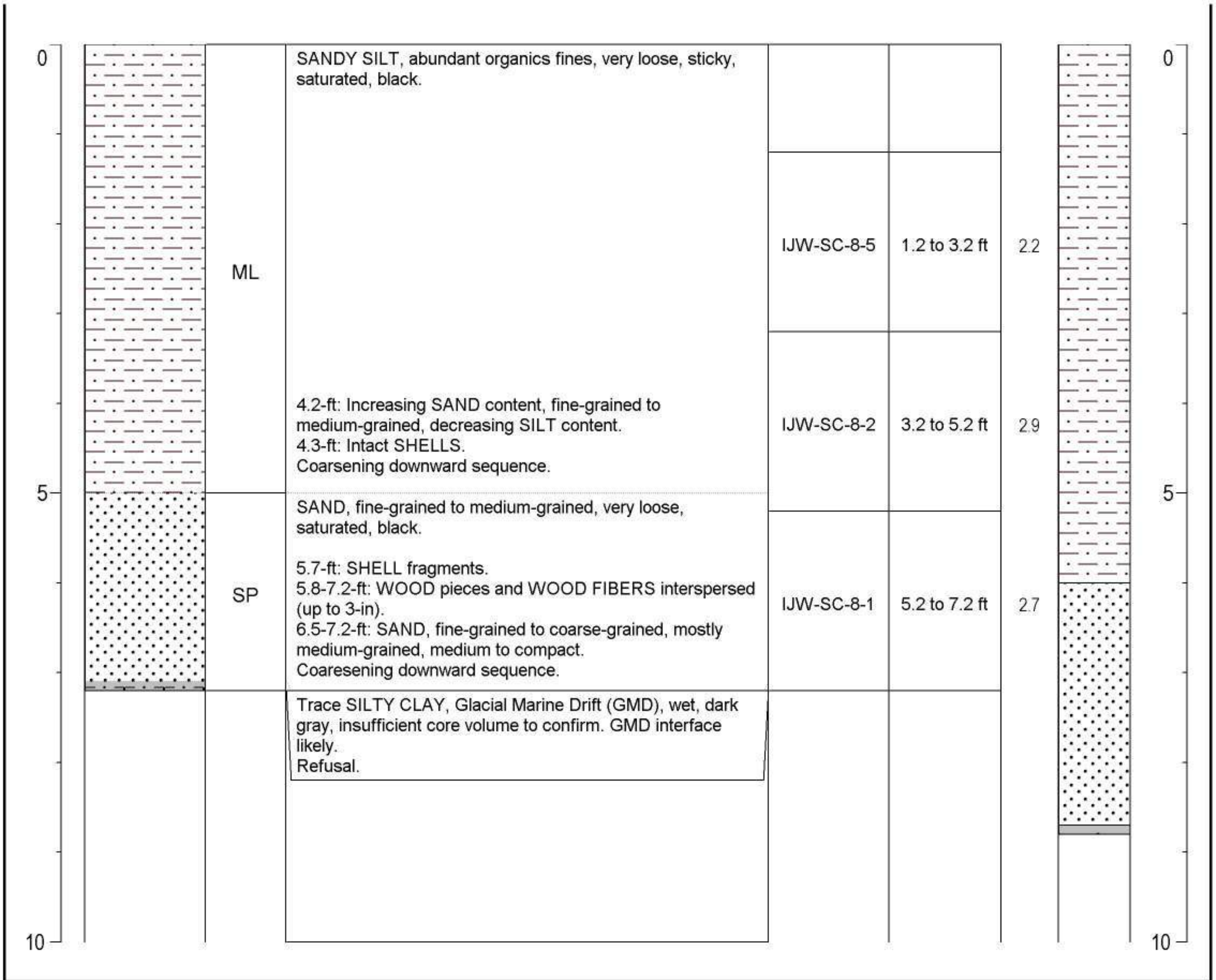
SEDIMENT LOG

BORING ID	**IJW-SC-8**
TOTAL DEPTH:	**8.8-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Mike Byers, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**6/17/2020**	PENETRATION DEPTH	**8.8-Feet**
LATITUDE	**48.75466317° N**	CORE LENGTH **7.2-Feet**	EST. COMPACTION **18%**
LONGITUDE	**122.4937835° W**	WATER DEPTH **19.0-Feet**	TIDE HEIGHT **4.1-Feet**



DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		ML	SANDY SILT, abundant organics fines, very loose, sticky, saturated, black.					0
				IJW-SC-8-5	1.2 to 3.2 ft	2.2		
			4.2-ft: Increasing SAND content, fine-grained to medium-grained, decreasing SILT content. 4.3-ft: Intact SHELLS. Coarsening downward sequence.	IJW-SC-8-2	3.2 to 5.2 ft	2.9		
5		SP	SAND, fine-grained to medium-grained, very loose, saturated, black. 5.7-ft: SHELL fragments. 5.8-7.2-ft: WOOD pieces and WOOD FIBERS interspersed (up to 3-in). 6.5-7.2-ft: SAND, fine-grained to coarse-grained, mostly medium-grained, medium to compact. Coaresening downward sequence.	IJW-SC-8-1	5.2 to 7.2 ft	2.7		5
			Trace SILTY CLAY, Glacial Marine Drift (GMD), wet, dark gray, insufficient core volume to confirm. GMD interface likely. Refusal.					
10								10

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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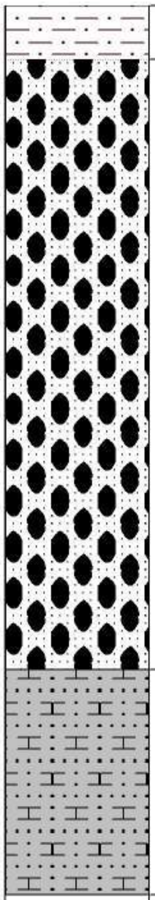
SEDIMENT LOG

BORING ID	**IJW-SC-9**
TOTAL DEPTH:	**9.3-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Mike Byers, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**6/16/2020**	PENETRATION DEPTH	**9.3-Feet**
LATITUDE	**48.75436542° N**	CORE LENGTH **8.3-Feet**	EST. COMPACTION **11%**
LONGITUDE	**122.4936444° W**	WATER DEPTH **16.9-Feet**	TIDE HEIGHT **4.4-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		SM	FINES/MUDS/SILTS, very soft, very oose, saturated, black.					0
		SM-OL	Mixed FINES, SILTS, FISH SCALES, minor FISH BONES, saturated, black. 0-3-ft: Minor mediumgrained to coarse-grained SAND.					
				IJW-SC-9-2	2.2 to 4.2 ft	2.7		
			4.8-6-ft: Predominantly FISH SCALES with fines, some clear GLASS fragments, saturated.					
5				IJW-SC-9-1	4.2 to 6.2 ft	2.4		5
		CL	SILTY CLAY, medium-soft, moderate plasticity, wet, gray to dark gray, minor subround to round GRAVEL (<1cm size). Glacial Marine Drift (GMD). Refusal.	IJW-SC-9-3	6.2 to 8.2 ft	1.6		
10								10



NOTES: `*Depicted depths are adjusted for estimated compaction.`

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SEDIMENT LOG

BORING ID **IJW-SC-10 #1**
TOTAL DEPTH: **6-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Jamie Stevens, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**1/28/2021**	PENETRATION DEPTH	**6-Feet**
LATITUDE	**48.75406381° N**	CORE LENGTH **4-Feet**	EST. COMPACTION **33%**
LONGITUDE	**122.49383945° W**	WATER DEPTH **10.0-Feet**	TIDE HEIGHT **7.66-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		SM	SILTY SAND, with some MUD FINES, some WOOD chips, soft and loose, saturated.		0 to 1 ft	6.2		0
		SP	SAND, very fine to medium-grained (mostly medium-grained), wet to saturated, well drained, dark gray. At 0.4 to 1.9 ft bgs: Abundant SHELLS, white. At 1.9 to 2.2 ft bgs: Subround to round GRAVEL (<2.5-inch observed).		1 to 2 ft	4.2		
			At 2.8 ft bgs: 0.5-inch thick SILT seam, dark brown. At 3 to 3.5 ft bgs: WOOD pieces.		2 to 3 ft	7.0		
			Refusal.	IJW-SC-10-3.7	3 to 4 ft	7.6		
5								5
10								10

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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SEDIMENT LOG

BORING ID	**IJW-SC-10 #4**
TOTAL DEPTH:	**5.0-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Jamie Stevens, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**1/28/2021**	PENETRATION DEPTH	**5.0-Feet**
LATITUDE	**48.75407586° N**	CORE LENGTH **4.8-Feet**	EST. COMPACTION **4%**
LONGITUDE	**122.49386522° W**	WATER DEPTH **12.9-Feet**	TIDE HEIGHT **7.12-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		OL-ML	SILTY MUD FINES, with abundant SAND, abundant WOOD pieces, very soft consistency, saturated, dark gray to black. At 2.5 ft bgs: Minor small BRICK fragments.		0 to 2 ft	8.7		0
		SM	SILTY SAND, with abundant FINES and SHELLS, small BRICK fragments, saturated, dark gray to black. Disturbed sediments with mixed underlying SANDS.		2 to 4 ft	9.7		
		SP	SAND, trace small subround GRAVEL (<1-inch observed). very fine to medium-grained (mostly medium-grained), firm consistency, wet to saturated, moderately drained, dark gray. Native and undisturbed. Sand resembles Glacial Marine Drift SILTY CLAY materials in color and GRAVEL composition.	IJW-SC-10-5 #4	4 to 5 ft	8.7		
5								5
10								10

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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SEDIMENT LOG

BORING ID	**IJW-SC-11 #3**
TOTAL DEPTH:	**4-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave** **Bellingham, WA**	DRILLING METHOD	**VibraCore Technology**
		EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores** **4-inch OD Lexan Tubes**
PROJECT MANAGER:	**Jamie Stevens, P.E.**		
DATES CORED/PROCESSED:	**1/26/2021**	PENETRATION DEPTH	**4-Feet**
LATITUDE	**48.75421084° N**	CORE LENGTH **4.8-Feet**	EST. COMPACTION **17% FLUFF**
LONGITUDE	**122.4941026° W**	WATER DEPTH **24.4-Feet**	TIDE HEIGHT **7.36-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0	▨	ML	SILTY MUD (FINES with SILT), minor very fine to fine-grained SAND, very soft to soft consistency, saturated, dark black, very faint sulfur-like odor. Homogeneous.		0 to 1 ft	5.6	▨	0
					1 to 2 ft	2.8		
			At 2.3 to 3.3 ft bgs: Trace WOOD and minor SHELL fragment.	IJW-SC-11-3.4	2.2 to 3.4 ft	4.4		
			Ceased coring. Glacial Marine Drift not encountered.		3.5 to 4.5 ft	4.0		
5								5
10								10

NOTES: `*Depicted depths are adjusted for estimated fluff.`

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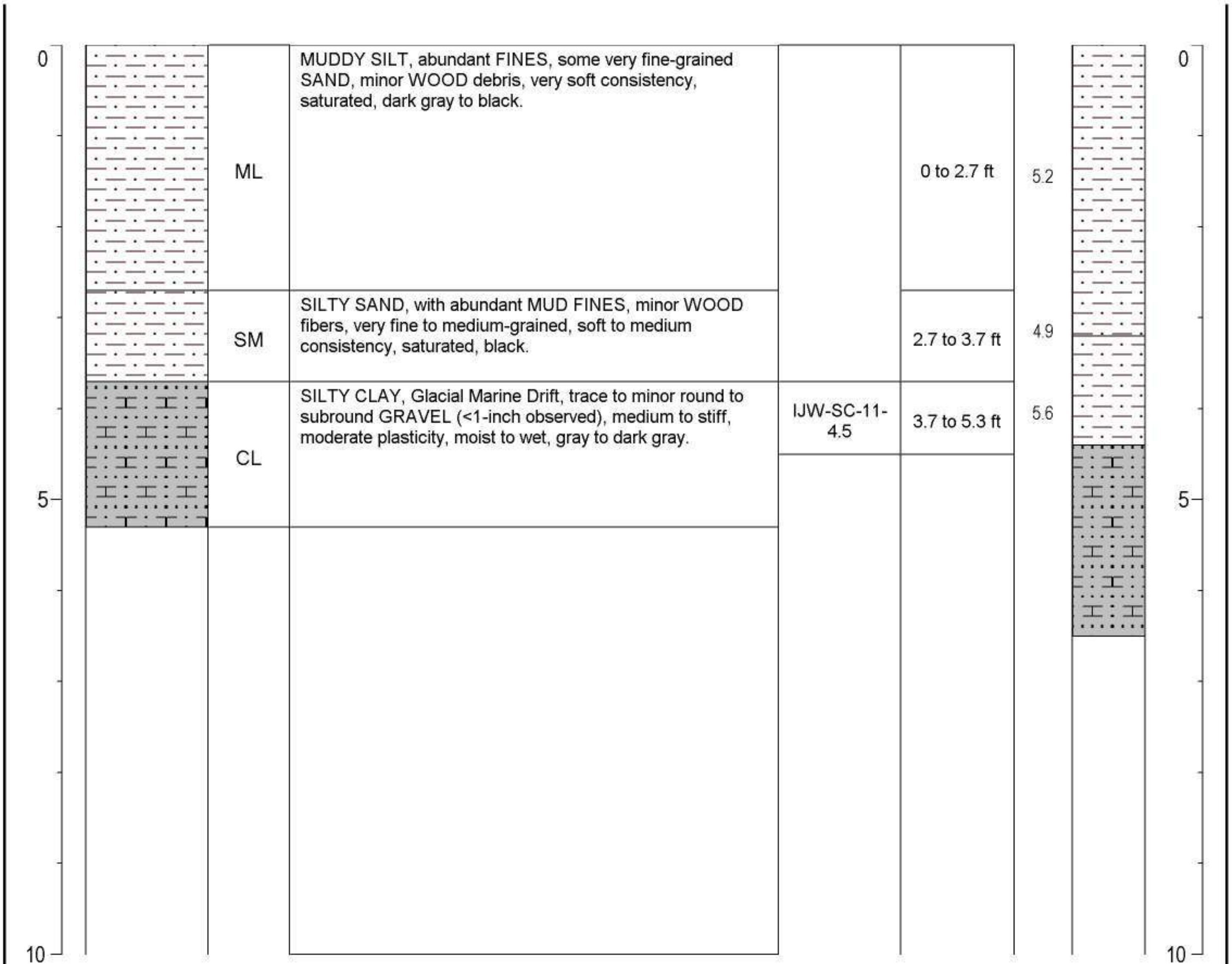
SEDIMENT LOG

BORING ID	**IJW-SC-11 #4**
TOTAL DEPTH:	**6.5-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave** **Bellingham, WA**	DRILLING METHOD	**VibraCore Technology**
		EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores** **4-inch OD Lexan Tubes**
PROJECT MANAGER:	**Jamie Stevens, P.E.**		
DATES CORED/PROCESSED:	**1/28/2021**	PENETRATION DEPTH	**6.5-Feet**
LATITUDE	**48.75418591° N**	CORE LENGTH **5.3-Feet**	EST. COMPACTION **19%**
LONGITUDE	**122.49381914° W**	WATER DEPTH **24.4-Feet**	TIDE HEIGHT **7.20-Feet**



DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
		ML	MUDDY SILT, abundant FINES, some very fine-grained SAND, minor WOOD debris, very soft consistency, saturated, dark gray to black.		0 to 2.7 ft	5.2		
		SM	SILTY SAND, with abundant MUD FINES, minor WOOD fibers, very fine to medium-grained, soft to medium consistency, saturated, black.		2.7 to 3.7 ft	4.9		
		CL	SILTY CLAY, Glacial Marine Drift, trace to minor round to subround GRAVEL (<1-inch observed), medium to stiff, moderate plasticity, moist to wet, gray to dark gray.	IJW-SC-11-4.5	3.7 to 5.3 ft	5.6		

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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SEDIMENT LOG

BORING ID **IJW-SC-12 #1**
TOTAL DEPTH: **4.1-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Jamie Stevens, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**1/26/2021**	PENETRATION DEPTH	**4.1-Feet**
LATITUDE	**48.75449548° N**	CORE LENGTH **3.7-Feet**	EST. COMPACTION **9%**
LONGITUDE	**122.49416077° W**	WATER DEPTH **22.8-Feet**	TIDE HEIGHT **7.55-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0	▨	ML	SILTY MUD FINES, minor to some very fine to fine-grained SAND, trace FISH BONES, soft to very soft consistency, saturated, black, trace fetid/lagoon-like odors, homogeneous.		0 to 1 ft	7.2	▨	0
	▨				1 to 2 ft	4.4	▨	
	▨				2 to 3 ft	6.6	▨	
	▨			IJW-SC-12-3	3 to 4 ft	4.3	▨	
5								5
10								10

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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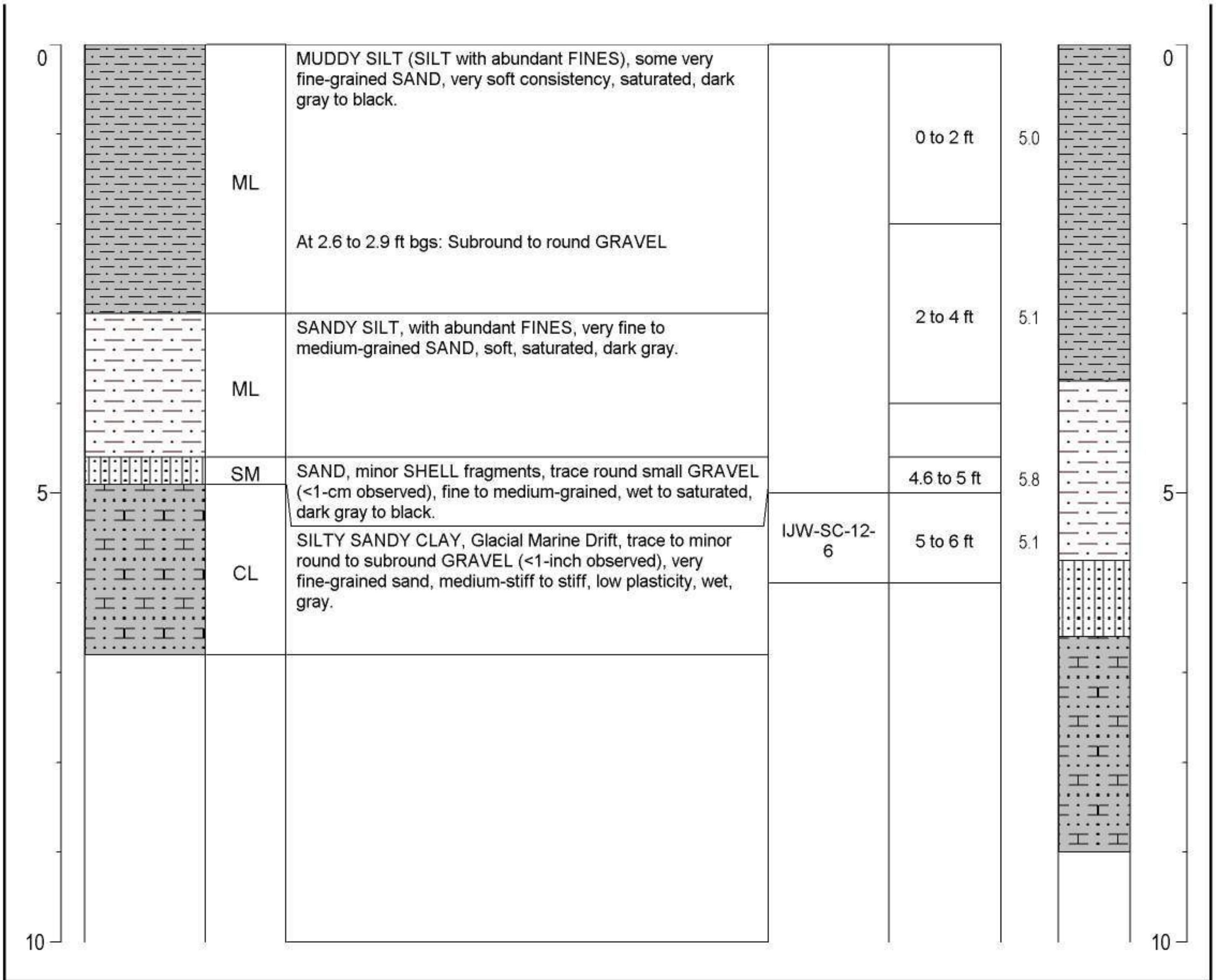
SEDIMENT LOG

BORING ID	**IJW-SC-12 #2**
TOTAL DEPTH:	**9-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave** **Bellingham, WA**	DRILLING METHOD	**VibraCore Technology**
		EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores** **4-inch OD Lexan Tubes**
PROJECT MANAGER:	**Jamie Stevens, P.E.**		
DATES CORED/PROCESSED:	**1/28/2021**	PENETRATION DEPTH	**9-Feet**
LATITUDE	**48.75448897° N**	CORE LENGTH **6.8-Feet**	EST. COMPACTION **25%**
LONGITUDE	**122.49415778° W**	WATER DEPTH **24.4-Feet**	TIDE HEIGHT **7.55-Feet**



DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		ML	MUDDY SILT (SILT with abundant FINES), some very fine-grained SAND, very soft consistency, saturated, dark gray to black.		0 to 2 ft	5.0		0
			At 2.6 to 2.9 ft bgs: Subround to round GRAVEL		2 to 4 ft	5.1		
		ML	SANDY SILT, with abundant FINES, very fine to medium-grained SAND, soft, saturated, dark gray.					
		SM	SAND, minor SHELL fragments, trace round small GRAVEL (<1-cm observed), fine to medium-grained, wet to saturated, dark gray to black.		4.6 to 5 ft	5.8		
5		CL	SILTY SANDY CLAY, Glacial Marine Drift, trace to minor round to subround GRAVEL (<1-inch observed), very fine-grained sand, medium-stiff to stiff, low plasticity, wet, gray.	IJW-SC-12-6	5 to 6 ft	5.1		5
10								10

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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SEDIMENT LOG

BORING ID	**IJW-SC-13 #1**
TOTAL DEPTH:	**5-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Jamie Stevens, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**1/26/2021**	PENETRATION DEPTH	**5-Feet**
LATITUDE	**48.75482928° N**	CORE LENGTH **4.6-Feet**	EST. COMPACTION **8%**
LONGITUDE	**122.49366596° W**	WATER DEPTH **22.0-Feet**	TIDE HEIGHT **7.71-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0	▨	SM	SILTY SAND, very fine to fine-grained, some to abundant mud fines, soft to medium consistency, homogenous, saturated, black.		0 to 1.5 ft	7.4	▨	0
			At 2 ft bgs: Trace FISH SCALES		1.5 to 3 ft	5.0		
			At 4 ft bgs: Minor FISH BONES, soft to very soft consistency	IJW-SC-13-4.1	3 to 4.1 ft	5.5		
			Ceased coring. No Glacial Marine Drift encountered.		4.1 to 4.6 ft	5.5		
5								5
10								10

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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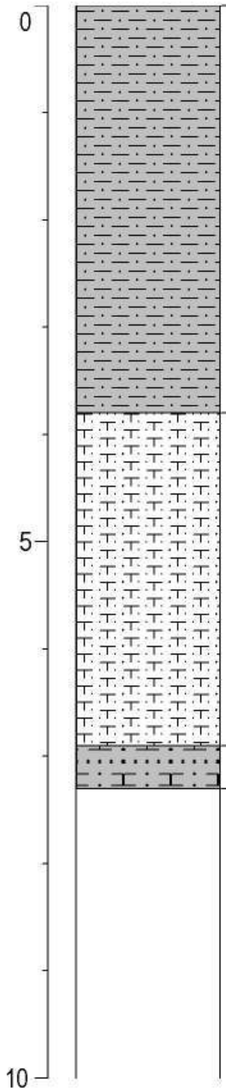
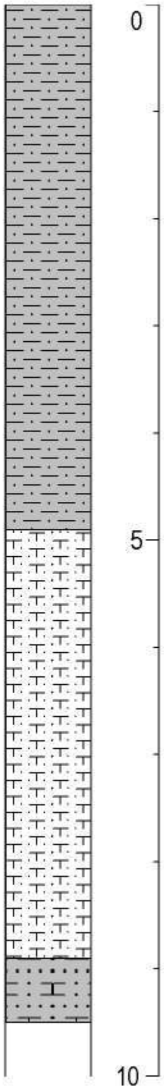
SEDIMENT LOG

BORING ID: **IJW-SC-13 #2**
TOTAL DEPTH: **9.5-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave** **Bellingham, WA**	DRILLING METHOD	**VibraCore Technology**
		EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores** **4-inch OD Lexan Tubes**
PROJECT MANAGER:	**Jamie Stevens, P.E.**		
DATES CORED/PROCESSED:	**1/28/2021**	PENETRATION DEPTH	**9.5-Feet**
LATITUDE	**48.75482273° N**	CORE LENGTH **7.3-Feet**	EST. COMPACTION **23%**
LONGITUDE	**122.49366595° W**	WATER DEPTH **22.1-Feet**	TIDE HEIGHT **7.66-Feet**



DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
		ML	SILT and mud FINES, minor very fine-grained SAND, very soft consistency, saturated, dark gray to black, very faint hydrogen sulfide odor. At 3 ft bgs: Very soft/loose consistency. At 3.3 ft bgs: Round to subround GRAVEL (<2-inch observed), trace WOOD.	No Sample Collected	0 to 2 ft 2 to 3.8 ft	4.0 5.0		
		SM	SANDY SILT, abundant mud FINES, very fine to medium-grained, soft consistency, saturated, dark gray to black, trace WOOD fragments. Increasing SAND with depth. At 5 ft bgs: More SAND than SILT.		3.8 to 6.9	4.0		
		CL	SILTY SANDY CLAY, Glacial Marine Drift, very fine to fine-grained, low to moderate plasticity, soft to medium consistency, wet, gray to dark gray.		6.9 to 7.3 ft	5.0		



NOTES: `*Depicted depths are adjusted for estimated compaction.`

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SEDIMENT LOG

BORING ID: **IJW-SC-14**
TOTAL DEPTH: **5.0-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Jamie Stevens, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**1/26/2021**	PENETRATION DEPTH	**5-Feet**
LATITUDE	**48.75494195° N**	CORE LENGTH **5.6-Feet**	EST. COMPACTION **11% FLUFF**
LONGITUDE	**122.4933277° W**	WATER DEPTH **22.0-Feet**	TIDE HEIGHT **7.19-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0	▨	SM	SILTY SAND, with abundant MUD FINES, very fine to fine-grained, saturated, black, strong hydrogen sulfide odor. Trace to minor fish bones intermittent.		0 to 1.5 ft	3.7	▨	0
	▨				1.5 to 3.3 ft	11.4	▨	
	▨		by 4.5 ft bgs: SILTY SAND with mostly fine-grained sands.	IJW-SC-14-4.4	3.3 to 4.4 ft	4.9	▨	
	▨		Coring ceased prior to Glacial Marine Drift.		4.4 to 5 ft	4.4	▨	
5	▨							5
10								10

NOTES: *Depicted depths are adjusted for estimated fluff.

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SEDIMENT LOG

BORING ID **IJW-SC-15**
TOTAL DEPTH: **5.0-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Jamie Stevens, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**1/26/2021**	PENETRATION DEPTH	**5-Feet**
LATITUDE	**48.75500819° N**	CORE LENGTH **4.75-Feet**	EST. COMPACTION **5%**
LONGITUDE	**122.49299903° W**	WATER DEPTH **21.8-Feet**	TIDE HEIGHT **6.28-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0	▨	ML	SILTY MUD FINES, abundant very fine to fine-grained SAND, very soft to loose consisitency, saturated, black, very faint hydrogen sulfide odor.		0 to 1 ft	4.1	▨	0
					1 to 2 ft	6.6		
	░	SM	SILTY SAND, with abundant MUD FINES, very fine to fine-grained, very soft to soft consistency, saturated, black, strong hydrogen sulfide odor. Slightly increasing grain size with depth (more fine-grained sand, less mud fines). At 2.9 to 3.7 ft bgs: Some to abundant FISH WASTE (scale and bones), shells. After 4 ft bgs: Trace to minor FISH WASTE. Ceased coring at 5-ft. No Glacial Marine Drift encountered.	IJW-SC-15-3.6	2.6 to 3.6 ft	4.7	░	
					4 to 5 ft	4.6		
5								5
10								10

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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SEDIMENT LOG

BORING ID: **IJW-SC-16**
TOTAL DEPTH: **8.3-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Jamie Stevens, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**1/27/2021**	PENETRATION DEPTH	**8.3-Feet**
LATITUDE	**48.75490253° N**	CORE LENGTH **8.4-Feet**	EST. COMPACTION **2% FLUFF**
LONGITUDE	**122.49273778° W**	WATER DEPTH **13.4-Feet**	TIDE HEIGHT **7.73-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		SM	SILTY SAND with abundant MUD FINES, minor FISH WASTE, very fine to fine-grained, very soft consistency, saturated, dark gray to black. At 1.8 to 2.3 ft bgs: Abundant WOOD mulch and minor FISH WASTE.	IJW-SC-16-2.2	1.2 to 2.2 ft	4.6		0
		SM	SILTY SAND with MUD FINES, with various WOOD debris and some BONES and SHELLS, fine-grained, saturated, dark gray to black, strong reducing and hydrogen sulfide odors. At 3.5 to 6.9 ft bgs: Dispersed weathered WOOD fibers.		2.2 to 3 ft	4.1		
					4 to 5 ft	4.2		
5					5 to 6 ft	4.5		5
					6 to 7 ft	4.2		
		CL	SILTY CLAY, Glacial Marine Drift, minor round to subround GRAVEL, medium-firm consistency, medium-high plasticity, moist to wet, gray. Refusal					
10								10

NOTES: `*Depicted depths are adjusted for estimated fluff.`

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Seattle, WA 98104

SEDIMENT LOG

BORING ID: **IJW-SC-17**
TOTAL DEPTH: **9.4-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Jamie Stevens, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**1/28/2021**	PENETRATION DEPTH	**9.4-Feet**
LATITUDE	**48.75414196° N**	CORE LENGTH **7.3-Feet**	EST. COMPACTION **22%**
LONGITUDE	**122.49386319° W**	WATER DEPTH **14.7-Feet**	TIDE HEIGHT **8.11-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		ML	SANDY SILT, with abundant MUD FINES, very fine to fine-grained, very soft consistency, saturated, black. With WOOD pieces and fibers, minor round GRAVEL (<1-inch observed). At 0 to 0.7 ft bgs: Abundant BRICK and ROCK fragments. At 0 to 2 ft bgs: Strong hydrogen sulfide odors.	No Sample Collected	0 to 2 ft	2.6		0
					2 to 3.5 ft	3.5		
5		ML	MUDDY SILT and SAND, very fine to fine-grained, very soft to soft consistency, saturated, black. At 4.7 ft bgs: BRICK fragment. At 5.9 to 7.4 ft bgs: Minor round to subround GRAVEL (<2-inch observed), trace SHELLS. At 7.2 ft bgs: Small BRICK fragment. Refusal. No Glacial Marine Drift encountered.		3.5 to 5.5 ft	4.7		5
					5.5 to 7.4 ft	3.6		
10								10

NOTES: `*Depicted depths are adjusted for estimated compaction.`

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Yelena Aravkina, M.S.
Michael Erdahl, B.S.
Arina Podnozova, B.S.
Eric Young, B.S.

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July 8, 2020

Jamie Stevens, Project Manager
Crete Consulting
108 S. Washington St., Suite 300
Seattle, WA 98104

Dear Ms Stevens:

Included are the results from the testing of material submitted on June 18, 2020 from the I&J Waterway 1001 Hilton Ave, F&BI 006296 project. There are 17 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days, or as directed by the Chain of Custody document. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
c: Grant Hainsworth
CTC0708R.DOC

CASE NARRATIVE

This case narrative encompasses samples received on June 18, 2020 by Friedman & Bruya, Inc. from the Crete Consulting I&J Waterway 1001 Hilton Ave, F&BI 006296 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	Crete Consulting
006296 -01	IJW-SS-14
006296 -02	IJW-SS-14-200
006296 -03	IJW-SC-2-1
006296 -04	IJW-SC-100
006296 -05	IJW-SC-2-2
006296 -06	IJW-SC-2-3
006296 -07	IJW-SC-2-4
006296 -08	IJW-SC-3-1
006296 -09	IJW-SC-3-3
006296 -10	IJW-SC-3-4
006296 -11	IJW-SS-15
006296 -12	IJW-SS-16
006296 -13	IJW-SS-17
006296 -14	IJW-SC-1-1
006296 -15	IJW-SC-1-2
006296 -16	IJW-SC-1-3
006296 -17	IJW-SC-4-1
006296 -18	IJW-SC-4-2
006296 -19	IJW-SC-4-3
006296 -20	IJW-SC-5-1
006296 -21	IJW-SC-5-2
006296 -22	IJW-SC-5-3
006296 -23	IJW-SC-6-1
006296 -24	IJW-SC-6-2
006296 -25	IJW-SC-6-3
006296 -26	IJW-SC-7-1
006296 -27	IJW-SC-7-2
006296 -28	IJW-SC-7-3
006296 -29	IJW-SC-8-1
006296 -30	IJW-SC-8-2
006296 -31	IJW-SC-8-5
006296 -32	IJW-SC-9-1
006296 -33	IJW-SC-9-2
006296 -34	IJW-SC-9-3

Samples IJW-SC-2-1, IJW-SC-100, and IJW-SC-3-1 were sent to Fremont Analytical for total oganic carbon analysis. The report is enclosed.

CASE NARRATIVE (continued)

Per your request, several 8270E compounds were reported between the method detection limit and the reporting limit. The data were flagged accordingly.

The 1631E mercury matrix spike and matrix spike duplicate exceeded the acceptance criteria. Mercury was not detected in the samples, therefore the results were acceptable.

The 8270E laboratory control sample and laboratory control sample duplicate failed the relative percent difference for 4-chloroaniline. The analyte was not detected therefore the data were acceptable.

All other quality control requirements were acceptable.

Analysis For Total Metals By EPA Method 6020B

Client ID:	IJW-SC-2-1	Client:	Crete Consulting
Date Received:	06/18/20	Project:	I&J Waterway 1001 Hilton Ave
Date Extracted:	06/22/20	Lab ID:	006296-03
Date Analyzed:	06/23/20	Data File:	006296-03.130
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Nickel	26.3

Analysis For Total Metals By EPA Method 6020B

Client ID:	IJW-SC-100	Client:	Crete Consulting
Date Received:	06/18/20	Project:	I&J Waterway 1001 Hilton Ave
Date Extracted:	06/22/20	Lab ID:	006296-04
Date Analyzed:	06/23/20	Data File:	006296-04.131
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Nickel	29.1

Analysis For Total Metals By EPA Method 6020B

Client ID:	IJW-SC-3-1	Client:	Crete Consulting
Date Received:	06/18/20	Project:	I&J Waterway 1001 Hilton Ave
Date Extracted:	06/22/20	Lab ID:	006296-08
Date Analyzed:	06/23/20	Data File:	006296-08.132
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Nickel	65.8

Analysis For Total Metals By EPA Method 6020B

Client ID:	Method Blank	Client:	Crete Consulting
Date Received:	Not Applicable	Project:	I&J Waterway 1001 Hilton Ave
Date Extracted:	06/22/20	Lab ID:	I0-361 mb
Date Analyzed:	06/22/20	Data File:	I0-361 mb.044
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Nickel	<1

Date of Report: 07/08/20
Date Received: 06/18/20
Project: I&J Waterway 1001 Hilton Ave, F&BI 006296
Date Extracted: 06/22/20
Date Analyzed: 06/22/20

RESULTS FROM THE ANALYSIS OF SOIL SAMPLES FOR TOTAL MERCURY USING EPA METHOD 1631E

Results Reported on a Dry Weight Basis
Results Reported as mg/kg (ppm)

Sample ID Laboratory ID	Total Mercury
IJW-SC-2-1 006296-03	<0.1
IJW-SC-100 006296-04	<0.1
IJW-SC-3-1 006296-08	<0.1
Method Blank	<0.1

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	IJW-SS-14	Client:	Crete Consulting
Date Received:	06/18/20	Project:	I&J Waterway 1001 Hilton Ave
Date Extracted:	06/22/20	Lab ID:	006296-01 1/25
Date Analyzed:	06/22/20	Data File:	062219.D
Matrix:	Soil	Instrument:	GCMS8
Units:	mg/kg (ppm) Dry Weight	Operator:	VM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	67 d	36	114
Phenol-d6	80 d	47	116
Nitrobenzene-d5	73 d	38	117
2-Fluorobiphenyl	73 d	50	150
2,4,6-Tribromophenol	123 d	25	187
Terphenyl-d14	68 d	50	150

Compounds:	Concentration mg/kg (ppm)
Benz(a)anthracene	0.20
Chrysene	0.70
Benzo(a)pyrene	0.18
Benzo(b)fluoranthene	0.29
Benzo(k)fluoranthene	0.12
Indeno(1,2,3-cd)pyrene	0.088
Dibenz(a,h)anthracene	<0.05

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	IJW-SS-14-200	Client:	Crete Consulting
Date Received:	06/18/20	Project:	I&J Waterway 1001 Hilton Ave
Date Extracted:	06/22/20	Lab ID:	006296-02 1/25
Date Analyzed:	06/22/20	Data File:	062220.D
Matrix:	Soil	Instrument:	GCMS8
Units:	mg/kg (ppm) Dry Weight	Operator:	VM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	55 d	36	114
Phenol-d6	70 d	47	116
Nitrobenzene-d5	58 d	38	117
2-Fluorobiphenyl	60 d	50	150
2,4,6-Tribromophenol	127 d	25	187
Terphenyl-d14	60 d	50	150

Compounds:	Concentration mg/kg (ppm)
Benz(a)anthracene	0.26
Chrysene	0.87
Benzo(a)pyrene	0.19
Benzo(b)fluoranthene	0.45
Benzo(k)fluoranthene	0.17
Indeno(1,2,3-cd)pyrene	0.093
Dibenz(a,h)anthracene	<0.05

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	IJW-SC-2-1	Client:	Crete Consulting
Date Received:	06/18/20	Project:	I&J Waterway 1001 Hilton Ave
Date Extracted:	06/22/20	Lab ID:	006296-03 1/5
Date Analyzed:	06/30/20	Data File:	063009.D
Matrix:	Soil	Instrument:	GCMS8
Units:	mg/kg (ppm) Dry Weight	Operator:	VM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	74 d	36	114
Phenol-d6	91 d	47	116
Nitrobenzene-d5	83 d	38	117
2-Fluorobiphenyl	76 d	50	150
2,4,6-Tribromophenol	73 d	25	187
Terphenyl-d14	78 d	50	150

Compounds:	Concentration mg/kg (ppm)	Compounds:	Concentration mg/kg (ppm)
Phenol	<0.5	2,6-Dinitrotoluene	<0.25
Bis(2-chloroethyl) ether	<0.05	3-Nitroaniline	<5
2-Chlorophenol	<0.5	Acenaphthene	<0.01
1,3-Dichlorobenzene	<0.05	2,4-Dinitrophenol	<1.5
1,4-Dichlorobenzene	<0.05	Dibenzofuran	<0.05
1,2-Dichlorobenzene	<0.05	2,4-Dinitrotoluene	<0.25
Benzyl alcohol	<0.15 j	4-Nitrophenol	<1.5
2,2'-Oxybis(1-chloropropane)	<0.05	Diethyl phthalate	<0.5
2-Methylphenol	<0.05 j	Fluorene	0.011
Hexachloroethane	<0.05	4-Chlorophenyl phenyl ether	<0.05
N-Nitroso-di-n-propylamine	<0.05	N-Nitrosodiphenylamine	<0.05
3-Methylphenol + 4-Methylphenol	<0.1 j	4-Nitroaniline	<5
Nitrobenzene	<0.05	4,6-Dinitro-2-methylphenol	<1.5
Isophorone	<0.05	4-Bromophenyl phenyl ether	<0.05
2-Nitrophenol	<0.5	Hexachlorobenzene	<0.05
2,4-Dimethylphenol	<0.04 j	Pentachlorophenol	<0.25
Benzoic acid	<0.2 j	Phenanthrene	0.051
Bis(2-chloroethoxy)methane	<0.05	Anthracene	0.018
2,4-Dichlorophenol	<0.5	Carbazole	<0.05
1,2,4-Trichlorobenzene	<0.05	Di-n-butyl phthalate	<0.5
Naphthalene	0.018	Fluoranthene	0.19
Hexachlorobutadiene	<0.05	Pyrene	0.35
4-Chloroaniline	<5	Benzyl butyl phthalate	<0.5
4-Chloro-3-methylphenol	<0.5	Benz(a)anthracene	0.058
2-Methylnaphthalene	<0.01	Chrysene	0.14
1-Methylnaphthalene	<0.01	Bis(2-ethylhexyl) phthalate	<0.8 j
Hexachlorocyclopentadiene	<0.15	Di-n-octyl phthalate	<0.5
2,4,6-Trichlorophenol	<0.5	Benzo(a)pyrene	0.071
2,4,5-Trichlorophenol	<0.5	Benzo(b)fluoranthene	0.14
2-Chloronaphthalene	<0.05	Benzo(k)fluoranthene	0.047
2-Nitroaniline	<0.25	Indeno(1,2,3-cd)pyrene	0.033
Dimethyl phthalate	<0.05 j	Dibenz(a,h)anthracene	<0.01
Acenaphthylene	<0.01	Benzo(g,h,i)perylene	0.028
N-Nitrosodimethylamine	<0.02 j		

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	IJW-SC-100	Client:	Crete Consulting
Date Received:	06/18/20	Project:	I&J Waterway 1001 Hilton Ave
Date Extracted:	06/22/20	Lab ID:	006296-04 1/5
Date Analyzed:	06/30/20	Data File:	063010.D
Matrix:	Soil	Instrument:	GCMS8
Units:	mg/kg (ppm) Dry Weight	Operator:	VM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	70 d	36	114
Phenol-d6	85 d	47	116
Nitrobenzene-d5	82 d	38	117
2-Fluorobiphenyl	76 d	50	150
2,4,6-Tribromophenol	89 d	25	187
Terphenyl-d14	74 d	50	150

Compounds:	Concentration mg/kg (ppm)	Compounds:	Concentration mg/kg (ppm)
Phenol	<0.5	2,6-Dinitrotoluene	<0.25
Bis(2-chloroethyl) ether	<0.05	3-Nitroaniline	<5
2-Chlorophenol	<0.5	Acenaphthene	0.011
1,3-Dichlorobenzene	<0.05	2,4-Dinitrophenol	<1.5
1,4-Dichlorobenzene	<0.05	Dibenzofuran	<0.05
1,2-Dichlorobenzene	<0.05	2,4-Dinitrotoluene	<0.25
Benzyl alcohol	<0.15 j	4-Nitrophenol	<1.5
2,2'-Oxybis(1-chloropropane)	<0.05	Diethyl phthalate	<0.5
2-Methylphenol	<0.05 j	Fluorene	0.018
Hexachloroethane	<0.05	4-Chlorophenyl phenyl ether	<0.05
N-Nitroso-di-n-propylamine	<0.05	N-Nitrosodiphenylamine	<0.05
3-Methylphenol + 4-Methylphenol	<0.1 j	4-Nitroaniline	<5
Nitrobenzene	<0.05	4,6-Dinitro-2-methylphenol	<1.5
Isophorone	<0.05	4-Bromophenyl phenyl ether	<0.05
2-Nitrophenol	<0.5	Hexachlorobenzene	<0.05
2,4-Dimethylphenol	<0.04 j	Pentachlorophenol	<0.25
Benzoic acid	<0.2 j	Phenanthrene	0.098
Bis(2-chloroethoxy)methane	<0.05	Anthracene	0.036
2,4-Dichlorophenol	<0.5	Carbazole	<0.05
1,2,4-Trichlorobenzene	<0.05	Di-n-butyl phthalate	<0.5
Naphthalene	0.024	Fluoranthene	0.69
Hexachlorobutadiene	<0.05	Pyrene	0.90
4-Chloroaniline	<5	Benzyl butyl phthalate	<0.5
4-Chloro-3-methylphenol	<0.5	Benz(a)anthracene	0.18
2-Methylnaphthalene	0.013	Chrysene	0.40
1-Methylnaphthalene	<0.01	Bis(2-ethylhexyl) phthalate	1.8 fc
Hexachlorocyclopentadiene	<0.15	Di-n-octyl phthalate	<0.5
2,4,6-Trichlorophenol	<0.5	Benzo(a)pyrene	0.18
2,4,5-Trichlorophenol	<0.5	Benzo(b)fluoranthene	0.36
2-Chloronaphthalene	<0.05	Benzo(k)fluoranthene	0.14
2-Nitroaniline	<0.25	Indeno(1,2,3-cd)pyrene	0.090
Dimethyl phthalate	<0.05 j	Dibenz(a,h)anthracene	0.023
Acenaphthylene	0.012	Benzo(g,h,i)perylene	0.072
N-Nitrosodimethylamine	<0.02 j		

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	IJW-SC-3-1	Client:	Crete Consulting
Date Received:	06/18/20	Project:	I&J Waterway 1001 Hilton Ave
Date Extracted:	06/22/20	Lab ID:	006296-08 1/5
Date Analyzed:	06/30/20	Data File:	063011.D
Matrix:	Soil	Instrument:	GCMS8
Units:	mg/kg (ppm) Dry Weight	Operator:	VM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	63 d	36	114
Phenol-d6	78 d	47	116
Nitrobenzene-d5	71 d	38	117
2-Fluorobiphenyl	66 d	50	150
2,4,6-Tribromophenol	80 d	25	187
Terphenyl-d14	63 d	50	150

Compounds:	Concentration mg/kg (ppm)	Compounds:	Concentration mg/kg (ppm)
Phenol	<0.5	2,6-Dinitrotoluene	<0.25
Bis(2-chloroethyl) ether	<0.05	3-Nitroaniline	<5
2-Chlorophenol	<0.5	Acenaphthene	<0.01
1,3-Dichlorobenzene	<0.05	2,4-Dinitrophenol	<1.5
1,4-Dichlorobenzene	<0.05	Dibenzofuran	<0.05
1,2-Dichlorobenzene	<0.05	2,4-Dinitrotoluene	<0.25
Benzyl alcohol	<0.15 j	4-Nitrophenol	<1.5
2,2'-Oxybis(1-chloropropane)	<0.05	Diethyl phthalate	<0.5
2-Methylphenol	<0.05 j	Fluorene	<0.01
Hexachloroethane	<0.05	4-Chlorophenyl phenyl ether	<0.05
N-Nitroso-di-n-propylamine	<0.05	N-Nitrosodiphenylamine	<0.05
3-Methylphenol + 4-Methylphenol	<0.1 j	4-Nitroaniline	<5
Nitrobenzene	<0.05	4,6-Dinitro-2-methylphenol	<1.5
Isophorone	<0.05	4-Bromophenyl phenyl ether	<0.05
2-Nitrophenol	<0.5	Hexachlorobenzene	<0.05
2,4-Dimethylphenol	<0.04 j	Pentachlorophenol	<0.25
Benzoic acid	<0.2 j	Phenanthrene	0.068
Bis(2-chloroethoxy)methane	<0.05	Anthracene	0.015
2,4-Dichlorophenol	<0.5	Carbazole	<0.05
1,2,4-Trichlorobenzene	<0.05	Di-n-butyl phthalate	<0.5
Naphthalene	<0.01	Fluoranthene	0.18
Hexachlorobutadiene	<0.05	Pyrene	0.36
4-Chloroaniline	<5	Benzyl butyl phthalate	<0.5
4-Chloro-3-methylphenol	<0.5	Benz(a)anthracene	0.055
2-Methylnaphthalene	<0.01	Chrysene	0.16
1-Methylnaphthalene	<0.01	Bis(2-ethylhexyl) phthalate	1.2 fc
Hexachlorocyclopentadiene	<0.15	Di-n-octyl phthalate	<0.5
2,4,6-Trichlorophenol	<0.5	Benzo(a)pyrene	0.077
2,4,5-Trichlorophenol	<0.5	Benzo(b)fluoranthene	0.19
2-Chloronaphthalene	<0.05	Benzo(k)fluoranthene	0.072
2-Nitroaniline	<0.25	Indeno(1,2,3-cd)pyrene	0.035
Dimethyl phthalate	<0.05 j	Dibenz(a,h)anthracene	<0.01
Acenaphthylene	<0.01	Benzo(g,h,i)perylene	0.029
N-Nitrosodimethylamine	<0.02 j		

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	Method Blank	Client:	Crete Consulting
Date Received:	Not Applicable	Project:	I&J Waterway 1001 Hilton Ave
Date Extracted:	06/22/20	Lab ID:	00-1453 mb
Date Analyzed:	06/22/20	Data File:	062216.D
Matrix:	Soil	Instrument:	GCMS8
Units:	mg/kg (ppm) Dry Weight	Operator:	VM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	98	36	114
Phenol-d6	114	47	116
Nitrobenzene-d5	108	38	117
2-Fluorobiphenyl	109	50	150
2,4,6-Tribromophenol	104	25	187
Terphenyl-d14	118	50	150

Compounds:	Concentration mg/kg (ppm)	Compounds:	Concentration mg/kg (ppm)
Phenol	<0.1	2,6-Dinitrotoluene	<0.05
Bis(2-chloroethyl) ether	<0.01	3-Nitroaniline	<1
2-Chlorophenol	<0.1	Acenaphthene	<0.002
1,3-Dichlorobenzene	<0.01	2,4-Dinitrophenol	<0.3
1,4-Dichlorobenzene	<0.01	Dibenzofuran	<0.01
1,2-Dichlorobenzene	<0.01	2,4-Dinitrotoluene	<0.05
Benzyl alcohol	<0.03 j	4-Nitrophenol	<0.3
2,2'-Oxybis(1-chloropropane)	<0.01	Diethyl phthalate	<0.1
2-Methylphenol	<0.01 j	Fluorene	<0.002
Hexachloroethane	<0.01	4-Chlorophenyl phenyl ether	<0.01
N-Nitroso-di-n-propylamine	<0.01	N-Nitrosodiphenylamine	<0.01
3-Methylphenol + 4-Methylphenol	<0.02 j	4-Nitroaniline	<1
Nitrobenzene	<0.01	4,6-Dinitro-2-methylphenol	<0.3
Isophorone	<0.01	4-Bromophenyl phenyl ether	<0.01
2-Nitrophenol	<0.1	Hexachlorobenzene	<0.01
2,4-Dimethylphenol	<0.008 j	Pentachlorophenol	<0.05
Benzoic acid	<0.03 j	Phenanthrene	<0.002
Bis(2-chloroethoxy)methane	<0.01	Anthracene	<0.002
2,4-Dichlorophenol	<0.1	Carbazole	<0.01
1,2,4-Trichlorobenzene	<0.01	Di-n-butyl phthalate	<0.1
Naphthalene	<0.002	Fluoranthene	<0.002
Hexachlorobutadiene	<0.01	Pyrene	<0.002
4-Chloroaniline	<1	Benzyl butyl phthalate	<0.1
4-Chloro-3-methylphenol	<0.1	Benz(a)anthracene	<0.002
2-Methylnaphthalene	<0.002	Chrysene	<0.002
1-Methylnaphthalene	<0.002	Bis(2-ethylhexyl) phthalate	<0.16 j
Hexachlorocyclopentadiene	<0.03	Di-n-octyl phthalate	<0.1
2,4,6-Trichlorophenol	<0.1	Benzo(a)pyrene	<0.002
2,4,5-Trichlorophenol	<0.1	Benzo(b)fluoranthene	<0.002
2-Chloronaphthalene	<0.01	Benzo(k)fluoranthene	<0.002
2-Nitroaniline	<0.05	Indeno(1,2,3-cd)pyrene	<0.002
Dimethyl phthalate	<0.01 j	Dibenz(a,h)anthracene	<0.002
Acenaphthylene	<0.002	Benzo(g,h,i)perylene	<0.002
N-Nitrosodimethylamine	<0.004 j		

Date of Report: 07/08/20
Date Received: 06/18/20
Project: I&J Waterway 1001 Hilton Ave, F&BI 006296

QUALITY ASSURANCE RESULTS
FOR THE ANALYSIS OF SOIL SAMPLES
FOR TOTAL METALS USING EPA METHOD 6020B

Laboratory Code: 006331-01 x5 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result (Wet wt)	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Nickel	mg/kg (ppm)	25	20.9	103	91	75-125	12

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Nickel	mg/kg (ppm)	25	102	80-120

Date of Report: 07/08/20
Date Received: 06/18/20
Project: I&J Waterway 1001 Hilton Ave, F&BI 006296

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR TOTAL MERCURY USING EPA METHOD 1631E

Laboratory Code: 006331-01 1/10 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result (Wet wt)	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Mercury	mg/kg (ppm)	5	<1	129 vo	131 vo	71-125	2

Laboratory Code: Laboratory Control Sample 1/10

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Mercury	mg/kg (ppm)	5	117	68-125

Date of Report: 07/08/20
Date Received: 06/18/20
Project: I&J Waterway 1001 Hilton Ave, F&BI 006296

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR SEMIVOLATILES BY EPA METHOD 8270E

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Percent Recovery LCSD	Acceptance Criteria	RPD (Limit 20)
Phenol	mg/kg (ppm)	0.17	93	89	68-117	4
Bis(2-chloroethyl) ether	mg/kg (ppm)	0.17	83	78	51-119	6
2-Chlorophenol	mg/kg (ppm)	0.17	89	84	58-116	6
1,3-Dichlorobenzene	mg/kg (ppm)	0.17	79	70	48-109	12
1,4-Dichlorobenzene	mg/kg (ppm)	0.17	80	72	50-107	11
1,2-Dichlorobenzene	mg/kg (ppm)	0.17	82	74	53-107	10
Benzyl alcohol	mg/kg (ppm)	0.33	91	92	70-130	1
2,2'-Oxybis(1-chloropropane)	mg/kg (ppm)	0.17	86	80	70-130	7
2-Methylphenol	mg/kg (ppm)	0.17	89	89	63-112	0
Hexachloroethane	mg/kg (ppm)	0.17	82	77	50-113	6
N-Nitroso-di-n-propylamine	mg/kg (ppm)	0.17	94	93	70-130	1
3-Methylphenol + 4-Methylphenol	mg/kg (ppm)	0.17	94	95	70-130	1
Nitrobenzene	mg/kg (ppm)	0.17	90	82	60-116	9
Isophorone	mg/kg (ppm)	0.17	89	89	66-119	0
2-Nitrophenol	mg/kg (ppm)	0.17	88	81	64-120	8
2,4-Dimethylphenol	mg/kg (ppm)	0.17	86	86	58-118	0
Benzoic acid	mg/kg (ppm)	0.25	106	92	56-169	14
Bis(2-chloroethoxy)methane	mg/kg (ppm)	0.17	91	85	68-110	7
2,4-Dichlorophenol	mg/kg (ppm)	0.17	90	89	63-116	1
1,2,4-Trichlorobenzene	mg/kg (ppm)	0.17	83	76	56-110	9
Naphthalene	mg/kg (ppm)	0.17	84	78	60-105	7
Hexachlorobutadiene	mg/kg (ppm)	0.17	78	69	52-111	12
4-Chloroaniline	mg/kg (ppm)	0.33	40	54	10-90	30 vo
4-Chloro-3-methylphenol	mg/kg (ppm)	0.17	98	97	65-120	1
2-Methylnaphthalene	mg/kg (ppm)	0.17	88	86	64-107	2
1-Methylnaphthalene	mg/kg (ppm)	0.17	88	85	64-105	3
Hexachlorocyclopentadiene	mg/kg (ppm)	0.17	92	82	54-131	11
2,4,6-Trichlorophenol	mg/kg (ppm)	0.17	90	85	63-125	6
2,4,5-Trichlorophenol	mg/kg (ppm)	0.17	93	89	70-130	4
2-Chloronaphthalene	mg/kg (ppm)	0.17	82	77	65-115	6
2-Nitroaniline	mg/kg (ppm)	0.33	93	87	64-128	7
Dimethyl phthalate	mg/kg (ppm)	0.17	96	97	64-127	1
Acenaphthylene	mg/kg (ppm)	0.17	93	89	70-130	4
2,6-Dinitrotoluene	mg/kg (ppm)	0.17	98	94	68-126	4
3-Nitroaniline	mg/kg (ppm)	0.33	74	77	52-108	4
Acenaphthene	mg/kg (ppm)	0.17	87	81	70-130	7
2,4-Dinitrophenol	mg/kg (ppm)	0.17	98	84	51-159	15
Dibenzofuran	mg/kg (ppm)	0.17	87	83	70-130	5
2,4-Dinitrotoluene	mg/kg (ppm)	0.17	97	99	66-125	2
4-Nitrophenol	mg/kg (ppm)	0.17	100	86	60-146	15
Diethyl phthalate	mg/kg (ppm)	0.17	90	95	63-133	5
Fluorene	mg/kg (ppm)	0.17	88	85	70-130	3
4-Chlorophenyl phenyl ether	mg/kg (ppm)	0.17	84	81	70-130	4
N-Nitrosodiphenylamine	mg/kg (ppm)	0.17	96	94	70-130	2
4-Nitroaniline	mg/kg (ppm)	0.33	93	82	50-124	13
4,6-Dinitro-2-methylphenol	mg/kg (ppm)	0.17	114	99	68-139	14
4-Bromophenyl phenyl ether	mg/kg (ppm)	0.17	98	91	43-167	7
Hexachlorobenzene	mg/kg (ppm)	0.17	103	98	70-130	5
Pentachlorophenol	mg/kg (ppm)	0.17	104	91	61-136	13
Phenanthrene	mg/kg (ppm)	0.17	97	90	70-130	7
Anthracene	mg/kg (ppm)	0.17	97	92	70-130	5
Carbazole	mg/kg (ppm)	0.17	111	104	70-130	7
Di-n-butyl phthalate	mg/kg (ppm)	0.17	105	95	70-130	10
Fluoranthene	mg/kg (ppm)	0.17	104	93	70-130	11
Pyrene	mg/kg (ppm)	0.17	102	99	70-130	3
Benzyl butyl phthalate	mg/kg (ppm)	0.17	110	102	70-130	8
Benz(a)anthracene	mg/kg (ppm)	0.17	103	97	70-130	6
Chrysene	mg/kg (ppm)	0.17	103	99	70-130	4
Bis(2-ethylhexyl) phthalate	mg/kg (ppm)	0.17	103	92	38-153	11
Di-n-octyl phthalate	mg/kg (ppm)	0.17	107	106	52-141	1
Benzo(a)pyrene	mg/kg (ppm)	0.17	94	95	64-112	1
Benzo(b)fluoranthene	mg/kg (ppm)	0.17	95	98	61-118	3
Benzo(k)fluoranthene	mg/kg (ppm)	0.17	96	102	61-116	6
Indeno(1,2,3-cd)pyrene	mg/kg (ppm)	0.17	104	90	52-130	14
Dibenz(a,h)anthracene	mg/kg (ppm)	0.17	105	90	54-125	15
Benzo(g,h,i)perylene	mg/kg (ppm)	0.17	100	86	47-128	15
N-Nitrosodimethylamine	mg/kg (ppm)	0.17	84	73	50-121	14

Data Qualifiers & Definitions

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for the analyte were outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte may be due to carryover from previous sample injections.

cf - The sample was centrifuged prior to analysis.

d - The sample was diluted. Detection limits were raised and surrogate recoveries may not be meaningful.

dv - Insufficient sample volume was available to achieve normal reporting limits.

f - The sample was laboratory filtered prior to analysis.

fb - The analyte was detected in the method blank.

fc - The analyte is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. Variability is attributed to sample inhomogeneity.

hs - Headspace was present in the container used for analysis.

ht – The analysis was performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of control limits due to sample matrix effects.

j - The analyte concentration is reported below the lowest calibration standard. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The laboratory control sample(s) percent recovery and/or RPD were out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the analyte is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc - The sample was received with incorrect preservation or in a container not approved by the method. The value reported should be considered an estimate.

ve - The analyte response exceeded the valid instrument calibration range. The value reported is an estimate.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Friedman & Bruya
Michael Erdahl
3012 16th Ave. W.
Seattle, WA 98119

RE: 006296
Work Order Number: 2006335

June 26, 2020

Attention Michael Erdahl:

Fremont Analytical, Inc. received 3 sample(s) on 6/19/2020 for the analyses presented in the following report.

Total Organic Carbon by EPA 9060

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Brianna Barnes
Project Manager

DoD/ELAP Certification #L17-135, ISO/IEC 17025:2005
ORELAP Certification: WA 100009-007 (NELAP Recognized)

Date: *06/26/2020*

CLIENT: Friedman & Bruya
Project: 006296
Work Order: 2006335

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2006335-001	IJW-SC-2-1	06/17/2020 8:10 AM	06/19/2020 10:52 AM
2006335-002	IJW-SC-100	06/17/2020 12:00 PM	06/19/2020 10:52 AM
2006335-003	IJW-SC-3-1	06/17/2020 9:20 AM	06/19/2020 10:52 AM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **2006335**
Date: **6/26/2020**

CLIENT: Friedman & Bruya
Project: 006296

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Qualifiers:

* - Flagged value is not within established control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20% Drift or minimum RRF)
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Reporting Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

CLIENT: Friedman & Bruya
Project: 006296

Lab ID: 2006335-001 **Collection Date:** 6/17/2020 8:10:00 AM
Client Sample ID: **IJW-SC-2-1** **Matrix:** Sediment

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Organic Carbon by EPA 9060				Batch ID: 28801		Analyst: SS
Total Organic Carbon	3.26	0.0750		%-dry	1	6/25/2020 3:48:00 PM

Lab ID: 2006335-002 **Collection Date:** 6/17/2020 12:00:00 PM
Client Sample ID: **IJW-SC-100** **Matrix:** Sediment

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Organic Carbon by EPA 9060				Batch ID: 28801		Analyst: SS
Total Organic Carbon	3.13	0.0750		%-dry	1	6/25/2020 4:03:00 PM

Lab ID: 2006335-003 **Collection Date:** 6/17/2020 9:20:00 AM
Client Sample ID: **IJW-SC-3-1** **Matrix:** Sediment

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Organic Carbon by EPA 9060				Batch ID: 28801		Analyst: SS
Total Organic Carbon	0.929	0.0750		%-dry	1	6/25/2020 4:22:00 PM

Work Order: 2006335
CLIENT: Friedman & Bruya
Project: 006296

QC SUMMARY REPORT

Total Organic Carbon by EPA 9060

Sample ID: **MB-28801** SampType: **MBLK** Units: **%-dry** Prep Date: **6/25/2020** RunNo: **60107**
Client ID: **MBLKS** Batch ID: **28801** Analysis Date: **6/25/2020** SeqNo: **1203398**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Organic Carbon	ND	0.0750									

Sample ID: **LCS-28801** SampType: **LCS** Units: **%-dry** Prep Date: **6/25/2020** RunNo: **60107**
Client ID: **LCSS** Batch ID: **28801** Analysis Date: **6/25/2020** SeqNo: **1203399**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Organic Carbon	1.03	0.0750	1.000	0	103	80	120				

Sample ID: **2006295-003ADUP** SampType: **DUP** Units: **%-dry** Prep Date: **6/25/2020** RunNo: **60107**
Client ID: **BATCH** Batch ID: **28801** Analysis Date: **6/25/2020** SeqNo: **1203403**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Organic Carbon	3.09	0.0750						3.199	3.50	20	

Sample ID: **2006295-003AMS** SampType: **MS** Units: **%-dry** Prep Date: **6/25/2020** RunNo: **60107**
Client ID: **BATCH** Batch ID: **28801** Analysis Date: **6/25/2020** SeqNo: **1203404**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Organic Carbon	4.11	0.0750	1.000	3.199	91.2	75	125				

Sample ID: **2006295-003AMSD** SampType: **MSD** Units: **%-dry** Prep Date: **6/25/2020** RunNo: **60107**
Client ID: **BATCH** Batch ID: **28801** Analysis Date: **6/25/2020** SeqNo: **1203405**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Organic Carbon	4.00	0.0750	1.000	3.199	80.3	75	125	4.111	2.69	20	

Fremont Analytical

Sample Log-In Check List

Client Name: **FB**
Work Order Number: **2006335**
Logged by: **Clare Griggs**
Date Received: **6/19/2020 10:52:00 AM**

Chain of Custody

1. Is Chain of Custody complete? Yes ☑ No ☐ Not Present ☐
2. How was the sample delivered? FedEx

Log In

3. Coolers are present? Yes ☑ No ☐ NA ☐
4. Shipping container/cooler in good condition? Yes ☑ No ☐
5. Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact) Yes ☐ No ☐ Not Present ☑
6. Was an attempt made to cool the samples? Yes ☑ No ☐ NA ☐
7. Were all items received at a temperature of >2°C to 6°C * Yes ☑ No ☐ NA ☐
8. Sample(s) in proper container(s)? Yes ☑ No ☐
9. Sufficient sample volume for indicated test(s)? Yes ☑ No ☐
10. Are samples properly preserved? Yes ☑ No ☐
11. Was preservative added to bottles? Yes ☐ No ☑ NA ☐
12. Is there headspace in the VOA vials? Yes ☐ No ☐ NA ☑
13. Did all samples containers arrive in good condition(unbroken)? Yes ☑ No ☐
14. Does paperwork match bottle labels? Yes ☑ No ☐
15. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
16. Is it clear what analyses were requested? Yes ☑ No ☐
17. Were all holding times able to be met? Yes ☑ No ☐

Special Handling (if applicable)

18. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: ______ Date: ______
By Whom: ______ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding: ______
Client Instructions: ______

19. Additional remarks:

Item Information

Item #	Temp ºC
Cooler	4.1
Sample	3.8

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

SUBCONTRACT SAMPLE CHAIN OF CUSTODY

2006335

Page # 1 of 1

Send Report To Michael Erdahl

Company Friedman and Bruya, Inc.

Address 3012 16th Ave W

City, State, ZIP Seattle, WA 98119

Phone # (206) 285-8282 merdahl@friedmanandbruya.com

SUBCONTRACTER Fremont

PROJECT NAME/NO.	PO #
006296	A-271

REMARKS

Please Email Results

TURNAROUND TIME
☒ Standard TAT
☐ RUSH
Rush charges authorized by:

SAMPLE DISPOSAL
☐ Dispose after 30 days
☐ Return samples
☐ Will call with instructions

						ANALYSES REQUESTED										
Sample ID	Lab ID	Date Sampled	Time Sampled	Matrix	# of jars	Dioxins/Furans	EPH	VPH	TOC							Notes
IJW-SC-2-1		6/17/20	0810	sediment	1				x							
IJW-SC-100		|	1200	↓	1				x							
IJW-SC-3-1		|	0920	↓	1				x							

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282
Fax (206) 283-5044

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	Michael Erdahl	Friedman & Bruya	6/19/20	
Received by:	Sara Becker-Mayer	FAI	6/19/20	1052
Relinquished by:				
Received by:				

006296

SAMPLE CHAIN OF CUSTODY ME 06/18/20

BI4

Report To Jamie Stevens

Company CRETE Consulting

Address 108 S. Washington St.

City, State, ZIP Seattle, WA 98104

Phone 206-799-2744 Email jamie.stevens@creteconsulting.com

SAMPLERS (signature)
Rusty Jones

PROJECT NAME	PO #
I&J Waterway – 1001 Hilton Ave	
REMARKS	INVOICE TO J. Stevens

Page # 1 of ~~5~~ RS ④

TURNAROUND TIME
✓Standard Turnaround
RUSH
Rush charges authorized by:

SAMPLE DISPOSAL
Dispose after 30 days
Archive Samples
Other

						ANALYSES REQUESTED											
Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	cPAH	TOC	Nickel	Mercury	PAH	SVOCs	Dioxin/Furans	D/F like Cong.	ARCHIVE			Notes
IJW-SS-14	01 AB	6.18.2020	0755	Sediment	② ~~1~~ RS	x											
IJW-SS-14-200	02 AB	6.18.2020	0900	Sediment	② ~~1~~	x											
IJW-SC-2-1	03 A-C	6.17.2020	0810	Sediment	3		x	x	x	x	x	~~x~~	~~x~~				Hold D/F
IJW-SC-100	04	6.17.2020	1200	Sediment	3		x	x	x	x	x	~~x~~	~~x~~				testing per
IJW-SC-2-2	05	↓	0815	Sediment	3									x			JS 6/22/20 ME
IJW-SC-2-3	06		0820	Sediment	3									x			↓
IJW-SC-2-4	07	6.17.2020	0825	Sediment	3									x			
IJW-SC-3-1	08 A-E	6.17.2020	0920	Sediment	⑤ ~~3~~ RS		x	x	x	x	x	~~x~~	~~x~~				
~~IJW-SC-3-2~~				~~Sediment~~	~~3~~									~~x~~			RS
IJW-SC-3-3	09 A-E	6.17.2020	0930	Sediment	⑤ ~~3~~ RS									x			
IJW-SC-3-4	10 A-C	↓	0935	Sediment	3									x			

EWB
Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by: R. Jones	Rusty Jones	CRETE Consulting	6.18.2020	1347
Received by:	Nhan Phan	FEBI	6-18-2020	1347
Relinquished by:				
Received by:				

Samples received at 3 °C

006296

SAMPLE CHAIN OF CUSTODY ME 06/18/20

BI4

Report To Jamie Stevens

Company CRETE Consulting

Address 108 S. Washington St.

City, State, ZIP Seattle, WA 98104

Phone 206-799-2744 Email jamie.stevens@creteconsulting.com

SAMPLERS (*signature*)
Rusty Jones

PROJECT NAME
I&J Waterway – 1001 Hilton Ave

PO #

REMARKS

INVOICE TO
J. Stevens

Page # 2 of ~~3~~ RJ ④

TURNAROUND TIME
✓ Standard Turnaround
RUSH
Rush charges authorized by:

SAMPLE DISPOSAL
Dispose after 30 days
Archive Samples
Other

						ANALYSES REQUESTED											
Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	cPAH	TOC	Nickel	Mercury	PAH	SVOCs	Dioxin/Furans	D/F like Cong.	ARCHIVE			Notes
IJW-SS-15	11 A-B	6.18.20	0815	Sediment	~~1~~ RJ ②									x			
IJW-SS-16	12	↓	0905	Sediment	~~1~~ RJ ②									x			
IJW-SS-17	13	↓	0930	Sediment	~~1~~ RJ ②									x			
IJW-SC-1-1	14 A-C	6.16.20	1300	Sediment	3									x			
IJW-SC-1-2	15	6.16.20	1305	Sediment	3									x			
IJW-SC-1-3	16	6.16.20	1310	Sediment	3									x			
~~IJW-SC-1-4~~				~~Sediment~~	~~3~~									~~x~~			RJ
IJW-SC-4-1	17 A-C	6.17.2020	1215	Sediment	3									x			
IJW-SC-4-2	18 A-E	↓	1220	Sediment	⑤ ~~3~~ RJ									x			
IJW-SC-4-3	19 A-E	↓	1225	Sediment	⑤ ~~3~~ RJ									x			

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

	SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	R. Jones	Rusty Jones	CRETE Consulting	6.18.2020	
Received by:		Nhan Phan	FeBI	6-18-20	1347
Relinquished by:					
Received by:					

006296

SAMPLE CHAIN OF CUSTODY

ME 06/18/20

5D4

Page # 3 of ~~8~~ ④

Report To Jamie Stevens

Company CRETE Consulting

Address 108 S. Washington St.

City, State, ZIP Seattle, WA 98104

Phone 206-799-2744 Email jamie.stevens@creteconsulting.com

SAMPLERS (*signature*)
Rusty Jones

PROJECT NAME	PO #
I&J Waterway – 1001 Hilton Ave	
REMARKS	INVOICE TO J. Stevens

TURNAROUND TIME
✓ Standard Turnaround
RUSH
Rush charges authorized by:

SAMPLE DISPOSAL
Dispose after 30 days
Archive Samples
Other

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	ANALYSES REQUESTED										Notes
						cPAH	TOC	Nickel	Mercury	PAH	SVOCs	Dioxin/Furans	D/F like Cong.	ARCHIVE		
~~IJW-SC-4-4~~				~~Sediment~~	~~3~~									~~x~~		RJ
IJW-SC-5-1	20A-C	6.16.2020	1615	Sediment	3									x		
IJW-SC-5-2	21	↓	1620	Sediment	3									x		
IJW-SC-5-3	22		1625	Sediment	3									x		
~~IJW-SC-5-4~~				~~Sediment~~	~~3~~									~~x~~		RJ
IJW-SC-6-1	23 A-C	6.17.2020	1540	Sediment	3									x		
IJW-SC-6-2	24 A-E	↓	1545	Sediment	⑤ ~~3~~ RJ									x		
IJW-SC-6-3	25 A-E		1550	Sediment	⑤ ~~3~~ RJ									x		
~~IJW-SC-6-4~~				~~Sediment~~	~~3~~									~~x~~		RJ
IJW-SC-7-1	26 A-C	6.17.2020	1100	Sediment	3									x		
IJW-SC-7-2	27 A-C	↓	1105	Sediment	3									x		

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

	SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	R. Jones	Rusty Jones	CRETE Consulting	6.18.2020	
Received by:		Nhan Phan	FeBI	6-18-20	1347
Relinquished by:					
Received by:					

000246

Report To Jamie Stevens

Company CRETE Consulting

Address 108 S. Washington St.

City, State, ZIP Seattle, WA 98104

Phone 206-799-2744 Email jamie.stevens@creteconsulting.com

SAMPLERS (*signature*) ME 06/18/20
Rusty Jones

PROJECT NAME
I&J Waterway – 1001 Hilton Ave

PO #

REMARKS

INVOICE TO
J. Stevens

Page # 4 of 4

TURNAROUND TIME
✓ Standard Turnaround BI4
RUSH
Rush charges authorized by:

SAMPLE DISPOSAL
Dispose after 30 days
Archive Samples
Other

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	cPAH	TOC	Nickel	Mercury	PAH	SVOCs	Dioxin/Furans	D/F like Cong.	ARCHIVE			Notes
						ANALYSES REQUESTED											
IJW-SC-7-3	28 A-C	6.17.2020	1110	Sediment	3									x			
~~IJW-SC-7-4~~				~~Sediment~~	~~3~~									~~x~~			RJ
IJW-SC-8-1	29 A-E	6.17.2020	1435	Sediment	⑤ ~~3~~ RJ									x			
IJW-SC-8-2	30 A-E	↓	1440	Sediment	⑤ ~~3~~ RJ									x			
~~IJW-SC-8-3~~ RJ IJW-SC-8-5	31 A-E	6.17.2020	1445	Sediment	⑤ ~~3~~ RJ									x			
~~IJW-SC-8-4~~				~~Sediment~~	~~3~~									~~x~~			RJ
IJW-SC-9-1	32 A-C	6.16.20	1420	Sediment	3									x			
IJW-SC-9-2	33 A-F	6.16.20	1425	Sediment	⑥ ~~3~~ RJ									x			
IJW-SC-9-3	34 A-F	6.16.20	1430	Sediment	⑥ ~~3~~ RJ									x			
~~IJW-SC-9-4~~				~~Sediment~~	~~3~~									~~x~~			RJ

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by: R. Jones	Rusty Jones	CRETE Consulting	6.18.2020	
Received by:	Nhan Phan	FEBI	6-18-20	1347
Relinquished by:				
Received by:				

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Yelena Aravkina, M.S.
Michael Erdahl, B.S.
Arina Podnozova, B.S.
Eric Young, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
(206) 285-8282
fbi@isomedia.com
www.friedmanandbruya.com

August 11, 2020

Jamie Stevens, Project Manager
Crete Consulting
108 S. Washington St., Suite 300
Seattle, WA 98104

Dear Ms Stevens:

Included are the additional results from the testing of material submitted on June 18, 2020 from the I&J Waterway 1001 Hilton Ave, F&BI 006296 project. There are 7 pages included in this report.

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
c: Grant Hainsworth
CTC0811R.DOC

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

CASE NARRATIVE

This case narrative encompasses samples received on June 18, 2020 by Friedman & Bruya, Inc. from the Crete Consulting I&J Waterway 1001 Hilton Ave, F&BI 006296 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	Crete Consulting
006296 -01	IJW-SS-14
006296 -02	IJW-SS-14-200
006296 -03	IJW-SC-2-1
006296 -04	IJW-SC-100
006296 -05	IJW-SC-2-2
006296 -06	IJW-SC-2-3
006296 -07	IJW-SC-2-4
006296 -08	IJW-SC-3-1
006296 -09	IJW-SC-3-3
006296 -10	IJW-SC-3-4
006296 -11	IJW-SS-15
006296 -12	IJW-SS-16
006296 -13	IJW-SS-17
006296 -14	IJW-SC-1-1
006296 -15	IJW-SC-1-2
006296 -16	IJW-SC-1-3
006296 -17	IJW-SC-4-1
006296 -18	IJW-SC-4-2
006296 -19	IJW-SC-4-3
006296 -20	IJW-SC-5-1
006296 -21	IJW-SC-5-2
006296 -22	IJW-SC-5-3
006296 -23	IJW-SC-6-1
006296 -24	IJW-SC-6-2
006296 -25	IJW-SC-6-3
006296 -26	IJW-SC-7-1
006296 -27	IJW-SC-7-2
006296 -28	IJW-SC-7-3
006296 -29	IJW-SC-8-1
006296 -30	IJW-SC-8-2
006296 -31	IJW-SC-8-5
006296 -32	IJW-SC-9-1
006296 -33	IJW-SC-9-2
006296 -34	IJW-SC-9-3

Samples IJW-SC-3-1, IJW-SC-3-3, IJW-SC-4-2, IJW-SC-4-3, IJW-SC-8-1, IJW-SC-8-2, IJW-SC-9-2, and IJW-SC-9-3 were sent to Fremont Analytical for grain size analysis. In addition, samples IJW-SC-3-3, IJW-SC-4-3, and IJW-SC-9-3 were sent to Eurofins - Burlington for Atterberg Limits. The Eurofins report is enclosed, and the Fremont report will be forwarded upon receipt.

The 8270E analysis was requested outside of the method recommended holding time. The data were qualified accordingly.

All quality control requirements were acceptable.

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	IJW-SS-15 ht	Client:	Crete Consulting
Date Received:	06/18/20	Project:	I&J Waterway 1001 Hilton Ave
Date Extracted:	07/15/20	Lab ID:	006296-11 1/25
Date Analyzed:	07/16/20	Data File:	071618.D
Matrix:	Soil	Instrument:	GCMS9
Units:	mg/kg (ppm) Dry Weight	Operator:	VM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	59 d	50	150
Phenol-d6	75 d	50	150
Nitrobenzene-d5	66 d	50	150
2-Fluorobiphenyl	73 d	50	150
2,4,6-Tribromophenol	84 d	50	150
Terphenyl-d14	82 d	50	150

Compounds:	Concentration mg/kg (ppm)
Benz(a)anthracene	0.092
Chrysene	0.14
Benzo(a)pyrene	0.076
Benzo(b)fluoranthene	0.13
Benzo(k)fluoranthene	<0.05
Indeno(1,2,3-cd)pyrene	<0.05
Dibenz(a,h)anthracene	<0.05

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	IJW-SS-16 ht	Client:	Crete Consulting
Date Received:	06/18/20	Project:	I&J Waterway 1001 Hilton Ave
Date Extracted:	07/15/20	Lab ID:	006296-12 1/25
Date Analyzed:	07/16/20	Data File:	071613.D
Matrix:	Soil	Instrument:	GCMS9
Units:	mg/kg (ppm) Dry Weight	Operator:	VM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	54 d	50	150
Phenol-d6	69 d	50	150
Nitrobenzene-d5	63 d	50	150
2-Fluorobiphenyl	72 d	50	150
2,4,6-Tribromophenol	83 d	50	150
Terphenyl-d14	83 d	50	150

Compounds:	Concentration mg/kg (ppm)
Benz(a)anthracene	0.15
Chrysene	0.26
Benzo(a)pyrene	<0.1
Benzo(b)fluoranthene	0.19
Benzo(k)fluoranthene	<0.1
Indeno(1,2,3-cd)pyrene	<0.1
Dibenz(a,h)anthracene	<0.1

Note: Reporting limits were raised due to high percent moisture in the sample.

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	IJW-SS-17 ht	Client:	Crete Consulting
Date Received:	06/18/20	Project:	I&J Waterway 1001 Hilton Ave
Date Extracted:	07/15/20	Lab ID:	006296-13 1/25
Date Analyzed:	07/16/20	Data File:	071614.D
Matrix:	Soil	Instrument:	GCMS9
Units:	mg/kg (ppm) Dry Weight	Operator:	VM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	51 d	50	150
Phenol-d6	63 d	50	150
Nitrobenzene-d5	56 d	50	150
2-Fluorobiphenyl	68 d	50	150
2,4,6-Tribromophenol	78 d	50	150
Terphenyl-d14	79 d	50	150

Compounds:	Concentration mg/kg (ppm)
Benz(a)anthracene	0.16
Chrysene	0.29
Benzo(a)pyrene	<0.1
Benzo(b)fluoranthene	0.20
Benzo(k)fluoranthene	<0.1
Indeno(1,2,3-cd)pyrene	<0.1
Dibenz(a,h)anthracene	<0.1

Note: Reporting limits were raised due to high percent moisture in the sample.

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	Method Blank	Client:	Crete Consulting
Date Received:	Not Applicable	Project:	I&J Waterway 1001 Hilton Ave
Date Extracted:	07/15/20	Lab ID:	00-1609 mb 1/5
Date Analyzed:	07/16/20	Data File:	071605.D
Matrix:	Soil	Instrument:	GCMS9
Units:	mg/kg (ppm) Dry Weight	Operator:	VM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	77	50	150
Phenol-d6	90	50	150
Nitrobenzene-d5	86	50	150
2-Fluorobiphenyl	88	50	150
2,4,6-Tribromophenol	81	50	150
Terphenyl-d14	90	50	150

Compounds:	Concentration mg/kg (ppm)
Benz(a)anthracene	<0.01
Chrysene	<0.01
Benzo(a)pyrene	<0.01
Benzo(b)fluoranthene	<0.01
Benzo(k)fluoranthene	<0.01
Indeno(1,2,3-cd)pyrene	<0.01
Dibenz(a,h)anthracene	<0.01

Date of Report: 08/11/20
Date Received: 06/18/20
Project: I&J Waterway 1001 Hilton Ave, F&BI 006296

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR SEMIVOLATILES BY EPA METHOD 8270E

Laboratory Code: 007235-21 1/5 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result (Wet wt)	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Benz(a)anthracene	mg/kg (ppm)	0.83	<0.01	89	92	50-150	3
Chrysene	mg/kg (ppm)	0.83	<0.01	89	92	50-150	3
Benzo(a)pyrene	mg/kg (ppm)	0.83	<0.01	81	83	50-150	2
Benzo(b)fluoranthene	mg/kg (ppm)	0.83	<0.01	83	84	50-150	1
Benzo(k)fluoranthene	mg/kg (ppm)	0.83	<0.01	83	85	50-150	2
Indeno(1,2,3-cd)pyrene	mg/kg (ppm)	0.83	<0.01	81	81	50-150	0
Dibenz(a,h)anthracene	mg/kg (ppm)	0.83	<0.01	84	84	50-150	0

Laboratory Code: Laboratory Control Sample 1/5

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Benz(a)anthracene	mg/kg (ppm)	0.83	99	70-130
Chrysene	mg/kg (ppm)	0.83	100	70-130
Benzo(a)pyrene	mg/kg (ppm)	0.83	90	70-130
Benzo(b)fluoranthene	mg/kg (ppm)	0.83	92	70-130
Benzo(k)fluoranthene	mg/kg (ppm)	0.83	94	70-130
Indeno(1,2,3-cd)pyrene	mg/kg (ppm)	0.83	94	70-130
Dibenz(a,h)anthracene	mg/kg (ppm)	0.83	93	70-130

Data Qualifiers & Definitions

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for the analyte were outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte may be due to carryover from previous sample injections.

cf - The sample was centrifuged prior to analysis.

d - The sample was diluted. Detection limits were raised and surrogate recoveries may not be meaningful.

dv - Insufficient sample volume was available to achieve normal reporting limits.

f - The sample was laboratory filtered prior to analysis.

fb - The analyte was detected in the method blank.

fc - The analyte is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. Variability is attributed to sample inhomogeneity.

hs - Headspace was present in the container used for analysis.

ht – The analysis was performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of control limits due to sample matrix effects.

j - The analyte concentration is reported below the lowest calibration standard. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The laboratory control sample(s) percent recovery and/or RPD were out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the analyte is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc - The sample was received with incorrect preservation or in a container not approved by the method. The value reported should be considered an estimate.

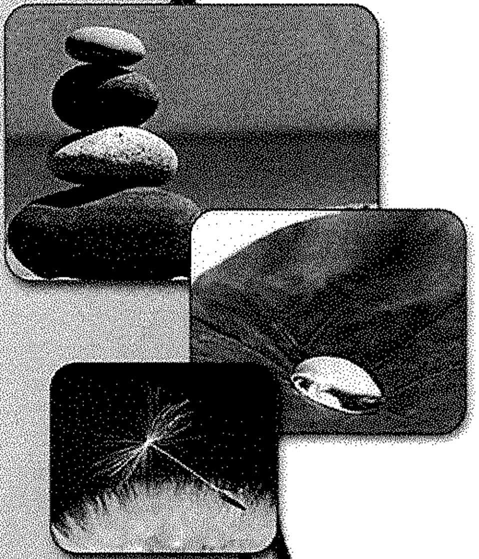
ve - The analyte response exceeded the valid instrument calibration range. The value reported is an estimate.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

eurofins

Environment Testing
America



ANALYTICAL REPORT

Eurofins TestAmerica, Burlington
30 Community Drive
Suite 11
South Burlington, VT 05403
Tel: (802)660-1990

Laboratory Job ID: 200-54398-1
Client Project/Site: 006296

For:
Friedman & Bruya
3012 16TH AVENUE WEST
Seattle, Washington 98119-2029

Attn: Michael Erdahl

Authorized for release by:
7/31/2020 3:18:21 PM

Nathan Lewis, Project Manager I
(253)922-2310
Nathan.Lewis@Eurofinset.com

The test results in this report meet all 2003 NELAC, 2009 TNI, and 2016 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Job ID: 200-54398-1

Laboratory: Eurofins TestAmerica, Burlington

Narrative

Job Narrative
200-54398-1

Comments
No additional comments.

Receipt
The samples were received on 7/16/2020 10:40 AM; the samples arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was 3.2° C.

General Chemistry
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Geotechnical
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Detection Summary

Client: Friedman & Bruya
Project/Site: 006296

Job ID: 200-54398-1

Client Sample ID: IJW-SC-3-3

Lab Sample ID: 200-54398-1

Analyte	Result	Qualifier	NONE	NONE	Unit	Dil Fac	D	Method	Prep Type
Liquid Limit	35				NONE	1		D4318	Total/NA
Plastic Limit	20				NONE	1		D4318	Total/NA
Plasticity Index	15				NONE	1		D4318	Total/NA

Client Sample ID: IJW-SC-4-3

Lab Sample ID: 200-54398-2

Analyte	Result	Qualifier	NONE	NONE	Unit	Dil Fac	D	Method	Prep Type
Liquid Limit	33				NONE	1		D4318	Total/NA
Plastic Limit	20				NONE	1		D4318	Total/NA
Plasticity Index	13				NONE	1		D4318	Total/NA

Client Sample ID: IJW-SC-9-3

Lab Sample ID: 200-54398-3

Analyte	Result	Qualifier	NONE	NONE	Unit	Dil Fac	D	Method	Prep Type
Liquid Limit	32				NONE	1		D4318	Total/NA
Plastic Limit	18				NONE	1		D4318	Total/NA
Plasticity Index	14				NONE	1		D4318	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: Friedman & Bruya
Project/Site: 006296

Job ID: 200-54398-1

Client Sample ID: IJW-SC-3-3

Lab Sample ID: 200-54398-1

Date Collected: 06/17/20 09:30
Date Received: 07/16/20 10:40

Matrix: Solid

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	81.3		0.3		%			07/29/20 14:40	1

Method: D4318 - Liquid Limit, Plastic Limit and Plasticity Index of Soils

Analyte	Result	Qualifier	NONE	NONE	Unit	D	Prepared	Analyzed	Dil Fac
Liquid Limit	35				NONE			07/28/20 20:15	1
Plastic Limit	20				NONE			07/28/20 20:15	1
Plasticity Index	15				NONE			07/28/20 20:15	1

Client Sample ID: IJW-SC-4-3

Lab Sample ID: 200-54398-2

Date Collected: 06/17/20 12:25
Date Received: 07/16/20 10:40

Matrix: Solid

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	81.9		0.3		%			07/29/20 14:40	1

Method: D4318 - Liquid Limit, Plastic Limit and Plasticity Index of Soils

Analyte	Result	Qualifier	NONE	NONE	Unit	D	Prepared	Analyzed	Dil Fac
Liquid Limit	33				NONE			07/28/20 20:15	1
Plastic Limit	20				NONE			07/28/20 20:15	1
Plasticity Index	13				NONE			07/28/20 20:15	1

Client Sample ID: IJW-SC-9-3

Lab Sample ID: 200-54398-3

Date Collected: 06/16/20 14:30
Date Received: 07/16/20 10:40

Matrix: Solid

General Chemistry

Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	86.7		0.3		%			07/29/20 14:40	1

Method: D4318 - Liquid Limit, Plastic Limit and Plasticity Index of Soils

Analyte	Result	Qualifier	NONE	NONE	Unit	D	Prepared	Analyzed	Dil Fac
Liquid Limit	32				NONE			07/28/20 20:15	1
Plastic Limit	18				NONE			07/28/20 20:15	1
Plasticity Index	14				NONE			07/28/20 20:15	1

QC Association Summary

General Chemistry

Analysis Batch: 157365

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
200-54398-1	IJW-SC-3-3	Total/NA	Solid	Moisture	
200-54398-2	IJW-SC-4-3	Total/NA	Solid	Moisture	
200-54398-3	IJW-SC-9-3	Total/NA	Solid	Moisture	

Geotechnical

Analysis Batch: 157329

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
200-54398-1	IJW-SC-3-3	Total/NA	Solid	D4318	
200-54398-2	IJW-SC-4-3	Total/NA	Solid	D4318	
200-54398-3	IJW-SC-9-3	Total/NA	Solid	D4318	

Lab Chronicle

Client: Friedman & Bruya
Project/Site: 006296

Job ID: 200-54398-1

Client Sample ID: IJW-SC-3-3

Lab Sample ID: 200-54398-1

Date Collected: 06/17/20 09:30

Matrix: Solid

Date Received: 07/16/20 10:40

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1	157365	07/29/20 14:40	CPF	TAL BUR
Total/NA	Analysis	D4318		1	157329	07/28/20 20:15	MAP	TAL BUR

Client Sample ID: IJW-SC-4-3

Lab Sample ID: 200-54398-2

Date Collected: 06/17/20 12:25

Matrix: Solid

Date Received: 07/16/20 10:40

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1	157365	07/29/20 14:40	CPF	TAL BUR
Total/NA	Analysis	D4318		1	157329	07/28/20 20:15	MAP	TAL BUR

Client Sample ID: IJW-SC-9-3

Lab Sample ID: 200-54398-3

Date Collected: 06/16/20 14:30

Matrix: Solid

Date Received: 07/16/20 10:40

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1	157365	07/29/20 14:40	CPF	TAL BUR
Total/NA	Analysis	D4318		1	157329	07/28/20 20:15	MAP	TAL BUR

Laboratory References:

TAL BUR = Eurofins TestAmerica, Burlington, 30 Community Drive, Suite 11, South Burlington, VT 05403, TEL (802)660-1990

Accreditation/Certification Summary

Client: Friedman & Bruya
Project/Site: 006296

Job ID: 200-54398-1

Laboratory: Eurofins TestAmerica, Burlington

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
ANAB	Dept. of Defense ELAP	L2336	02-25-23
Connecticut	State	PH-0751	09-30-21
DE Haz. Subst. Cleanup Act (HSCA)	State	N/A	05-16-21
Florida	NELAP	E87467	06-30-21
Minnesota	NELAP	050-999-436	12-31-20
New Hampshire	NELAP	2006	12-18-20
New Jersey	NELAP	VT972	06-30-21
New York	NELAP	10391	04-01-21
Pennsylvania	NELAP	68-00489	04-30-21
Rhode Island	State	LAO00298	12-30-20
US Fish & Wildlife	US Federal Programs	058448	07-31-20
USDA	US Federal Programs	P330-17-00272	08-09-20
Vermont	State	VT4000	12-31-20
Virginia	NELAP	460209	12-14-20
Wisconsin	State	399133350	08-31-21

Method Summary

Client: Friedman & Bruya
Project/Site: 006296

Job ID: 200-54398-1

Method	Method Description	Protocol	Laboratory
Moisture	Percent Moisture	EPA	TAL BUR
D4318	Liquid Limit, Plastic Limit and Plasticity Index of Soils	ASTM	TAL BUR

Protocol References:

ASTM = ASTM International
EPA = US Environmental Protection Agency

Laboratory References:

TAL BUR = Eurofins TestAmerica, Burlington, 30 Community Drive, Suite 11, South Burlington, VT 05403, TEL (802)660-1990

Sample Summary

Client: Friedman & Bruya
Project/Site: 006296

Job ID: 200-54398-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received	Asset ID
200-54398-1	IJW-SC-3-3	Solid	06/17/20 09:30	07/16/20 10:40	
200-54398-2	IJW-SC-4-3	Solid	06/17/20 12:25	07/16/20 10:40	
200-54398-3	IJW-SC-9-3	Solid	06/16/20 14:30	07/16/20 10:40	

SUBCONTRACT SAMPLE CHAIN OF CUSTODY

Send Report To Michael Erdahl
Company Friedman and Bruya, Inc.
Address 3012 16th Ave W
City, State, ZIP Seattle, WA 98119
Phone # (206) 285-8282 merdahl@friedmanandbruya.com

SUBCONTRACTER Test America
PROJECT NAME/NO. 006296
PO # A-305
REMARKS
Please Email Results

Page # 1 of 1

TURNAROUND TIME
☒ Standard TAT
☐ RUSH
Rush charges authorized by:

SAMPLE DISPOSAL
☐ Dispose after 30 days
☐ Return samples
☐ Will call with instructions

						ANALYSES REQUESTED										
Sample ID	Lab ID	Date Sampled	Time Sampled	Matrix	# of jars	Dioxins/Furans	EPH	VPH	Atterberg Limits							Notes
IJW-SC-3-3		6/17/20	0930	Soil	1				X							
IJW-SC-4-3		6/17/20	1225	Soil	1				X							
IJW-SC-9-3		6/16/20	1430	Soil	1				X							

200-54398 Chain of Custody

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282
Fax (206) 283-5044

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	Michael Erdahl	Friedman & Bruya	7/15/20	
Received by:	Rob McNabb	TA Bu	7/16/2020	10:40
Relinquished by:				
Received by:				

30100

FedEx Express *Package US Airbill*

FedEx Tracking Number 8137 9559 7030

fedex.com 1.800.GoFedEx 1.800.463.3339

1 From

Date 7/15/70 [redacted]

Sender's Name Michael Erdahl Phone 206 285-8282

Company FRIEDMAN & BRUYA INC

Address 3012 16TH AVE W

Dept/Floor/Suite/Room

City SEATTLE State WA ZIP 98119-2029

2 Your Internal Billing Reference :A: 308

3 To

Recipient's Name Kyse Zalani Phone 802 660-1990

Company Eurofins-TestAmerica

Address 30 Community Drive

We cannot deliver to P.O. boxes or P.O. ZIP codes.

Dept/Floor/Suite/Room

☐ Hold Weekday
FedEx location address REQUIRED. NOT available for FedEx First Overnight.

Address

Use this line for the HOLD location address or for continuation of your shipping address.

☐ Hold Saturday
FedEx location address REQUIRED. Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations.

City Burlington State VT ZIP 05403

0131964444

8137 9559 7030

Form ID No. 0215

4 Express Package Service *To most locations.

Packages up to 150 lbs. For packages over 150 lbs., use the FedEx Express Freight US Airbill.

Next Business Day

☐ FedEx First Overnight
Earliest next business morning delivery to select locations. Friday shipments will be delivered on Monday unless Saturday Delivery is selected.

☒ FedEx Priority Overnight
Next business morning.* Friday shipments will be delivered on Monday unless Saturday Delivery is selected.

☐ FedEx Standard Overnight
Next business afternoon.* Saturday Delivery NOT available.

2 or 3 Business Days

☐ FedEx 2Day A.M.
Second business morning.* Saturday Delivery NOT available.

☐ FedEx 2Day
Second business afternoon.* Thursday shipments will be delivered on Monday unless Saturday Delivery is selected.

☐ FedEx Express Saver
Third business day.* Saturday Delivery NOT available.

5 Packaging *Declared value limit $500.

☐ FedEx Envelope* ☐ FedEx Pak* ☐ FedEx Box ☐ FedEx Tube ☒ Other

6 Special Handling and Delivery Signature Options Fees may apply. See the FedEx Service Guide.

☐ Saturday Delivery
NOT available for FedEx Standard Overnight, FedEx 2Day A.M., or FedEx Express Saver.

☐ No Signature Required
Package may be left without obtaining a signature for delivery.

☐ Direct Signature
Someone at recipient's address may sign for delivery.

☐ Indirect Signature
If no one is available at recipient's address, someone at a neighboring address may sign for delivery. For residential deliveries only.

Does this shipment contain dangerous goods?

One box must be checked.

☒ No ☐ Yes As per attached Shipper's Declaration. ☐ Yes Shipper's Declaration not required. ☐ Dry Ice Dry Ice, 9, UN 1845 ____ x ____ kg

Restrictions apply for dangerous goods — see the current FedEx Service Guide. ☐ Cargo Aircraft Only

7 Payment *Bill to:*

Enter FedEx Acct. No. or Credit Card No. below.

☒ Sender Acct. No. in Section 1 will be billed. ☐ Recipient ☐ Third Party ☐ Credit Card ☐ Cash/Check ☐ Obtain recip. Acct. No.

[redacted]

[redacted]

Total Packages 1

Total Weight 12 lbs

Credit Card Auth.

†Our liability is limited to US$100 unless you declare a higher value. See the current FedEx Service Guide for details.

611

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Login Sample Receipt Checklist

Client: Friedman & Bruya

Job Number: 200-54398-1

Login Number: 54398
List Number: 1
Creator: Khudaier, Zahraa

List Source: Eurofins TestAmerica, Burlington

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	Lab does not accept radioactive samples.
The cooler's custody seal, if present, is intact.	N/A	Not present
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	3.2°C
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	N/A	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

30100

fedex.com 1.800.GoFedEx 1.800.463.3339

FedEx Express Package US Airbill

FedEx Tracking Number 8137 9559 7030

Form ID No. 0215

1 From [redacted]

Date 7/15/70

Sender's Name Michael Erdahl Phone 206 285-8282

Company FRIEDMAN & BRUYA INC

Address 3012 16TH AVE W

Dept./Floor/Suite/Room

City SEATTLE State WA ZIP 98119-2029

2 Your Internal Billing Reference A: 308

3 To

Recipient's Name Kyse Zalani Phone 802 660-1990

Company Eurofins-TestAmerica

Address 30 Community Drive

We cannot deliver to P.O. boxes or P.O. ZIP codes.

Dept./Floor/Suite/Room

Address

Use this line for the HOLD location address or for continuation of your shipping address.

☐ Hold Weekday FedEx location address REQUIRED. NOT available for FedEx First Overnight.

☐ Hold Saturday FedEx location address REQUIRED. Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations.

City Burlington State VT ZIP 05403

0131964444

8137 9559 7030

4 Express Package Service *To most locations.

Packages up to 150 lbs. For packages over 150 lbs., use the FedEx Express Freight US Airbill.

Next Business Day

☐ FedEx First Overnight Earliest next business morning delivery to select locations. Friday shipments will be delivered on Monday unless Saturday Delivery is selected.

☒ FedEx Priority Overnight Next business morning.* Friday shipments will be delivered on Monday unless Saturday Delivery is selected.

☐ FedEx Standard Overnight Next business afternoon.* Saturday Delivery NOT available.

2 or 3 Business Days

☐ FedEx 2Day A.M. Second business morning.* Saturday Delivery NOT available.

☐ FedEx 2Day Second business afternoon.* Thursday shipments will be delivered on Monday unless Saturday Delivery is selected.

☐ FedEx Express Saver Third business day.* Saturday Delivery NOT available.

5 Packaging *Declared value limit $500.

☐ FedEx Envelope* ☐ FedEx Pak* ☐ FedEx Box ☐ FedEx Tube ☒ Other

6 Special Handling and Delivery Signature Options Fees may apply. See the FedEx Service Guide.

☐ Saturday Delivery NOT available for FedEx Standard Overnight, FedEx 2Day A.M., or FedEx Express Saver.

☐ No Signature Required Package may be left without obtaining a signature for delivery.

☐ Direct Signature Someone at recipient's address may sign for delivery.

☐ Indirect Signature If no one is available at recipient's address, someone at a neighboring address may sign for delivery. For residential deliveries only.

Does this shipment contain dangerous goods?

One box must be checked.

☒ No ☐ Yes As per attached Shipper's Declaration. ☐ Yes Shipper's Declaration not required. ☐ Dry Ice Dry Ice, 9, UN 1845 ____ x ____ kg

Restrictions apply for dangerous goods — see the current FedEx Service Guide.

☐ Cargo Aircraft Only

7 Payment Bill to:

Enter FedEx Acct. No. or Credit Card No. below.

☒ Sender Acct. No. in Section 1 will be billed. ☐ Recipient ☐ Third Party ☐ Credit Card ☐ Cash/Check ☐ Obtain recip. Acct. No.

[redacted]

[redacted]

Total Packages 1

Total Weight 12 lbs lbs.

Credit Card Auth.

611

†Our liability is limited to US$100 unless you declare a higher value. See the current FedEx Service Guide for details.

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fedex.com 1.800.GoFedEx 1.800.463.3339

SUBCONTRACT SAMPLE CHAIN OF COUSTODY

Send Report To Michael Erdahl

Company Friedman and Bruya, Inc.

Address 3012 16th Ave W

City, State, ZIP Seattle, WA 98119

Phone # (206) 285-8282 merdahl@friedmanandbruya.com

SUBCONTRACTER Test America

PROJECT NAME/NO. 006296

PO # A-305

REMARKS

Please Email Results

Page # 1 of 1

TURNAROUND TIME
☒ Standard TAT
☐ RUSH
Rush charges authorized by:

SAMPLE DISPOSAL
☐ Dispose after 30 days
☐ Return samples
☐ Will call with instructions

						ANALYSES REQUESTED										
Sample ID	Lab ID	Date Sampled	Time Sampled	Matrix	# of jars	Dioxins/Furans	EPH	VPH	Atterberg Limits							Notes
IJW-SC-3-3		6/17/20	0930	soil	1				X							
IJW-SC-4-3		6/17/20	1225	soil	1				X							
IJW-SC-9-3		6/16/20	1430	soil	1				X							

200-54398 Chain of Custody

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282
Fax (206) 283-5044

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	Michael Erdahl	Friedman & Bruya	7/15/20	
Received by:	Rob McNabb	TA Buf	7/16/2020	10:40
Relinquished by:				
Received by:				

006296

SAMPLE CHAIN OF CUSTODY ME 06/18/20

BI4

Report To Jamie Stevens

Company CRETE Consulting

Address 108 S. Washington St.

City, State, ZIP Seattle, WA 98104

Phone 206-799-2744 Email jamie.stevens@creteconsulting.com

SAMPLERS (signature) [redacted]

Rusty Jones

PROJECT NAME	PO #
I&J Waterway – 1001 Hilton Ave	

REMARKS	INVOICE TO
Grain Size = Sieve + Hydrometer (X) - per RJ 7/14/20 ME	J. Stevens

Page # 1 of ~~5~~ RJ ④

TURNAROUND TIME

✓Standard Turnaround

RUSH

Rush charges authorized by:

SAMPLE DISPOSAL

Dispose after 30 days

Archive Samples

Other

						ANALYSES REQUESTED											
Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	cPAH	TOC	Nickel	Mercury	PAH	SVOCs	Dioxin/Furans	D/F like Cong.	ARCHIVE	Grain Size	Atterberg Limits	Notes
IJW-SS-14	01 AB	6.18.2020	0755	Sediment	② ~~1~~ RJ	x											
IJW-SS-14-200	02 AB	6.18.2020	0900	Sediment	② ~~1~~	x											
IJW-SC-2-1	03 A-C	6.17.2020	0810	Sediment	3		x	x	x	x	x	~~x~~	~~x~~				Hold D/F
IJW-SC-100	04	6.17.2020	1200	Sediment	3		x	x	x	x	x	~~x~~	~~x~~				testing per
IJW-SC-2-2	05		0815	Sediment	3									x			JS 6/22/20 ME
IJW-SC-2-3	06		0820	Sediment	3									x			
IJW-SC-2-4	07	6.17.2020	0825	Sediment	3									x			
IJW-SC-3-1	08 A-E	6.17.2020	0920	Sediment	⑤ ~~3~~ RJ		x	x	x	x	x	~~x~~	~~x~~		(X)	~~(X)~~	no - ME
~~IJW-SC-3-2~~				~~Sediment~~	~~3~~									~~x~~			RJ
IJW-SC-3-3	09 A-E	6.17.2020	0930	Sediment	⑤ ~~3~~ RJ									x	(X)	(X)	
IJW-SC-3-4	10 A-C		0935	Sediment	3									x			

ME

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by: R. Jones	Rusty Jones	CRETE Consulting	6.18.2020	1347
Received by:	Nhan Phan	FEBI	6-18-2020	1347
Relinquished by:		Samples received at 3 °C		
Received by:				

006296

SAMPLE CHAIN OF CUSTODY ME 06/18/20

BI4

Report To Jamie Stevens

Company CRETE Consulting

Address 108 S. Washington St.

City, State, ZIP Seattle. WA 98104

Phone 206-799-2744 Email jamie.stevens@creteconsulting.com

SAMPLERS (*signature*) Rusty Jones	
PROJECT NAME I&J Waterway – 1001 Hilton Ave	PO #
REMARKS	INVOICE TO J. Stevens

Page # 2 of ~~3~~ 4

TURNAROUND TIME
✓ Standard Turnaround
RUSH
Rush charges authorized by:

SAMPLE DISPOSAL
Dispose after 30 days
Archive Samples
Other

						ANALYSES REQUESTED											
Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	cPAH	TOC	Nickel	Mercury	PAH	SVOCs	Dioxin/Furans	D/F like Cong.	ARCHIVE	Grain Size	Atterberg Limits	(y)-per JS 7/15/20 ME Notes
IJW-SS-15	11 A-B	6.18.20	0815	Sediment	~~1~~ 2	⊗								~~x~~			
IJW-SS-16	12	↓	0905	Sediment	~~1~~ 2	⊗								~~x~~			
IJW-SS-17	13	↓	0930	Sediment	~~1~~ 2	⊗								~~x~~			
IJW-SC-1-1	14 A-C	6.16.20	1300	Sediment	3									x			
IJW-SC-1-2	15	6.16.20	1305	Sediment	3									x			
IJW-SC-1-3	16	6.16.20	1310	Sediment	3									x			
~~IJW-SC-1-4~~				~~Sediment~~	~~3~~									~~x~~			RS
IJW-SC-4-1	17 A-C	6.17.2020	1215	Sediment	3									x			
IJW-SC-4-2	18 A-E	↓	1220	Sediment	5 ~~3~~ RS									x	⊗	⊗	no Atterberg Limits ME
IJW-SC-4-3	19 A-E	↓	1225	Sediment	5 ~~3~~ RS									x	⊗	⊗	

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by: R. Jones	Rusty Jones	CRETE Consulting	6.18.2020	
Received by:	Nhan Phan	FeBI	6-18-20	1347
Relinquished by:				
Received by:				

006296

SAMPLE CHAIN OF CUSTODY

ME 06/18/20

524

Page # 3 of ~~3~~ ④

Report To Jamie Stevens

Company CRETE Consulting

Address 108 S. Washington St.

City, State, ZIP Seattle, WA 98104

Phone 206-799-2744 Email jamie.stevens@creteconsulting.com

SAMPLERS (*signature*) Rusty Jones	
PROJECT NAME I&J Waterway – 1001 Hilton Ave	PO #
REMARKS	INVOICE TO J. Stevens

TURNAROUND TIME
✓ Standard Turnaround
RUSH
Rush charges authorized by:

SAMPLE DISPOSAL
Dispose after 30 days
Archive Samples
Other

						ANALYSES REQUESTED											
Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	cPAH	TOC	Nickel	Mercury	PAH	SVOCs	Dioxin/Furans	D/F like Cong.	ARCHIVE			Notes
~~IJW-SC-4-4~~				~~Sediment~~	~~3~~									~~x~~			RJ
IJW-SC-5-1	20A-C	6.16.2020	1615	Sediment	3									x			
IJW-SC-5-2	21	↓	1620	Sediment	3									x			
IJW-SC-5-3	22		1625	Sediment	3									x			
~~IJW-SC-5-4~~				~~Sediment~~	~~3~~									~~x~~			RJ
IJW-SC-6-1	23A-C	6.17.2020	1540	Sediment	3									x			
IJW-SC-6-2	24 A-E	↓	1545	Sediment	⑤ ~~3~~ RJ									x			
IJW-SC-6-3	25 A-E		1550	Sediment	⑤ ~~3~~ RJ									x			
~~IJW-SC-6-4~~				~~Sediment~~	~~3~~									~~x~~			RJ
IJW-SC-7-1	26 A-C	6.17.2020	1100	Sediment	3									x			
IJW-SC-7-2	27 A-C	↓	1105	Sediment	3									x			

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by: R. Jones	Rusty Jones	CRETE Consulting	6.18.2020	
Received by:	Nhan Phan	FeBI	6-18-20	1347
Relinquished by:				
Received by:				

000246
[redacted]

Report To Jamie Stevens

Company CRETE Consulting

Address 108 S. Washington St.

City, State, ZIP Seattle, WA 98104

Phone 206-799-2744 Email jamie.stevens@creteconsulting.com

SAMPLERS (*signature*) Rusty Jones	ME 06/18/20 [redacted]
PROJECT NAME I&J Waterway – 1001 Hilton Ave	PO #
REMARKS	INVOICE TO J. Stevens

Page # 4 of 4

TURNAROUND TIME
✓ Standard Turnaround BIY RUSH Rush charges authorized by:
SAMPLE DISPOSAL Dispose after 30 days Archive Samples Other

						ANALYSES REQUESTED											
Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	cPAH	TOC	Nickel	Mercury	PAH	SVOCs	Dioxin/Furans	D/F like Cong.	ARCHIVE	Grain Size	Atterberg Limits	Notes
IJW-SC-7-3	28 A-C	6.17.2020	1110	Sediment	3									x			
~~IJW-SC-7-4~~				~~Sediment~~	~~3~~									~~x~~			RJ
IJW-SC-8-1	29 A-E	6.17.2020	1435	Sediment	⑤ ~~3~~ RJ									x	ⓧ		
IJW-SC-8-2	30 A-E	↓	1440	Sediment	⑤ ~~3~~ RJ									x	ⓧ		
~~IJW-SC-8-3~~ RJ IJW-SC-8-5	31 A-E	6.17.2020	1445	Sediment	⑤ ~~3~~ RJ									x			
~~IJW-SC-8-4~~				~~Sediment~~	~~3~~									~~x~~			RJ
IJW-SC-9-1	32 A-C	6.16.20	1420	Sediment	3									x			
IJW-SC-9-2	33 A-F	6.16.20	1425	Sediment	⑥ ~~3~~ RJ									x	ⓧ		
IJW-SC-9-3	34 A-F	6.16.20	1430	Sediment	⑥ ~~3~~ RJ									x	ⓧ	ⓧ	
~~IJW-SC-9-4~~				~~Sediment~~	~~3~~									~~x~~			RJ

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by: R. Jones	Rusty Jones	CRETE Consulting	6.18.2020	
Received by:	Nhan Phan	FeBI	6-18-20	1347
Relinquished by:				
Received by:				

3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Friedman & Bruya
Michael Erdahl
3012 16th Ave. W.
Seattle, WA 98119

RE: 006296
Work Order Number: 2007225

Attention Michael Erdahl:

Fremont Analytical, Inc. received 8 sample(s) on 7/15/2020 for the analyses presented in the following report.

Grain Size by ASTM D422

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Brianna Barnes
Project Manager

CC:
Grant Hainsworth

DoD-ELAP Accreditation #79636 by PJLA, ISO/IEC 17025:2017 and QSM 5.3 for Environmental Testing
ORELAP Certification: WA 100009 (NELAP Recognized) for Environmental Testing
Washington State Department of Ecology Accredited for Environmental Testing, Lab ID C910

CLIENT: Friedman & Bruya
Project: 006296
Work Order: 2007225

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2007225-001	IJW-SC-3-1	06/17/2020 9:20 AM	07/15/2020 10:23 AM
2007225-002	IJW-SC-3-3	06/17/2020 9:30 AM	07/15/2020 10:23 AM
2007225-003	IJW-SC-4-2	06/17/2020 12:20 PM	07/15/2020 10:23 AM
2007225-004	IJW-SC-4-3	06/17/2020 12:25 PM	07/15/2020 10:23 AM
2007225-005	IJW-SC-8-1	06/17/2020 2:35 PM	07/15/2020 10:23 AM
2007225-006	IJW-SC-8-2	06/17/2020 2:40 PM	07/15/2020 10:23 AM
2007225-007	IJW-SC-9-2	06/16/2020 2:25 PM	07/15/2020 10:23 AM
2007225-008	IJW-SC-9-3	06/16/2020 2:30 PM	07/15/2020 10:23 AM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **2007225**

Date:

CLIENT: Friedman & Bruya

Project: 006296

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Note: The grainsize data indicate a discontinuity between the sieve analyses and hydrometer analyses in the size range below 100 microns. It is not uncommon to observe a discontinuity in this range due to differences in analytical procedure and the effects of irregular soil particle shape. In some samples, this effect is more pronounced than expected. Data for percent fines produced by the hydrometer may be biased high.

Qualifiers:

* - Flagged value is not within established control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20% Drift or minimum RRF)
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Reporting Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
DUP - Sample Duplicate
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
REP - Sample Replicate
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Grain Size by ASTM D422

Project: 006296
Client: Friedman & Bruya
Lab Project #: 2007225

Percent Finer (Passing) than the Indicated Size

UOM = Percent

Grain Size Classification	***Gravel***						***Coarse Sand***	***Medium Sand***		***Fine Sand***			***Silt and Finer***
Sieve Size	**3"**	**2"**	**1 1/2"**	**1"**	**3/4"**	**3/8"**	**#4**	**#10**	**#20**	**#40**	**#60**	**#140**	**#200**
Particle Size (Microns)	**76200**	**50800**	**38100**	**25400**	**19050**	**9525**	**4750**	**2000**	**850**	**425**	**250**	**106**	**75**
IJW-SC-3-1	100%	100%	100%	100%	100%	92.0%	83.0%	73.4%	67.3%	57.9%	42.9%	11.3%	8.56%
IJW-SC-3-3	100%	100%	100%	100%	100%	98.4%	92.5%	71.4%	52.7%	41.4%	33.6%	21.9%	17.2%
IJW-SC-4-2	100%	100%	100%	64.7%	29.1%	13.8%	5.92%	0.939%	0.853%	0.646%	0.373%	-0.127%	-0.286%
IJW-SC-4-3	100%	100%	100%	100%	100%	99.3%	97.1%	79.2%	59.4%	46.8%	37.6%	24.6%	18.6%
IJW-SC-8-1	100%	100%	100%	100%	100%	97.2%	94.4%	90.9%	88.8%	83.0%	65.6%	24.5%	20.1%
IJW-SC-8-2	100%	100%	100%	100%	100%	100%	97.3%	84.1%	76.2%	67.9%	59.6%	38.5%	33.0%
IJW-SC-9-2	100%	100%	100%	100%	100%	94.5%	72.7%	40.6%	33.3%	26.8%	22.5%	17.5%	16.4%
IJW-SC-9-3	100%	100%	77.6%	63.3%	23.7%	9.06%	7.17%	2.19%	0.985%	0.667%	0.289%	-0.327%	-0.483%

Grain Size by ASTM D422

Project: 006296
Client: Friedman & Bruya
Lab Project #: 2007225

Percent Retained in Each Size Fraction

UOM = Percent

Grain Size Classification	***Gravel***							***Coarse Sand***	***Medium Sand***		***Fine Sand***			***Silt and Finer***
Sieve Size (Microns)	**>76200**	**76200-50800**	**50800-38100**	**38100-25400**	**25400-19000**	**19050-9525**	**9525-4750**	**4750-2000**	**2000-850**	**850-425**	**425-250**	**250-106**	**106-75**	**<75**
IJW-SC-3-1	0.00%	0.00%	0.00%	0.00%	0.00%	8.05%	9.00%	9.53%	6.12%	9.36%	15.0%	31.6%	2.70%	8.56%
IJW-SC-3-3	0.00%	0.00%	0.00%	0.00%	0.00%	1.60%	5.92%	21.1%	18.8%	11.2%	7.79%	11.7%	4.70%	17.2%
IJW-SC-4-2	0.00%	0.00%	0.00%	35.3%	35.6%	15.4%	7.84%	4.98%	0.0866%	0.206%	0.273%	0.500%	0.160%	-0.286%
IJW-SC-4-3	0.00%	0.00%	0.00%	0.00%	0.00%	0.682%	2.21%	17.9%	19.8%	12.6%	9.20%	13.0%	5.95%	18.6%
IJW-SC-8-1	0.00%	0.00%	0.00%	0.00%	0.00%	2.80%	2.75%	3.52%	2.11%	5.77%	17.4%	41.1%	4.40%	20.1%
IJW-SC-8-2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.67%	13.2%	7.88%	8.27%	8.30%	21.2%	5.48%	33.0%
IJW-SC-9-2	0.00%	0.00%	0.00%	0.00%	0.00%	5.50%	21.8%	32.1%	7.25%	6.57%	4.31%	4.95%	1.07%	16.4%
IJW-SC-9-3	0.00%	0.00%	22.4%	14.2%	39.7%	14.6%	1.88%	4.99%	1.20%	0.319%	0.377%	0.616%	0.157%	-0.483%

3600 Fremont Ave. N.
Seattle, WA 98103
Tel: 206-352-3790
Fax: 206-352-7178
Email: info@fremontanalytical.com

Grainsize by ASTM D422 - Hydrometer

Project: 006296
Client: Friedman & Bruya
Lab Project #: 2007225

	Specific Gravity Determination				Hygroscopic Moisture Determination		
Sample	**Initial Mass of Volumetric Flask + Water**	**Mass of Soil in empty flask**	**Flask with Soil filled to 500mL DI**	**Specific Gravity**	**Air Dried Weight (g)**	**Oven Dried Weight (g)**	**Hygroscopic Moisture Correction Factor**
IJW-SC-3-1	500	87.0	550	2.35	10.0	9.79	0.979
IJW-SC-3-3	660	30.4	676	2.11	10.0	9.84	0.984
IJW-SC-4-2	500	87.0	550	2.35	10.0	9.79	0.979
IJW-SC-4-3	660	30.0	679	2.75	10.0	9.80	0.980
IJW-SC-8-1	500	87.0	550	2.35	10.0	9.79	0.979
IJW-SC-8-2	660	22.3	672	2.17	10.0	9.68	0.968
IJW-SC-9-2	660	6.84	664	2.43	5.00	4.82	0.964
IJW-SC-9-3	500	87.0	550	2.35	10.0	9.79	0.979

Grainsize by ASTM D422 - Hydrometer

Project: 006296
Client: Friedman & Bruya
Lab Project #: 2007225

Sample 1: IJW-SC-3-1

Corrected Soil Weight through #10: 49.8
Air-dried aliquot through #10 used for hydrometer: 50.9
Biased Sample Weight 67.8

Time (minutes)	2	5	15	30	60	250	1440
Temperature, ℃	21.8	21.9	22.0	22.3	22.6	24.3	22.0
Hydrometer Reading	21.0	20.3	20.0	18.0	16.3	13.0	11.3
Percent finer than	26.6%	25.4%	25.0%	21.9%	19.2%	14.1%	11.3%
Diameter of particle (microns)	36.5	23.2	13.2	9.46	6.79	3.31	1.43

Sample 2: IJW-SC-3-3

Corrected Soil Weight through #10: 49.5
Air-dried aliquot through #10 used for hydrometer: 50.3
Biased Sample Weight 69.3

Time (minutes)	2	5	15	30	60	250	1440
Temperature, ℃	22.6	22.6	22.4	22.3	22.2	22.9	22.3
Hydrometer Reading	31.5	29.0	26.0	24.5	22.0	18.0	13.8
Percent Finer than	42.0%	38.2%	33.6%	31.3%	27.5%	21.4%	14.9%
Diameter of particle (microns)	33.6	21.6	12.7	9.14	6.54	3.28	1.41

Sample 3: IJW-SC-4-2

Corrected Soil Weight through #10: 11.6
Air-dried aliquot through #10 used for hydrometer: 11.8
Biased Sample Weight 1234

Time (minutes)	2	5	15	30	60	250	1440
Temperature, ℃	22.1	22.2	22.3	22.5	22.8	24.4	22.2
Hydrometer Reading	16.0	14.5	14.0	13.3	13.0	9.75	9.00
Percent Finer than	1.03%	0.902%	0.859%	0.795%	0.773%	0.494%	0.430%
Diameter of particle (microns)	37.2	23.8	13.7	9.78	6.91	3.38	1.44

Grainsize by ASTM D422 - Hydrometer

Project: 006296
Client: Friedman & Bruya
Lab Project #: 2007225

Sample 4: IJW-SC-4-3

Corrected Soil Weight through #10: 49.3
Air-dried aliquot through #10 used for hydrometer: 50.3
Biased Sample Weight 62.3

Time (minutes)	2	5	15	30	60	250	1440
Temperature, ℃	22.8	22.8	22.8	22.8	22.9	23.8	23.5
Hydrometer Reading	36.5	33.3	30.0	27.5	25.0	20.0	15.0
Percent Finer than	51.7%	46.5%	41.3%	37.4%	33.4%	25.4%	17.5%
Diameter of particle (microns)	29.9	19.4	11.4	8.26	5.92	2.96	1.27

Sample 5: IJW-SC-8-1

Corrected Soil Weight through #10: 49.0
Air-dried aliquot through #10 used for hydrometer: 50.1
Biased Sample Weight 53.9

Time (minutes)	2	5	15	30	60	250	1440
Temperature, ℃	22.3	22.3	22.4	22.5	22.7	23.5	22.7
Hydrometer Reading	17.0	15.0	13.0	11.5	10.5	9.25	7.00
Percent Finer than	25.6%	21.6%	17.7%	14.8%	12.8%	10.3%	5.90%
Diameter of particle (microns)	36.9	23.6	13.8	9.88	7.03	3.42	1.46

Sample 6: IJW-SC-8-2

Corrected Soil Weight through #10: 48.7
Air-dried aliquot through #10 used for hydrometer: 50.3
Biased Sample Weight 57.9

Time (minutes)	2	5	15	30	60	250	1440
Temperature, ℃	22.7	22.7	22.8	22.8	22.9	23.7	23.5
Hydrometer Reading	32.0	30.5	27.5	25.0	22.0	16.5	12.3
Percent Finer than	51.2%	48.5%	43.0%	38.4%	32.9%	22.9%	15.1%
Diameter of particle (microns)	33.5	21.5	12.7	9.06	6.54	3.29	1.40

Grainsize by ASTM D422 - Hydrometer

Project: 006296
Client: Friedman & Bruya
Lab Project #: 2007225

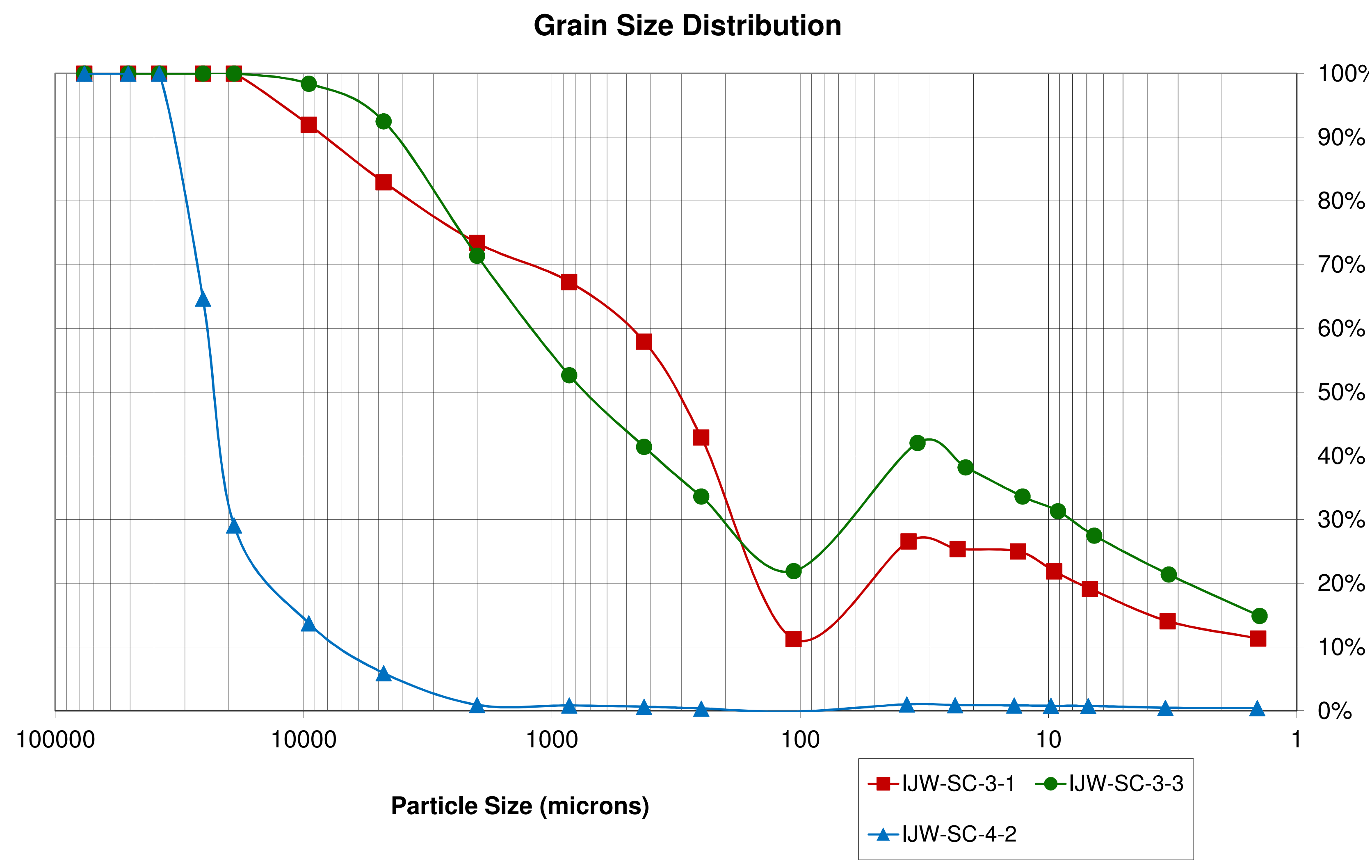
Sample 7:	**IJW-SC-9-2**						
Corrected Soil Weight through #10:	48.6		Air-dried aliquot through #10 used for hydrometer:		50.5		
Biased Sample Weight	120						
Time (minutes)	2	5	15	30	60	250	1440
Temperature,℃	22.4	22.4	22.3	22.2	22.1	23.0	22.5
Hydrometer Reading	26.0	25.0	24.0	21.5	18.0	12.3	9.75
Percent Finer than	19.5%	18.6%	17.7%	15.5%	12.4%	7.30%	5.09%
Diameter of particle (microns)	34.8	22.2	12.9	9.32	6.69	3.40	1.44

Sample 8:	**IJW-SC-9-3**						
Corrected Soil Weight through #10:	18.3		Air-dried aliquot through #10 used for hydrometer:		18.7		
Biased Sample Weight	837						
Time (minutes)	2	5	15	30	60	250	1440
Temperature,℃	22.3	22.4	22.5	22.6	22.7	23.6	22.7
Hydrometer Reading	10.0	9.75	8.50	8.25	7.75	7.00	7.00
Percent Finer than	0.760%	0.728%	0.570%	0.538%	0.475%	0.380%	0.380%
Diameter of particle (microns)	38.5	24.4	14.2	10.05	7.15	3.46	1.46

3600 Fremont Ave. N.
Seattle, WA 98103
Tel: 206-352-3790
Fax: 206-352-7178
Email: info@fremontanalytical.com

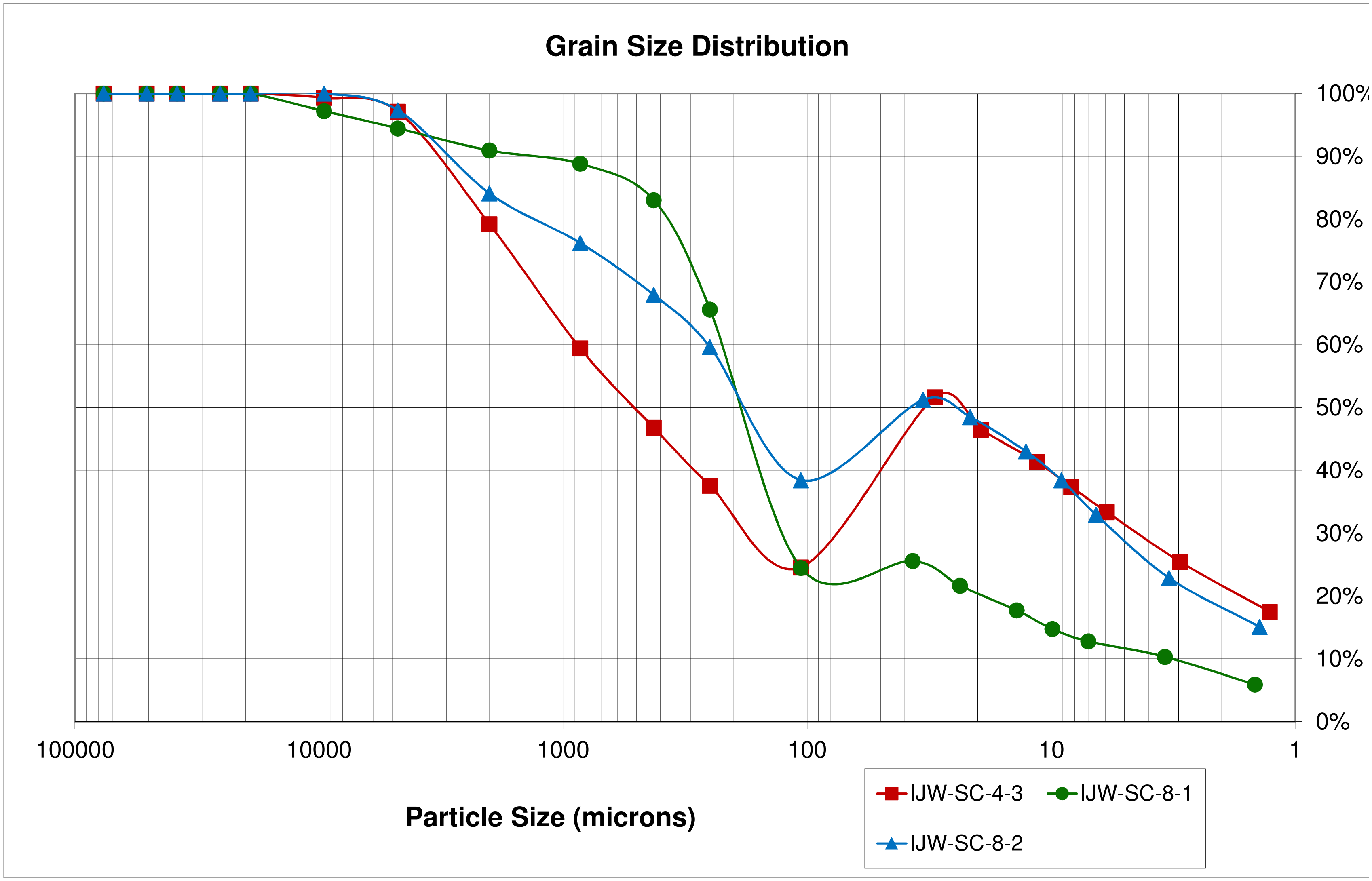
Grain Size by ASTM D422

Project: 006296
Client: Friedman & Bruya
Lab Project #: 2007225



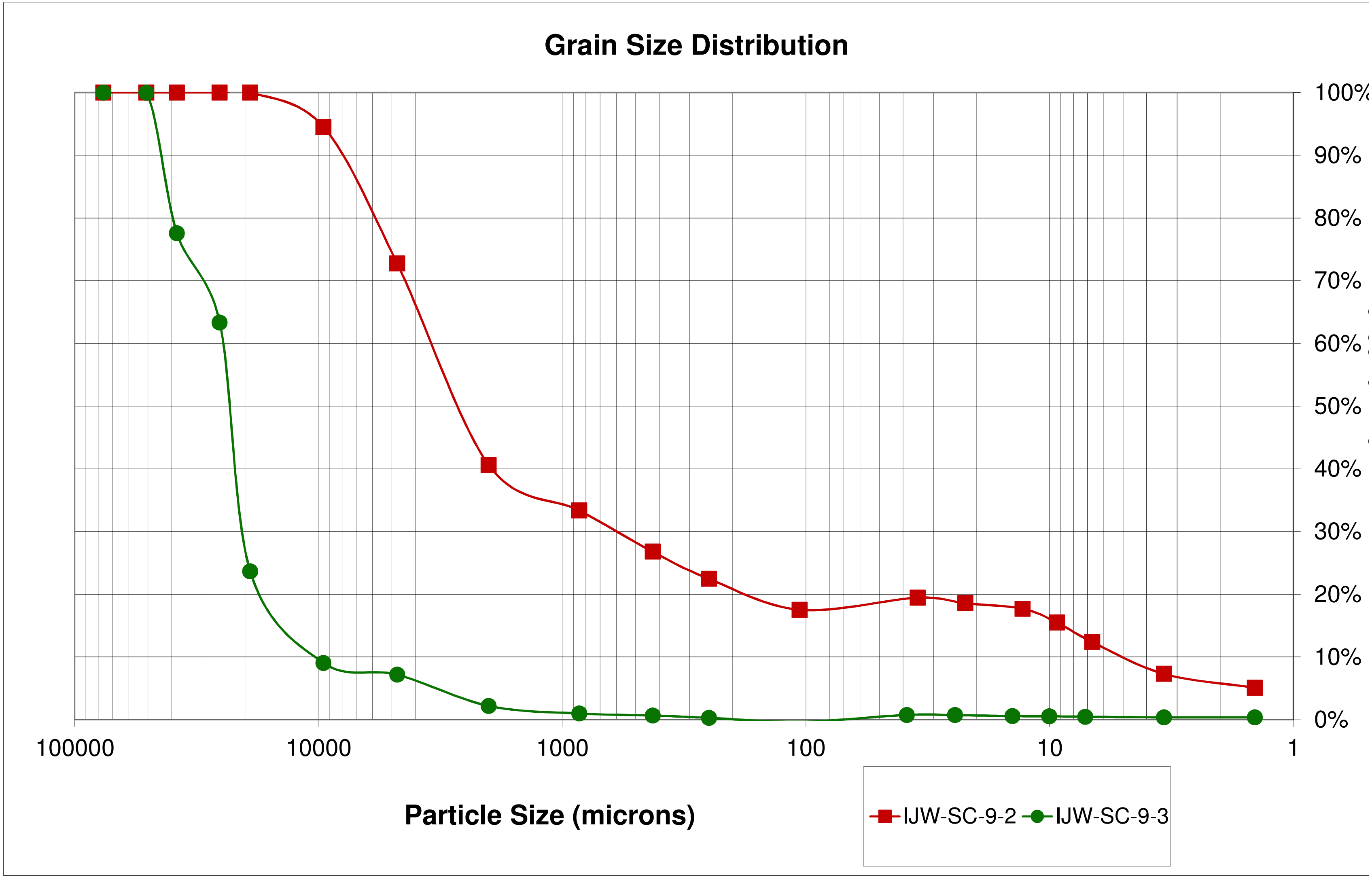
Grain Size by ASTM D422

Project: 006296
Client: Friedman & Bruya
Lab Project #: 2007225



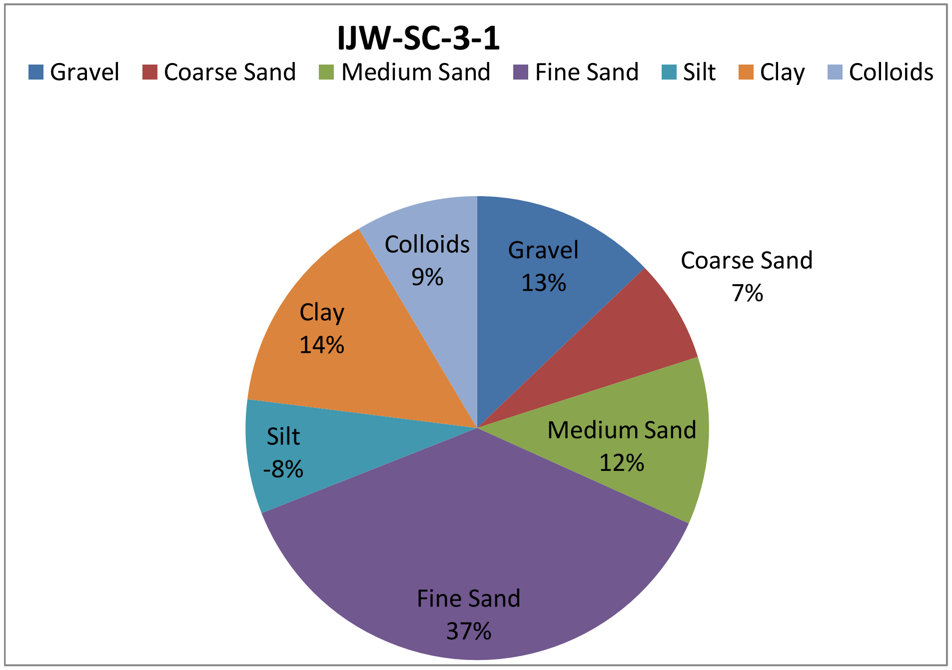
Grain Size by ASTM D422

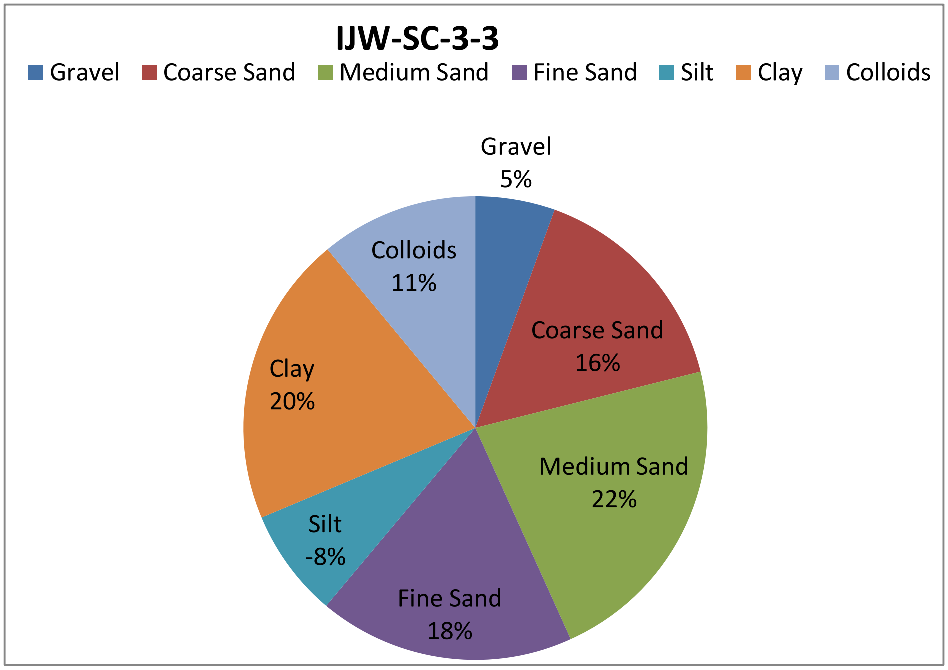
Project: 006296
Client: Friedman & Bruya
Lab Project #: 2007225

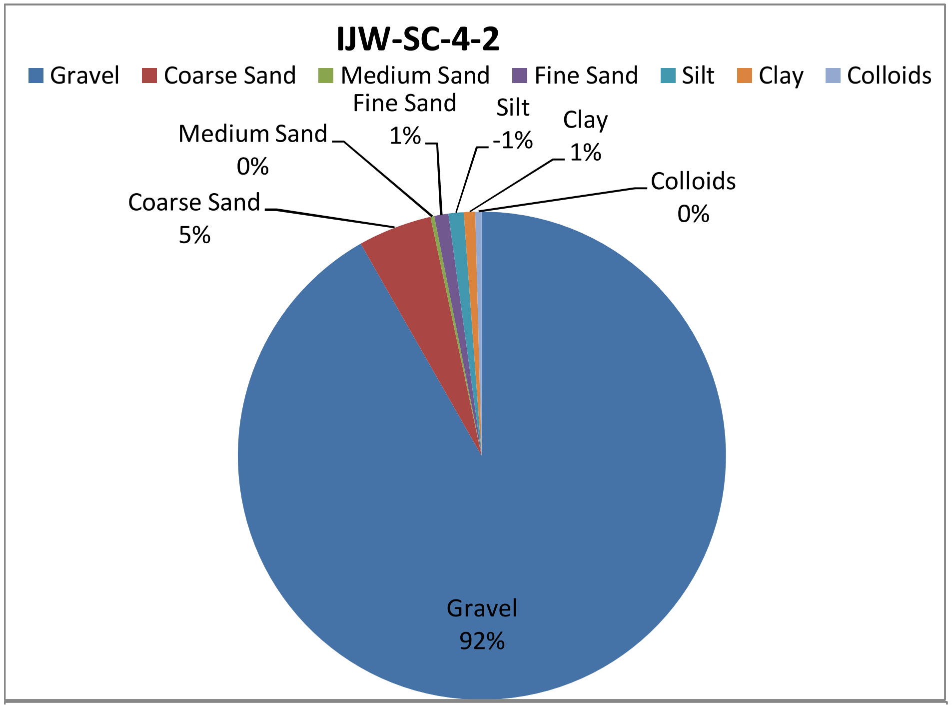


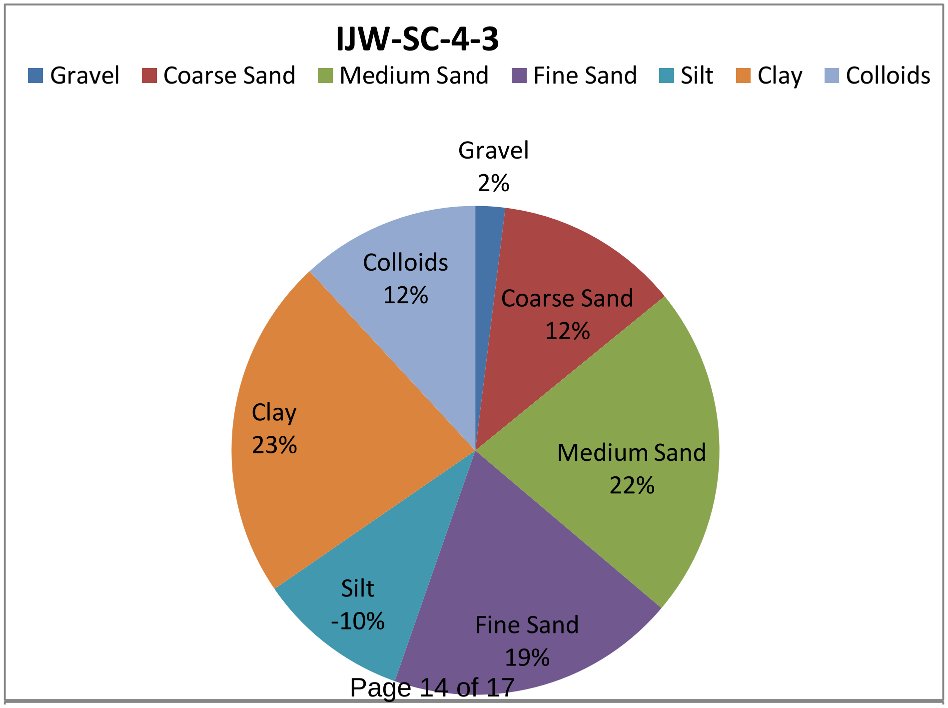
Project: 006296
Client: Friedman & Bruya
Lab Project #: 2007225

Percent Retained in Each Size Fraction



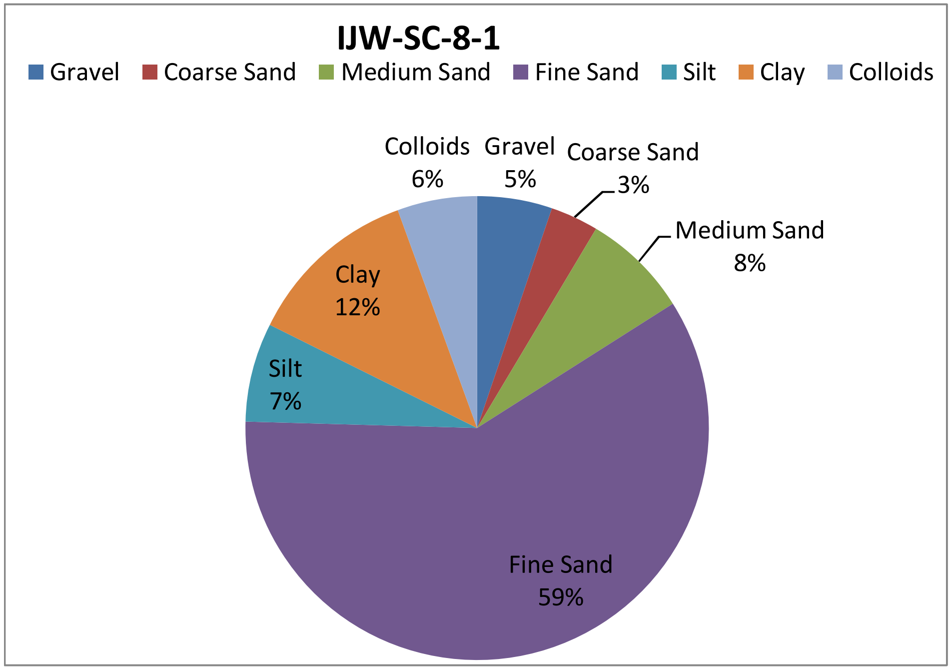


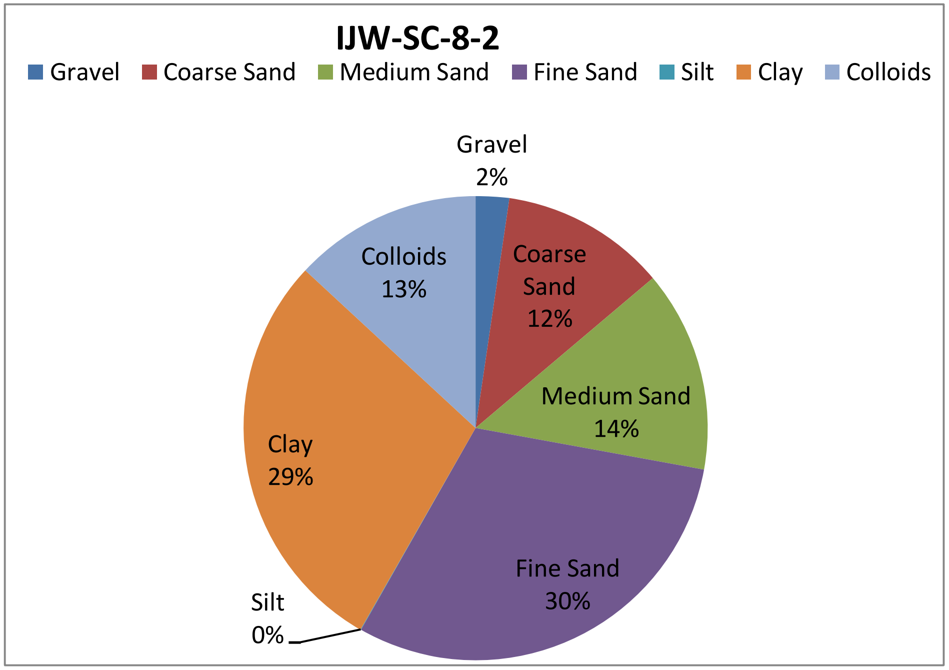


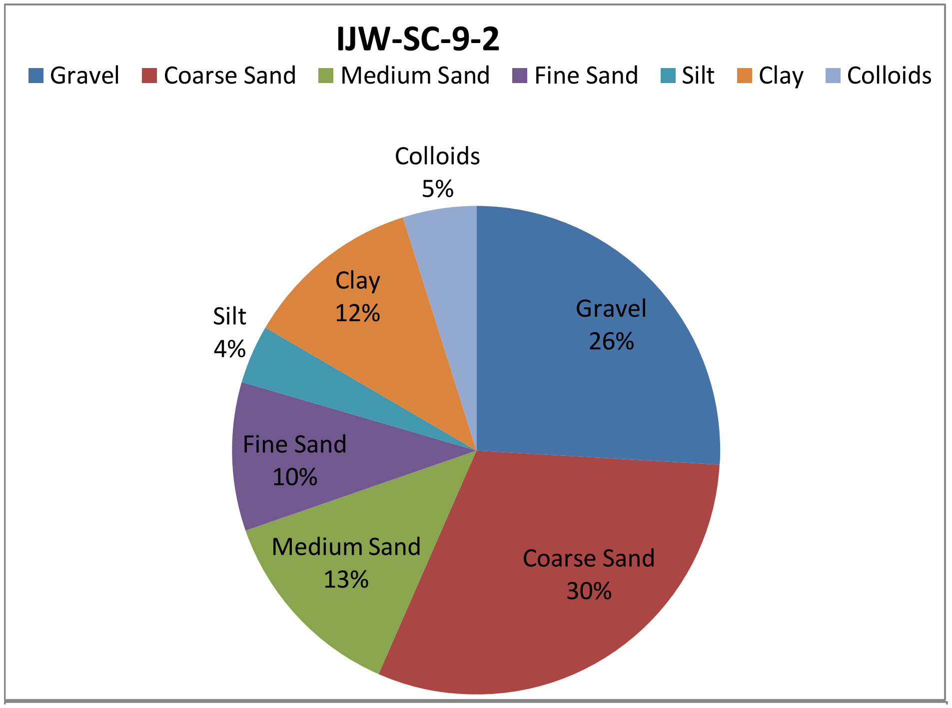


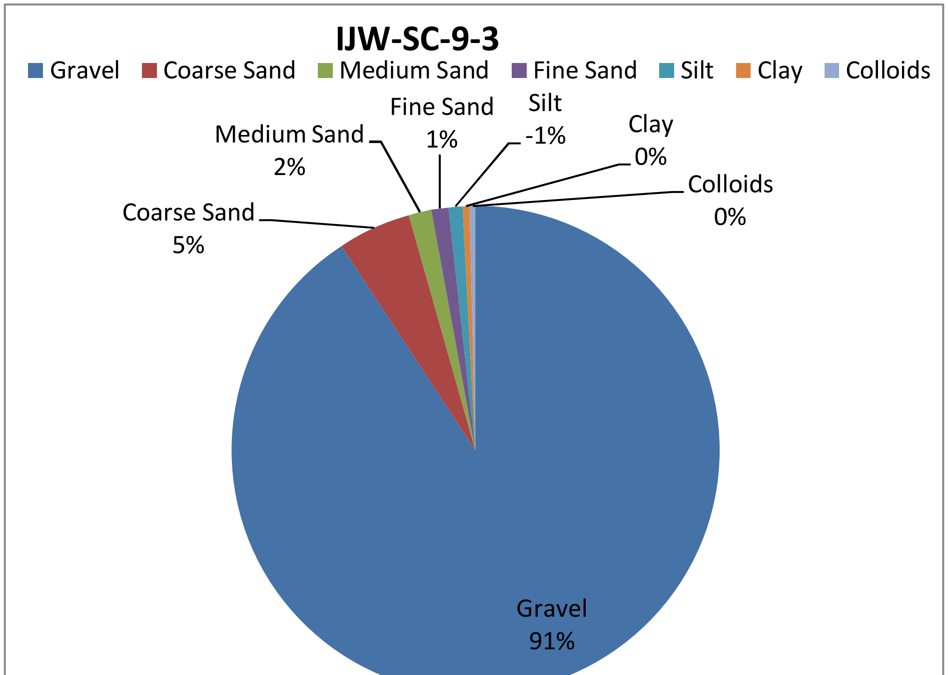
Project: 006296
Client: Friedman & Bruya
Lab Project #: 2007225

Percent Retained in Each Size Fraction









Fremont Analytical

Sample Log-In Check List

Client Name: **FB**
Work Order Number: **2007225**
Logged by: **Gabrielle Coeuille**
Date Received: **7/15/2020 10:23:00 AM**

Chain of Custody

1. Is Chain of Custody complete? Yes ☑ No ☐ Not Present ☐
2. How was the sample delivered? Client

Log In

3. Coolers are present? Yes ☑ No ☐ NA ☐
4. Shipping container/cooler in good condition? Yes ☑ No ☐
5. Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact) Yes ☐ No ☐ Not Present ☑
6. Was an attempt made to cool the samples? Yes ☑ No ☐ NA ☐
7. Were all items received at a temperature of >2°C to 6°C * Yes ☑ No ☐ NA ☐
8. Sample(s) in proper container(s)? Yes ☑ No ☐
9. Sufficient sample volume for indicated test(s)? Yes ☑ No ☐
10. Are samples properly preserved? Yes ☑ No ☐
11. Was preservative added to bottles? Yes ☐ No ☑ NA ☐
12. Is there headspace in the VOA vials? Yes ☐ No ☐ NA ☑
13. Did all samples containers arrive in good condition(unbroken)? Yes ☑ No ☐
14. Does paperwork match bottle labels? Yes ☑ No ☐
15. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
16. Is it clear what analyses were requested? Yes ☑ No ☐
17. Were all holding times able to be met? Yes ☑ No ☐

Special Handling (if applicable)

18. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified:
Date:
By Whom:
Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:
Client Instructions:

19. Additional remarks:

Item Information

Item #	Temp ºC
Cooler 1	1.8
Sample 1	3.2

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

2007225

SUBCONTRACT SAMPLE CHAIN OF CUSTODY

Page # 1 of 1

Send Report To Michael Erdahl
Company Friedman and Bruya, Inc.
Address 3012 16th Ave W
City, State, ZIP Seattle, WA 98119
Phone # (206) 285-8282 merdahl@friedmanandbruya.com

SUBCONTRACTER Fremont
PROJECT NAME/NO. 006296
PO # A.293
REMARKS
Please Email Results

TURNAROUND TIME
☒ Standard TAT
☐ RUSH
Rush charges authorized by:

SAMPLE DISPOSAL
☐ Dispose after 30 days
☐ Return samples
☐ Will call with instructions

						ANALYSES REQUESTED										
Sample ID	Lab ID	Date Sampled	Time Sampled	Matrix	# of jars	Dioxins/Furans	EPH	VPH	Grain Size w/ Hydrometer							Notes
IJW-SC-3-1		6/17/20	0920	soil	1				X							
IJW-SC-3-3		6/17/20	0930	soil	1				X							
IJW-SC-4-2		6/17/20	1220	soil	1				X							
IJW-SC-4-3		6/17/20	1225	soil	1				X							
IJW-SC-8-1		6/17/20	1435	soil	1				X							
IJW-SC-8-2		6/17/20	1440	soil	1				X							
IJW-SC-9-2		6/16/20	1425	soil	1				X							
IJW-SC-9-3		6/16/20	1430	soil	1				X							

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282
Fax (206) 283-5044

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	Michael Erdahl	Friedman & Bruya	7/15/20	0930
Received by:	Carter Johnson	FAI	7/15/20	1023
Relinquished by:				
Received by:				

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Yelena Aravkina, M.S.
Michael Erdahl, B.S.
Arina Podnozova, B.S.
Eric Young, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
(206) 285-8282
fbi@isomedia.com
www.friedmanandbruya.com

February 16, 2021

Grant Hainsworth, Project Manager
Crete Consulting
108 S. Washington St., Suite 300
Seattle, WA 98104

Dear Mr Hainsworth:

Included are the amended results from the testing of material submitted on January 27, 2021 from the I&J Waterway Phase 2 Sediment, F&BI 101387 project. Several 8270 reporting limits have been lowered to the required site levels.

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
c: Jamie Stevens, Rusty Jones
CTC0209R.DOC

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

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3012 16th Avenue West
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fbi@isomedia.com
www.friedmanandbruya.com

February 9, 2021

Grant Hainsworth, Project Manager
Crete Consulting
108 S. Washington St., Suite 300
Seattle, WA 98104

Dear Mr Hainsworth:

Included are the results from the testing of material submitted on January 27, 2021 from the I&J Waterway Phase 2 Sediment, F&BI 101387 project. There are 19 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days, or as directed by the Chain of Custody document. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
c: Jamie Stevens, Rusty Jones
CTC0209R.DOC

CASE NARRATIVE

This case narrative encompasses samples received on January 27, 2021 by Friedman & Bruya, Inc. from the Crete Consulting I&J Waterway Phase 2 Sediment, F&BI 101387 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	Crete Consulting
101387 -01	IJW-SC-11-3.4
101387 -02	IJW-SC-12-3
101387 -03	IJW-SC-13-4.1
101387 -04	IJW-SC-14-4.4
101387 -05	IJW-SC-15-3.6
101387 -06	IJW-SC-16-2.2

The samples were sent to Fremont Analytical for TOC analysis. The report is enclosed.

The 8270E laboratory control sample and laboratory control sample duplicate failed the relative percent difference for 4-chloroaniline. The analyte was not detected therefore the data were acceptable.

All other quality control requirements were acceptable.

Analysis For Total Metals By EPA Method 6020B

Client ID:	IJW-SC-11-3.4	Client:	Crete Consulting
Date Received:	01/27/21	Project:	I&J Waterway Phase 2 Sediment
Date Extracted:	01/29/21	Lab ID:	101387-01
Date Analyzed:	01/31/21	Data File:	101387-01.112
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Nickel	66.3

Analysis For Total Metals By EPA Method 6020B

Client ID:	IJW-SC-12-3	Client:	Crete Consulting
Date Received:	01/27/21	Project:	I&J Waterway Phase 2 Sediment
Date Extracted:	01/29/21	Lab ID:	101387-02
Date Analyzed:	01/31/21	Data File:	101387-02.113
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Nickel	74.3

Analysis For Total Metals By EPA Method 6020B

Client ID:	IJW-SC-13-4.1	Client:	Crete Consulting
Date Received:	01/27/21	Project:	I&J Waterway Phase 2 Sediment
Date Extracted:	01/29/21	Lab ID:	101387-03
Date Analyzed:	01/31/21	Data File:	101387-03.114
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Nickel	61.9

Analysis For Total Metals By EPA Method 6020B

Client ID:	IJW-SC-14-4.4	Client:	Crete Consulting
Date Received:	01/27/21	Project:	I&J Waterway Phase 2 Sediment
Date Extracted:	01/29/21	Lab ID:	101387-04
Date Analyzed:	01/31/21	Data File:	101387-04.115
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Nickel	70.5

Analysis For Total Metals By EPA Method 6020B

Client ID:	IJW-SC-15-3.6	Client:	Crete Consulting
Date Received:	01/27/21	Project:	I&J Waterway Phase 2 Sediment
Date Extracted:	01/29/21	Lab ID:	101387-05
Date Analyzed:	01/31/21	Data File:	101387-05.116
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Nickel	72.7

Analysis For Total Metals By EPA Method 6020B

Client ID:	IJW-SC-16-2.2	Client:	Crete Consulting
Date Received:	01/27/21	Project:	I&J Waterway Phase 2 Sediment
Date Extracted:	01/29/21	Lab ID:	101387-06
Date Analyzed:	01/31/21	Data File:	101387-06.117
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Nickel	235

Analysis For Total Metals By EPA Method 6020B

Client ID:	Method Blank	Client:	Crete Consulting
Date Received:	Not Applicable	Project:	I&J Waterway Phase 2 Sediment
Date Extracted:	01/29/21	Lab ID:	I1-54 mb2
Date Analyzed:	01/31/21	Data File:	I1-54 mb2.103
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Nickel	<5

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	IJW-SC-11-3.4	Client:	Crete Consulting
Date Received:	01/27/21	Project:	I&J Waterway Phase 2 Sediment
Date Extracted:	01/28/21	Lab ID:	101387-01
Date Analyzed:	01/29/21	Data File:	012913.D
Matrix:	Soil	Instrument:	GCMS8
Units:	mg/kg (ppm) Dry Weight	Operator:	YA

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	71	36	114
Phenol-d6	81	47	116
Nitrobenzene-d5	82	38	117
2-Fluorobiphenyl	83	50	150
2,4,6-Tribromophenol	87	25	187
Terphenyl-d14	102	50	150

Compounds:	Concentration mg/kg (ppm)	Compounds:	Concentration mg/kg (ppm)
Phenol	<0.1	2,6-Dinitrotoluene	<0.05
Bis(2-chloroethyl) ether	<0.01	3-Nitroaniline	<1
2-Chlorophenol	<0.1	Acenaphthene	0.0061
1,3-Dichlorobenzene	<0.01	2,4-Dinitrophenol	<0.3
1,4-Dichlorobenzene	<0.01	Dibenzofuran	0.013
1,2-Dichlorobenzene	<0.01	2,4-Dinitrotoluene	<0.05
Benzyl alcohol	<0.057	4-Nitrophenol	<0.3
2,2'-Oxybis(1-chloropropane)	<0.01	Diethyl phthalate	<0.1
2-Methylphenol	<0.063	Fluorene	0.011
Hexachloroethane	<0.01	4-Chlorophenyl phenyl ether	<0.01
N-Nitroso-di-n-propylamine	<0.01	N-Nitrosodiphenylamine	<0.01
3-Methylphenol + 4-Methylphenol	<0.2	4-Nitroaniline	<1
Nitrobenzene	<0.01	4,6-Dinitro-2-methylphenol	<0.3
Isophorone	<0.01	4-Bromophenyl phenyl ether	<0.01
2-Nitrophenol	<0.1	Hexachlorobenzene	<0.01
2,4-Dimethylphenol	<0.029	Pentachlorophenol	<0.05
Benzoic acid	<0.5	Phenanthrene	0.045
Bis(2-chloroethoxy)methane	<0.01	Anthracene	0.020
2,4-Dichlorophenol	<0.1	Carbazole	<0.01
1,2,4-Trichlorobenzene	<0.01	Di-n-butyl phthalate	<0.1
Naphthalene	0.014	Fluoranthene	0.097
Hexachlorobutadiene	<0.01	Pyrene	0.18
4-Chloroaniline	<1	Benzyl butyl phthalate	<0.1
4-Chloro-3-methylphenol	<0.1	Benz(a)anthracene	0.053
2-Methylnaphthalene	0.014	Chrysene	0.11
1-Methylnaphthalene	0.0061	Bis(2-ethylhexyl) phthalate	<0.16
Hexachlorocyclopentadiene	<0.03	Di-n-octyl phthalate	<0.1
2,4,6-Trichlorophenol	<0.1	Benzo(a)pyrene	0.063
2,4,5-Trichlorophenol	<0.1	Benzo(b)fluoranthene	0.13
2-Chloronaphthalene	<0.01	Benzo(k)fluoranthene	0.048
2-Nitroaniline	<0.05	Indeno(1,2,3-cd)pyrene	0.038
Dimethyl phthalate	<0.071	Dibenz(a,h)anthracene	0.0083
Acenaphthylene	<0.002	Benzo(g,h,i)perylene	0.030

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	IJW-SC-12-3	Client:	Crete Consulting
Date Received:	01/27/21	Project:	I&J Waterway Phase 2 Sediment
Date Extracted:	01/28/21	Lab ID:	101387-02
Date Analyzed:	01/29/21	Data File:	012914.D
Matrix:	Soil	Instrument:	GCMS8
Units:	mg/kg (ppm) Dry Weight	Operator:	YA

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	70	36	114
Phenol-d6	81	47	116
Nitrobenzene-d5	81	38	117
2-Fluorobiphenyl	82	50	150
2,4,6-Tribromophenol	85	25	187
Terphenyl-d14	98	50	150

Compounds:	Concentration mg/kg (ppm)	Compounds:	Concentration mg/kg (ppm)
Phenol	<0.1	2,6-Dinitrotoluene	<0.05
Bis(2-chloroethyl) ether	<0.01	3-Nitroaniline	<1
2-Chlorophenol	<0.1	Acenaphthene	0.0042
1,3-Dichlorobenzene	<0.01	2,4-Dinitrophenol	<0.3
1,4-Dichlorobenzene	<0.01	Dibenzofuran	<0.01
1,2-Dichlorobenzene	<0.01	2,4-Dinitrotoluene	<0.05
Benzyl alcohol	<0.057	4-Nitrophenol	<0.3
2,2'-Oxybis(1-chloropropane)	<0.01	Diethyl phthalate	<0.1
2-Methylphenol	<0.063	Fluorene	0.0089
Hexachloroethane	<0.01	4-Chlorophenyl phenyl ether	<0.01
N-Nitroso-di-n-propylamine	<0.01	N-Nitrosodiphenylamine	<0.01
3-Methylphenol + 4-Methylphenol	<0.2	4-Nitroaniline	<1
Nitrobenzene	<0.01	4,6-Dinitro-2-methylphenol	<0.3
Isophorone	<0.01	4-Bromophenyl phenyl ether	<0.01
2-Nitrophenol	<0.1	Hexachlorobenzene	<0.01
2,4-Dimethylphenol	<0.029	Pentachlorophenol	<0.05
Benzoic acid	<0.5	Phenanthrene	0.032
Bis(2-chloroethoxy)methane	<0.01	Anthracene	0.013
2,4-Dichlorophenol	<0.1	Carbazole	<0.01
1,2,4-Trichlorobenzene	<0.01	Di-n-butyl phthalate	<0.1
Naphthalene	0.011	Fluoranthene	0.072
Hexachlorobutadiene	<0.01	Pyrene	0.12
4-Chloroaniline	<1	Benzyl butyl phthalate	<0.1
4-Chloro-3-methylphenol	<0.1	Benz(a)anthracene	0.037
2-Methylnaphthalene	0.0098	Chrysene	0.057
1-Methylnaphthalene	0.0044	Bis(2-ethylhexyl) phthalate	<0.16
Hexachlorocyclopentadiene	<0.03	Di-n-octyl phthalate	<0.1
2,4,6-Trichlorophenol	<0.1	Benzo(a)pyrene	0.044
2,4,5-Trichlorophenol	<0.1	Benzo(b)fluoranthene	0.080
2-Chloronaphthalene	<0.01	Benzo(k)fluoranthene	0.027
2-Nitroaniline	<0.05	Indeno(1,2,3-cd)pyrene	0.026
Dimethyl phthalate	<0.071	Dibenz(a,h)anthracene	0.0058
Acenaphthylene	0.0027	Benzo(g,h,i)perylene	0.022

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	IJW-SC-13-4.1	Client:	Crete Consulting
Date Received:	01/27/21	Project:	I&J Waterway Phase 2 Sediment
Date Extracted:	01/28/21	Lab ID:	101387-03
Date Analyzed:	01/29/21	Data File:	012915.D
Matrix:	Soil	Instrument:	GCMS8
Units:	mg/kg (ppm) Dry Weight	Operator:	YA

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	72	36	114
Phenol-d6	84	47	116
Nitrobenzene-d5	86	38	117
2-Fluorobiphenyl	86	50	150
2,4,6-Tribromophenol	88	25	187
Terphenyl-d14	103	50	150

Compounds:	Concentration mg/kg (ppm)	Compounds:	Concentration mg/kg (ppm)
Phenol	<0.1	2,6-Dinitrotoluene	<0.05
Bis(2-chloroethyl) ether	<0.01	3-Nitroaniline	<1
2-Chlorophenol	<0.1	Acenaphthene	0.010
1,3-Dichlorobenzene	<0.01	2,4-Dinitrophenol	<0.3
1,4-Dichlorobenzene	<0.01	Dibenzofuran	0.020
1,2-Dichlorobenzene	<0.01	2,4-Dinitrotoluene	<0.05
Benzyl alcohol	<0.057	4-Nitrophenol	<0.3
2,2'-Oxybis(1-chloropropane)	<0.01	Diethyl phthalate	<0.1
2-Methylphenol	<0.063	Fluorene	0.019
Hexachloroethane	<0.01	4-Chlorophenyl phenyl ether	<0.01
N-Nitroso-di-n-propylamine	<0.01	N-Nitrosodiphenylamine	<0.01
3-Methylphenol + 4-Methylphenol	<0.2	4-Nitroaniline	<1
Nitrobenzene	<0.01	4,6-Dinitro-2-methylphenol	<0.3
Isophorone	<0.01	4-Bromophenyl phenyl ether	<0.01
2-Nitrophenol	<0.1	Hexachlorobenzene	<0.01
2,4-Dimethylphenol	<0.029	Pentachlorophenol	0.051
Benzoic acid	<0.5	Phenanthrene	0.078
Bis(2-chloroethoxy)methane	<0.01	Anthracene	0.029
2,4-Dichlorophenol	<0.1	Carbazole	<0.01
1,2,4-Trichlorobenzene	<0.01	Di-n-butyl phthalate	<0.1
Naphthalene	0.026	Fluoranthene	0.16
Hexachlorobutadiene	<0.01	Pyrene	0.34
4-Chloroaniline	<1	Benzyl butyl phthalate	<0.1
4-Chloro-3-methylphenol	<0.1	Benz(a)anthracene	0.078
2-Methylnaphthalene	0.019	Chrysene	0.13
1-Methylnaphthalene	0.0095	Bis(2-ethylhexyl) phthalate	2.0 ve
Hexachlorocyclopentadiene	<0.03	Di-n-octyl phthalate	<0.1
2,4,6-Trichlorophenol	<0.1	Benzo(a)pyrene	0.10
2,4,5-Trichlorophenol	<0.1	Benzo(b)fluoranthene	0.17
2-Chloronaphthalene	<0.01	Benzo(k)fluoranthene	0.067
2-Nitroaniline	<0.05	Indeno(1,2,3-cd)pyrene	0.051
Dimethyl phthalate	<0.071	Dibenz(a,h)anthracene	0.011
Acenaphthylene	0.0069	Benzo(g,h,i)perylene	0.040

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	IJW-SC-13-4.1	Client:	Crete Consulting
Date Received:	01/27/21	Project:	I&J Waterway Phase 2 Sediment
Date Extracted:	01/28/21	Lab ID:	101387-03 1/5
Date Analyzed:	01/29/21	Data File:	012910.D
Matrix:	Soil	Instrument:	GCMS8
Units:	mg/kg (ppm) Dry Weight	Operator:	YA

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	69 d	36	114
Phenol-d6	80 d	47	116
Nitrobenzene-d5	82 d	38	117
2-Fluorobiphenyl	84 d	50	150
2,4,6-Tribromophenol	86 d	25	187
Terphenyl-d14	90 d	50	150

Compounds:	Concentration mg/kg (ppm)	Compounds:	Concentration mg/kg (ppm)
Phenol	<0.5	2,6-Dinitrotoluene	<0.25
Bis(2-chloroethyl) ether	<0.05	3-Nitroaniline	<5
2-Chlorophenol	<0.5	Acenaphthene	0.011
1,3-Dichlorobenzene	<0.05	2,4-Dinitrophenol	<1.5
1,4-Dichlorobenzene	<0.05	Dibenzofuran	<0.05
1,2-Dichlorobenzene	<0.05	2,4-Dinitrotoluene	<0.25
Benzyl alcohol	<0.29	4-Nitrophenol	<1.5
2,2'-Oxybis(1-chloropropane)	<0.05	Diethyl phthalate	<0.5
2-Methylphenol	<0.32	Fluorene	0.018
Hexachloroethane	<0.05	4-Chlorophenyl phenyl ether	<0.05
N-Nitroso-di-n-propylamine	<0.05	N-Nitrosodiphenylamine	<0.05
3-Methylphenol + 4-Methylphenol	<1	4-Nitroaniline	<5
Nitrobenzene	<0.05	4,6-Dinitro-2-methylphenol	<1.5
Isophorone	<0.05	4-Bromophenyl phenyl ether	<0.05
2-Nitrophenol	<0.5	Hexachlorobenzene	<0.05
2,4-Dimethylphenol	<0.15	Pentachlorophenol	<0.25
Benzoic acid	<2.5	Phenanthrene	0.082
Bis(2-chloroethoxy)methane	<0.05	Anthracene	0.029
2,4-Dichlorophenol	<0.5	Carbazole	<0.05
1,2,4-Trichlorobenzene	<0.05	Di-n-butyl phthalate	<0.5
Naphthalene	0.026	Fluoranthene	0.18
Hexachlorobutadiene	<0.05	Pyrene	0.33
4-Chloroaniline	<5	Benzyl butyl phthalate	<0.5
4-Chloro-3-methylphenol	<0.5	Benz(a)anthracene	0.077
2-Methylnaphthalene	0.018	Chrysene	0.13
1-Methylnaphthalene	<0.01	Bis(2-ethylhexyl) phthalate	2.1
Hexachlorocyclopentadiene	<0.15	Di-n-octyl phthalate	<0.5
2,4,6-Trichlorophenol	<0.5	Benzo(a)pyrene	0.10
2,4,5-Trichlorophenol	<0.5	Benzo(b)fluoranthene	0.17
2-Chloronaphthalene	<0.05	Benzo(k)fluoranthene	0.069
2-Nitroaniline	<0.25	Indeno(1,2,3-cd)pyrene	0.055
Dimethyl phthalate	<0.36	Dibenz(a,h)anthracene	0.011
Acenaphthylene	<0.01	Benzo(g,h,i)perylene	0.048

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	IJW-SC-14-4.4	Client:	Crete Consulting
Date Received:	01/27/21	Project:	I&J Waterway Phase 2 Sediment
Date Extracted:	01/28/21	Lab ID:	101387-04
Date Analyzed:	01/29/21	Data File:	012916.D
Matrix:	Soil	Instrument:	GCMS8
Units:	mg/kg (ppm) Dry Weight	Operator:	YA

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	69	36	114
Phenol-d6	82	47	116
Nitrobenzene-d5	83	38	117
2-Fluorobiphenyl	82	50	150
2,4,6-Tribromophenol	86	25	187
Terphenyl-d14	98	50	150

Compounds:	Concentration mg/kg (ppm)	Compounds:	Concentration mg/kg (ppm)
Phenol	<0.1	2,6-Dinitrotoluene	<0.05
Bis(2-chloroethyl) ether	<0.01	3-Nitroaniline	<1
2-Chlorophenol	<0.1	Acenaphthene	0.0088
1,3-Dichlorobenzene	<0.01	2,4-Dinitrophenol	<0.3
1,4-Dichlorobenzene	<0.01	Dibenzofuran	0.021
1,2-Dichlorobenzene	<0.01	2,4-Dinitrotoluene	<0.05
Benzyl alcohol	<0.057	4-Nitrophenol	<0.3
2,2'-Oxybis(1-chloropropane)	<0.01	Diethyl phthalate	<0.1
2-Methylphenol	<0.063	Fluorene	0.018
Hexachloroethane	<0.01	4-Chlorophenyl phenyl ether	<0.01
N-Nitroso-di-n-propylamine	<0.01	N-Nitrosodiphenylamine	<0.01
3-Methylphenol + 4-Methylphenol	<0.2	4-Nitroaniline	<1
Nitrobenzene	<0.01	4,6-Dinitro-2-methylphenol	<0.3
Isophorone	<0.01	4-Bromophenyl phenyl ether	<0.01
2-Nitrophenol	<0.1	Hexachlorobenzene	<0.01
2,4-Dimethylphenol	<0.029	Pentachlorophenol	<0.05
Benzoic acid	<0.5	Phenanthrene	0.058
Bis(2-chloroethoxy)methane	<0.01	Anthracene	0.028
2,4-Dichlorophenol	<0.1	Carbazole	<0.01
1,2,4-Trichlorobenzene	<0.01	Di-n-butyl phthalate	<0.1
Naphthalene	0.019	Fluoranthene	0.14
Hexachlorobutadiene	<0.01	Pyrene	0.29
4-Chloroaniline	<1	Benzyl butyl phthalate	<0.1
4-Chloro-3-methylphenol	<0.1	Benz(a)anthracene	0.079
2-Methylnaphthalene	0.021	Chrysene	0.17
1-Methylnaphthalene	0.0081	Bis(2-ethylhexyl) phthalate	0.25
Hexachlorocyclopentadiene	<0.03	Di-n-octyl phthalate	<0.1
2,4,6-Trichlorophenol	<0.1	Benzo(a)pyrene	0.084
2,4,5-Trichlorophenol	<0.1	Benzo(b)fluoranthene	0.18
2-Chloronaphthalene	<0.01	Benzo(k)fluoranthene	0.063
2-Nitroaniline	<0.05	Indeno(1,2,3-cd)pyrene	0.043
Dimethyl phthalate	<0.071	Dibenz(a,h)anthracene	0.0092
Acenaphthylene	0.0050	Benzo(g,h,i)perylene	0.035

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	IJW-SC-15-3.6	Client:	Crete Consulting
Date Received:	01/27/21	Project:	I&J Waterway Phase 2 Sediment
Date Extracted:	01/28/21	Lab ID:	101387-05
Date Analyzed:	01/29/21	Data File:	012917.D
Matrix:	Soil	Instrument:	GCMS8
Units:	mg/kg (ppm) Dry Weight	Operator:	YA

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	66	36	114
Phenol-d6	79	47	116
Nitrobenzene-d5	80	38	117
2-Fluorobiphenyl	79	50	150
2,4,6-Tribromophenol	88	25	187
Terphenyl-d14	92	50	150

Compounds:	Concentration mg/kg (ppm)	Compounds:	Concentration mg/kg (ppm)
Phenol	<0.1	2,6-Dinitrotoluene	<0.05
Bis(2-chloroethyl) ether	<0.01	3-Nitroaniline	<1
2-Chlorophenol	<0.1	Acenaphthene	0.016
1,3-Dichlorobenzene	<0.01	2,4-Dinitrophenol	<0.3
1,4-Dichlorobenzene	<0.01	Dibenzofuran	0.030
1,2-Dichlorobenzene	<0.01	2,4-Dinitrotoluene	<0.05
Benzyl alcohol	<0.057	4-Nitrophenol	<0.3
2,2’-Oxybis(1-chloropropane)	<0.01	Diethyl phthalate	<0.1
2-Methylphenol	<0.063	Fluorene	0.031
Hexachloroethane	<0.01	4-Chlorophenyl phenyl ether	<0.01
N-Nitroso-di-n-propylamine	<0.01	N-Nitrosodiphenylamine	<0.01
3-Methylphenol + 4-Methylphenol	<0.2	4-Nitroaniline	<1
Nitrobenzene	<0.01	4,6-Dinitro-2-methylphenol	<0.3
Isophorone	<0.01	4-Bromophenyl phenyl ether	<0.01
2-Nitrophenol	<0.1	Hexachlorobenzene	<0.01
2,4-Dimethylphenol	<0.029	Pentachlorophenol	<0.05
Benzoic acid	<0.5	Phenanthrene	0.11
Bis(2-chloroethoxy)methane	<0.01	Anthracene	0.066
2,4-Dichlorophenol	<0.1	Carbazole	0.011
1,2,4-Trichlorobenzene	<0.01	Di-n-butyl phthalate	<0.1
Naphthalene	0.030	Fluoranthene	0.29
Hexachlorobutadiene	<0.01	Pyrene	0.44
4-Chloroaniline	<1	Benzyl butyl phthalate	<0.1
4-Chloro-3-methylphenol	<0.1	Benz(a)anthracene	0.15
2-Methylnaphthalene	0.027	Chrysene	0.21
1-Methylnaphthalene	0.011	Bis(2-ethylhexyl) phthalate	0.19
Hexachlorocyclopentadiene	<0.03	Di-n-octyl phthalate	<0.1
2,4,6-Trichlorophenol	<0.1	Benzo(a)pyrene	0.16
2,4,5-Trichlorophenol	<0.1	Benzo(b)fluoranthene	0.26
2-Chloronaphthalene	<0.01	Benzo(k)fluoranthene	0.11
2-Nitroaniline	<0.05	Indeno(1,2,3-cd)pyrene	0.059
Dimethyl phthalate	<0.071	Dibenz(a,h)anthracene	0.014
Acenaphthylene	0.0071	Benzo(g,h,i)perylene	0.046

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	IJW-SC-16-2.2	Client:	Crete Consulting
Date Received:	01/27/21	Project:	I&J Waterway Phase 2 Sediment
Date Extracted:	01/28/21	Lab ID:	101387-06 1/5
Date Analyzed:	01/29/21	Data File:	012922.D
Matrix:	Soil	Instrument:	GCMS8
Units:	mg/kg (ppm) Dry Weight	Operator:	YA

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	66 d	36	114
Phenol-d6	80 d	47	116
Nitrobenzene-d5	83 d	38	117
2-Fluorobiphenyl	81 d	50	150
2,4,6-Tribromophenol	86 d	25	187
Terphenyl-d14	102 d	50	150

Compounds:	Concentration mg/kg (ppm)	Compounds:	Concentration mg/kg (ppm)
Phenol	<0.5	2,6-Dinitrotoluene	<0.25
Bis(2-chloroethyl) ether	<0.05	3-Nitroaniline	<5
2-Chlorophenol	<0.5	Acenaphthene	0.034
1,3-Dichlorobenzene	<0.05	2,4-Dinitrophenol	<1.5
1,4-Dichlorobenzene	<0.05	Dibenzofuran	<0.05
1,2-Dichlorobenzene	<0.05	2,4-Dinitrotoluene	<0.25
Benzyl alcohol	<0.29	4-Nitrophenol	<1.5
2,2'-Oxybis(1-chloropropane)	<0.05	Diethyl phthalate	<0.5
2-Methylphenol	<0.32	Fluorene	0.081
Hexachloroethane	<0.05	4-Chlorophenyl phenyl ether	<0.05
N-Nitroso-di-n-propylamine	<0.05	N-Nitrosodiphenylamine	<0.05
3-Methylphenol + 4-Methylphenol	<1	4-Nitroaniline	<5
Nitrobenzene	<0.05	4,6-Dinitro-2-methylphenol	<1.5
Isophorone	<0.05	4-Bromophenyl phenyl ether	<0.05
2-Nitrophenol	<0.5	Hexachlorobenzene	<0.05
2,4-Dimethylphenol	<0.15	Pentachlorophenol	<0.25
Benzoic acid	<2.5	Phenanthrene	0.18
Bis(2-chloroethoxy)methane	<0.05	Anthracene	0.24
2,4-Dichlorophenol	<0.5	Carbazole	<0.05
1,2,4-Trichlorobenzene	<0.05	Di-n-butyl phthalate	<0.5
Naphthalene	0.025	Fluoranthene	1.2
Hexachlorobutadiene	<0.05	Pyrene	1.2
4-Chloroaniline	<5	Benzyl butyl phthalate	<0.5
4-Chloro-3-methylphenol	<0.5	Benz(a)anthracene	0.22
2-Methylnaphthalene	0.022	Chrysene	0.25
1-Methylnaphthalene	0.012	Bis(2-ethylhexyl) phthalate	<0.8
Hexachlorocyclopentadiene	<0.15	Di-n-octyl phthalate	<0.5
2,4,6-Trichlorophenol	<0.5	Benzo(a)pyrene	0.16
2,4,5-Trichlorophenol	<0.5	Benzo(b)fluoranthene	0.25
2-Chloronaphthalene	<0.05	Benzo(k)fluoranthene	0.099
2-Nitroaniline	<0.25	Indeno(1,2,3-cd)pyrene	0.062
Dimethyl phthalate	<0.36	Dibenz(a,h)anthracene	0.016
Acenaphthylene	0.015	Benzo(g,h,i)perylene	0.049

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	Method Blank	Client:	Crete Consulting
Date Received:	Not Applicable	Project:	I&J Waterway Phase 2 Sediment
Date Extracted:	01/28/21	Lab ID:	01-266 mb
Date Analyzed:	01/29/21	Data File:	012907.D
Matrix:	Soil	Instrument:	GCMS8
Units:	mg/kg (ppm) Dry Weight	Operator:	YA

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	81	36	114
Phenol-d6	90	47	116
Nitrobenzene-d5	92	38	117
2-Fluorobiphenyl	91	50	150
2,4,6-Tribromophenol	85	25	187
Terphenyl-d14	98	50	150

Compounds:	Concentration mg/kg (ppm)	Compounds:	Concentration mg/kg (ppm)
Phenol	<0.1	2,6-Dinitrotoluene	<0.05
Bis(2-chloroethyl) ether	<0.01	3-Nitroaniline	<1
2-Chlorophenol	<0.1	Acenaphthene	<0.002
1,3-Dichlorobenzene	<0.01	2,4-Dinitrophenol	<0.3
1,4-Dichlorobenzene	<0.01	Dibenzofuran	<0.01
1,2-Dichlorobenzene	<0.01	2,4-Dinitrotoluene	<0.05
Benzyl alcohol	<0.057	4-Nitrophenol	<0.3
2,2'-Oxybis(1-chloropropane)	<0.01	Diethyl phthalate	<0.1
2-Methylphenol	<0.063	Fluorene	<0.002
Hexachloroethane	<0.01	4-Chlorophenyl phenyl ether	<0.01
N-Nitroso-di-n-propylamine	<0.01	N-Nitrosodiphenylamine	<0.01
3-Methylphenol + 4-Methylphenol	<0.2	4-Nitroaniline	<1
Nitrobenzene	<0.01	4,6-Dinitro-2-methylphenol	<0.3
Isophorone	<0.01	4-Bromophenyl phenyl ether	<0.01
2-Nitrophenol	<0.1	Hexachlorobenzene	<0.01
2,4-Dimethylphenol	<0.029	Pentachlorophenol	<0.05
Benzoic acid	<0.5	Phenanthrene	<0.002
Bis(2-chloroethoxy)methane	<0.01	Anthracene	<0.002
2,4-Dichlorophenol	<0.1	Carbazole	<0.01
1,2,4-Trichlorobenzene	<0.01	Di-n-butyl phthalate	<0.1
Naphthalene	<0.002	Fluoranthene	<0.002
Hexachlorobutadiene	<0.01	Pyrene	<0.002
4-Chloroaniline	<1	Benzyl butyl phthalate	<0.1
4-Chloro-3-methylphenol	<0.1	Benz(a)anthracene	<0.002
2-Methylnaphthalene	<0.002	Chrysene	<0.002
1-Methylnaphthalene	<0.002	Bis(2-ethylhexyl) phthalate	<0.16
Hexachlorocyclopentadiene	<0.03	Di-n-octyl phthalate	<0.1
2,4,6-Trichlorophenol	<0.1	Benzo(a)pyrene	<0.002
2,4,5-Trichlorophenol	<0.1	Benzo(b)fluoranthene	<0.002
2-Chloronaphthalene	<0.01	Benzo(k)fluoranthene	<0.002
2-Nitroaniline	<0.05	Indeno(1,2,3-cd)pyrene	<0.002
Dimethyl phthalate	<0.071	Dibenz(a,h)anthracene	<0.002
Acenaphthylene	<0.002	Benzo(g,h,i)perylene	<0.002

Date of Report: 02/09/21
Date Received: 01/27/21
Project: I&J Waterway Phase 2 Sediment, F&BI 101387

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR TOTAL METALS USING EPA METHOD 6020B

Laboratory Code: 101401-13 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result (Wet wt)	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Nickel	mg/kg (ppm)	25	14.3	77	80	75-125	4

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Nickel	mg/kg (ppm)	25	107	80-120

Date of Report: 02/09/21
Date Received: 01/27/21
Project: I&J Waterway Phase 2 Sediment, F&BI 101387

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR SEMIVOLATILES BY EPA METHOD 8270E

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Percent Recovery LCSD	Acceptance Criteria	RPD (Limit 20)
Phenol	mg/kg (ppm)	0.83	86	89	68-117	3
Bis(2-chloroethyl) ether	mg/kg (ppm)	0.83	79	84	51-119	6
2-Chlorophenol	mg/kg (ppm)	0.83	82	85	58-116	4
1,3-Dichlorobenzene	mg/kg (ppm)	0.83	73	75	48-109	3
1,4-Dichlorobenzene	mg/kg (ppm)	0.83	75	77	50-107	3
1,2-Dichlorobenzene	mg/kg (ppm)	0.83	77	78	53-107	1
Benzyl alcohol	mg/kg (ppm)	2.5	88	91	70-130	3
2,2'-Oxybis(1-chloropropane)	mg/kg (ppm)	0.83	84	86	70-130	2
2-Methylphenol	mg/kg (ppm)	0.83	84	88	63-112	5
Hexachloroethane	mg/kg (ppm)	0.83	79	79	50-113	0
N-Nitroso-di-n-propylamine	mg/kg (ppm)	0.83	96	98	70-130	2
3-Methylphenol + 4-Methylphenol	mg/kg (ppm)	0.83	89	93	70-130	4
Nitrobenzene	mg/kg (ppm)	0.83	84	86	60-116	2
Isophorone	mg/kg (ppm)	0.83	91	93	66-119	2
2-Nitrophenol	mg/kg (ppm)	0.83	83	86	64-120	4
2,4-Dimethylphenol	mg/kg (ppm)	0.83	77	77	58-118	0
Benzoic acid	mg/kg (ppm)	2.5	72	74	56-169	3
Bis(2-chloroethoxy)methane	mg/kg (ppm)	0.83	90	91	68-110	1
2,4-Dichlorophenol	mg/kg (ppm)	0.83	82	85	63-116	4
1,2,4-Trichlorobenzene	mg/kg (ppm)	0.83	79	80	56-110	1
Naphthalene	mg/kg (ppm)	0.83	84	87	60-105	4
Hexachlorobutadiene	mg/kg (ppm)	0.83	73	75	52-111	3
4-Chloroaniline	mg/kg (ppm)	2.5	19	25	10-90	27 vo
4-Chloro-3-methylphenol	mg/kg (ppm)	0.83	89	93	65-120	4
2-Methylnaphthalene	mg/kg (ppm)	0.83	90	92	64-107	2
1-Methylnaphthalene	mg/kg (ppm)	0.83	90	91	64-105	1
Hexachlorocyclopentadiene	mg/kg (ppm)	0.83	83	78	54-131	6
2,4,6-Trichlorophenol	mg/kg (ppm)	0.83	90	90	63-125	0
2,4,5-Trichlorophenol	mg/kg (ppm)	0.83	91	94	70-130	3
2-Chloronaphthalene	mg/kg (ppm)	0.83	87	86	65-115	1
2-Nitroaniline	mg/kg (ppm)	2.5	99	102	64-128	3
Dimethyl phthalate	mg/kg (ppm)	0.83	97	98	64-127	1
Acenaphthylene	mg/kg (ppm)	0.83	98	99	70-130	1
2,6-Dinitrotoluene	mg/kg (ppm)	0.83	92	95	68-126	3
3-Nitroaniline	mg/kg (ppm)	2.5	79	86	52-108	8
Acenaphthene	mg/kg (ppm)	0.83	94	94	70-130	0
2,4-Dinitrophenol	mg/kg (ppm)	1.7	95	101	51-159	6
Dibenzofuran	mg/kg (ppm)	0.83	95	96	70-130	1
2,4-Dinitrotoluene	mg/kg (ppm)	0.83	90	92	66-125	2
4-Nitrophenol	mg/kg (ppm)	1.7	86	94	60-146	9
Diethyl phthalate	mg/kg (ppm)	0.83	89	93	63-133	4
Fluorene	mg/kg (ppm)	0.83	95	98	70-130	3
4-Chlorophenyl phenyl ether	mg/kg (ppm)	0.83	85	88	70-130	3
N-Nitrosodiphenylamine	mg/kg (ppm)	0.83	86	89	70-130	3
4-Nitroaniline	mg/kg (ppm)	2.5	73	81	50-124	10
4,6-Dinitro-2-methylphenol	mg/kg (ppm)	0.83	103	106	68-139	3
4-Bromophenyl phenyl ether	mg/kg (ppm)	0.83	91	91	43-167	0
Hexachlorobenzene	mg/kg (ppm)	0.83	89	90	70-130	1
Pentachlorophenol	mg/kg (ppm)	0.83	105	111	61-136	6
Phenanthrene	mg/kg (ppm)	0.83	96	98	70-130	2
Anthracene	mg/kg (ppm)	0.83	94	98	70-130	4
Carbazole	mg/kg (ppm)	0.83	102	107	70-130	5
Di-n-butyl phthalate	mg/kg (ppm)	0.83	96	99	70-130	3
Fluoranthene	mg/kg (ppm)	0.83	103	107	70-130	4
Pyrene	mg/kg (ppm)	0.83	100	97	70-130	3
Benzyl butyl phthalate	mg/kg (ppm)	0.83	108	106	70-130	2
Benz(a)anthracene	mg/kg (ppm)	0.83	98	100	70-130	2
Chrysene	mg/kg (ppm)	0.83	97	101	70-130	4
Bis(2-ethylhexyl) phthalate	mg/kg (ppm)	0.83	97	99	38-153	2
Di-n-octyl phthalate	mg/kg (ppm)	0.83	114	110	52-141	4
Benzo(a)pyrene	mg/kg (ppm)	0.83	101	104	64-112	3
Benzo(b)fluoranthene	mg/kg (ppm)	0.83	109	106	61-118	3
Benzo(k)fluoranthene	mg/kg (ppm)	0.83	104	104	61-116	0
Indeno(1,2,3-cd)pyrene	mg/kg (ppm)	0.83	109	115	52-130	5
Dibenz(a,h)anthracene	mg/kg (ppm)	0.83	105	111	54-125	6
Benzo(g,h,i)perylene	mg/kg (ppm)	0.83	101	105	47-128	4

Data Qualifiers & Definitions

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for the analyte were outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte may be due to carryover from previous sample injections.

cf - The sample was centrifuged prior to analysis.

d - The sample was diluted. Detection limits were raised and surrogate recoveries may not be meaningful.

dv - Insufficient sample volume was available to achieve normal reporting limits.

f - The sample was laboratory filtered prior to analysis.

fb - The analyte was detected in the method blank.

fc - The analyte is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. Variability is attributed to sample inhomogeneity.

hs - Headspace was present in the container used for analysis.

ht – The analysis was performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of control limits due to sample matrix effects.

j - The analyte concentration is reported below the lowest calibration standard. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The laboratory control sample(s) percent recovery and/or RPD were out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the analyte is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc - The sample was received with incorrect preservation or in a container not approved by the method. The value reported should be considered an estimate.

ve - The analyte response exceeded the valid instrument calibration range. The value reported is an estimate.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

101387

SAMPLE CHAIN OF CUSTODY ME

01-27-21 BI3

Report To Hainsworth, Stevens, Jones
Company Crete Consulting
Address 108 S. Washington St., Suite 300
City, State, ZIP Seattle, WA 98104
Phone ______ Email ______

SAMPLERS (signature) Rusty Jones R. Jones

PROJECT NAME
I&J Waterway
Phase 2 Sediment

PO #

REMARKS

INVOICE TO

Project specific RLs? - Yes / No

Page # 1 of 1

TURNAROUND TIME
☒ Standard turnaround
☐ RUSH
Rush charges authorized by

SAMPLE DISPOSAL
☐ Archive samples
☐ Other
Default: Dispose after 30 days

						ANALYSES REQUESTED											
Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	NWTPH-Dx	NWTPH-Gx	BTEX EPA 8021	NWTPH-HCID	VOCs EPA 8260	PAHs EPA 8270	~~PCBs EPA 8082~~	SVOCs (8270)	Bis(2-ethylhexyl)phth	Nickel	TOC	Notes
IJW-SC-11-3.4	01 A-C	1/26/2021	1130	SEDIMENT	3						X	~~X~~	X	X	X	X	HOLD ALL for Mercury, Dioxins, Furans, Dioxin-like PCB Congeners
IJW-SC-12-3	02		1230		3						X		X	X	X	X	
IJW-SC-13-4.1	03		1355		3						X		X	X	X	X	
IJW-SC-14-4.4	04		1535		3						X		X	X	X	X	
IJW-SC-15-3.6	05		1630		3						X		X	X	X	X	
IJW-SC-16-2.2	06	1/27/2021	0950		3						X		X	X	X	X	

Samples received at 3 °C

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by: R. Jones	Rusty Jones	Crete Consulting	1/27/21	1556
Received by: D. W	Liz Webber	F&B	1/27/21	1556
Relinquished by:				
Received by:				

3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Friedman & Bruya
Michael Erdahl
3012 16th Ave. W.
Seattle, WA 98119

RE: 101387
Work Order Number: 2101446

February 04, 2021

Attention Michael Erdahl:

Fremont Analytical, Inc. received 6 sample(s) on 1/28/2021 for the analyses presented in the following report.

Total Organic Carbon by EPA 9060

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Brianna Barnes
Project Manager

DoD-ELAP Accreditation #79636 by PJLA, ISO/IEC 17025:2017 and QSM 5.3 for Environmental Testing
ORELAP Certification: WA 100009 (NELAP Recognized) for Environmental Testing
Washington State Department of Ecology Accredited for Environmental Testing, Lab ID C910

Original

CLIENT: Friedman & Bruya
Project: 101387
Work Order: 2101446

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2101446-001	IJW-SC-11-3.4	01/26/2021 11:30 AM	01/28/2021 11:54 AM
2101446-002	IJW-SC-12-3	01/26/2021 12:30 AM	01/28/2021 11:54 AM
2101446-003	IJW-SC-13-4.1	01/26/2021 1:55 PM	01/28/2021 11:54 AM
2101446-004	IJW-SC-14-4.4	01/26/2021 3:35 PM	01/28/2021 11:54 AM
2101446-005	IJW-SC-15-3.6	01/26/2021 4:30 PM	01/28/2021 11:54 AM
2101446-006	IJW-SC-16-2.2	01/27/2021 9:50 AM	01/28/2021 11:54 AM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **2101446**

Date: **2/4/2021**

CLIENT: Friedman & Bruya

Project: 101387

I. SAMPLE RECEIPT:

Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:

Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:

Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Qualifiers & Acronyms

WO#: **2101446**

Date Reported: **2/4/2021**

Qualifiers:

* - Flagged value is not within established control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20% Drift or minimum RRF)
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Reporting Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
DUP - Sample Duplicate
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
REP - Sample Replicate
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **2101446**
Date Reported: **2/4/2021**

CLIENT: Friedman & Bruya
Project: 101387

Lab ID: 2101446-001
Client Sample ID: **IJW-SC-11-3.4**
Collection Date: 1/26/2021 11:30:00 AM
Matrix: Sediment

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Organic Carbon by EPA 9060				Batch ID: 31235		Analyst: SS
Total Organic Carbon	1.74	0.150		%-dry	1	2/2/2021 11:27:00 AM

Lab ID: 2101446-002
Client Sample ID: **IJW-SC-12-3**
Collection Date: 1/26/2021 12:30:00 AM
Matrix: Sediment

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Organic Carbon by EPA 9060				Batch ID: 31235		Analyst: SS
Total Organic Carbon	1.65	0.150		%-dry	1	2/2/2021 11:44:00 AM

Lab ID: 2101446-003
Client Sample ID: **IJW-SC-13-4.1**
Collection Date: 1/26/2021 1:55:00 PM
Matrix: Sediment

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Organic Carbon by EPA 9060				Batch ID: 31235		Analyst: SS
Total Organic Carbon	2.78	0.150		%-dry	1	2/2/2021 12:11:00 PM

Lab ID: 2101446-004
Client Sample ID: **IJW-SC-14-4.4**
Collection Date: 1/26/2021 3:35:00 PM
Matrix: Sediment

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Organic Carbon by EPA 9060				Batch ID: 31235		Analyst: SS
Total Organic Carbon	2.25	0.150		%-dry	1	2/2/2021 12:27:00 PM

CLIENT: Friedman & Bruya
Project: 101387

Lab ID: 2101446-005
Client Sample ID: **IJW-SC-15-3.6**
Collection Date: 1/26/2021 4:30:00 PM
Matrix: Sediment

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Organic Carbon by EPA 9060				Batch ID: 31235		Analyst: SS
Total Organic Carbon	1.63	0.150		%-dry	1	2/2/2021 1:33:00 PM

Lab ID: 2101446-006
Client Sample ID: **IJW-SC-16-2.2**
Collection Date: 1/27/2021 9:50:00 AM
Matrix: Sediment

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Organic Carbon by EPA 9060				Batch ID: 31260		Analyst: SS
Total Organic Carbon	12.1	0.150		%-dry	1	2/4/2021 11:43:00 AM

Date: *2/4/2021*

Work Order: 2101446
CLIENT: Friedman & Bruya
Project: 101387

QC SUMMARY REPORT

Total Organic Carbon by EPA 9060

Sample ID: **MB-31235** SampType: **MBLK** Units: **%-dry** Prep Date: **2/2/2021** RunNo: **65052**
Client ID: **MBLKS** Batch ID: **31235** Analysis Date: **2/2/2021** SeqNo: **1308350**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Organic Carbon	ND	0.150									

Sample ID: **LCS-31235** SampType: **LCS** Units: **%-dry** Prep Date: **2/2/2021** RunNo: **65052**
Client ID: **LCSS** Batch ID: **31235** Analysis Date: **2/2/2021** SeqNo: **1308351**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Organic Carbon	1.04	0.150	1.000	0	104	80	120				

Sample ID: **2101446-004ADUP** SampType: **DUP** Units: **%-dry** Prep Date: **2/2/2021** RunNo: **65052**
Client ID: **IJW-SC-14-4.4** Batch ID: **31235** Analysis Date: **2/2/2021** SeqNo: **1308356**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Organic Carbon	2.15	0.150						2.252	4.68	20	

Sample ID: **2101446-004AMS** SampType: **MS** Units: **%-dry** Prep Date: **2/2/2021** RunNo: **65052**
Client ID: **IJW-SC-14-4.4** Batch ID: **31235** Analysis Date: **2/2/2021** SeqNo: **1308357**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Organic Carbon	3.19	0.150	1.000	2.252	93.9	75	125				

Sample ID: **2101446-004AMSD** SampType: **MSD** Units: **%-dry** Prep Date: **2/2/2021** RunNo: **65052**
Client ID: **IJW-SC-14-4.4** Batch ID: **31235** Analysis Date: **2/2/2021** SeqNo: **1308358**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Organic Carbon	3.24	0.150	1.000	2.252	99.2	75	125	3.191	1.65	20	

Work Order: 2101446
CLIENT: Friedman & Bruya
Project: 101387

QC SUMMARY REPORT

Total Organic Carbon by EPA 9060

Sample ID: **MB-31260** SampType: **MBLK** Units: **%-dry** Prep Date: **2/4/2021** RunNo: **65113**
Client ID: **MBLKS** Batch ID: **31260** Analysis Date: **2/4/2021** SeqNo: **1309518**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Organic Carbon	ND	0.150									

Sample ID: **LCS-31260** SampType: **LCS** Units: **%-dry** Prep Date: **2/4/2021** RunNo: **65113**
Client ID: **LCSS** Batch ID: **31260** Analysis Date: **2/4/2021** SeqNo: **1309519**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Organic Carbon	1.05	0.150	1.000	0	105	80	120				

Sample ID: **2101472-001ADUP** SampType: **DUP** Units: **%-dry** Prep Date: **2/4/2021** RunNo: **65113**
Client ID: **BATCH** Batch ID: **31260** Analysis Date: **2/4/2021** SeqNo: **1309522**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Organic Carbon	ND	0.150						0		20	

Sample ID: **2101472-001AMS** SampType: **MS** Units: **%-dry** Prep Date: **2/4/2021** RunNo: **65113**
Client ID: **BATCH** Batch ID: **31260** Analysis Date: **2/4/2021** SeqNo: **1309523**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Organic Carbon	1.16	0.150	1.000	0.08100	108	75	125				

Sample ID: **2101472-001AMSD** SampType: **MSD** Units: **%-dry** Prep Date: **2/4/2021** RunNo: **65113**
Client ID: **BATCH** Batch ID: **31260** Analysis Date: **2/4/2021** SeqNo: **1309524**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Organic Carbon	1.17	0.150	1.000	0.08100	109	75	125	1.161	0.687	20	

Fremont Analytical

Sample Log-In Check List

Client Name: **FB**

Work Order Number: **2101446**

Logged by: **Gabrielle Coeuille**

Date Received: **1/28/2021 11:54:00 AM**

Chain of Custody

1. Is Chain of Custody complete? Yes ☑ No ☐ Not Present ☐
2. How was the sample delivered? Client

Log In

3. Coolers are present? Yes ☑ No ☐ NA ☐
4. Shipping container/cooler in good condition? Yes ☑ No ☐
5. Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact) Yes ☐ No ☐ Not Present ☑
6. Was an attempt made to cool the samples? Yes ☑ No ☐ NA ☐
7. Were all items received at a temperature of >2°C to 6°C * Yes ☑ No ☐ NA ☐
8. Sample(s) in proper container(s)? Yes ☑ No ☐
9. Sufficient sample volume for indicated test(s)? Yes ☑ No ☐
10. Are samples properly preserved? Yes ☑ No ☐
11. Was preservative added to bottles? Yes ☐ No ☑ NA ☐
12. Is there headspace in the VOA vials? Yes ☐ No ☐ NA ☑
13. Did all samples containers arrive in good condition(unbroken)? Yes ☑ No ☐
14. Does paperwork match bottle labels? Yes ☑ No ☐
15. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
16. Is it clear what analyses were requested? Yes ☑ No ☐
17. Were all holding times able to be met? Yes ☑ No ☐

Special Handling (if applicable)

18. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified:

Date:

By Whom:

Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding:

Client Instructions:

19. Additional remarks:

Item Information

Item #	Temp ºC
Sample 1	3.5

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

SUBCONTRACT SAMPLE CHAIN OF CUSTODY

2101446

Page # 1 of 1

Send Report To Michael Erdahl

Company Friedman and Bruya, Inc.

Address 3012 16th Ave W

City, State, ZIP Seattle, WA 98119

Phone # (206) 285-8282 merdahl@friedmanandbruya.com

SUBCONTRACTER Fremont

PROJECT NAME/NO.	PO #
101387	B-128

REMARKS

Please Email Results

TURNAROUND TIME

☒ Standard TAT

☐ RUSH

Rush charges authorized by:

SAMPLE DISPOSAL

☐ Dispose after 30 days

☐ Return samples

☐ Will call with instructions

Sample ID	Lab ID	Date Sampled	Time Sampled	Matrix	# of jars	TOC										Notes
IJW-SC-11-3.4		1/26/2021	1130	sediment		x										
IJW SC-12-3			1230			x										
IJW-SC-13-4.1			1355			x										
IJW-SC-14-4.4			1535			x										
IJW-SC-15-3.6			1630			x										
IJW-SC-16-2.2		1/27/2021	0950			x										

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282
Fax (206) 283-5044

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	Ann Webber-Bruya	Friedman & Bruya	1/28/21	8:05AM
Received by:	Carter Johnson	FAI	1/28/21	1154
Relinquished by:				
Received by:				

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Yelena Aravkina, M.S.
Michael Erdahl, B.S.
Arina Podnozova, B.S.
Eric Young, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
(206) 285-8282
fbi@isomedia.com
www.friedmanandbruya.com

February 16, 2021

Grant Hainsworth, Project Manager
Crete Consulting
108 S. Washington St., Suite 300
Seattle, WA 98104

Dear Mr Hainsworth:

Included are the amended results from the testing of material submitted on January 29, 2021 from the I&J Waterway Phase 2 Sediment, F&BI 101419 project. Several 8270 reporting limits have been lowered to the required site levels.

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
c: Jamie Stevens, Rusty Jones
CTC0209R.DOC

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Yelena Aravkina, M.S.
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February 9, 2021

Grant Hainsworth, Project Manager
Crete Consulting
108 S. Washington St., Suite 300
Seattle, WA 98104

Dear Mr Hainsworth:

Included are the results from the testing of material submitted on January 29, 2021 from the I&J Waterway Phase 2 Sediment, F&BI 101419 project. There are 9 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days, or as directed by the Chain of Custody document. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
c: Jamie Stevens, Rusty Jones
CTC0209R.DOC

CASE NARRATIVE

This case narrative encompasses samples received on January 29, 2021 by Friedman & Bruya, Inc. from the Crete Consulting I&J Waterway Phase 2 Sediment, F&BI 101419 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	Crete Consulting
101419 -01	IJW-SC-10-3.7
101419 -02	IJW-SC-10-5 No. 4
101419 -03	IJW-SC-11-4.5
101419 -04	IJW-SC-12-6

Sample IJW-SC-10-3.7 was sent to Fremont Analytical for TOC analysis. The report is enclosed.

All quality control requirements were acceptable.

Analysis For Total Metals By EPA Method 6020B

Client ID:	IJW-SC-10-3.7	Client:	Crete Consulting
Date Received:	01/29/21	Project:	I&J Waterway Phase 2 Sediment
Date Extracted:	02/02/21	Lab ID:	101419-01
Date Analyzed:	02/03/21	Data File:	101419-01.075
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Nickel	10.4

Analysis For Total Metals By EPA Method 6020B

Client ID:	Method Blank	Client:	Crete Consulting
Date Received:	Not Applicable	Project:	I&J Waterway Phase 2 Sediment
Date Extracted:	02/02/21	Lab ID:	I1-61 mb
Date Analyzed:	02/02/21	Data File:	I1-61 mb.054
Matrix:	Soil	Instrument:	ICPMS2
Units:	mg/kg (ppm) Dry Weight	Operator:	SP

Analyte:	Concentration mg/kg (ppm)
Nickel	<1

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	IJW-SC-10-3.7	Client:	Crete Consulting
Date Received:	01/29/21	Project:	I&J Waterway Phase 2 Sediment
Date Extracted:	02/01/21	Lab ID:	101419-01
Date Analyzed:	02/01/21	Data File:	020108.D
Matrix:	Soil	Instrument:	GCMS8
Units:	mg/kg (ppm) Dry Weight	Operator:	VM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	70	36	114
Phenol-d6	86	47	116
Nitrobenzene-d5	84	38	117
2-Fluorobiphenyl	81	50	150
2,4,6-Tribromophenol	92	25	187
Terphenyl-d14	100	50	150

Compounds:	Concentration mg/kg (ppm)	Compounds:	Concentration mg/kg (ppm)
Phenol	<0.1	2,6-Dinitrotoluene	<0.05
Bis(2-chloroethyl) ether	<0.01	3-Nitroaniline	<1
2-Chlorophenol	<0.1	Acenaphthene	<0.002
1,3-Dichlorobenzene	<0.01	2,4-Dinitrophenol	<0.3
1,4-Dichlorobenzene	<0.01	Dibenzofuran	<0.01
1,2-Dichlorobenzene	<0.01	2,4-Dinitrotoluene	<0.05
Benzyl alcohol	<0.051	4-Nitrophenol	<0.3
2,2'-Oxybis(1-chloropropane)	<0.01	Diethyl phthalate	<0.1
2-Methylphenol	<0.063	Fluorene	<0.002
Hexachloroethane	<0.01	4-Chlorophenyl phenyl ether	<0.01
N-Nitroso-di-n-propylamine	<0.01	N-Nitrosodiphenylamine	<0.01
3-Methylphenol + 4-Methylphenol	<0.2	4-Nitroaniline	<1
Nitrobenzene	<0.01	4,6-Dinitro-2-methylphenol	<0.3
Isophorone	<0.01	4-Bromophenyl phenyl ether	<0.01
2-Nitrophenol	<0.1	Hexachlorobenzene	<0.01
2,4-Dimethylphenol	<0.029	Pentachlorophenol	<0.05
Benzoic acid	<0.5	Phenanthrene	<0.002
Bis(2-chloroethoxy)methane	<0.01	Anthracene	<0.002
2,4-Dichlorophenol	<0.1	Carbazole	<0.01
1,2,4-Trichlorobenzene	<0.01	Di-n-butyl phthalate	<0.1
Naphthalene	<0.002	Fluoranthene	<0.002
Hexachlorobutadiene	<0.01	Pyrene	<0.002
4-Chloroaniline	<1	Benzyl butyl phthalate	<0.1
4-Chloro-3-methylphenol	<0.1	Benz(a)anthracene	<0.002
2-Methylnaphthalene	<0.002	Chrysene	<0.002
1-Methylnaphthalene	<0.002	Bis(2-ethylhexyl) phthalate	<0.16
Hexachlorocyclopentadiene	<0.03	Di-n-octyl phthalate	<0.1
2,4,6-Trichlorophenol	<0.1	Benzo(a)pyrene	<0.002
2,4,5-Trichlorophenol	<0.1	Benzo(b)fluoranthene	<0.002
2-Chloronaphthalene	<0.01	Benzo(k)fluoranthene	<0.002
2-Nitroaniline	<0.05	Indeno(1,2,3-cd)pyrene	<0.002
Dimethyl phthalate	<0.071	Dibenz(a,h)anthracene	<0.002
Acenaphthylene	<0.002	Benzo(g,h,i)perylene	<0.002

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	Method Blank	Client:	Crete Consulting
Date Received:	Not Applicable	Project:	I&J Waterway Phase 2 Sediment
Date Extracted:	02/01/21	Lab ID:	01-273 mb2
Date Analyzed:	02/01/21	Data File:	020107.D
Matrix:	Soil	Instrument:	GCMS8
Units:	mg/kg (ppm) Dry Weight	Operator:	VM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	90	36	114
Phenol-d6	102	47	116
Nitrobenzene-d5	99	38	117
2-Fluorobiphenyl	107	50	150
2,4,6-Tribromophenol	112	25	187
Terphenyl-d14	133	50	150

Compounds:	Concentration mg/kg (ppm)	Compounds:	Concentration mg/kg (ppm)
Phenol	<0.1	2,6-Dinitrotoluene	<0.05
Bis(2-chloroethyl) ether	<0.01	3-Nitroaniline	<1
2-Chlorophenol	<0.1	Acenaphthene	<0.002
1,3-Dichlorobenzene	<0.01	2,4-Dinitrophenol	<0.3
1,4-Dichlorobenzene	<0.01	Dibenzofuran	<0.01
1,2-Dichlorobenzene	<0.01	2,4-Dinitrotoluene	<0.05
Benzyl alcohol	<0.057	4-Nitrophenol	<0.3
2,2’-Oxybis(1-chloropropane)	<0.01	Diethyl phthalate	<0.1
2-Methylphenol	<0.063	Fluorene	<0.002
Hexachloroethane	<0.01	4-Chlorophenyl phenyl ether	<0.01
N-Nitroso-di-n-propylamine	<0.01	N-Nitrosodiphenylamine	<0.01
3-Methylphenol + 4-Methylphenol	<0.2	4-Nitroaniline	<1
Nitrobenzene	<0.01	4,6-Dinitro-2-methylphenol	<0.3
Isophorone	<0.01	4-Bromophenyl phenyl ether	<0.01
2-Nitrophenol	<0.1	Hexachlorobenzene	<0.01
2,4-Dimethylphenol	<0.029	Pentachlorophenol	<0.05
Benzoic acid	<0.5	Phenanthrene	<0.002
Bis(2-chloroethoxy)methane	<0.01	Anthracene	<0.002
2,4-Dichlorophenol	<0.1	Carbazole	<0.01
1,2,4-Trichlorobenzene	<0.01	Di-n-butyl phthalate	<0.1
Naphthalene	<0.002	Fluoranthene	<0.002
Hexachlorobutadiene	<0.01	Pyrene	<0.002
4-Chloroaniline	<1	Benzyl butyl phthalate	<0.1
4-Chloro-3-methylphenol	<0.1	Benz(a)anthracene	<0.002
2-Methylnaphthalene	<0.002	Chrysene	<0.002
1-Methylnaphthalene	<0.002	Bis(2-ethylhexyl) phthalate	<0.16
Hexachlorocyclopentadiene	<0.03	Di-n-octyl phthalate	<0.1
2,4,6-Trichlorophenol	<0.1	Benzo(a)pyrene	<0.002
2,4,5-Trichlorophenol	<0.1	Benzo(b)fluoranthene	<0.002
2-Chloronaphthalene	<0.01	Benzo(k)fluoranthene	<0.002
2-Nitroaniline	<0.05	Indeno(1,2,3-cd)pyrene	<0.002
Dimethyl phthalate	<0.071	Dibenz(a,h)anthracene	<0.002
Acenaphthylene	<0.002	Benzo(g,h,i)perylene	<0.002

Date of Report: 02/09/21
Date Received: 01/29/21
Project: I&J Waterway Phase 2 Sediment, F&BI 101419

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR TOTAL METALS USING EPA METHOD 6020B

Laboratory Code: 101404-41 x5 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result (Wet wt)	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Nickel	mg/kg (ppm)	25	12.6	104	100	75-125	4

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Nickel	mg/kg (ppm)	25	110	80-120

Date of Report: 02/09/21
Date Received: 01/29/21
Project: I&J Waterway Phase 2 Sediment, F&BI 101419

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR SEMIVOLATILES BY EPA METHOD 8270E

Laboratory Code: 101411-03 1/5 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result (Wet wt)	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Phenol	mg/kg (ppm)	0.83	<0.5	90	82	50-150	9
Bis(2-chloroethyl) ether	mg/kg (ppm)	0.83	<0.05	89	84	40-125	6
2-Chlorophenol	mg/kg (ppm)	0.83	<0.5	86	83	41-131	4
1,3-Dichlorobenzene	mg/kg (ppm)	0.83	<0.05	80	74	28-126	8
1,4-Dichlorobenzene	mg/kg (ppm)	0.83	<0.05	81	77	29-124	5
1,2-Dichlorobenzene	mg/kg (ppm)	0.83	<0.05	81	76	36-123	6
Benzyl alcohol	mg/kg (ppm)	2.5	<0.5	89	86	50-150	3
2,2'-Oxybis(1-chloropropane)	mg/kg (ppm)	0.83	<0.05	92	89	50-150	3
2-Methylphenol	mg/kg (ppm)	0.83	<0.5	90	86	42-143	5
Hexachloroethane	mg/kg (ppm)	0.83	<0.05	85	81	31-132	5
N-Nitroso-di-n-propylamine	mg/kg (ppm)	0.83	<0.05	98	95	50-150	3
3-Methylphenol + 4-Methylphenol	mg/kg (ppm)	0.83	<1	94	88	50-150	7
Nitrobenzene	mg/kg (ppm)	0.83	<0.05	90	87	25-151	3
Isophorone	mg/kg (ppm)	0.83	<0.05	93	91	23-164	2
2-Nitrophenol	mg/kg (ppm)	0.83	<0.5	84	82	29-152	2
2,4-Dimethylphenol	mg/kg (ppm)	0.83	<0.5	88	83	16-163	6
Benzoic acid	mg/kg (ppm)	2.5	<2.5	34	28	10-250	19
Bis(2-chloroethoxy)methane	mg/kg (ppm)	0.83	<0.05	96	89	50-150	8
2,4-Dichlorophenol	mg/kg (ppm)	0.83	<0.5	83	80	39-145	4
1,2,4-Trichlorobenzene	mg/kg (ppm)	0.83	<0.05	81	79	44-122	2
Naphthalene	mg/kg (ppm)	0.83	<0.01	88	84	10-188	5
Hexachlorobutadiene	mg/kg (ppm)	0.83	<0.05	79	73	39-122	8
4-Chloroaniline	mg/kg (ppm)	2.5	<5	70	70	19-113	0
4-Chloro-3-methylphenol	mg/kg (ppm)	0.83	<0.5	89	88	50-150	1
2-Methylnaphthalene	mg/kg (ppm)	0.83	<0.01	91	88	50-150	3
1-Methylnaphthalene	mg/kg (ppm)	0.83	<0.01	90	87	43-132	3
Hexachlorocyclopentadiene	mg/kg (ppm)	0.83	<0.15	77	82	10-150	6
2,4,6-Trichlorophenol	mg/kg (ppm)	0.83	<0.5	87	86	50-150	1
2,4,5-Trichlorophenol	mg/kg (ppm)	0.83	<0.5	90	87	50-150	3
2-Chloronaphthalene	mg/kg (ppm)	0.83	<0.05	86	84	50-150	2
2-Nitroaniline	mg/kg (ppm)	2.5	<0.25	101	100	50-150	1
Dimethyl phthalate	mg/kg (ppm)	0.83	<0.5	86	86	50-150	0
Acenaphthylene	mg/kg (ppm)	0.83	<0.01	98	95	50-150	3
2,6-Dinitrotoluene	mg/kg (ppm)	0.83	<0.25	90	90	49-142	0
3-Nitroaniline	mg/kg (ppm)	2.5	<5	86	85	23-125	1
Acenaphthene	mg/kg (ppm)	0.83	<0.01	94	91	50-150	3
2,4-Dinitrophenol	mg/kg (ppm)	1.7	<1.5	80	78	10-152	3
Dibenzofuran	mg/kg (ppm)	0.83	<0.05	93	91	50-150	2
2,4-Dinitrotoluene	mg/kg (ppm)	0.83	<0.25	90	89	48-143	1
4-Nitrophenol	mg/kg (ppm)	1.7	<1.5	98	98	19-154	0
Diethyl phthalate	mg/kg (ppm)	0.83	<0.5	88	87	50-150	1
Fluorene	mg/kg (ppm)	0.83	<0.01	95	93	46-140	2
4-Chlorophenyl phenyl ether	mg/kg (ppm)	0.83	<0.05	84	82	50-150	2
N-Nitrosodiphenylamine	mg/kg (ppm)	0.83	<0.05	90	88	50-150	2
4-Nitroaniline	mg/kg (ppm)	2.5	<5	84	84	26-130	0
4,6-Dinitro-2-methylphenol	mg/kg (ppm)	0.83	<1.5	98	96	9-157	2
4-Bromophenyl phenyl ether	mg/kg (ppm)	0.83	<0.05	87	83	47-143	5
Hexachlorobenzene	mg/kg (ppm)	0.83	<0.05	88	84	50-150	5
Pentachlorophenol	mg/kg (ppm)	0.83	<0.25	101	99	32-151	2
Phenanthrene	mg/kg (ppm)	0.83	<0.01	94	91	15-244	3
Anthracene	mg/kg (ppm)	0.83	<0.01	96	94	33-146	2
Carbazole	mg/kg (ppm)	0.83	<0.05	109	106	50-150	3
Di-n-butyl phthalate	mg/kg (ppm)	0.83	<0.5	99	91	50-150	8
Fluoranthene	mg/kg (ppm)	0.83	<0.01	105	101	19-162	4
Pyrene	mg/kg (ppm)	0.83	<0.01	97	90	10-238	7
Benzyl butyl phthalate	mg/kg (ppm)	0.83	<0.5	100	95	9-215	5
Benz(a)anthracene	mg/kg (ppm)	0.83	<0.01	97	94	50-150	3
Chrysene	mg/kg (ppm)	0.83	<0.01	96	93	50-150	3
Bis(2-ethylhexyl) phthalate	mg/kg (ppm)	0.83	<0.8	94	90	23-187	4
Di-n-octyl phthalate	mg/kg (ppm)	0.83	<0.5	106	98	10-253	8
Benzo(a)pyrene	mg/kg (ppm)	0.83	<0.01	104	101	48-134	3
Benzo(b)fluoranthene	mg/kg (ppm)	0.83	<0.01	101	97	38-158	4
Benzo(k)fluoranthene	mg/kg (ppm)	0.83	<0.01	102	94	41-151	8
Indeno(1,2,3-cd)pyrene	mg/kg (ppm)	0.83	<0.01	104	102	19-144	2
Dibenz(a,h)anthracene	mg/kg (ppm)	0.83	<0.01	99	98	21-140	1
Benzo(g,h,i)perylene	mg/kg (ppm)	0.83	<0.01	96	94	7-144	2

Date of Report: 02/09/21
Date Received: 01/29/21
Project: I&J Waterway Phase 2 Sediment, F&BI 101419

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF SOIL SAMPLES FOR SEMIVOLATILES BY EPA METHOD 8270E

Laboratory Code: Laboratory Control Sample 1/5

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Phenol	mg/kg (ppm)	0.83	89	68-117
Bis(2-chloroethyl) ether	mg/kg (ppm)	0.83	89	51-119
2-Chlorophenol	mg/kg (ppm)	0.83	86	58-116
1,3-Dichlorobenzene	mg/kg (ppm)	0.83	80	48-109
1,4-Dichlorobenzene	mg/kg (ppm)	0.83	82	50-107
1,2-Dichlorobenzene	mg/kg (ppm)	0.83	81	53-107
Benzyl alcohol	mg/kg (ppm)	2.5	86	70-130
2,2'-Oxybis(1-chloropropane)	mg/kg (ppm)	0.83	92	70-130
2-Methylphenol	mg/kg (ppm)	0.83	90	63-112
Hexachloroethane	mg/kg (ppm)	0.83	86	50-113
N-Nitroso-di-n-propylamine	mg/kg (ppm)	0.83	96	70-130
3-Methylphenol + 4-Methylphenol	mg/kg (ppm)	0.83	91	70-130
Nitrobenzene	mg/kg (ppm)	0.83	96	60-116
Isophorone	mg/kg (ppm)	0.83	93	66-119
2-Nitrophenol	mg/kg (ppm)	0.83	88	64-120
2,4-Dimethylphenol	mg/kg (ppm)	0.83	92	58-118
Benzoic acid	mg/kg (ppm)	2.5	70	56-169
Bis(2-chloroethoxy)methane	mg/kg (ppm)	0.83	96	68-110
2,4-Dichlorophenol	mg/kg (ppm)	0.83	84	63-116
1,2,4-Trichlorobenzene	mg/kg (ppm)	0.83	83	56-110
Naphthalene	mg/kg (ppm)	0.83	88	60-105
Hexachlorobutadiene	mg/kg (ppm)	0.83	84	52-111
4-Chloroaniline	mg/kg (ppm)	2.5	73	10-90
4-Chloro-3-methylphenol	mg/kg (ppm)	0.83	85	65-120
2-Methylnaphthalene	mg/kg (ppm)	0.83	86	64-107
1-Methylnaphthalene	mg/kg (ppm)	0.83	85	64-105
Hexachlorocyclopentadiene	mg/kg (ppm)	0.83	81	54-131
2,4,6-Trichlorophenol	mg/kg (ppm)	0.83	88	63-125
2,4,5-Trichlorophenol	mg/kg (ppm)	0.83	89	70-130
2-Chloronaphthalene	mg/kg (ppm)	0.83	84	65-115
2-Nitroaniline	mg/kg (ppm)	2.5	100	64-128
Dimethyl phthalate	mg/kg (ppm)	0.83	86	64-127
Acenaphthylene	mg/kg (ppm)	0.83	97	70-130
2,6-Dinitrotoluene	mg/kg (ppm)	0.83	89	68-126
3-Nitroaniline	mg/kg (ppm)	2.5	78	52-108
Acenaphthene	mg/kg (ppm)	0.83	92	70-130
2,4-Dinitrophenol	mg/kg (ppm)	1.7	90	51-159
Dibenzofuran	mg/kg (ppm)	0.83	93	70-130
2,4-Dinitrotoluene	mg/kg (ppm)	0.83	82	66-125
4-Nitrophenol	mg/kg (ppm)	1.7	89	60-146
Diethyl phthalate	mg/kg (ppm)	0.83	81	63-133
Fluorene	mg/kg (ppm)	0.83	91	70-130
4-Chlorophenyl phenyl ether	mg/kg (ppm)	0.83	81	70-130
N-Nitrosodiphenylamine	mg/kg (ppm)	0.83	97	70-130
4-Nitroaniline	mg/kg (ppm)	2.5	78	50-124
4,6-Dinitro-2-methylphenol	mg/kg (ppm)	0.83	102	68-139
4-Bromophenyl phenyl ether	mg/kg (ppm)	0.83	92	43-167
Hexachlorobenzene	mg/kg (ppm)	0.83	94	70-130
Pentachlorophenol	mg/kg (ppm)	0.83	116	61-136
Phenanthrene	mg/kg (ppm)	0.83	99	70-130
Anthracene	mg/kg (ppm)	0.83	99	70-130
Carbazole	mg/kg (ppm)	0.83	104	70-130
Di-n-butyl phthalate	mg/kg (ppm)	0.83	91	70-130
Fluoranthene	mg/kg (ppm)	0.83	103	70-130
Pyrene	mg/kg (ppm)	0.83	106	70-130
Benzyl butyl phthalate	mg/kg (ppm)	0.83	93	70-130
Benz(a)anthracene	mg/kg (ppm)	0.83	97	70-130
Chrysene	mg/kg (ppm)	0.83	98	70-130
Bis(2-ethylhexyl) phthalate	mg/kg (ppm)	0.83	91	38-153
Di-n-octyl phthalate	mg/kg (ppm)	0.83	85	52-141
Benzo(a)pyrene	mg/kg (ppm)	0.83	103	64-112
Benzo(b)fluoranthene	mg/kg (ppm)	0.83	101	61-118
Benzo(k)fluoranthene	mg/kg (ppm)	0.83	100	61-116
Indeno(1,2,3-cd)pyrene	mg/kg (ppm)	0.83	107	52-130
Dibenz(a,h)anthracene	mg/kg (ppm)	0.83	103	54-125
Benzo(g,h,i)perylene	mg/kg (ppm)	0.83	104	47-128

Data Qualifiers & Definitions

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for the analyte were outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte may be due to carryover from previous sample injections.

cf - The sample was centrifuged prior to analysis.

d - The sample was diluted. Detection limits were raised and surrogate recoveries may not be meaningful.

dv - Insufficient sample volume was available to achieve normal reporting limits.

f - The sample was laboratory filtered prior to analysis.

fb - The analyte was detected in the method blank.

fc - The analyte is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. Variability is attributed to sample inhomogeneity.

hs - Headspace was present in the container used for analysis.

ht – The analysis was performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of control limits due to sample matrix effects.

j - The analyte concentration is reported below the lowest calibration standard. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The laboratory control sample(s) percent recovery and/or RPD were out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the analyte is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc - The sample was received with incorrect preservation or in a container not approved by the method. The value reported should be considered an estimate.

ve - The analyte response exceeded the valid instrument calibration range. The value reported is an estimate.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

101419

SAMPLE CHAIN OF CUSTODY

ME 01/29/21

BI2

Page # 1 of 1

Report To Hainsworth, Stevens, Jones
Company Crete Consulting
Address 108 S. Washington, Ste. 300
City, State, ZIP Seattle, WA 98104
Phone ______ Email ______

SAMPLERS (*signature*) Rusty Jones R. Jones

PROJECT NAME I&J Waterway Phase 2 Sediment

PO #

REMARKS HOLD for Mercury, Dioxins/Furans, Dioxin-like PCB congeners

Project specific RLs? [✓ Yes] / No

INVOICE TO

TURNAROUND TIME
☒ Standard turnaround
☐ RUSH ______
Rush charges authorized by:

SAMPLE DISPOSAL
☐ Archive samples
☐ Other ______
Default: Dispose after 30 days

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	NWTPH-Dx	NWTPH-Gx	BTEX EPA 8021	NWTPH-HCID	VOCs EPA 8260	PAHs EPA 8270	PCBs EPA 8082	SVOCs (8270)	Bis (2-ethylhexyl) phthalate	Nickel	TOC	Notes
IJW-SC-10-3.7	01 A-C	1.28.2021	1215	SEDIMENT	3						X		X	X	X	X	
IJW-SC-10-5 #4	02	↓	1220	↓	3												HOLD
IJW-SC-11-4.5	03	↓	1400	↓	3												HOLD
IJW-SC-12-6	04	↓	1505	↓	3												HOLD

Samples received at 2 °C

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

	SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	R. Jones	Rusty Jones	Crete Consulting	1/29/21	1109
Received by:		Nhan Phan	FeBI	1/29/21	1109
Relinquished by:					
Received by:					

3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Friedman & Bruya
Michael Erdahl
3012 16th Ave. W.
Seattle, WA 98119

RE: 101419
Work Order Number: 2101472

February 05, 2021

Attention Michael Erdahl:

Fremont Analytical, Inc. received 1 sample(s) on 1/29/2021 for the analyses presented in the following report.

Total Organic Carbon by EPA 9060

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Brianna Barnes
Project Manager

DoD-ELAP Accreditation #79636 by PJLA, ISO/IEC 17025:2017 and QSM 5.3 for Environmental Testing
ORELAP Certification: WA 100009 (NELAP Recognized) for Environmental Testing
Washington State Department of Ecology Accredited for Environmental Testing, Lab ID C910

Original

CLIENT: Friedman & Bruya
Project: 101419
Work Order: 2101472

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2101472-001	IJW-SC-10-3.7	01/28/2021 12:15 PM	01/29/2021 1:45 PM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **2101472**

Date: **2/5/2021**

CLIENT: Friedman & Bruya

Project: 101419

I. SAMPLE RECEIPT:

Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:

Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:

Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Qualifiers & Acronyms

Qualifiers:

* - Flagged value is not within established control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20% Drift or minimum RRF)
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Reporting Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
DUP - Sample Duplicate
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
REP - Sample Replicate
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **2101472**
Date Reported: **2/5/2021**

Client: Friedman & Bruya
Collection Date: 1/28/2021 12:15:00 PM
Project: 101419
Lab ID: 2101472-001
Matrix: Sediment
Client Sample ID: **IJW-SC-10-3.7**

Total Organic Carbon by EPA 9060

Batch ID: 31260   Analyst: SS

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Organic Carbon	ND	0.150		%-dry	1	2/4/2021 11:57:00 AM

Work Order: 2101472
CLIENT: Friedman & Bruya
Project: 101419

QC SUMMARY REPORT

Total Organic Carbon by EPA 9060

Sample ID: **MB-31260** SampType: **MBLK** Units: **%-dry** Prep Date: **2/4/2021** RunNo: **65113**
Client ID: **MBLKS** Batch ID: **31260** Analysis Date: **2/4/2021** SeqNo: **1309518**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Organic Carbon	ND	0.150									

Sample ID: **LCS-31260** SampType: **LCS** Units: **%-dry** Prep Date: **2/4/2021** RunNo: **65113**
Client ID: **LCSS** Batch ID: **31260** Analysis Date: **2/4/2021** SeqNo: **1309519**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Organic Carbon	1.05	0.150	1.000	0	105	80	120				

Sample ID: **2101472-001ADUP** SampType: **DUP** Units: **%-dry** Prep Date: **2/4/2021** RunNo: **65113**
Client ID: **IJW-SC-10-3.7** Batch ID: **31260** Analysis Date: **2/4/2021** SeqNo: **1309522**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Organic Carbon	ND	0.150						0		20	

Sample ID: **2101472-001AMS** SampType: **MS** Units: **%-dry** Prep Date: **2/4/2021** RunNo: **65113**
Client ID: **IJW-SC-10-3.7** Batch ID: **31260** Analysis Date: **2/4/2021** SeqNo: **1309523**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Organic Carbon	1.16	0.150	1.000	0.08100	108	75	125				

Sample ID: **2101472-001AMSD** SampType: **MSD** Units: **%-dry** Prep Date: **2/4/2021** RunNo: **65113**
Client ID: **IJW-SC-10-3.7** Batch ID: **31260** Analysis Date: **2/4/2021** SeqNo: **1309524**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Total Organic Carbon	1.17	0.150	1.000	0.08100	109	75	125	1.161	0.687	20	

Fremont Analytical

Sample Log-In Check List

Client Name: **FB**
Work Order Number: **2101472**
Logged by: **Clare Griggs**
Date Received: **1/29/2021 1:45:00 PM**

Chain of Custody

1. Is Chain of Custody complete? Yes ☑ No ☐ Not Present ☐
2. How was the sample delivered? FedEx

Log In

3. Coolers are present? Yes ☑ No ☐ NA ☐
4. Shipping container/cooler in good condition? Yes ☑ No ☐
5. Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact) Yes ☐ No ☐ Not Present ☑
6. Was an attempt made to cool the samples? Yes ☑ No ☐ NA ☐
7. Were all items received at a temperature of >2°C to 6°C * Yes ☑ No ☐ NA ☐
8. Sample(s) in proper container(s)? Yes ☑ No ☐
9. Sufficient sample volume for indicated test(s)? Yes ☑ No ☐
10. Are samples properly preserved? Yes ☑ No ☐
11. Was preservative added to bottles? Yes ☐ No ☑ NA ☐
12. Is there headspace in the VOA vials? Yes ☐ No ☐ NA ☑
13. Did all samples containers arrive in good condition(unbroken)? Yes ☑ No ☐
14. Does paperwork match bottle labels? Yes ☑ No ☐
15. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
16. Is it clear what analyses were requested? Yes ☑ No ☐
17. Were all holding times able to be met? Yes ☑ No ☐

Special Handling (if applicable)

18. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: Date:
By Whom: Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:
Client Instructions:

19. Additional remarks:

Item Information

Item #	Temp ºC
Sample	5.1

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

SUBCONTRACT SAMPLE CHAIN OF CUSTODY

2101472

Page # 1 of 1

Send Report To Michael Erdahl
Company Friedman and Bruya, Inc.
Address 3012 16th Ave W
City, State, ZIP Seattle, WA 98119
Phone # (206) 285-8282 merdahl@friedmanandbruya.com

SUBCONTRACTER Fremont

PROJECT NAME/NO.	PO #
101419	B-128

REMARKS
Please Email Results

TURNAROUND TIME
☒ Standard TAT
☐ RUSH
Rush charges authorized by:

SAMPLE DISPOSAL
☐ Dispose after 30 days
☐ Return samples
☐ Will call with instructions

						ANALYSES REQUESTED										
Sample ID	Lab ID	Date Sampled	Time Sampled	Matrix	# of jars	Dioxins/Furans	EPH	VPH	TOC							Notes
IJW-SC-10-3.7		1/28/21	1215	sediment	1				X							

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282
Fax (206) 283-5044

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	Michael Erdahl	Friedman & Bruya	1/28/21	1149
Received by: Claire Anderson	Claire Anderson	FAI	1/29/21	1345
Relinquished by:				
Received by:				

Appendix B

Geotechnical Basis of Design Report

I&J Waterway Site
Sediment Cleanup Unit 1

Geotechnical Engineering Report

90% Design

February 2022

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Table of Contents

List of Tables

List of Figures

Appendices

Distribution

To:	Grant Hainsworth CRETE Consulting
From:	Lynn Salvati, PE McMillen Jacobs Associates
Prepared By:	Lynn Salvati, PE McMillen Jacobs Associates Cecilia Burke McMillen Jacobs Associates
Reviewed By:	Mike Coryell, PE McMillen Jacobs Associates

Revision Log

Revision No.	Date	Revision Description
0	8/7/20	Preliminary Draft for 30% Design Kickoff
1	12/11/20	Draft for 30% Design
2	10/11/21	Preliminary Draft for 60% Design
3	10/15/21	Draft for 60% Design
4	1/17/22	Preliminary Draft for 90% Design
5	2/23/22	Draft for 90% Design

1.0 Introduction

1.1 Purpose and Scope

This Geotechnical Engineering Report (GER) presents the procedures and results of the field exploration and laboratory testing programs completed for the I&J Waterway Site Sediment Cleanup Unit 1 Project (Project) in Bellingham, Washington. The location of the Project is shown in the Project Vicinity Map (Figure 1). This report also summarizes the geotechnical conditions for the Project and provides geotechnical engineering recommendations for design and construction of the Project.

1.2 Project Description

The Project includes implementing the cleanup of the Sediment Cleanup Unit 1 (SCU-1) area of the I&J Waterway site in Bellingham, Washington as identified in the Agreed Order No. DE 16186 (Agreed Order) with Washington State Department of Ecology (Ecology). 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. The cleanup action area for the I&J Waterway site is shown on Figure 2. Studies at the site have found polycyclic aromatic hydrocarbons (PAHs), phthalates, phenols, and nickel in marine sediment. Other contaminants such as dioxins/furans, polychlorinated biphenyls (PCBs), and mercury were also found at the Site. The Cleanup Action Plan describes the cleanup action proposed by Ecology for the cleanup of contamination at the I&J Waterway Site (Project site) in Bellingham, Washington. To stabilize the slopes after dredging, slope protection will be provided as part of the Project. The dock will be replaced, and a new bulkhead (retaining) wall will be constructed along the waterway. The new bulkhead will be constructed in front of the existing bulkhead wall on the waterway side.

1.2.1 Datum

Elevations (El.) are referenced to the Mean Lower Low Water (MLLW) datum. The horizontal datum used is NAD83/98 (North American Datum of 1983/98).

1.3 Limitations

This report has been prepared for the exclusive use of CRETE Consulting and its consultants and contractors for the I&J Waterway Site Sediment Cleanup Unit I Project only. The data presented in this report is based on the subsurface conditions encountered by McMillen Jacobs Associates at the time that the geotechnical investigation for the Project was conducted. The observations presented in this report are based on the subsurface explorations and observations completed for this investigation and a review of previous geotechnical work in the project area. Subsurface conditions may vary between exploration locations and with time. As a result, conditions which differ from those summarized in the report, and which are unanticipated, can and do occur. McMillen Jacobs Associates cannot be held responsible for the interpretation by others for the data contained herein.

Within the limitations of scope, schedule and budget, our services have been performed in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions in this area. No other warranty, express or implied, is made.

2.0 Site Conditions

2.1 Site Description

The I&J Waterway site is located between Hilton Avenue and Bellwether Way on the Bellingham waterfront. It includes the federally authorized I&J Waterway navigation channel, which has an authorized channel depth of 18 feet below MLLW (El. -18 feet). 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 occupied 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.

2.1.1 Topography

The I&J Waterway site is located along Bellingham Bay in Bellingham, Washington. The upland area is relatively flat ranging from approximately El. 12 feet to El. 16 feet. In the navigation channel the existing mudline varies from El. -3 feet in the northern corner to approximately El. -16 feet in the center of the channel and El. -18 feet in a localized area near the USCG dock.

2.2 Regional Geology

The Bellingham area has been shaped by glacial deposits with the advance and retreat of the of Cordilleran Ice Sheet and by subsequent sedimentation and filling activities. The Project site is in a beach and intertidal area along the Bellingham Bay shoreline that has been filled in the past. 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. In the area, the bedrock is from the Chuckanut Formation consisting of sandstone, siltstone, and shale. Bedrock was not encountered at the I&J Waterway site, but it was encountered at El. -26 feet at its shallowest at the Whatcom Waterway site just to the southeast of the I&J Waterway.

2.3 Regional Seismicity

Based on the regional tectonics, three types of seismic sources provide contributions to the seismic hazard.

Deep earthquakes, which occur within the subducting Juan de Fuca plate, usually have a magnitude less than 7.5. The range of distances between the earthquake source and the site is similar to the depths. The shaking from deep earthquakes is typically weaker but felt over a wider area when compared to shallow earthquakes. The Nisqually Earthquake (M=6.8) in 2001 is the most recent example of a deep earthquake in this area.

Subduction earthquakes occur at the interface of the subducting Juan de Fuca plate and the North American plate. Huge areas of slip may occur resulting in earthquakes with a magnitude of up to 9.1. The strong shaking could continue for several minutes, and many aftershocks will occur. The most recent interplate event on the Cascadia Subduction Zone is believed to have occurred in 1700. This fault zone is over 60 miles from the site.

Shallow earthquakes occur within the North American plate at depths typically less than 10 miles and magnitudes of 7.5 or less. The Birch Bay Fault is the closest fault to this project, which is more than 5 miles from the Project site.

3.0 Subsurface Exploration and In Situ Testing Program

The geotechnical subsurface exploration program for the I&J Waterway Site Sediment Cleanup Unit I Project included geotechnical borings, cone penetration tests (CPTs), and vibracores. The purpose of the exploration program was to obtain subsurface data to interpret the geotechnical and geologic conditions at the site. This information will be used in the design of retaining structures and foundations needed for the Project.

Three borings, seven CPTs, and twenty-one vibracores were completed for this investigation. The location the explorations are shown on the Exploration Plan (Figure 3). Figure 4 provides a legend for the site plan. The locations of over-water explorations were measured with a hand-held GPS unit. Other exploration locations were estimated using measurements from existing features and the site topographic survey. Elevations for the borings and CPTs were estimated using the site topographic survey. Table 3-1 provides a summary of the exploration methods, locations, and dates of completion.

Existing geotechnical data at the site was also reviewed. The deepest existing explorations were performed by Harding Lawson Associates (1995), which extended up to 22 feet below ground surface.

Table 3-1. Summary of Exploration Locations

Exploration ID	Exploration Method	Exploration Location		Surface Elevation (feet)	Final Depth (feet)	Exploration Date
		Northing	Easting			
IJW-SB-1	Mud-rotary	644,202	1,239,901	12.5	60	6/03/2020
IJW-SB-2	Mud-rotary	644,288	1,239,969	15.8	60	6/03/2020
IJW-SB-3	Mud-rotary	644,390	1,240,012	12.8	70	6/02/2020
IJW-CPT-1	CPT	644,259	1,239,888	-10.0	16.9	6/26/2020
IJW-CPT-2	CPT	644,315	1,239,953	-7.8	26.6	6/27/2020
IJW-CPT-3	CPT	644,458	1,240,061	-13.0	23.3	6/23/2020
IJW-CPT-4	CPT	644,291	1,239,789	-15.9	14.6	6/25/2020
IJW-CPT-5	CPT	644,414	1,239,877	-14.7	20.3	6/23/2020
IJW-CPT-6	CPT	644,517	1,240,012	-14.0	21.3	6/24/2020
IJW-sCPT-7	CPT	644,329	1,240,022	13.6	97.3	6/24/2020
IJW-SC-1	Vibracore	644,207	1,239,853	-	9.5	6/16/2020
IJW-SC-2	Vibracore	644,368	1,240,022	-	6.3	6/17/2020
IJW-SC-3	Vibracore	644,412	1,240,071	-	6.5	6/17/2020
IJW-SC-4	Vibracore	644,476	1,240,084	-	6.7	6/17/2020

Exploration ID	Exploration Method	Exploration Location		Surface Elevation (feet)	Final Depth (feet)	Exploration Date
		Northing	Easting			
IJW-SC-5	Vibracore	644,457	1,240,028	-	10.7	6/16/2020
IJW-SC-6	Vibracore	644,371	1,239,914	-	6.4	6/17/2020
IJW-SC-7	Vibracore	644,306	1,239,881	-	5.5	6/17/2020
IJW-SC-8	Vibracore	644,397	1,239,877	-	8.8	6/17/2020
IJW-SC-9	Vibracore	644,287	1,239,908	-	9.3	6/16/2020
IJW-SC-10 #1	Vibracore	644,178	1,239,859	-	6.0	1/28/2021
IJW-SC-10 #4	Vibracore	644,183	1,239,853	-	5.0	1/28/2021
IJW-SC-11 #3	Vibracore	644,233	1,239,796	-	4.0	1/26/2021
IJW-SC-11 #4	Vibracore	644,236	1,239,799	-	6.5	1/28/2021
IJW-SC-12 #1	Vibracore	644,337	1,239,785	-	4.1	1/26/2021
IJW-SC-12 #2	Vibracore	644,335	1,239,785	-	9.0	1/28/2021
IJW-SC-13 #1	Vibracore	644,457	1,239,907	-	5.0	1/26/2021
IJW-SC-13 #2	Vibracore	644,454	1,239,907	-	9.5	1/28/2021
IJW-SC-14	Vibracore	644,496	1,239,989	-	5.0	1/26/2021
IJW-SC-15	Vibracore	644,518	1,240,069	-	5.0	1/26/2021
IJW-SC-16	Vibracore	644,479	1,240,131	-	8.3	1/27/2021
IJW-SC-17	Vibracore	644,207	1,239,854	-	9.4	1/28/2021

3.1 Project Borings

All three borings were performed on land. Holt Services Inc. (Holt) completed the geotechnical borings using mud-rotary drilling methods with a truck-mounted drill rig from June 2, 2020 to June 3, 2020. McMillen Jacobs Associates personnel were on-site to observe drilling and excavation operations, prepare field logs of each exploration, and collect soil samples for geotechnical laboratory testing.

The mud-rotary method consists of drilling an approximately 4-inch to 6-inch diameter borehole in the ground using a tri-cone roller bit and drilling mud. The mud is used to wash the soil cuttings from the borehole, to cool the bit, and to maintain borehole stability. The tri-cone bit is used to advance the borehole. Drilling mud is pumped from a mud tub at the surface, down the drill rods, and out through the bit. The drilling mud carries soil cuttings up the annular space between the drill rods and the borehole wall, back up to the mud tub at the surface. Cuttings carried by the drilling mud are allowed to settle out in the mud tub and the drilling fluid is re-circulated back down the borehole. After completing the borings, Holt decommissioned the borings by backfilling the open boreholes with bentonite chips in accordance with Washington Administrative Code (WAC) 173-160-450.

3.1.1 Sampling Methods

3.1.1.1 Driven Samples

Driven soil samples were obtained by removing the drilling assembly from the borehole and driving a standard 2-inch outer-diameter (O.D.), 18-inch long split-spoon (or split-barrel) sampler via the Standard Penetration Test (SPT; See 3.4.1). These samples are considered disturbed. A driven sample can recover up to 18 inches of soil. Split-spoon samples were visually classified and described on the borehole logs, then placed in plastic Ziploc bags for possible laboratory testing.

3.1.1.2 Undisturbed Samples

Relatively undisturbed soil samples of fine-grained soils were recovered from soil borings using steel, thin-walled Shelby tubes. The 3-inch O.D., 30-inch long sampling tubes are pushed 24 inches into the soil at the bottom of the borehole and retrieved, and then sealed at both ends to maintain the integrity of the samples for laboratory testing. These relatively undisturbed samples were used for consolidation testing.

3.1.2 Boring Logs

The boring log is a written record of the subsurface conditions encountered during drilling. Project Boring logs are included in Appendix A.1, and the existing boring log closest to the project is included in Appendix A.2. Boring logs provide a description of each identified soil unit and graphically illustrate the geologic units encountered at each boring location. The Unified Soil Classification System (USCS) is used to describe the various soil types encountered in the borings and a graphical symbol for each identified soil layer is included on the boring logs. A legend of these symbols is included on Figure 4. The boring logs show the type and depth of soil samples, sample recoveries, and uncorrected SPT N-values, if applicable. Other information included on the boring logs include ground surface elevations and coordinates.

Material descriptions shown on the logs are based on the material recovered from the borings; however, there are instances where a sample was not recovered, or recovery was poor. In these instances, the material descriptions were inferred from the drill action (e.g., ease or difficulty of drilling, rate of advancement) and the cuttings observed in the drilling mud circulating up from the borehole. These descriptions were noted on the logs and should be considered as only general indicators of subsurface conditions at those depths.

3.2 Project CPTs

CPT soundings were performed by In Situ Engineering in general accordance with ASTM D5778 from June 23, 2020 to June 27, 2020. One CPT was performed on land, two CPTs were performed through the Bornstein dock, and the remaining four CPTs were performed from a barge in the waterway. To perform the CPTs from the dock, the concrete covering the dock and the wood dock was cored, and casing was extended from the dock to mudline. The CPT probe was advanced through the casing to the mudline.

To complete a CPT, a penetrometer that consists of a cone tip at the end of steel rods is pushed continually into the ground. The cone tip has a porous element that is used to measure the pore pressure in addition to transducers to measure tip resistance and side friction. Measurements are taken at 5 cm intervals and provide a nearly continuous record of soil stratigraphy. Samples are not retrieved with CPT testing.

CPT-01 met refusal at what was thought to be wood and was stopped shallower than anticipated. The remaining CPTs were extended to the depths planned. See Table 3-1 for depths of explorations.

3.2.1 CPT Logs

Logs of each CPT can be found in Appendix B. The measured tip resistance, sleeve friction, and pore pressure recorded during each test are presented on the logs along with inferred soil units and estimated N-values (Robertson and Campanella, 1983a; Robertson and Campanella, 1983b).

3.3 Project Vibracores

All twenty-one vibracores were advanced in-water from a boat by Gravity Marine. 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 disturbance. In the vibracore sampling, continuous relatively undisturbed cores of sediment were retrieved in 4-inch diameter Lexan tubes. CRETE Consulting personnel were on-site to observe the vibracores, prepare field logs of each exploration, and collect sediment cores.

3.3.1 Sediment Logs

The sediment log is a written record of the subsurface conditions observed in the vibracore. Sediment logs are included in Appendix C and provide a description of each identified soil unit and graphically illustrate the geologic units encountered at each boring location. The Unified Soil Classification System (USCS) is used to describe the various soil types encountered in the cores and a graphical symbol for each identified soil layer is included on the sediment logs.

3.4 In Situ Geotechnical Tests

3.4.1 Standard Penetration Testing (SPT)

SPTs were performed by driving a 2-inch O.D., 1.375-inch I.D. split-spoon sampler into the soil at the bottom of the borehole with an auto-hammer. An auto-hammer delivers energy per blow to the split spoon sampler equivalent to a 140-pound hammer falling freely from a height of 30 inches. The actual energy delivered depends on the condition and efficiency of the drill rig hammer. The number of blows to advance the sampler the final 12 inches (or portion thereof) of the 18-inch drive is recorded as the Standard Penetration Resistance, or N-value. The N-value provides a relative indication of soil density (for granular soils) or consistency (for fine-grained soils). If the penetration resistance exceeded 50 blows for 6 inches or less of penetration, the test was terminated and the number of blows along with the penetration distance was recorded on the boring log. The presence of gravels or cobbles larger than the sampler can impact measured penetration resistances and may result in artificially high values. A soil sample is collected in conjunction with the test, as described in Section 3.1.1.1. The SPT N-values are provided in the boring logs included in Appendix A. The reported SPT N-values are uncorrected field values. An energy ratio of 87.7% was measured using a Pile Driving Analyzer by GRL Engineers for Holt's Mobile B-59 truck mounted rig in August 2019. This value was used to calculate corrected N-values for all Project borings.

3.4.2 Seismic CPT

Geophysical testing was performed in CPT-7 during the current exploration program. The primary purpose of this testing was to obtain estimates of the soil shear wave velocity, which is used to identify boundaries between soil layers and to evaluate the appropriate site classification for seismic design. The seismic test consists of triggering a seismic wave in the soil medium by hitting an anvil resting on the ground surface with a sledgehammer. Then, the wave is recorded by a system of accelerometers or geophones located behind the cone tip. The results of the seismic CPT (sCPT) are provided on the CPT Log for CPT-7 in Appendix B.

4.0 Geotechnical Laboratory Testing

The following sections describe the geotechnical laboratory testing performed for the geotechnical exploration program. Results of geotechnical laboratory testing for the exploration program are included in Appendix D.

4.1 Geotechnical Index Testing

Index tests were completed on selected soil samples recovered from the soil borings and vibracores to confirm soil sample classification in accordance with ASTM standards. Geotechnical index tests include water content, grain size distribution (sieve analysis), and Atterberg limits. Geotechnical index tests on samples from the soil borings were performed by Hong West and Associates, Inc. (HWA) from Bothell, Washington. Geotechnical index tests on samples from the vibracores were performed by Eurofins TestAmerica.

4.1.1 Classification

Using the USCS, coarse-grained soils (greater than 50 percent coarser than 0.075 mm) are classified based on particle-size distribution. Fine-grained soils (greater than 50 percent finer than 0.075 mm) are classified based on Atterberg limits. Field descriptions of the soil samples are based on ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). When geotechnical index testing results were available, descriptions were reviewed and modified as necessary in accordance with ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes.

4.1.2 Water Content Determination

The water content of the samples retrieved from the explorations was determined in general accordance with ASTM D2216, Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass. The water content is shown graphically on the borehole logs in Appendix A.1 and the results are included in Appendix D.

4.1.3 Grain Size Analysis

The grain size distribution of selected samples was determined in general accordance with the ASTM D422, Standard Test Method for Particle-Size Analysis of Soils. Grain size analysis results could potentially be affected by sample type and drilling method. The sample type or, more specifically, the inside diameter of the sampler, directly impacts the maximum particle size that can be sampled. For example, the largest diameter particle that can be sampled by a 2-inch SPT sampler (1.375-inch I.D.) is approximately 1.3 inches, regardless of the maximum particle size of the soil unit being sampled. The drilling method could also potentially impact grain size analysis data. During mud-rotary drilling, drilling mud can infiltrate open deposits of sand and gravel. This process can affect the sample by “cleaning” the sample (removing fines), adding bentonite clay (contained in the drilling mud) to the sample, or varying degrees of both. Field staff removed drilling mud from mud-rotary borehole samples to the extent practical; however, it is often impossible to completely clean the samples. Grain size curves are included in Appendix D.

4.1.4 Atterberg Limits Determination

Atterberg limits tests were performed in general accordance with ASTM D4318, Standard Test Method for Liquid Limit (LL), Plastic Limit (PL), and Plasticity Index (PI) of Soils. Summary plasticity charts are included in Appendix D. The results are also shown graphically on the exploration logs in Appendix A.1.

4.2 Geotechnical Engineering Property Tests

Engineering property tests were performed on relatively undisturbed soil samples obtained from the thin-walled Shelby tube samples retrieved from the mud-rotary borings. Geotechnical engineering property tests were conducted by HWA.

4.2.1 One-Dimensional Consolidation

Incremental loading consolidation tests were performed on relatively undisturbed soil samples in general accordance with ASTM D2435, Standard Test Methods for One-Dimensional Consolidation Properties of Soils Using Incremental Loading. The consolidation test measures the coefficient of consolidation for estimating the rate of soil consolidation and provides an estimate of the maximum past pressure (pre-consolidation pressure). These parameters were used to evaluate strength-deformation properties and the degree of over-consolidation of the tested soils. Determination of the maximum past pressure helps in providing a better understanding of the strength-deformation behavior. The results of the one-dimensional consolidation tests are in Appendix D. The results include plots of both percent consolidation and void ratio versus stress on a logarithmic scale.

5.0 Subsurface Conditions

5.1 Engineering Soil Units

Soils encountered and tested in the exploration program have been grouped based on common engineering properties into four engineering soil units (ESUs). Soil type, index and strength tests, and expected behavior are used to differentiate the ESUs. The ESUs used for this Project are described briefly below.

- **Glacial Marine Drift (GMD):** Glacial Marine Drift (Glaciomarine Drift) is a fine-grained glacial sediment that was deposited in marine water. In the Bellingham area, the glacial marine drift contains unstratified silt and clay with varying amounts of sand, gravel, cobbles, and occasional boulders. This unit may contain small percentages of shells and wood (WSDOT, 2019). At this site, the GMD consists of soft to stiff, low-plasticity clay with varying amounts of sand and gravel. In testing completed for this project, the average value of the plasticity index in the GMD was 18, with PI values ranging from 13 to 29. Consolidation tests indicate that the top 10 to 15 feet of the GMD is lightly overconsolidated.

- **Post-Glacial Fluvial Deposits (PGF):** This unit consists of native fluvial sediments, primarily from Whatcom Creek, deposited prior to industrialization of the area. The PGF consist of loose to dense, slightly silty to silty sand with varying amounts of gravel. Shells and wood were observed in this deposit. Trace organics were also observed in this deposit.

- **Fill:** This ESU consists of very loose to medium dense, or locally very dense, cohesionless fill and medium stiff cohesive fill. The fill was typically silty to very silty sand to silty to very silty gravel, but cohesive layers were locally observed. Wood, brick, shells, and charcoal were found in these deposits. This ESU consists of soils characterized by their recent man-made placement and larger variability in soil properties.

- **Recent Sediments:** This ESU consists of very soft to soft, organic silts, silts and clays with varying amount of silt and gravel with localized layers of loose, silty sands and sands that were deposited in the waterway. Fish bones, fish waste and shells were observed in this unit.

5.2 Subsurface Profile

Figures 5 and 6 show the interpreted subsurface conditions along the bulkhead and across the waterway, respectively, including approximate contacts between ESUs. The profile stationing is shown on Figure 3.

In the upland area near Bornstein Seafood the Fill is 8 to 18 feet thick. The base of the fill varied from El. 4 to El. -3 feet. The Fill is underlain by PGF deposits that are 5 to 12 feet thick, and the base of the PGF varied from El. -4 to El. -12 feet. The PGF deposits were underlain by GMD to the depths explored (El. -84 feet).

In the navigation channel, the Recent Sediments are underlain by the GMD. The Recent Sediments were observed to be 1.8 to 7.2 feet thick, but in most areas, they were 3 to 4 feet thick. The top of the GMD ranges from El. -4 to -12 feet in the upland area and slopes down to El. -22 feet near the center of the navigation channel.

The table below provides the interpreted depth to the GMD in the CPT logs, since not all of the CPTs are shown on the subsurface profile. Where there is a range listed, the contact was difficult to interpret, and it is possible that the sediments were disturbed.

Table 5-1. Depth to Glacial Marine Drift

Location ID	Ground Surface Elevation (feet)	Depth to Glacial Marine Drift (feet)	Top of Glacial Marine Drift (feet)
IJW-CPT-1	-10.0	3.5	-13.5
IJW-CPT-2	-7.8	4.0 to 5.5	-11.8 to -13.3
IJW-CPT-3	-13.0	4.0	-17.0
IJW-CPT-4	-15.9	3.5	-19.4
IJW-CPT-5	-14.7	4.0 to 5.5	-18.7 to -20.2
IJW-CPT-6	-14.0	2.5	-16.5
IJW-CPT-7	13.6	21.5	-7.9

5.3 Groundwater

The groundwater levels at the Project site are influenced by tidal fluctuations. The I&J Waterway is open to Bellingham Bay and is subjected to tidal fluctuations and seasonal variations in tides. This site experiences a mean higher high water (MHHW) of El. 8.51 feet, a mean sea level (MSL) of El. 4.95 feet, and a lowest observed tide of El. -3.47 feet. These values are measured relative to the vertical datum of MLLW (El. 0 feet).

6.0 Geotechnical Design Parameters

6.1 Engineering Properties for Soil

The engineering soil properties for the ESUs that are anticipated to be encountered in the Project work are provided in Table 6-1. These properties are based on in situ testing, downhole seismic testing, laboratory testing, and our experience on local construction projects in similar soil deposits. Where a range of properties is provided, it represents the range of values observed or expected in the deposit. The higher increase in strength with depth in the GMD is used for the seismic slope stability to account for higher strength with increased rate of loading.

Table 6-1. Engineering Properties of ESUs

ESU	Unit Weight (pcf)	Effective Strength		Undrained Shear Strength (psf)
		ϕ'(deg)	c' (psf)	
Recent Sediments	115	26	20	250
Fill	125	32	20 to 50	NA
PGF	125	32	10 to 30	NA
GMD	130	30	20 to 50	650 at top of GMD increasing at 10 to 15 psf per foot

Notes: NA=Not Applicable, Unit Weights listed are Saturated Unit Weights

6.2 Design Groundwater Elevations

The groundwater at the Project site varies with tidal fluctuations. We recommend using MSL (El. 4.95 feet) as the design groundwater elevation for most analysis. Where fluctuations in the groundwater level will influence the results of the analysis, we recommend using high and low water cases equivalent to the MHHW (El. 8.51 feet) and MLLW (El. 0 feet) elevations.

6.3 Seismic Design

Seismic design parameters for the project were developed in accordance with ASCE 7-16 (Minimum Design Loads and Associated Criteria for Buildings and Other Structures). Seismic design parameters from ASCE 7-16 are used both in the International Building Code and for Design Earthquakes in ASCE 61-14 (Seismic Design of Piers and Wharves).

6.3.1 Site Class

The shear wave velocity values measured in the sCPT test were used to determine the site class for the Project. The average shear wave velocity for the top 100 feet was calculated in accordance with the procedure recommended in ASCE 7-16 as 755 feet/sec, which corresponds to Site Class D. The clay layers at the site do not meet the criteria that would correspond to Site Class E. The PGF deposits are susceptible to liquefaction, which would generally require the site to be considered Site Class F.

However, since the structures at the site are not expected to have fundamental periods of greater than 0.5 sec, structures may be designed using Site Class D seismic parameters in accordance with ASCE 7-16.

6.3.2 Building Code Design Parameters

The ASCE 7-16 seismic design parameters for the site are given in Table 6-2 below.

Table 6-2. Seismic Design Parameters

Spectral Accelerations (g)		Site Coefficients		Design Spectral Response (g)		PGA_M
S_S (0.2 sec)	S_1 (1.0 sec)	Fa	Fv*	S_{DS}	S_{D1}*	
1.00	0.35	1.2	1.95	0.80	0.46	0.515

*Note, these values can only be used if the seismic response coefficient, Cs is calculated using ASCE 7-16 Eq 12.8-3 for T<1.5Ts and taken as equal to 1.5 times the values computed in accordance with either ASCE 7-16 Eq 12.8-3 or 12.8-4, since this is Site Class D with S1 greater than 0.2.

6.3.3 Liquefaction Susceptibility

Liquefaction susceptibility was evaluated at each boring using empirical procedures from Idriss and Boulanger (2008). Fine-grained soils were considered susceptible to liquefaction if they met the criteria recommended in Bray and Sancio (2006). The PGA_M, which is the PGA for the maximum considered earthquake (MCE) with a return period of 2475 years, is used for the liquefaction analysis, as recommended in ASCE 7-16. A de-aggregation of the of the hazard for the 2475-year return period earthquake was performed and the mode contributing earthquake from that de-aggregation, M=7.1, was used in the liquefaction analysis. Liquefaction is considered when the factor of safety for liquefaction triggering is less than 1.2.

Based on the water content and Atterberg limits the GMD was not found to be potentially liquefiable (Bray and Sancio, 2006). One lens of the Fill was found to be potentially liquefiable, but since it was only one isolated lens, the Fill unit was not considered potentially liquefiable. The PGF deposits in IJW-SB-1 were not liquefiable. The top portion of the PGF deposits in IJW-SB-2 and all the PGF deposits IJW-SB-3 were found to be potentially liquefiable. Based on this analysis, portions of the PGF limited in thickness and areal extent are considered potentially liquefiable.

7.0 Geotechnical Design Considerations

7.1 Dock

The existing dock will be demolished, and a new dock will be constructed in the same location with two approach spans connecting to the upland. Driven piles will be used to support the dock and as mooring and dolphin piles, if needed, since they will require minimal management of site soils. Timber, concrete, or steel piles could be used. It is our understanding that open-ended steel pipe piles will be used; therefore, axial capacities have been provided for 2.5-foot and 3-foot diameter open-ended steel pipe piles.

7.1.1 Axial Pile Capacity

For open-ended piles the axial capacity is provided by side resistance. The resistance for the piles was calculated using the alpha method for cohesive soils with the equations presented in the FHWA (2016). For ASD analysis with most loading combinations (usual loads), a factor of safety of 2.5 is recommended for piles in compression and a factor of safety of 3.0 is recommended for piles in uplift. These factors of safety assume dynamic testing will be performed on a small percentage of the piles during construction to confirm capacities. For extreme loading (seismic) conditions a factor of safety of 1.4 in compression and a factor of safety of 1.7 in uplift is recommended for the pile capacity (USACE, 1991). For unusual loading (e.g., maintenance, infrequent floods, or barge impact) a factor of safety of 1.9 in compression and a factor of safety of 2.25 in uplift is recommended (USACE, 1991).

Capacities are provided for open-end piles assuming dredging has lowered the mudline to El. -24 feet. Figure 7 shows the ultimate and allowable axial resistances for ASD design for usual loads recommended for the design of single 2.5-foot and 3-foot diameter pipe piles based on the expected geotechnical conditions with depth at the current dock location in the waterway. It is our understanding the piles are loaded individually, rather than loaded as a group, so no group efficiency factor is considered.

If LFRD analysis is performed, the recommended resistance factors range from 0.35 to 0.8, depending on the type and extent of testing performed. Without any testing, AASHTO (2017) recommends a resistance factor of 0.35 for use with the alpha method. If driving criteria are established by dynamic testing and dynamic testing is performed on at least two piles (or 2% of piles, whichever is more) the recommended resistance factor is 0.65. These resistance factors can be applied to the ultimate axial resistances provided.

7.1.1.1 Soil Structure Interaction (t-z curves)

The soil-structure interaction between the soil and the pile can be represented with load transfer curves. The t-z curves provide load transfer through side resistance as a function of pile movement. Since the GMD strength increases with depth, t-z curves are provided for depth ranges. Bi-linear t-z curves were developed based on the load transfer curves from Reese and O'Neill (1988) for use in structural modelling programs. The bi-linear curves can be defined by the point (x,y) as shown in Diagram 7-1 below and vary based on depth and pile size, as provided in Table 7-1. For modelling programs with t-z curves from literature, the Coyle and Reese (1966) t-z curves for driven piles in clay can be utilized, with the ultimate skin friction for each depth range as provided in Table 7-1.

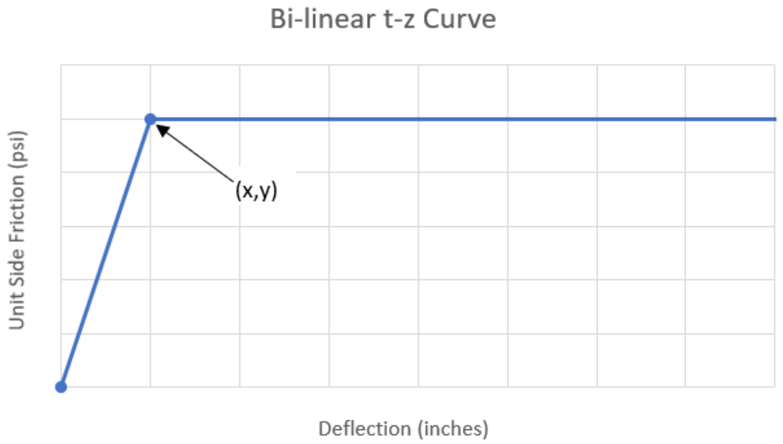

Diagram 7-1 Bi-Linear t-z curve

Table 7-1. Bi-linear t-z Curve Coordinates for GMD

Depth Range (feet)	30-inch Pipe Pile		36-inch Pipe Pile	
	x (inches)	y (psi)	x (inches)	y (psi)
0 to 20	0.066	3.63	0.079	3.63
20 to 40	0.066	4.57	0.079	4.57
40 to 60	0.066	5.51	0.079	5.51
Greater than 60	0.066	6.33	0.079	6.33

7.1.2 Lateral Loading

7.1.2.1 Single Piles

The lateral loads acting on the dock would be resisted by the deep foundations. The horizontal movement criteria for the deep foundations should be based on the tolerance of the structure to lateral movement. It is recommended that the deflection calculation consider the stiffness of the pile and the surrounding soil, using a software package such as LPILE. For the purposes of design, we have developed p-y spring parameters in Table 7-2 to represent the lateral resistance of the soil for the GMD. Since the Recent Deposits will be removed in the cleanup operation, parameters are not provided for that ESU. The Glacial Marine Drift is not considered liquefiable and the lateral loads from the upland deposits will be supported by the bulkhead. Therefore, no lateral spreading forces are provided for the lateral design of the piles.

Table 7-2. Recommended LPILE Design Parameters

ESU	Soil Model	Unit Weight (pcf)	Su (psf)	ε50
GMD	Soft Clay	67.6	750	0.01

SOFT CLAY= Soft Clay in the Presence of Free Water

7.1.2.2 Pile Groups

A group of piles will have less lateral resistance than the sum of the single pile lateral resistances for pile center-to-center (CTC) spacing less than five diameters (5B) or less. A p-multiplier is used to reduce the static p-y curves of the soil surrounding an individual pile based on the location of the pile within the group with respect to the direction of loading (e.g., row 1, 2, 3, or greater) and the center-to-center spacing of the piles in the group. After an appropriate p-multiplier has been applied at every pile location in the group, the adjusted resistance values can be summed to estimate the group lateral resistance. The p-multipliers based on the loading direction, row, and CTC pile spacing as recommended by AASHTO (2017) are provided in Table 7-3 with the row and load directions shown in Diagram 7-2.

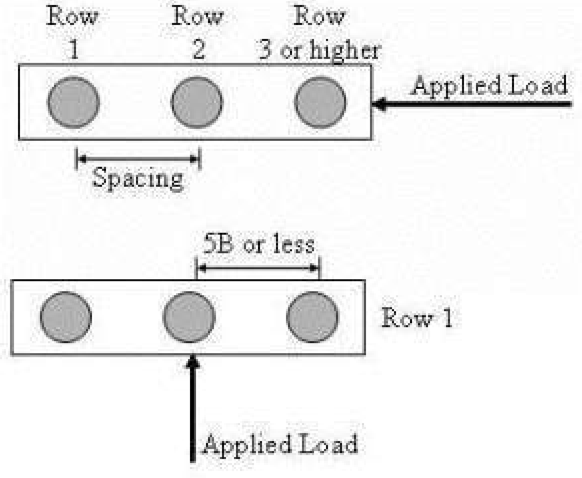

Diagram 7-2 Definition of Loading Direction and Spacing for Group Effects

Table 7-3. Pile P-Multipliers

Pile CTC Spacing (in direction of loading)	P-Multipliers (Pm)		
	Row 1	Row 2	Row 3
3B	0.8	0.4	0.3
5B	1.0	0.85	0.7

7.2 Retaining (Bulkhead) Wall

A new retaining (bulkhead) wall will be constructed at the waterway along the Bornstein property, in front of the existing bulkhead wall on the waterway side. The wall will support the upland soils while the recent sediments in the channel are removed, the retained height of soil will exceed 20 feet. It is our understanding that a king pile wall, consisting of sheet piles between wide flange sections, with tiebacks will be used for the new bulkhead.

7.2.1 Lateral Earth Pressures

Lateral earth pressures for design of the permanent anchored wall are presented in Figure 8. The lateral earth pressures were developed using the design procedures outlined in FHWA Geotechnical Engineering Circular No. 4 (FHWA, 1999).

A temporary construction lateral surcharge pressure is shown in Figure 8, based on a 20-foot-wide strip with a vertical surcharge of 600 psf that runs parallel to the wall. This surcharge accounts for loads from construction equipment and storage of construction materials. Depending on the construction means and methods, surcharges from equipment such as a large crane, may need to be considered separately.

For earthquake loading, the active and seismic earth pressures are combined and distributed into the same trapezoidal pressure distribution shape as was used for the static apparent earth pressures. The PGA from the ASCE 7-16 design response spectrum was used to calculate seismic earth pressures (FHWA, 2011; TRB, 2008). No reduction of the PGA was taken since the tiebacks will limit the deformation of the wall during seismic loading. The dynamic passive earth pressure coefficient, K_{pe}, used to calculate the seismic passive pressures was calculated using the procedure described in NCHRP Report 611 (TRB, 2008). Since the bulkhead retains potentially liquefiable soils, two analyses were performed. Both a pseudo-static analysis using the Mononobe-Okabe method and a general limit equilibrium (GLE) analysis using residual strengths for the potentially liquefiable PGF layer (WSDOT, 2019) were performed. Since the main contributing earthquakes to the hazard have magnitudes less than 7.5, it can be assumed that $k_h=0$ when the soil is liquefied (WSDOT, 2019) in the GLE analysis. The larger lateral earth pressure calculated using these two methods is provided for design.

7.2.2 Axial Pile Capacity

The axial capacities for the king piles in end bearing and side resistance were calculated using the alpha method for cohesive soils using the equations presented in the FHWA (2016) as discussed above and are provided on Figure 8.

7.2.3 Tieback Anchors

The bonded zone for tieback anchors should be located behind the no-load (unbonded) zone as shown in Figure 8. Recommended ultimate (unfactored) bond strengths for anchors with a minimum diameter of 6 inches are given in Table 7-4. These values are based on recommendations from the Post-Tensioning Institute (PTI, 2014), the ESU properties, and previous experience on local projects.

Table 7-4. Tieback Ultimate Bond Strength

Engineering Soil Unit (ESU)	Ultimate Bond Strength (kips/ft)	Allowable Bond Strength (kips/ft)
Fill and PGF	4	2
GMD	2	1

A factor of safety of 2.0 should be applied to the bond strength for allowable strength design. For LRFD design, apply a resistance factor of 0.65 to the ultimate bond strength (AASHTO, 2017), which would apply to both strength and service load cases.

Performance tests should be performed on the first two or three anchors and a minimum of 2% of the remaining anchors. Proof tests should be conducted on all tiebacks that are not subjected to performance tests. Performance and proof tests should be accomplished in accordance with the Post-Tensioning Institute's recommendations (PTI, 2014). Two preproduction or verification tests are recommended to test the anchors to approximately 200% of the design bond strength.

7.3 Slope Stability

The stability of various slopes was analyzed using the limit equilibrium method in Slide2 (Rocscience, 2020). Both static and seismic loading conditions were considered. For the seismic loading, one-half the PGA from the ASCE 7-16 design response spectrum was used as the seismic coefficient (k_h) in the seismic slope stability analysis. The minimum factor of safety used should be based on the consequences that ensue from the failure. Minimum factors of safety of 1.25 to 1.5 can be appropriate (Duncan et al., 2014; WSDOT, 2019) based on those consequences. Since the slopes at this site do not directly support structures, a minimum factor of safety of 1.3 is used (WSDOT, 2019). For seismic analysis, a minimum factor of safety of 1.1 is used (WSDOT, 2019). The slope stability results are shown in Appendix E.

7.3.1 Notch Area

At the east end (City of Bellingham side) of the site, there is a section of the shoreline that is not retained by the existing bulkhead. In this "Notch Area" (Notch), which is shown on Figure E.1, the soils just slope back to the upland grades with concrete blocks providing some grade breaks. Following the dredging, the slope in Notch will be modified and slope protection (angular gravel) will be placed. The section modeled in these analyses is shown in Figure E.1 at ST 3+63 in the Dredge Plans. The evaluation of the existing slope finds that it meets the minimum factor of safety for the long-term static condition (Figure E.2 and E.3). When the seismic condition is considered, the slope doesn't meet the typical minimum factor of safety for the seismic condition (Figure E.4). However, it is our understanding that the new bulkhead will be extended across the Notch. When the bulkhead was included in the analysis, an adequate factor of safety was achieved for the seismic case (see Figure E.5). The stability of the slope armoring on the waterway side of the bulkhead (see Figure E.6) in this area is discussed in Section 7.3.3.

7.3.2 Southwest Corner

At the west (Bellingham Bay) side of the site, the existing rubble-covered slope will be modified to accommodate the SCU-1 dredging activities. After rubble is removed and sediment dredged, slope protection (riprap) will be placed to stabilize the slope. The section modeled in these analyses is shown on

Figure E.1 as “ST 7+00 Section”. The evaluation of the proposed slope and slope protection finds that it meets the minimum factor of safety for the long-term static condition (Figure E.7 and E.8). When the seismic condition is considered, the slope protection doesn’t meet the typical minimum factor of safety for the seismic condition (Figure E.9). However, the new bulkhead will support the upland area during seismic loading. The section perpendicular to the waterway was analyzed for the Notch and had an adequate factor of safety the seismic case (as shown in Figure E.5). An additional section parallel to the waterway was analyzed as well. This section is labeled the “Marina Section” on Figure E.1. This section parallel to the waterway also had an adequate factor of safety the seismic case (as shown in Figure E.10), Areas protected by the new bulkhead should have acceptable performance in seismic loading.

7.3.3 Slope Protection

In the static case, the slope protection has an adequate factor of safety for slope stability (see Figures E.6, E.7 and E.8). The function of the slope protection (armor) material for this application is to provide erosion protection not seismic slope stability. Where other structures, such as retaining walls, provide seismic stability, it is common practice in coastal engineering to manage seismic stability risks associated with slope armor as an element of site operations and maintenance. The bulkhead wall is designed for seismic loading and the slope stability analyses indicate that the upland area has an adequate factor of safety with seismic loading when the bulkhead is considered. The rip rap material placed on the slopes may be subject localized movement during an earthquake. Such movement would not affect the overall (global) stability of the slopes, adjacent upland area, the dock structure, or the overall integrity of the cleanup action. Rather, the localized shifting of rip rap could require maintenance following an earthquake. While a more substantial rip rap slope could be designed to remain stable under seismic loading conditions, the size and configuration of such an embankment would encroach on the berthing area and operations at the Bornstein dock, and the cost of such an embankment would be disproportionate to the benefits since the bulkhead wall will support the upland areas.

7.3.4 Dredge Prism Slopes

The proposed dredge prism side slopes of 3H:1V on the north and south sides of the waterway meet the minimum factors of safety for both long-term static and seismic conditions (See Figures E.11 to E.14).

8.0 Construction Considerations

Construction considerations are provided below for the geotechnical components of the Project.

8.1 Piles for Dock

Driven piles will be used to support the new dock. It is our understanding that steel pipe piles will be used to support the dock.

8.1.1 Corrosion Protection

We recommend that the steel piles should be protected with a coating applied to both the interior and exterior steel surfaces to reduce corrosion or the thickness of the steel section should be sized to allow for steel loss due to corrosion.

8.1.2 Pile Setup

Pile driving can generate pore pressures in the GMD, which temporarily reduce the strength of the GMD and therefore the capacity of the pile. The capacity of the pile may increase over time as the excess pore pressures developed during driving are dissipated. Open-end piles typically do not generate as much excess pore pressure as closed-end pipe piles. Dynamic measurements and analyses can be completed on a pile over time to estimate the time it takes for the GMD to “set-up” and achieve their long-term capacity. The time for the “set-up” to occur depends on the soil, pile, and installation methods, but can be on the order of a few days to a month.

8.1.3 Pile Driving

The Contractor should provide a pile driving hammer that has enough energy to drive the piles to the proposed embedment and required capacity. A diesel-powered hammer or a vibratory hammer may be used for pile driving. A variable frequency vibratory pile driver will limit the impact of vibrations on nearby structures and can minimize ground vibration amplification by avoiding the resonance frequency of the soil stratum. If a vibratory hammer is used to advance the piles, a diesel-powered hammer can be used to drive the final five to ten feet to measure pile driving blow counts. If a diesel-powered (impact) hammer is used, the pile driving will likely need to be contained within a bubble curtain.

Wave Equation Analyses for Pile Driving (WEAP) can be used to select the actual hammer/pile combination for installing the production piles. This method allows evaluation of driving stresses so that an appropriate pile driving hammer size can be selected to obtain the desired pile resistance with reasonable blow counts without damaging the piles. The driving stress in the piles should be limited to less than 90 percent of the steel’s yield strength. This analysis also provides an estimate of the nominal pile capacity and hammer stroke for a given driving resistance. We recommend that the Contractor be required to submit their WEAP analyses for each pile/hammer combination as a submittal for review.

We have assumed a factor of safety of 2.5 (static case) for the pile design. This factor of safety requires that testing be performed on no less than 2% of production piles. We recommend that PDA (Pile Driver Analyzer)/CAPWAP (Case Pile Wave Analysis Program) analyses be performed during construction to confirm pile capacity. A diesel-powered impact hammer is required, at least at the end of the pile driving, to perform PDA tests to confirm the pile capacity. Since we don't know the set-up time, we recommend performing dynamic tests on indicator piles. Indicator piles, which can be production piles or sacrificial piles, need to be installed early enough in construction to allow for a series of PDA tests to be performed over time (such as 1-day, 7-day, 14-day, and 28-days) after the pile is installed, if the strength gain with pile-setup is needed to meet design pile capacities. The PDA test data and WEAP analyses should be used together to establish "end-of drive" criteria. Note that additional PDA testing may be needed to confirm capacities in the production piles if the driving starts to vary significantly from the "end-of-drive" criteria.

8.1.4 Pile Driving Monitoring

A geotechnical engineer should observe and evaluate all pile driving by making a continuous driving record of each pile. For this purpose, the pile should be marked in 1-foot increments to facilitate monitoring when driving with an impact hammer. During re-strikes and as the pile reaches the desired tip elevation, additional 1-inch increments between the 1-foot marks would be required.

The pile-driving record should be completed for each pile driven and submitted to the Engineer. The pile-driving record should include hammer stroke and blows per foot for impact hammers, date, time, reasons for delays, and other pertinent information. In addition, the record should include pile tip elevations, and specified criteria.

8.2 Retaining (Bulkhead) Wall

8.2.1 Corrosion Protection

We recommend that the steel sheet piles and wide flange sections be protected with a coating applied to both the interior and exterior steel surfaces to reduce corrosion or the thickness of the steel section should be sized to allow for steel loss due to corrosion.

The tiebacks will be permanent, and therefore will need corrosion protection. Class I protection (PTI, 2014), often referred to as double-corrosion protection, encases the prestressing steel inside a plastic encapsulation filled with grout. Class I protection is recommended unless the aggressiveness of the environment indicates that Class II protection would provide a reliable system for the design life of the wall.

8.2.2 King Pile Wall

Obstructions encountered by the sheet piles and wide flange sections during driving could affect pile penetration. Concrete and wood debris were observed near the existing bulkhead at low tide. The likelihood of encountering obstructions is expected to decrease once the piles penetrate the Glacial Marine Drift. Obstructions may need to pushed aside or removed using a large excavator from the landward side of the wall. It is recommended that the Contractor provide a plan for removing obstructions and keeping sheet piles and wide flange sections in alignment with their work plan. For example, a sheet-pile template may help keep sheet piles in alignment during installation.

A pile driving hammer should be provided that has enough energy to drive the piles to the proposed embedment and required capacity. A diesel-powered hammer or a vibratory hammer may be used for pile driving, but a diesel-powered hammer may be needed to drive wide flange sections at depth. The excess pore pressures generated when driving the wide flange section with an impact hammer may force adjacent piles up. To limit the impact of vibrations on nearby structures, use of a variable frequency vibratory pile driver may be used for sheet pile installation. The use of a variable frequency vibratory pile driver can minimize ground vibration amplification by avoiding the resonance frequency of the soil stratum.

8.2.3 Tiebacks

Obstructions may be encountered when drilling the tiebacks in the Fill, and tieback may have to be grouted and redrilled in an adjacent location if the obstruction cannot be drilled through. In the no-load zone, tiebacks must not be restrained from elongation. Proof tests should be conducted on all tiebacks that are not subjected to performance tests. Performance and proof tests should be accomplished in accordance with the Post-Tensioning Institute’s recommendations (PTI, 2014). If means or methods change during construction or different ESUs are encountered, additional performance tests will be required. The criteria for performance, proof, and creep tests for anchors recommended by the Post-Tensioning Institute (PTI, 2014) will be used to determine if the tiebacks are acceptable.

8.2.4 Construction Observation

The installation of the sheet piles, wide flange sections, and tiebacks should be observed by a geotechnical engineer. During the sheet pile and wide flange section installation, the date, time, pile size, pile length, pile tip elevation, and driving information should be noted. The tieback anchor details, drill-hole diameter, drill-hole length, drill-hole inclination, grout mix, grout pressures, and test results should be recorded as well.

8.3 Monitoring

Geotechnical monitoring of the existing structures, such as the Bornstein Seafood building should be performed before, during and after the installation of the sheet piles and tiebacks as well as pipe piles. Data collected from the monitoring program would be used to assess vibrations and settlement associated with construction. The following instrumentation should be considered. Action levels would need to be developed for vibrations (PPV) and settlements.

- Pre-construction survey of structures within 100 feet of pile-driving operations, including the placement of crack gauges on any cracks observed as part of the pre-construction survey.

- Monitor vibrations at the nearest structures to pile driving observations. Vibration monitoring points should be monitored daily during pile driving activity. Geophones to monitor the ground vibrations can be located on nearby critical structures. Signals from the geophones can be collected and compared to the designated maximum allowable Peak Particle Velocity (PPV).

- Install and monitor structural settlement points where vibration monitoring is performed. Structure settlement points should be monitored weekly during pile driving. Baseline readings should be obtained consisting of three separate measurements taken at least 1 day apart before pile installation begins.

9.0 References

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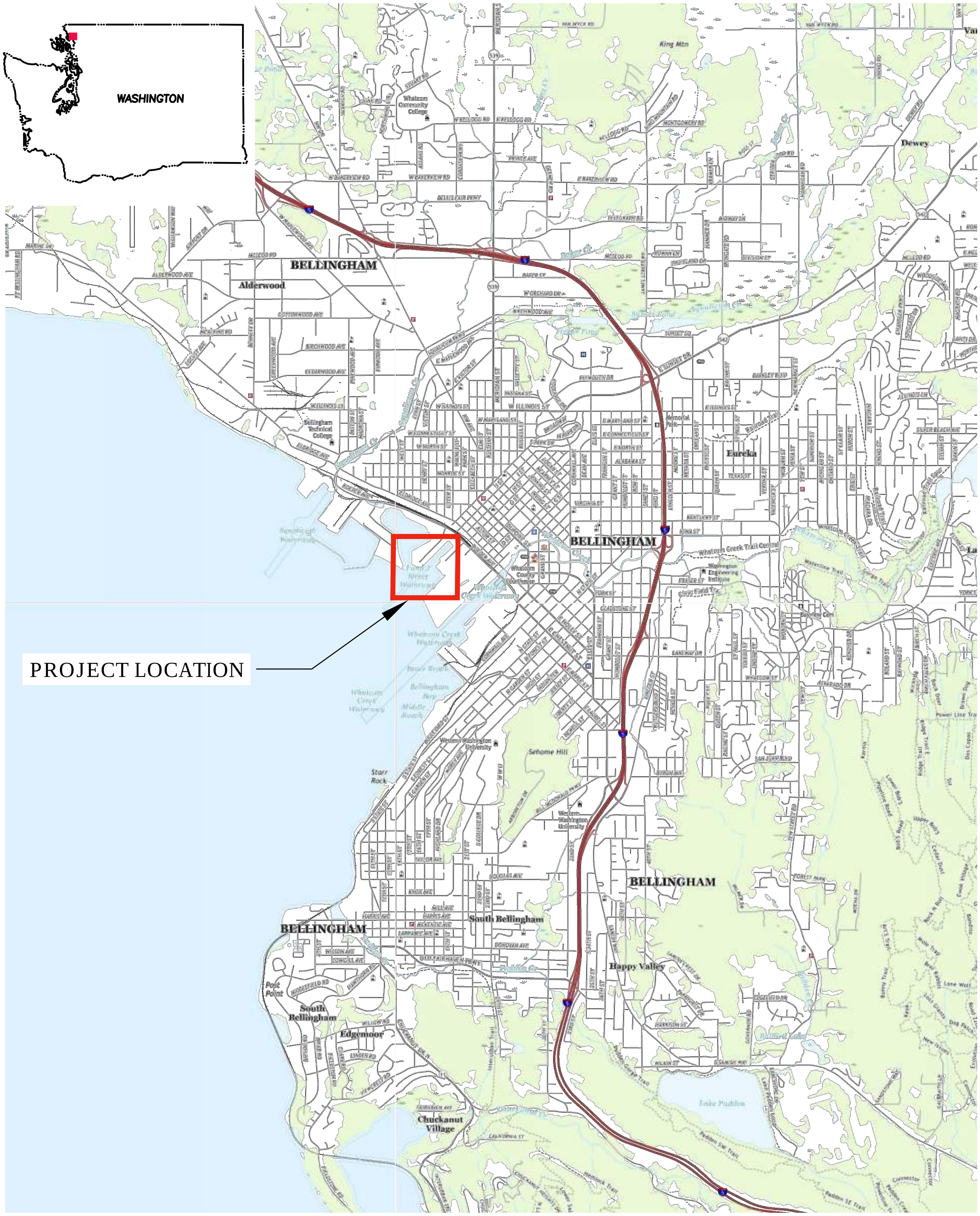
Figures



PROJECT LOCATION

PROJECT VICINITY MAP

SCALE: 1"=1MILE 0 1 MILE 2 MILES

N

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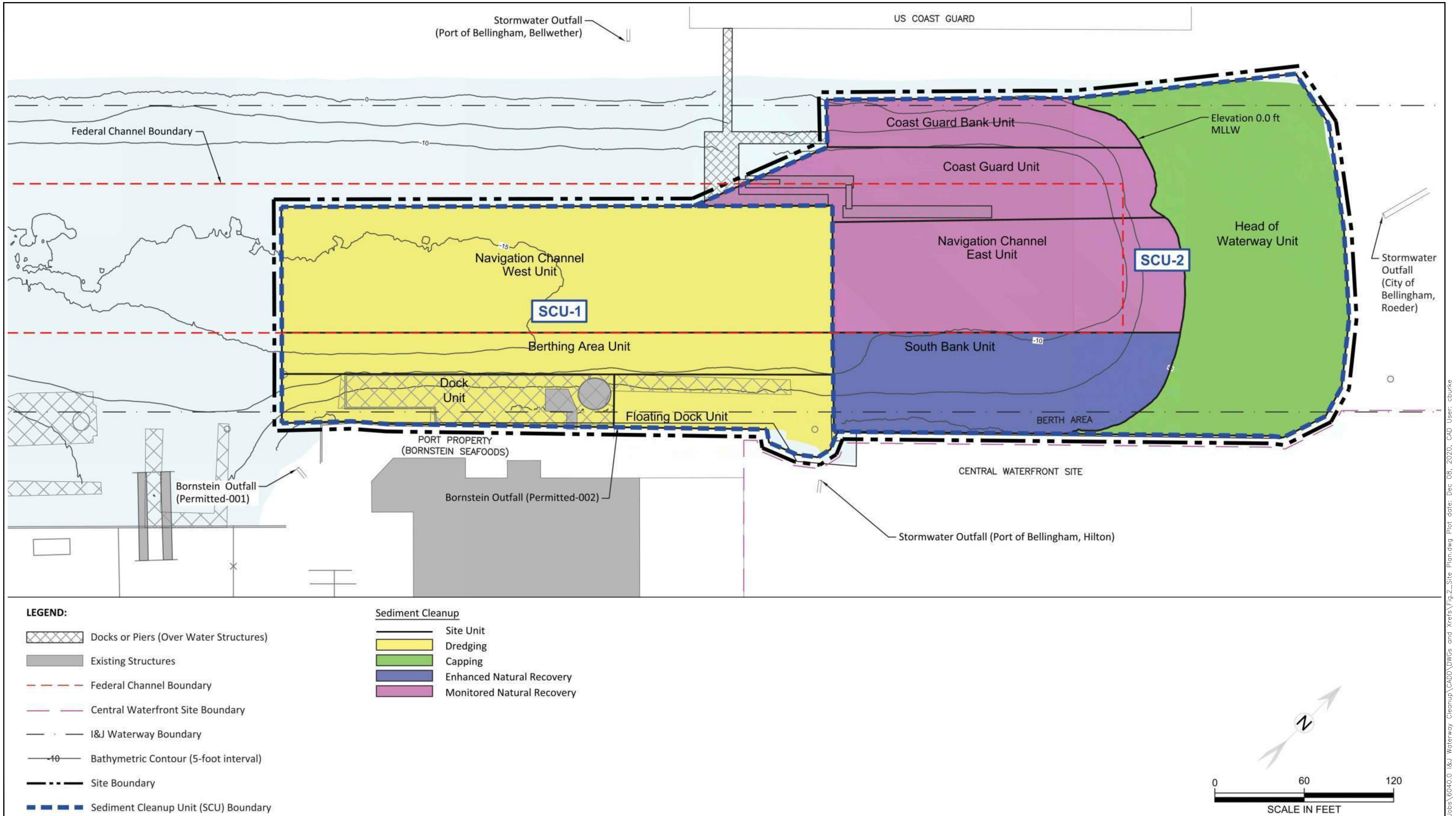
I&J WATERWATERWAY SITE, SEDIMENT CLEANUP UNIT 1

PROJECT VICINITY MAP

FIG.1

JAN 2022

Path: C:\Users\cburke\Box\Jobs\6040.0 I&J Waterway Cleanup\CADD\DWGs and Xrefs\Fig.1_Project Vicinity Map.dwg Plot date: Dec 08, 2020, CAD User: cburke



NOTES:

1. DRAWING FROM CRETE CONSULTING INC., MARCH 2020, PRE-REMEDIAL DESIGN INVESTIGATION WORK PLAN.

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CITY OF BELLINGHAM
I&J WATERWAY SITE, SEDIMENT CLEANUP UNIT 1
CLEANUP ACTION PLAN

FIG.2

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Path: C:\Users\cburke\Box\Jobs\6040.0 I&J Waterway Cleanup\CADD\DWGs and Xrefs\Fig.2_Site Plan.dwg Plot date: Dec 08, 2020, CAD User: cburke

WSE Survey Control Point Table (NAD83)				
Point #	Elevation	Northing	Easting	Description
105	15.23	644457.96	1240159.77	REBAR AND CAP
110	12.74	644204.81	1239889.56	MAG NAIL AND WASHER
111	12.88	644351.08	1240043.32	MAG NAIL AND WASHER

SITE PLAN
SCALE: 1"=50'

0" 50' 100'

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I&J WATERWAY SITE, SEDIMENT CLEANUP UNIT 1
SUBSURFACE EXPLORATION PLAN AND PROFILE
EXPLORATION PLAN

FIG.3

JAN 2022

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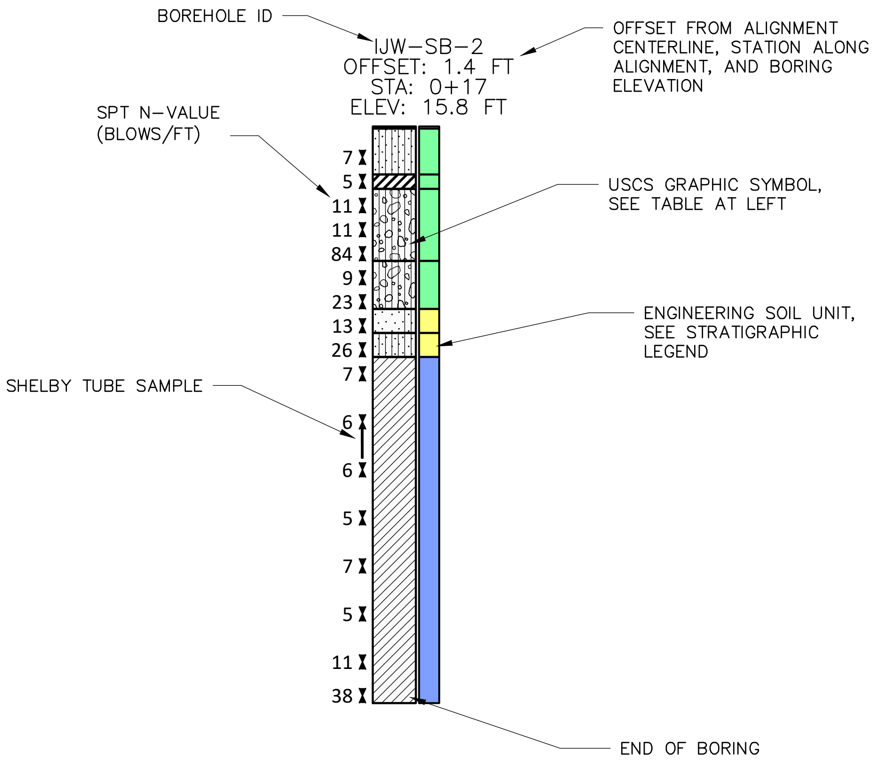
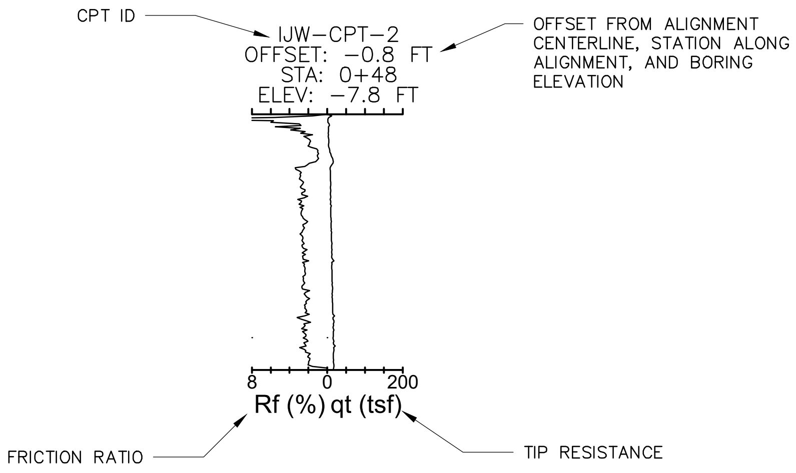
UNIFIED SOIL CLASSIFICATION SYSTEM (Based on ASTM D2488 & D2487)

MAJOR DIVISIONS			GROUP/GRAPHIC SYMBOL		TYPICAL DESCRIPTION
COARSE-GRAINED SOILS (50% or more retained on No. 200 sieve)	GRAVELS (more than 50% retained on No. 4 sieve)	CLEAN GRAVELS (less than 5% fines)	GW	▨	WELL-GRADED GRAVEL
			GP	▨	POORLY GRADED GRAVEL
		GRAVELS (with 5 to 12% fines)	GW-GM	▨	WELL-GRADED GRAVEL WITH SILT
			GW-GC	▨	WELL-GRADED GRAVEL WITH CLAY
			GP-GM	▨	POORLY GRADED GRAVEL WITH SILT
			GP-GC	▨	POORLY GRADED GRAVEL WITH CLAY
		GRAVELS WITH FINES (more than 12% fines)	GM	▨	SILTY GRAVEL
			GC	▨	CLAYEY GRAVEL
			GC-GM	▨	SILTY CLAYEY GRAVEL
	SANDS (less than 50% retained on No. 4 sieve)	CLEAN SANDS (less than 5% fines)	SW	▨	WELL-GRADED SAND
			SP	▨	POORLY GRADED SAND
		SANDS (with 5 to 12% fines)	SW-SM	▨	WELL-GRADED SAND WITH SILT
			SW-SC	▨	WELL-GRADED SAND WITH CLAY
			SP-SM	▨	POORLY GRADED SAND WITH SILT
			SP-SC	▨	POORLY GRADED SAND WITH CLAY
		SANDS WITH FINES (more than 12% fines)	SM	▨	SILTY SAND
			SC	▨	CLAYEY SAND
			SC-SM	▨	CLAYEY SAND WITH SILT
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)	SILTS & CLAYS (liquid limit less than 50)	INORGANIC	ML	▨	SILT
			CL	▨	LEAN CLAY
			CL-ML	▨	CLAY WITH SILT
		ORGANIC	OL	▨	LOW PLASTICTIY ORGANIC CLAY
	SILTS & CLAYS (liquid limit greater than 50)	INORGANIC	MH	▨	ELASTIC SILT
			CH	▨	FAT CLAY
		ORGANIC	OH	▨	HIGH PLASTICTIY ORGANIC CLAY
HIGHLY ORGANIC SOILS	PRIMARILY ORGANIC MATTER		PT	▨	PEAT

BORING LEGEND:



CPT LEGEND:



STRATIGRAPHIC LEGEND:

COLOR	ENGINEERING SOIL UNITS
⬜	RECENT SEDIMENTS
🟩	FILL
🟨	POST-GLACIAL FLUVIAL DEPOSITS
🟦	GLACIAL MARINE DRIFT

BORING SYMBOL KEY:

IJW-SB-01	⌖	BOREHOLE LOCATION
IJW-CPT-1	⊞	CPT LOCATION
IJW-SC-1	△	SEDIMENT VIBRACORE
MW-4	⊕	HISTORICAL BORING LOG
A ----- A'		PROFILE DESTINATION & LOCATION

NOTES:

1. ALL EXPLORATION LOCATIONS ARE APPROXIMATE.
2. SITE PLAN AND SURVEY CONTROL POINT TABLE BASED ON DESIGN DRAWINGS PROVIDED BY WILSON ENGINEER JUNE, 2020.
3. HORIZONTAL DATUM – NAD 1983, USFT, PER CITY OF BELLINGHAM CONTROL NETWORK
4. VERTICAL DATUM – LOCAL TIDAL MLLW, PER CITY OF BELLINGHAM WATERFRONT VERTICAL CONTROL NETWORK.
5. POSITIVE OFFSET = RIGHT OF CENTERLINE, LOOKING UP STATION NEGATIVE OFFSET = LEFT OF CENTERLINE, LOOKING UP STATION.
6. THE SOIL STRATIGRAPHY SHOWN IS AN INTERPRETATION BASED ON THE SAMPLES COLLECTED WITHIN EACH BORING AND CPT TESTS.

ABBREVIATIONS:

MC: MOISTURE CONTENT
SA: SIEVE ANALYSIS
AL: ATTERBERG LIMITS
TV: TORVANE
CONSOL: CONSOLIDATION TEST

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I&J WATERWAY SITE, SEDIMENT CLEANUP UNIT 1
SUBSURFACE EXPLORATION PLAN AND PROFILE
LEGEND

FIG.4
JAN 2022

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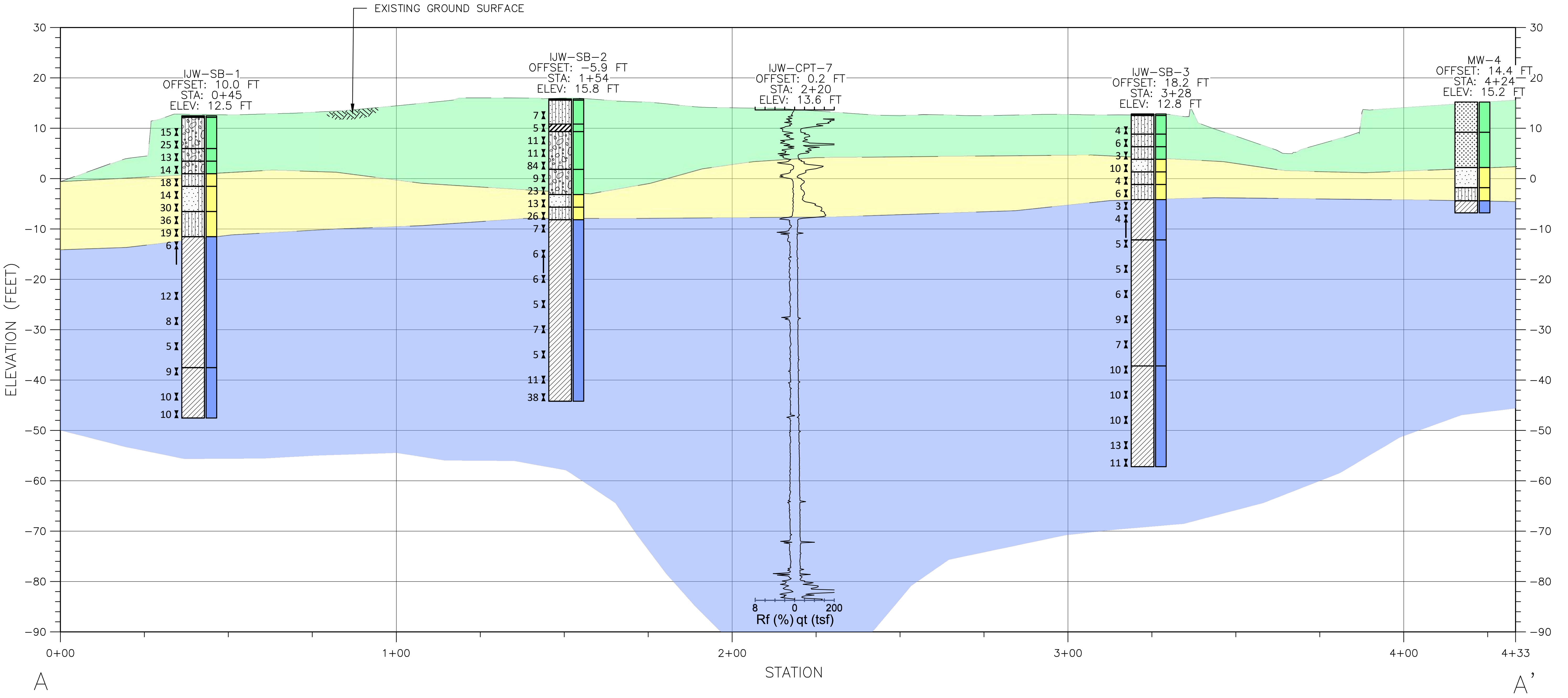

PROFILE A–A'

SCALE: 1"=30' HORIZ 0" 30' 60'

1"=20' VERT 0" 20' 40'

VERTICAL EXAGGERATION =1.5X

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SUBSURFACE EXPLORATION PLAN AND PROFILE
PROFILE A – A'

FIG.5

JAN 2022

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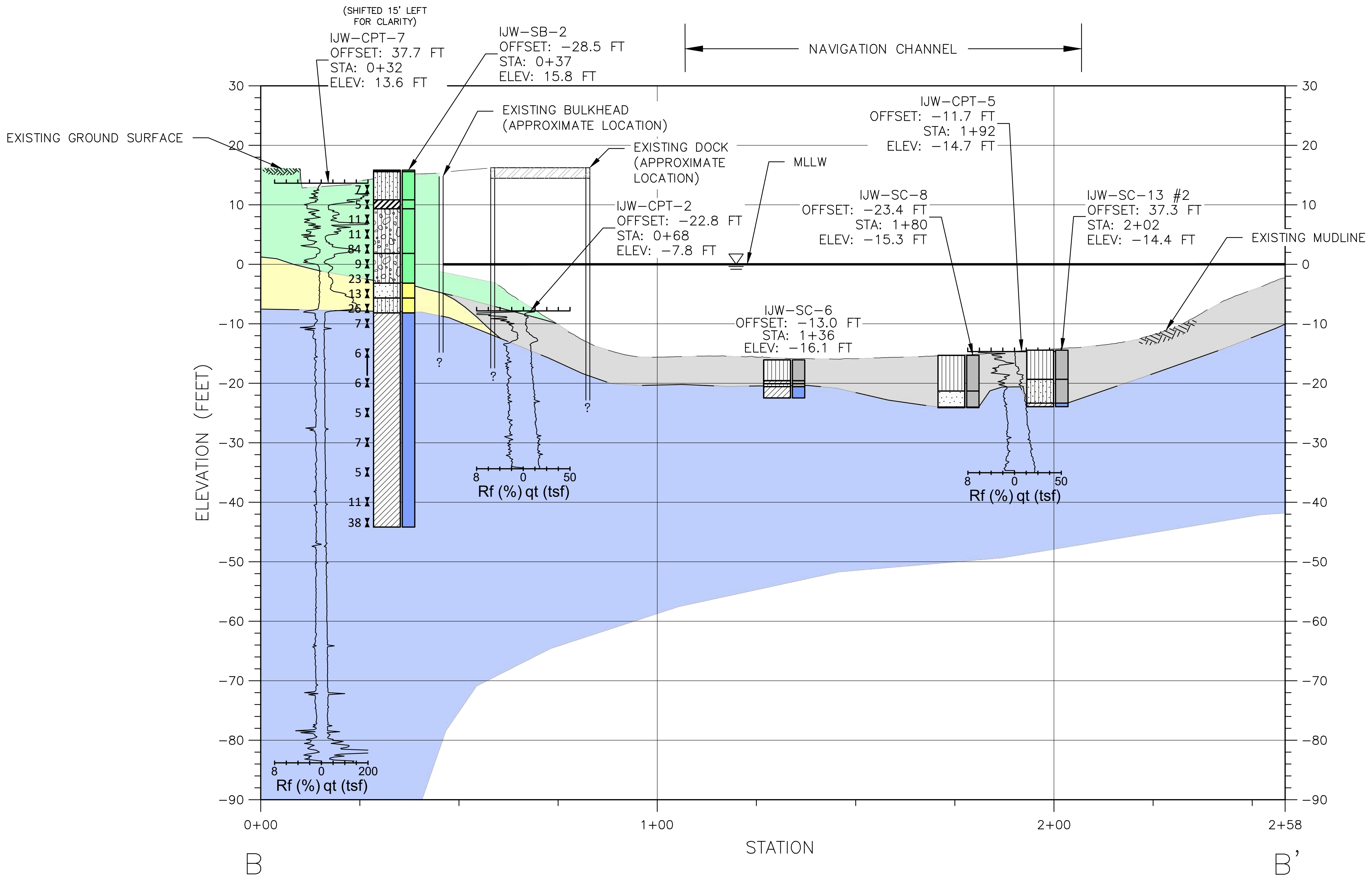

PROFILE B–B'

SCALE: 1"=30' HORIZ

0" 30' 60'

1"=20' VERT

0" 20' 40'

VERTICAL EXAGGERATION =1.5X

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I&J WATERWAY SITE, SEDIMENT CLEANUP UNIT 1

SUBSURFACE EXPLORATION PLAN AND PROFILE
PROFILE B – B'

FIG.6

JAN 2022

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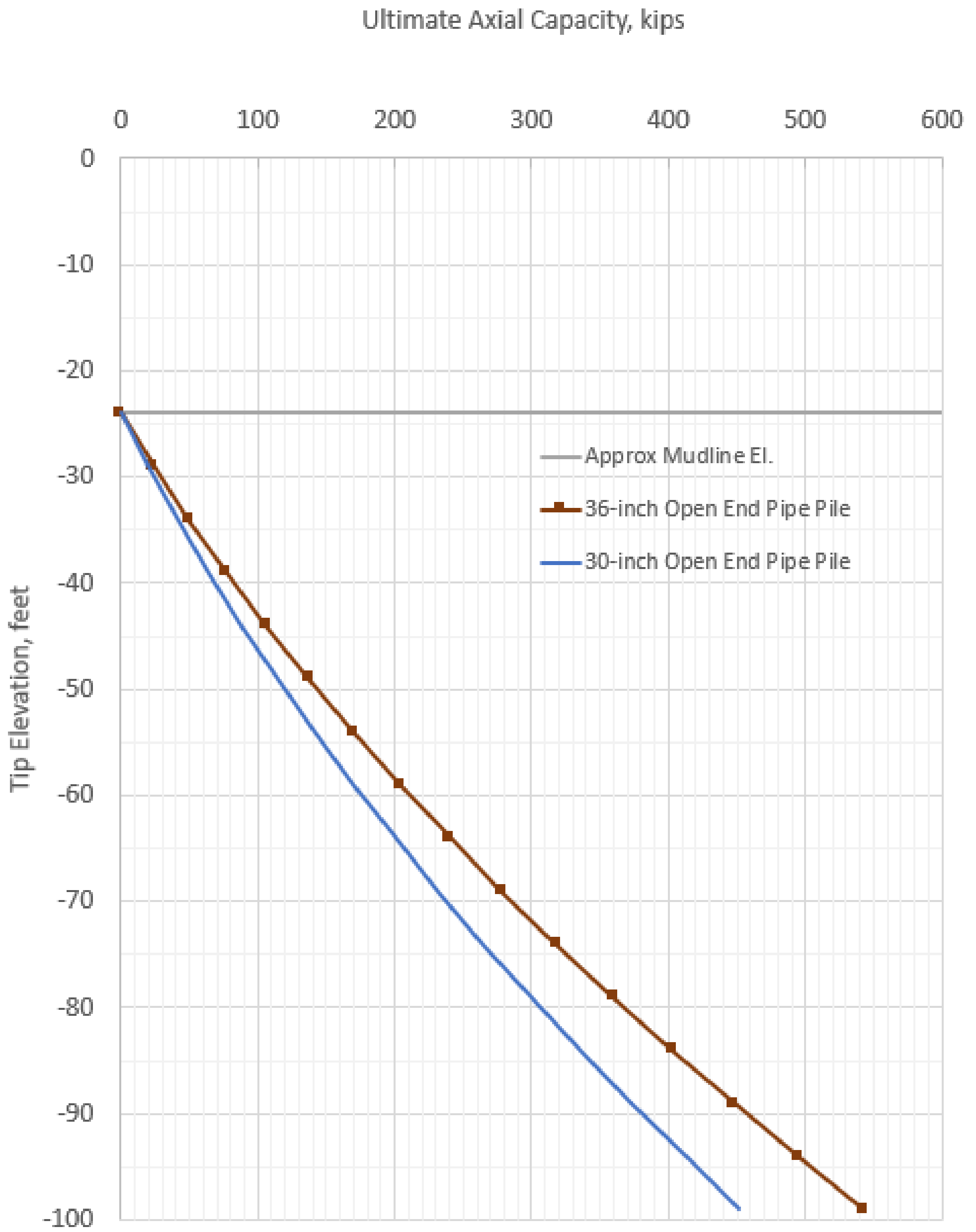

FIGURE 7.A

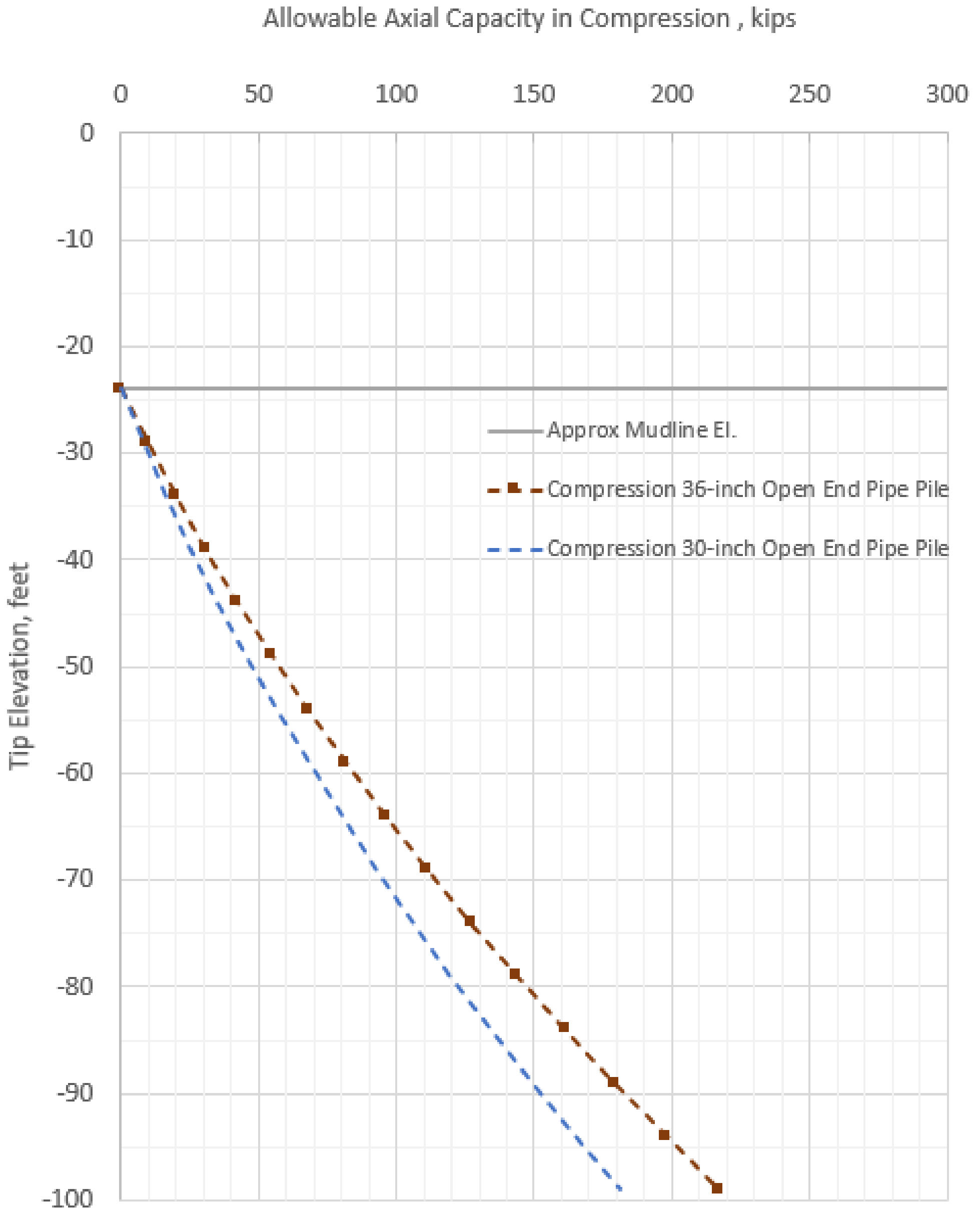

FIGURE 7.B

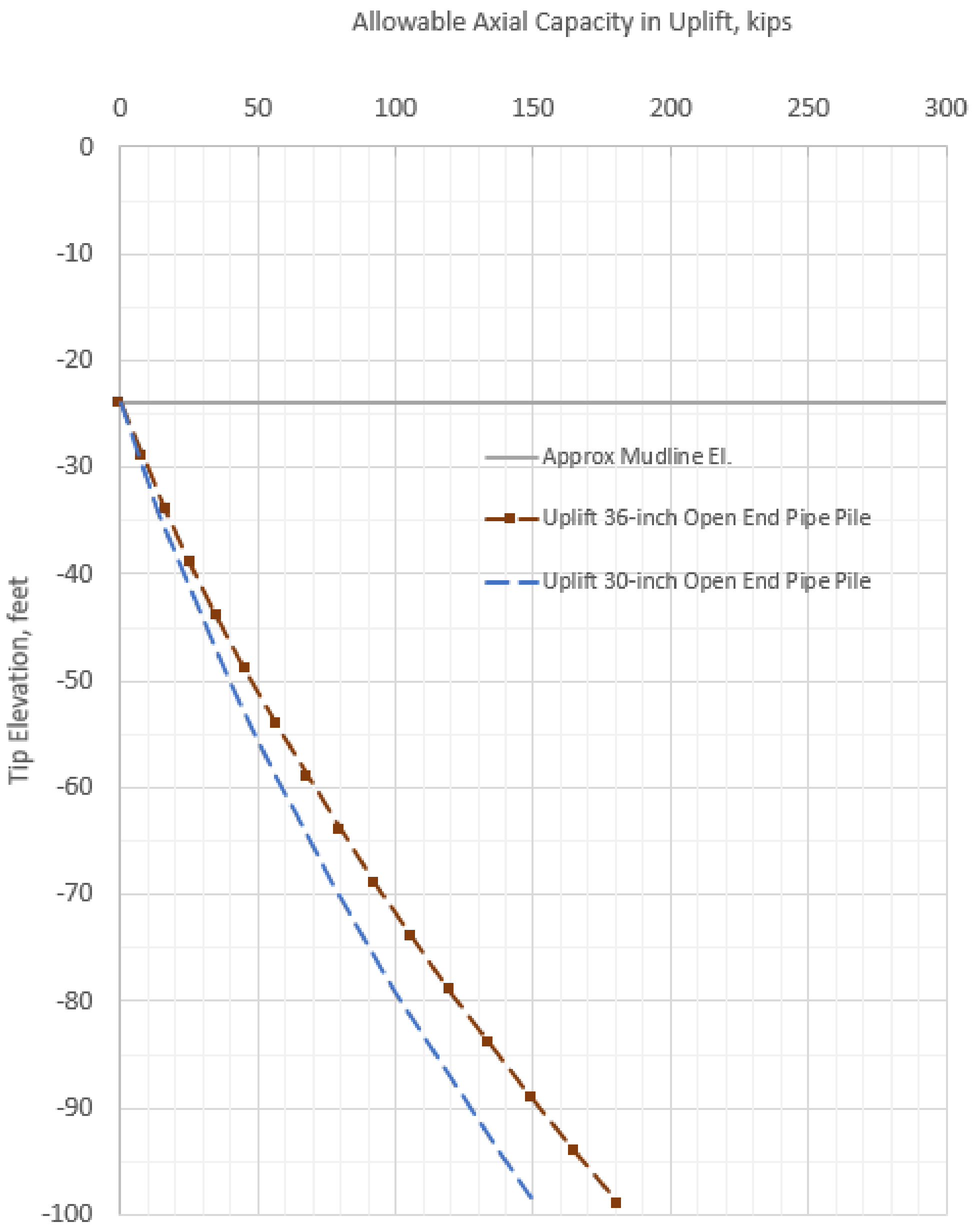

FIGURE 7.C

NOTES:

1. THE AXIAL CAPACITIES PROVIDED IN FIGURE 7.A ARE ULTIMATE CAPACITIES FOR OPEN END PIPE PILES. FOR ASD DESIGN, A FACTOR OF SAFETY SHOULD BE APPLIED. FOR LRFD DESIGN, A RESISTANCE FACTOR SHOULD BE APPLIED. SEE REPORT FOR RECOMMENDATIONS.

2. FOR ASD ANALYSES FOR MOST LOADING COMBINATIONS (EXCEPTIONS IN NOTE 3), A FACTOR OF SAFETY OF 2.5 IS RECOMMENDED FOR PILES IN COMPRESSION AND A FACTOR OF SAFETY OF 3.0 IS RECOMMENDED FOR PILES IN UPLIFT. THESE FACTORS OF SAFETY HAVE BEEN APPLIED TO THE ULTIMATE CAPACITES. THE ALLOWABLE CAPACITIES IN COMPRESSION ARE PROVIDED IN FIGURE 7.B AND THE ALLOWABLE CAPACITIES IN UPLIFT ARE ARE PROVIDED IN 7.C.

3. FOR EXTREME LOADING (SEISMIC) CONDITIONS A FACTOR OF SAFETY OF 1.4 IN COMPRESSION AND A FACTOR OF SAFETY OF 1.7 IN UPLIFT IS RECOMMENDED FOR THE PILE CAPACITY. FOR UNUSUAL LOADING (E.G., MAINTENANCE, INFREQUENT FLOODS, OR BARGE IMPACT) A FACTOR OF SAFETY OF 1.9 IN COMPRESSION AND A FACTOR OF SAFETY OF 2.25 IN UPLIFT IS RECOMMENDED. THESE FACTORS OF SAFETY CAN BE APPLIED TO THE ULTIMATE AXIAL CAPACITIES PROVIDED IN FIGURE 7.A.

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AXIAL CAPACITY FOR STEEL PIPE PILES

FIG. 7

JAN 2022

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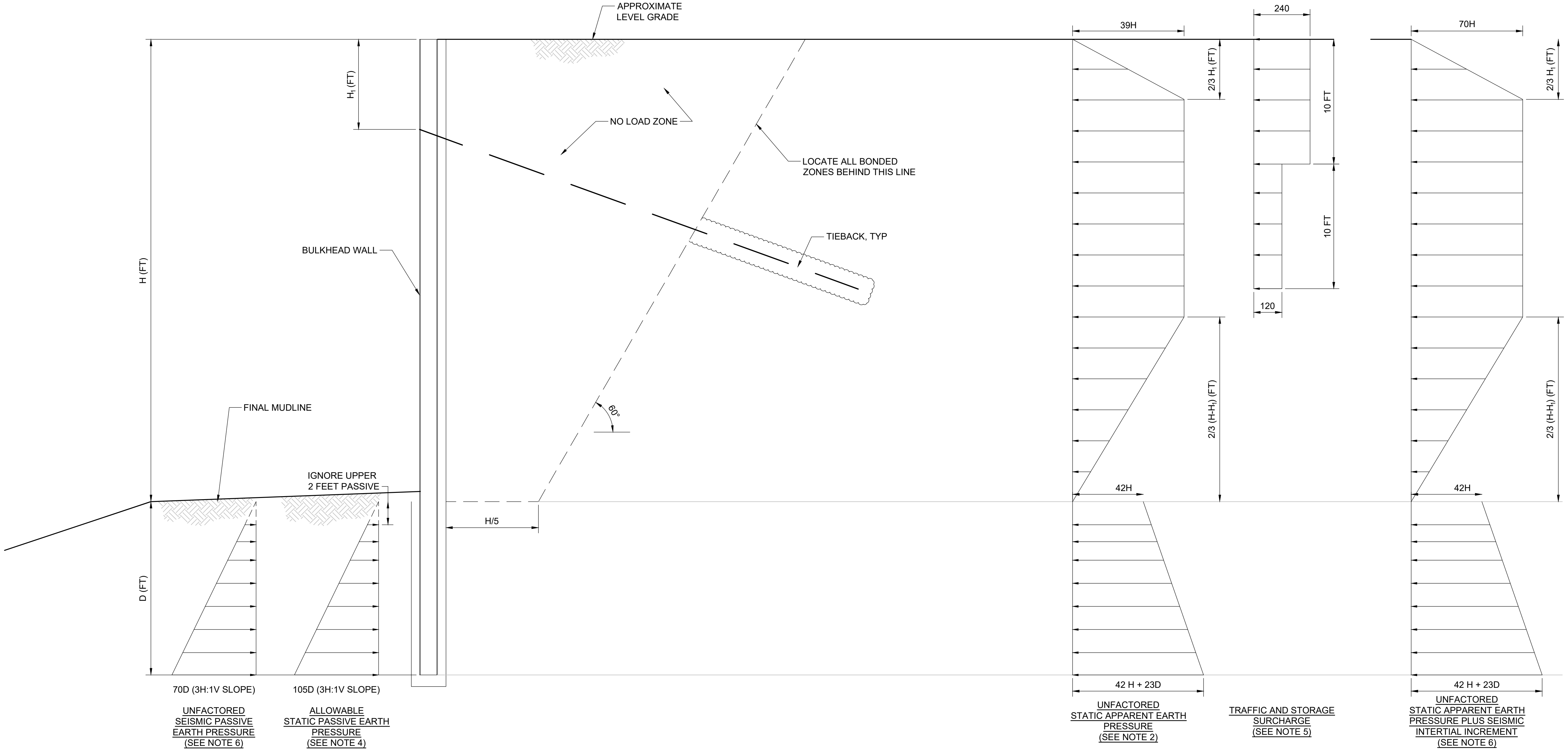

NOTES:

1. ALL EARTH PRESSURE ARE IN UNITS OF POUNDS PER SQUARE FOOT (PSF). A FACTOR OF SAFETY HAS BEEN APPLIED TO STATIC PASSIVE PRESSURES. ALL OTHER EARTH PRESSURES ARE UNFACTORED.
2. THE APPARENT EARTH PRESSURE IS APPROPRIATE FOR A SINGLE ROW OF TIEBACKS.
3. WALL EMBEDMENT (D) SHOULD CONSIDER KICKOUT RESISTANCE. EMBEDMENT SHOULD BE DETERMINED BY SATISFYING HORIZONTAL EQUILIBRIUM ABOUT THE BOTTOM OF THE PILE. MINIMUM EMBEDMENT DEPTH IS 10 FEET.
4. IGNORE THE PASSIVE EARTH PRESSURE RESISTANCE DOWN TO 2 FEET BELOW BASE OF EXCAVATION.
5. TRAFFIC AND STORAGE SURCHARGE CORRESPONDS TO A 600 PSF VERTICAL STRIP LOAD PARALLEL TO THE WALL EXTENDING 20 FEET FROM THE BACK OF WALL. MORE SEVERE LOADING REQUIRES SPECIAL ANALYSIS.
6. THE STATIC APPARENT EARTH PRESSURE PLUS SEISMIC INERTIAL INCREMENT AND THE SEISMIC PASSIVE EARTH PRESSURES SHOULD BE USED FOR SEISMIC DESIGN OF WALL.
7. FOR LOADS IN COMPRESSION, THE ALLOWABLE END BEARING CAPACITY FOR BULKHEAD PILES IS 2350 PSF AT AN ELEVATION OF -25 FEET INCREASING LINEARLY TO 3000 PSF AT AN ELEVATION OF -45 FEET. THE ALLOWABLE SIDE RESISTANCE FOR BULKHEAD PILES IS 200 PSF/FT AT AN ELEVATION OF -25 FEET INCREASING LINEARLY TO 250 PSF/FT AT AN ELEVATION OF -45 FEET.

LEGEND:

H: RETAINED HEIGHT OF SOIL
D: DEPTH OF EMBEDMENT
H_1: DEPTH OF FIRST TIEBACK

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I&J WATERWAY SITE, SEDIMENT CLEANUP UNIT 1
LATERAL EARTH PRESSURES FOR
ANCHORED WALL

FIG.8

JAN 2022

Path: C:\Users\lilly\Box\Jobs\6040.0 I&J Waterway Cleanup\CADD\DWGs and Xrefs\Fig.7 Earth Pressures.dwg Plot date: Sep 29, 2021, CAD User: lilly

Appendix A

Boring Logs

Appendix A.1

Project Boring Logs

Key to Log of Borings
I&J Waterway Site, Sediment Cleanup Unit 1
Bellingham, WA

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS Based on ASTM D2488 & D2487)					
MAJOR DIVISIONS			GROUP/SYMBOL		TYPICAL DESCRIPTION
COARSE-GRAINED SOILS (50% or more retained on No. 200 sieve)	GRAVELS (more than 50% retained on No. 4 sieve)	CLEAN GRAVELS (less than 5% fines)	GW	●	WELL-GRADED GRAVEL
			GP	○	POORLY GRADED GRAVEL
		GRAVELS (with 5 to 12% fines)	GW-GM	●▥	WELL-GRADED GRAVEL WITH SILT
			GW-GC	●▨	WELL-GRADED GRAVEL WITH CLAY
			GP-GM	○▥	POORLY GRADED GRAVEL WITH SILT
			GP-GC	○▨	POORLY GRADED GRAVEL WITH CLAY
		GRAVELS WITH FINES (more than 12% fines)	GM	○▥	SILTY GRAVEL
			GC	○▨	CLAYEY GRAVEL
	SANDS (less than 50% retained on No. 4 sieve)	CLEAN SANDS (less than 5% fines)	SW	░	WELL-GRADED SAND
			SP	⁚	POORLY GRADED SAND
		SANDS (with 5 to 12% fines)	SW-SM	░▥	WELL-GRADED SAND WITH SILT
			SW-SC	░▨	WELL-GRADED SAND WITH CLAY
			SP-SM	⁚▥	POORLY GRADED SAND WITH SILT
			SP-SC	⁚▨	POORLY GRADED SAND WITH CLAY
		SANDS WITH FINES (more than 12% fines)	SM	▥	SILTY SAND
			SC	▨	CLAYEY SAND
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)	SILTS & CLAYS (liquid limit less than 50)	INORGANIC	ML	▥	SILT
			CL	▨	LEAN CLAY
		ORGANIC	OL	∫∫	LOW PLASTICITY ORGANIC CLAY
	SILTS & CLAYS (liquid limit greater than 50)	INORGANIC	MH	▥	ELASTIC SILT
			CH	▨	FAT CLAY
		ORGANIC	OH	≀≀	HIGH PLASTICITY ORGANIC CLAY
	SILT/CLAY (liquid limit between 12 and 25)	INORGANIC	CL-ML	▨▥	CLAYEY SILT / SILTY CLAY
Rock			-	▒	ANDESITE

1. Dual symbols (symbols separated by a hyphen, e.g. SP-SM, slightly silty fine SAND) are used for soils between 5% and 12% fines or when liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart.

Abbreviations

SPT	2" O.D. Split Barrel
AL	Atterberg Limit
MC	Moisture Content
SA	Sieve Analysis
LL	Liquid Limit
PL	Plastic Limit
ST	3" O.D. Thin Wall (Shelby Tube)

Sample Symbols

⧗	SPT Sample 2" OD
▮	Shelby Tube
✋	Grab Sample

Backfill Symbols

▦	3/8" Bentonite Chips
░	Cement Grout

AL / MC Symbols

☐ Penetration Resistance Blows / Ft

10 20 30 40

○ Water Content (MC)

├┤ Atterberg Liquid Limit / Plastic Limit

Relative Density or Consistency

Coarse - Grained Soils	
Relative Density	N, SPT Blows/Foot
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

Fine - Grained Soils	
Relative Density	N, SPT Blows/Foot
Very Soft	0 - 1
Soft	2 - 4
Medium Stiff	5 - 8
Stiff	9 - 15
Very Stiff	16 - 30
Hard	> 30

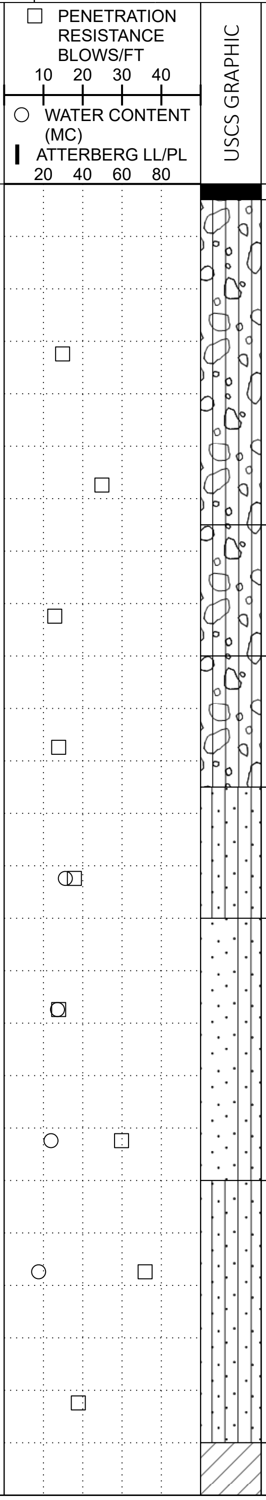
Modifiers & Percentages

Modifiers	Criteria
Trace	Particles present at levels estimated at <5%.
Slightly (Clayey, Silty, Sandy or Gravelly)	Particles present at levels estimated at 5% to 12%.
Clayey, Silty, Sandy or Gravelly	Particles Present at levels estimated at 12% to 30%.
Very (Clayey, Silty, Sandy or Gravelly)	Percentage of minor constituent estimated to be >30%.
With (Cobbles or Boulders)	Present at any concentration, estimate percentage.

Project: I&J Waterway
Project Location: Bellingham, WA
Project Number: 6040.0

Log of Boring IJW-SB-1

Date(s) Drilled	**06/03/2020 - 06/03/2020**	Geotechnical Consultant	**MJA**	Logged By	**C Burke**	Checked By	**LAS**
Drilling Method/ Rig Type	**Mud Rotary/Mobile B-59 Truck-rig**	Drilling Contractor	**Holt Services Inc.**	Total Depth of Borehole	**60.0 ft**		
Hole Diameter	**5.88 in**	Hammer Weight/Drop (lb/in.)/Type	**140 lb / 30 in / Automatic**	Ground Surface Elevation/Datum	**12.5 ft**		
Location	**West corner of Bornstein Bldg, next to propane tank**	Coordinates	**1239900.74E,644201.83N**	Elevation Source	**Topo survey drawing**		



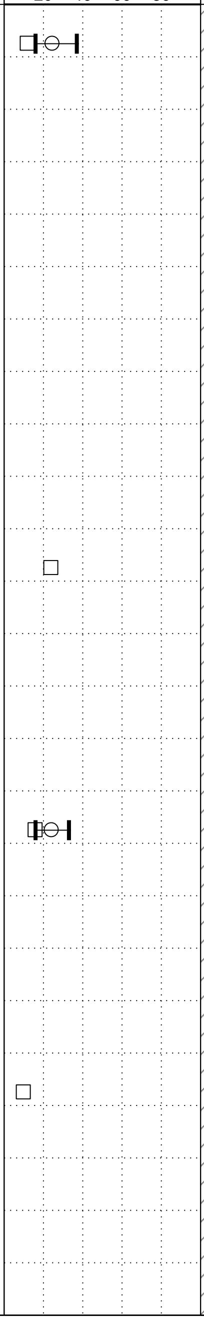
ELEV. (FT)	WATER LEVEL	DEPTH (FT)	SAMPLE TYPE	RECOVERY (%)	SAMPLE NUMBER	BLOW COUNTS	USCS	MATERIAL DESCRIPTION	BACKFILL/INSTALL.	REMARKS AND TESTS
								Asphalt. (Fill)		
				0	SPT_1	10-7-8	GM	Medium dense, GRAVEL (GM). (Fill)		Soil description based on cuttings.
8		5		0	SPT_2	16-12-13		*5.5 - 7.5 ft.: Fresh wood chips and gravel in cuttings*		
				11	SPT_3	11-7-6	GM	Medium dense, moist, white and orange, silty sandy GRAVEL (GM); with shells, brick, organics, wood. (Fill)		
3		10		44	SPT_4	8-5-9	GM	Medium dense, moist, black with orange and white mottling, silty sandy GRAVEL (GM); with shells, brick, organics, charcoal, fresh and decomposing wood. (Fill) *10.5 - 11.0 ft.: Fresh wood chips and gravel in cuttings*		
				61	SPT_5	2-7-11	SM	Medium dense, moist, gray, silty SAND (SM); trace organics, layers of fine sand interbedded with coarser sand. (Post-Glacial Fluvial Deposits)		SA, AL, MC
-2		15		61	SPT_6	7-6-8	SP-SM	Medium dense, moist, gray, slightly silty SAND (SP-SM); trace gravel, layers of shells. (Post-Glacial Fluvial Deposits) *16.5 - 19.0 ft.: Grades to trace shells*		SA, MC
				61	SPT_7	10-15-15				SA, MC
-7		20		39	SPT_8	16-19-17	SM	Dense, moist, gray, silty gravelly SAND (SM). (Post-Glacial Fluvial Deposits) *21.5 - 24.0 ft.: Grades to medium dense with pieces of wood, shells.*		SA, MC
				0	SPT_9	19-11-8				Soil description based on cuttings.
-12							CL	Medium stiff, moist, gray, CLAY (CL); trace sand, trace gravel. (Glacial Marine Drift)		

Project: I&J Waterway
Project Location: Bellingham, WA
Project Number: 6040.0

Log of Boring IJW-SB-1

Date(s) Drilled	**06/03/2020 - 06/03/2020**	Geotechnical Consultant	**MJA**	Logged By	**C Burke**	Checked By	**LAS**
Drilling Method/ Rig Type	**Mud Rotary/Mobile B-59 Truck-rig**	Drilling Contractor	**Holt Services Inc.**	Total Depth of Borehole	**60.0 ft**		
Hole Diameter	**5.88 in**	Hammer Weight/Drop (lb/in.)/Type	**140 lb / 30 in / Automatic**	Ground Surface Elevation/Datum	**12.5 ft**		
Location	**West corner of Bornstein Bldg, next to propane tank**	Coordinates	**1239900.74E,644201.83N**	Elevation Source	**Topo survey drawing**		

ELEV. (FT)	WATER LEVEL	DEPTH (FT)	SAMPLE TYPE	RECOVERY (%)	SAMPLE NUMBER	BLOW COUNTS	☐ PENETRATION RESISTANCE BLOWS/FT 10 20 30 40 ○ WATER CONTENT (MC) ❙ ATTERBERG LL/PL 20 40 60 80	USCS GRAPHIC	USCS	MATERIAL DESCRIPTION	BACKFILL/INSTALL.	REMARKS AND TESTS
				100	SPT_10	2-3-3				Medium stiff, moist, gray, CLAY (CL); trace sand, trace gravel. (Glacial Marine Drift)		AL, MC ST_1 pushed at 550 psi. TV = 600 psf.
				83	ST_1							
-17		30										
-22		35		33	SPT_11	5-5-7				*35.0 - 40.0 ft.: Grades to stiff, sandy*		
									CL			
-27		40		83	SPT_12	5-4-4				*40.0 - 50.0 ft.: Grades to medium stiff*		AL, MC
-32		45		100	SPT_13	1-2-3						
-37												



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Boring IJW-SB-1

Sheet 2

Project: I&J Waterway
Project Location: Bellingham, WA
Project Number: 6040.0

Log of Boring IJW-SB-1

Date(s) Drilled	**06/03/2020 - 06/03/2020**	Geotechnical Consultant	**MJA**	Logged By	**C Burke**	Checked By	**LAS**
Drilling Method/ Rig Type	**Mud Rotary/Mobile B-59 Truck-rig**	Drilling Contractor	**Holt Services Inc.**	Total Depth of Borehole	**60.0 ft**		
Hole Diameter	**5.88 in**	Hammer Weight/Drop (lb/in.)/Type	**140 lb / 30 in / Automatic**	Ground Surface Elevation/Datum	**12.5 ft**		
Location	**West corner of Bornstein Bldg, next to propane tank**	Coordinates	**1239900.74E,644201.83N**	Elevation Source	**Topo survey drawing**		

ELEV. (FT)	WATER LEVEL	DEPTH (FT)	SAMPLE TYPE	RECOVERY (%)	SAMPLE NUMBER	BLOW COUNTS	☐ PENETRATION RESISTANCE BLOWS/FT 10 20 30 40 ○ WATER CONTENT (MC) ❘ ATTERBERG LL/PL 20 40 60 80	USCS GRAPHIC	USCS	MATERIAL DESCRIPTION	BACKFILL/INSTALL.	REMARKS AND TESTS
				89	SPT_14	2-4-5				Stiff, moist, gray, slightly sandy CLAY (CL); trace gravel. (Glacial Marine Drift) *50.0 - 60.0 ft.: Grades to stiff, slightly sandy*		AL, MC
-42		55		72	SPT_15	2-5-5			CL			
												Bentonite chip and cement backfill.
-47		60		50	SPT_16	1-4-6						
												Borehole completed at 60 feet below ground surface (bgs).
-52		65										
-57		70										
-62												

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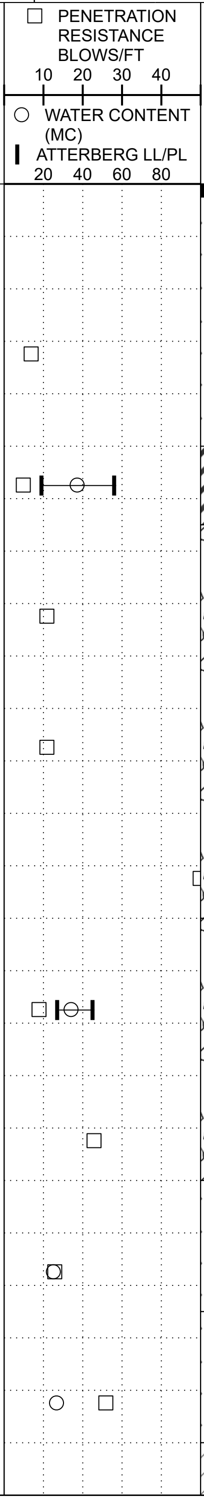
Boring IJW-SB-1

Sheet 3

Project: I&J Waterway
Project Location: Bellingham, WA
Project Number: 6040.0

Log of Boring IJW-SB-2

Date(s) Drilled	**06/02/2020 - 06/03/2020**	Geotechnical Consultant	**MJA**	Logged By	**C Burke**	Checked By	**LAS**
Drilling Method/ Rig Type	**Mud Rotary/Mobile B-59 Truck-rig**	Drilling Contractor	**Holt Services Inc.**	Total Depth of Borehole	**60.0 ft**		
Hole Diameter	**5.88 in**	Hammer Weight/Drop (lb/in.)/Type	**140 lb / 30 in / Automatic**	Ground Surface Elevation/Datum	**15.8 ft**		
Location	**NW side of Bornstein Bldg, near dock unit entrance**	Coordinates	**1239969.37E,644288.38N**	Elevation Source	**Topo survey drawing**		



ELEV. (FT)	WATER LEVEL	DEPTH (FT)	SAMPLE TYPE	RECOVERY (%)	SAMPLE NUMBER	BLOW COUNTS	USCS	MATERIAL DESCRIPTION	BACKFILL/INSTALL.	REMARKS AND TESTS
								Asphalt. (Fill)		
							SM	Loose, moist, gray and orange, very silty SAND (SM). (Fill)		
				11	SPT_1	11-5-2				
11		5					CH	Medium stiff, moist, brown, slightly sandy CLAY (CH). (Fill)		AL, MC
				39	SPT_2	4-2-3				
							GM	Medium dense, moist, brown, sandy, slightly silty GRAVEL (GM). (Fill)		
				11	SPT_3	7-6-5				
6		10								Gravel in SPT_4 split spoon sampler tip.
				0	SPT_4	6-5-6				
				56	SPT_5	19-34-50/6"				Difficult drilling. Losing drilling mud circulation. SPT_5 split spoon sampler on cobble. At 12.5', after SPT_5, drillers put 2 bags bentonite chips in hole and let sit 10 mins.
							GM	Loose, moist, gray, sandy, very silty GRAVEL (GM); trace organics, trace mica, trace wood, trace shells. (Fill)		
1		15		39	SPT_6	6-4-5				AL, SA, MC
				44	SPT_7	20-13-10		*17.5 -19.0 ft.: Grading to medium dense*		Bentonite chips and drilling slough in SPT_7.
-4		20					SP-SM	Medium dense, moist, gray, slightly silty, slightly gravelly SAND (SP-SM). (Post-Glacial Fluvial Deposits) *20.0 - 21.5 ft.: Grading to less silt, less organics*		SA, MC
				61	SPT_8	5-6-7				
							SM	Medium dense, moist, gray, silty SAND (SM); trace gravel, trace organics. (Post-Glacial Fluvial Deposits)		SA, MC
				67	SPT_9	10-11-15				
							CL	Medium stiff, moist, gray, sandy CLAY (CL); trace gravel. (Glacial Marine Drift)		

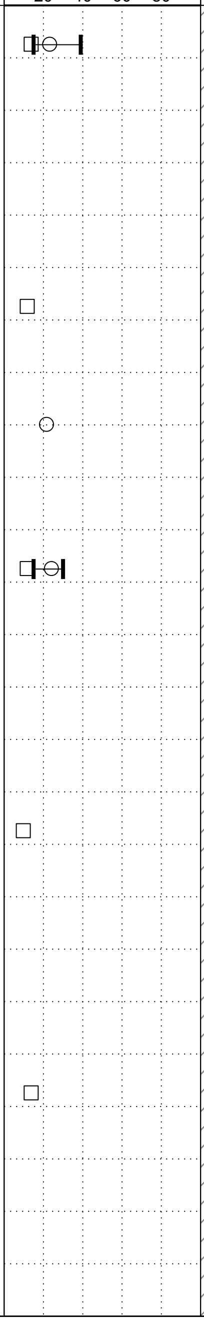
McMILLEN JACOBS ASSOCIATES

Boring IJW-SB-2

Project: I&J Waterway
Project Location: Bellingham, WA
Project Number: 6040.0

Log of Boring IJW-SB-2

Date(s) Drilled	**06/02/2020 - 06/03/2020**	Geotechnical Consultant	**MJA**	Logged By	**C Burke**
Checked By	**LAS**				
Drilling Method/ Rig Type	**Mud Rotary/Mobile B-59 Truck-rig**	Drilling Contractor	**Holt Services Inc.**	Total Depth of Borehole	**60.0 ft**
Hole Diameter	**5.88 in**	Hammer Weight/Drop (lb/in.)/Type	**140 lb / 30 in / Automatic**	Ground Surface Elevation/Datum	**15.8 ft**
Location	**NW side of Bornstein Bldg, near dock unit entrance**	Coordinates	**1239969.37E,644288.38N**	Elevation Source	**Topo survey drawing**



ELEV. (FT)	WATER LEVEL	DEPTH (FT)	SAMPLE TYPE	RECOVERY (%)	SAMPLE NUMBER	BLOW COUNTS	USCS GRAPHIC	USCS	MATERIAL DESCRIPTION	BACKFILL/INSTALL.	REMARKS AND TESTS
				72	SPT_10	4-4-3			Medium stiff, moist, gray, sandy CLAY (CL); trace gravel. (Glacial Marine Drift)		AL, MC Stop drilling at 25 ft on 6/2/2020. Resume drilling 6/3/2020.
-14		30							*30.0 - 31.5 ft.: Trace mica*		
				100	SPT_11	2-2-4					
											ST_1 pushed at 550 psi. TV = 400 psf.
				61	ST_1						CONSOL
-19		35									AL, MC
				100	SPT_12	1-2-4					
								CL			
-24		40							*40.0 - 40.1 ft.: 1 inch seam of silty sand*		
				89	SPT_13	2-2-3					
-29		45									
				83	SPT_14	5-4-3					

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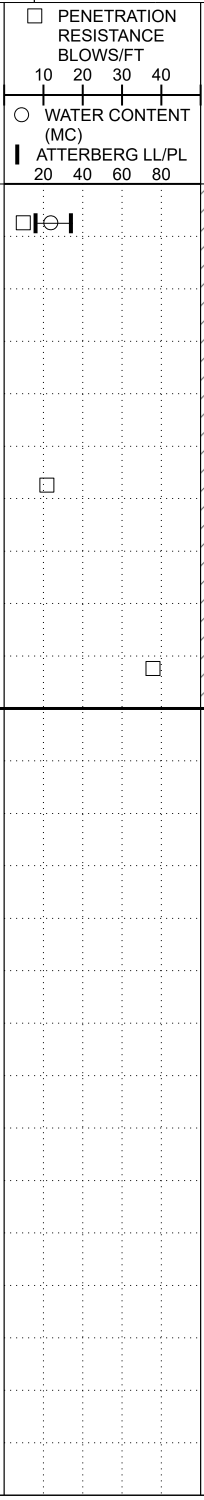
Project: I&J Waterway
Project Location: Bellingham, WA
Project Number: 6040.0

Log of Boring IJW-SB-2

Date(s) Drilled	**06/02/2020 - 06/03/2020**	Geotechnical Consultant	**MJA**	Logged By	**C Burke**	Checked By	**LAS**
Drilling Method/ Rig Type	**Mud Rotary/Mobile B-59 Truck-rig**	Drilling Contractor	**Holt Services Inc.**	Total Depth of Borehole	**60.0 ft**		
Hole Diameter	**5.88 in**	Hammer Weight/Drop (lb/in.)/Type	**140 lb / 30 in / Automatic**	Ground Surface Elevation/Datum	**15.8 ft**		
Location	**NW side of Bornstein Bldg, near dock unit entrance**	Coordinates	**1239969.37E,644288.38N**	Elevation Source	**Topo survey drawing**		



ELEV. (FT)	WATER LEVEL	DEPTH (FT)	SAMPLE TYPE	RECOVERY (%)	SAMPLE NUMBER	BLOW COUNTS	USCS GRAPHIC	USCS	MATERIAL DESCRIPTION	BACKFILL/INSTALL.	REMARKS AND TESTS
			⧗	78	SPT_15	3-2-3	▨		Medium stiff, moist, gray, sandy CLAY (CL); trace gravel. (Glacial Marine Drift)	▒	AL, MC
-39		55	⧗	22	SPT_16	3-5-6	▨	CL	*55.0 - 58.5 ft.: Grades to stiff*	▒	
			⧗	56	SPT_17	20-17-21	▨		*58.5 - 60.0 ft.: Grades to hard*	▒	Bentonite chip and cement backfill.
-44		60									Borehole completed at 60 feet below ground surface (bgs).
-49		65									
-54		70									

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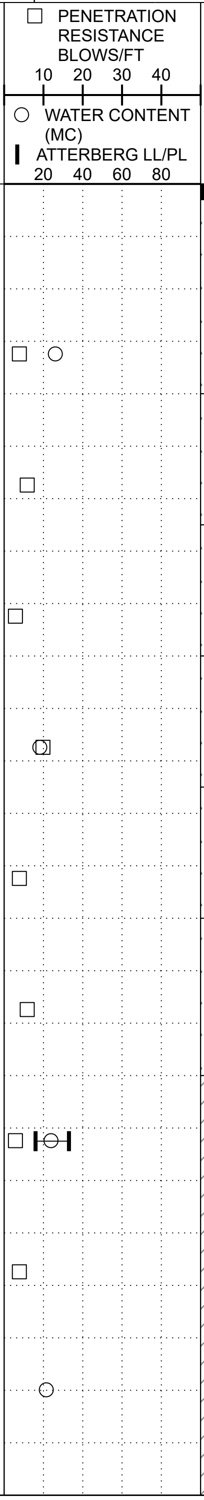
Boring IJW-SB-2

Sheet 3

Project: I&J Waterway
Project Location: Bellingham, WA
Project Number: 6040.0

Log of Boring IJW-SB-3

Date(s) Drilled	**06/02/2020 - 06/02/2020**	Geotechnical Consultant	**MJA**	Logged By	**C Burke**	Checked By	**LAS**
Drilling Method/ Rig Type	**Mud Rotary/Mobile B-59 Truck-rig**	Drilling Contractor	**Holt Services Inc.**	Total Depth of Borehole	**70.0 ft**		
Hole Diameter	**5.88 in**	Hammer Weight/Drop (lb/in.)/Type	**140 lb / 30 in / Automatic**	Ground Surface Elevation/Datum	**12.8 ft**		
Location	**North corner of Bornstein Bldg, inside gate**	Coordinates	**1240112.05E,644389.89N**	Elevation Source	**Topo survey drawing**		

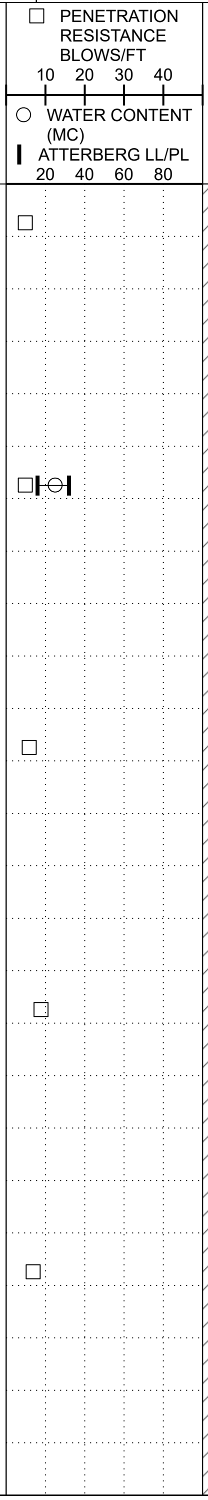


ELEV. (FT)	DEPTH (FT)	RECOVERY (%)	SAMPLE NUMBER	BLOW COUNTS	USCS	MATERIAL DESCRIPTION	REMARKS AND TESTS
						Asphalt. (Fill)	
					SM	Very loose, moist, gray, gravelly, silty SAND (SM); trace organics, trace brick, trace woodchips. Top 2" gravel. (Fill)	SA, MC
		72	SPT_1	2-2-2			
8	5	28	SPT_2	4-3-3	SM	Loose, moist, brown and orange, silty SAND (SM); trace organics, trace charcoal. (Fill)	
		11	SPT_3	4-1-2	SM	Very loose, wet, gray, silty SAND (SM); trace organics, Sulfuric odor. Metal bolt. (Fill)	
3	10	72	SPT_4	5-4-6	SP-SM	Loose, moist, gray, slightly silty, gravelly SAND (SP-SM); trace organics. (Post-Glacial Fluvial Deposits)	SA, MC
		50	SPT_5	6-2-2	SM	Very loose, moist, gray, silty SAND (SM); trace organics, trace shells, seams of black. Hydrocarbon odor. (Post-Glacial Fluvial Deposits)	
-2	15	67	SPT_6	3-3-3	SM	Loose, moist, gray, silty SAND (SM); trace organics, trace shells. (Post-Glacial Fluvial Deposits)	
		50	SPT_7	1-1-2	CL	Soft, moist, gray, sandy CLAY (CL); trace gravel. (Glacial Marine Drift)	AL, MC
-7	20	100	SPT_8	0-2-2			
		100	ST_1			*21.5 - 40.0 ft.: Grades to medium stiff, slightly sandy*	ST_1 pushed at 550 psi. TV = 800 psf. CONSOL

Project: I&J Waterway
Project Location: Bellingham, WA
Project Number: 6040.0

Log of Boring IJW-SB-3

Date(s) Drilled	**06/02/2020 - 06/02/2020**	Geotechnical Consultant	**MJA**	Logged By **C Burke**	Checked By **LAS**
Drilling Method/ Rig Type	**Mud Rotary/Mobile B-59 Truck-rig**	Drilling Contractor	**Holt Services Inc.**	Total Depth of Borehole	**70.0 ft**
Hole Diameter	**5.88 in**	Hammer Weight/Drop (lb/in.)/Type	**140 lb / 30 in / Automatic**	Ground Surface Elevation/Datum	**12.8 ft**
Location	**North corner of Bornstein Bldg, inside gate**	Coordinates	**1240112.05E,644389.89N**	Elevation Source	**Topo survey drawing**



ELEV. (FT)	WATER LEVEL	DEPTH (FT)	SAMPLE TYPE	RECOVERY (%)	SAMPLE NUMBER	BLOW COUNTS	USCS GRAPHIC	USCS	MATERIAL DESCRIPTION	BACKFILL/INSTALL.	REMARKS AND TESTS
				78	SPT_9	1-2-3			Medium stiff, moist, gray, slightly sandy CLAY (CL); trace gravel. (Glacial Marine Drift)		
-17		30		100	SPT_10	4-2-3					AL, MC
-22		35		0		3-3-3		CL			
-27		40		61	SPT_11	3-4-5			*40.0 - 45.0 ft.: Grades to stiff, sandy*		
-32		45		100	SPT_12	2-3-4			*45.0 - 50.0 ft.:Grades to medium stiff*		

McMILLEN JACOBS ASSOCIATES

Boring IJW-SB-3

Project: I&J Waterway
Project Location: Bellingham, WA
Project Number: 6040.0

Log of Boring IJW-SB-3

Date(s) Drilled	**06/02/2020 - 06/02/2020**	Geotechnical Consultant	**MJA**	Logged By	**C Burke**	Checked By	**LAS**
Drilling Method/ Rig Type	**Mud Rotary/Mobile B-59 Truck-rig**	Drilling Contractor	**Holt Services Inc.**	Total Depth of Borehole	**70.0 ft**		
Hole Diameter	**5.88 in**	Hammer Weight/Drop (lb/in.)/Type	**140 lb / 30 in / Automatic**	Ground Surface Elevation/Datum	**12.8 ft**		
Location	**North corner of Bornstein Bldg, inside gate**	Coordinates	**1240112.05E,644389.89N**	Elevation Source	**Topo survey drawing**		

ELEV. (FT)	WATER LEVEL	DEPTH (FT)	SAMPLE TYPE	RECOVERY (%)	SAMPLE NUMBER	BLOW COUNTS	☐ PENETRATION RESISTANCE BLOWS/FT 10 20 30 40 ○ WATER CONTENT (MC) ❙ ATTERBERG LL/PL 20 40 60 80	USCS GRAPHIC	USCS	MATERIAL DESCRIPTION	BACKFILL/INSTALL.	REMARKS AND TESTS
				100	SPT_13	2-5-5				Stiff, moist, gray, sandy CLAY (CL); trace gravel. (Glacial Marine Drift) *50.0 - 70.0 ft.: Grades to stiff*		
-42		55		100	SPT_14	4-4-6				*55.0 - 56.5 ft.: Trace shells*		
-47		60		94	SPT_15	2-4-6			CL			
-52		65		100	SPT_16	5-5-8						
				100	SPT_17	1-4-7						AL, MC Bentonite chip and cement backfill.
-57		70										Borehole completed at 70 feet below ground surface (bgs).

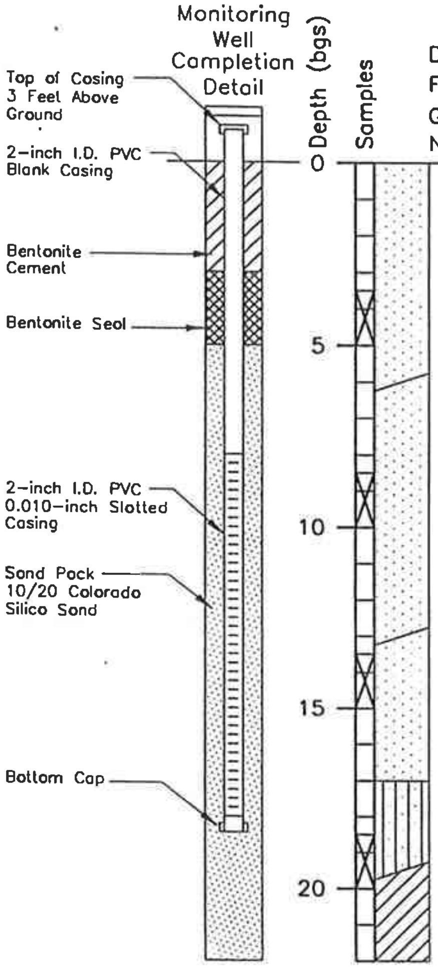
Appendix A.2

Existing Boring Logs

LOG OF BORING

Date Drilled 1/23/95
Drilling Co. HOLT Driller C. MOORE
Field Engineer B. GEIGER Drill Rig MOBILE B-59
Ground Elev.(ft)(2) 15.2 Top of Casing.(ft)(2) 18.17
Northing (ft)(3) 644510.4 Easting (ft)(3) 1600066.7

Blows/ Foot **	Headspace VOC (ppm)	Sample Number (4)
9	0.0	MW4-3.5*
16	0.0	MW4-8.5*
8	0.0	MW4-13.5*
0	0.0	



0 to 6.0 ft
GRAVELLY SAND (SW)
brown, very dense, dry, fine grained with pockets of very dark grey clayey sand, some wood debris; sampler refusal on debris (FILL)

6.0 to 13.0 ft
SAND (SW)
dark grey to black, medium dense medium grained with trace silt and gravel and brick pieces (FILL)

WATER TABLE ENCOUNTERED AT 8 ft DURING DRILLING

13.0 to 17.0 ft
SAND (SP)
dark grey, medium dense, wet, poorly graded, with trace of fine gravel, some seashell fragments

17.0 to 19.6 ft
SILTY SAND (SM)
17.0 to 19.6 ft
olive grey, loose, wet, fine to medium grained with seashell fragments, clayey pockets

19.6 to 22.0 ft
SANDY CLAY (CL/SC)
19.6-22.0 ft, olive grey, fine to medium grained, medium plastic

BOTTOM OF BOREHOLE 21.0 ft 15:00 PM 1/23/95

Notes: * sample submitted for VOA analysis only

** Blow counts obtained by driving a 3-inch O.D. split-spoon sampler 18 inches with a 300-pound hammer falling 30 inches. The blow count is the number of blows required to advance the sampler the final 12 inches unless otherwise noted.

() Soil Classifications are based on field tests and observations. No physical testing was conducted.

bgs below ground surface

1) Contacts are approximate where shown at an angle

2) Elevation given in feet above mean lower low water

3) Washington State Plane Coordinate System: Coordinates are North 644,852.98 and East 1,600,574.94 for the North half of the State of Washington

4) Sample MW4-C was composited from four samples, and submitted for all other analyses

HARDING LAWSON ASSOCIATES
Engineering and Environmental Services

Log of Boring MW-4
Environmental Investigation
USCG Olivine Site
Bellingham, Washington

FIGURE
A-4

DRAWN	PROJECT NUMBER	APPROVED	DATE	FILE NAME
TG	30555 .1		2/95	169T

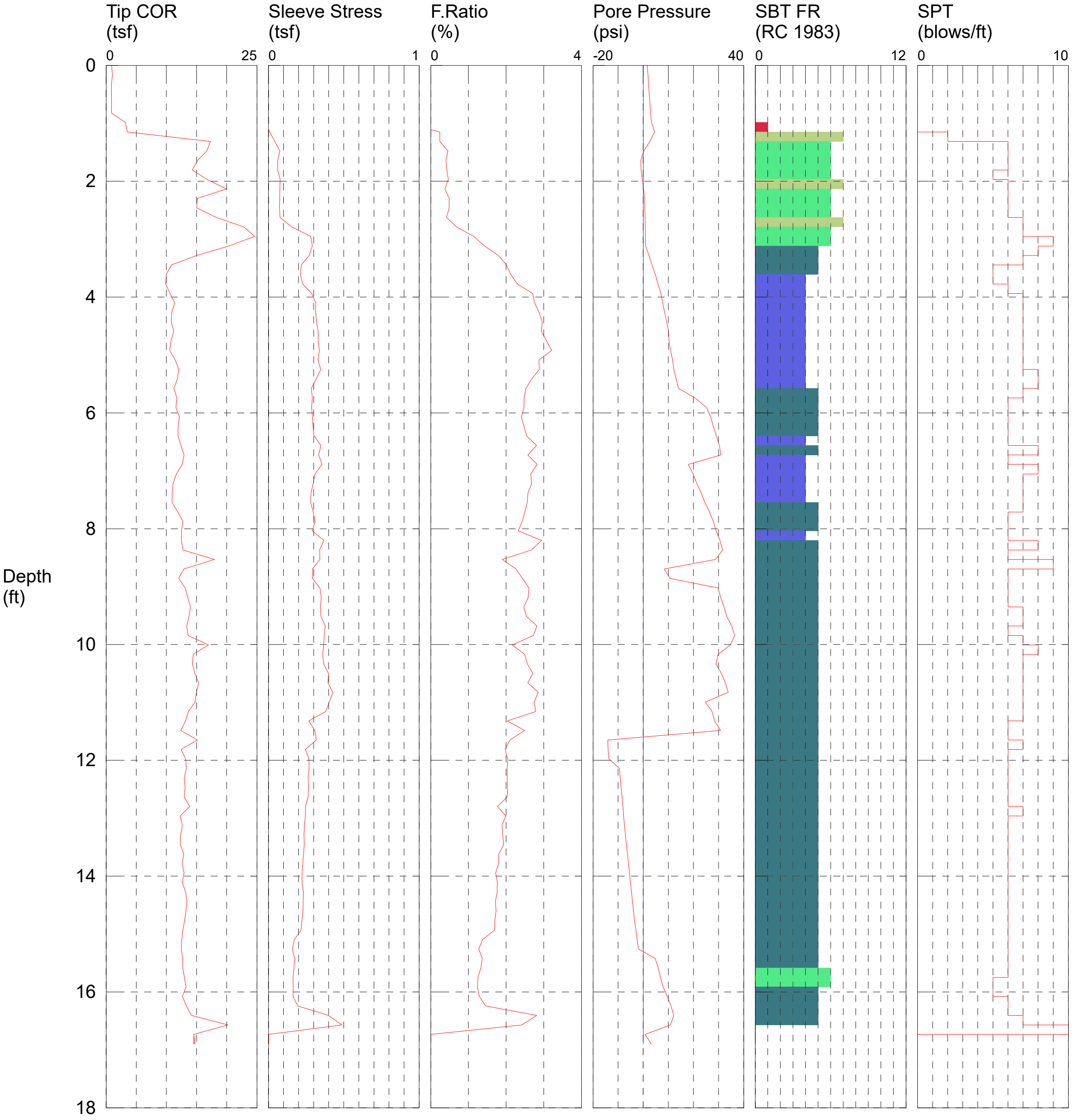
Appendix B

CPT Logs

IJW-CPT-1

CPT CONTRACTOR: In Situ Engineering
CUSTOMER: CRETE Consulting
LOCATION: Bellingham
JOB NUMBER: N/A
COMMENT: I and J Waterway Project

OPERATOR: Okbay/Walsh
CONE ID: DDG1394
TEST DATE: 6/26/2020 3:19:36 PM
PREDRILL : 0 ft
BACKFILL: N/A
NOTE: Depth is from Mud-Line



TOTAL DEPTH: 16.896 ft

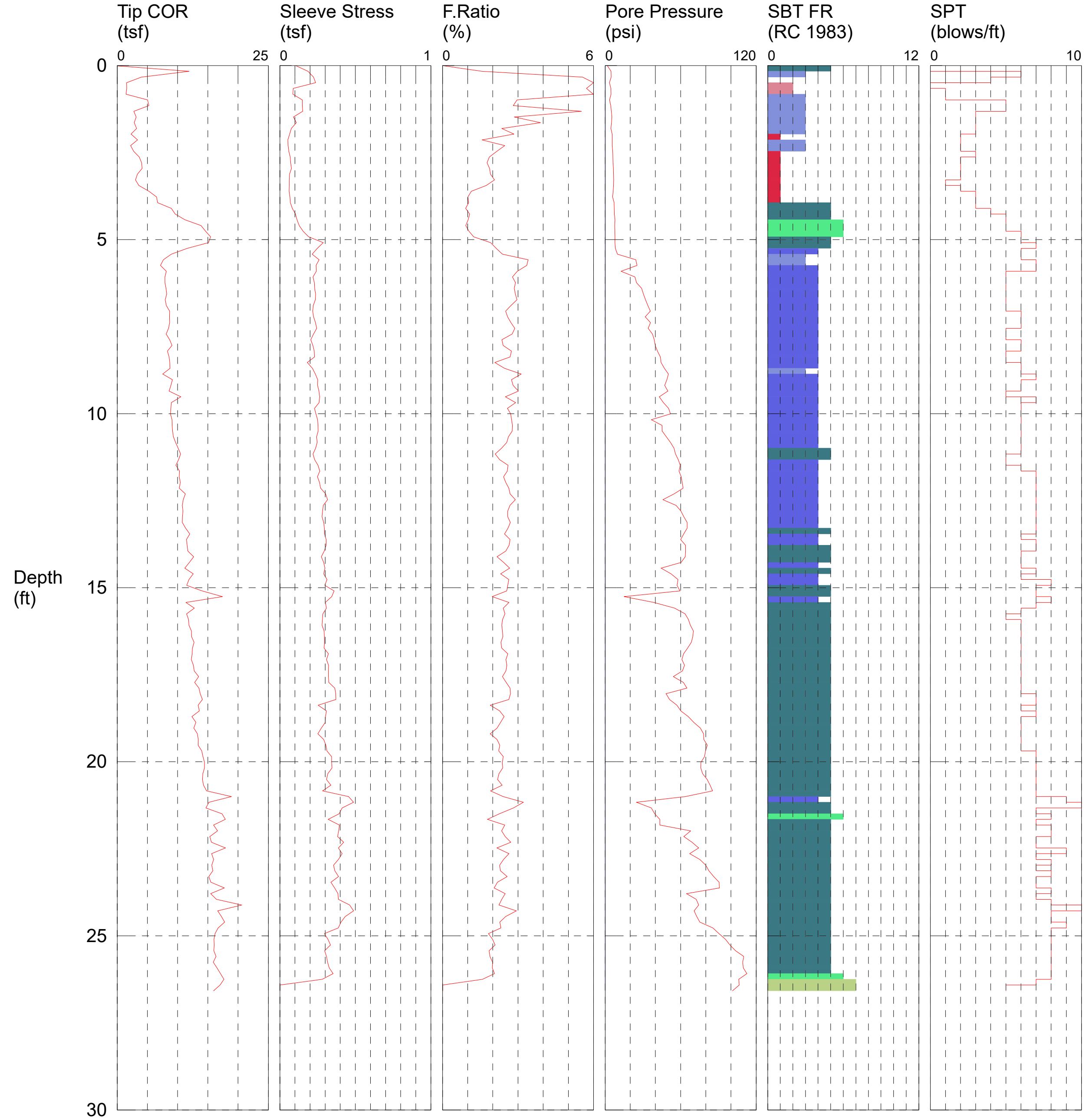
🟥 1 sensitive fine grained
🟥 2 organic material
🟦 3 clay
🟦 4 silty clay to clay
🟦 5 clayey silt to silty clay
🟩 6 sandy silt to clayey silt
🟩 7 silty sand to sandy silt
🟨 8 sand to silty sand
🟫 9 sand
🟧 10 gravelly sand to sand
⬜ 11 very stiff fine grained (*)
⬛ 12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

IJW-CPT-2

CPT CONTRACTOR: In Situ Engineering
CUSTOMER: CRETE Consulting
LOCATION: Bellingham
JOB NUMBER: N/A
COMMENT: I and J Waterway Project

OPERATOR: Okbay/Walsh
CONE ID: DDG1394
TEST DATE: 6/27/2020 11:51:01 AM
PREDRILL : 0 ft
BACKFILL: N/A
NOTE: Depth is from Mud-Line



TOTAL DEPTH: 26.575 ft

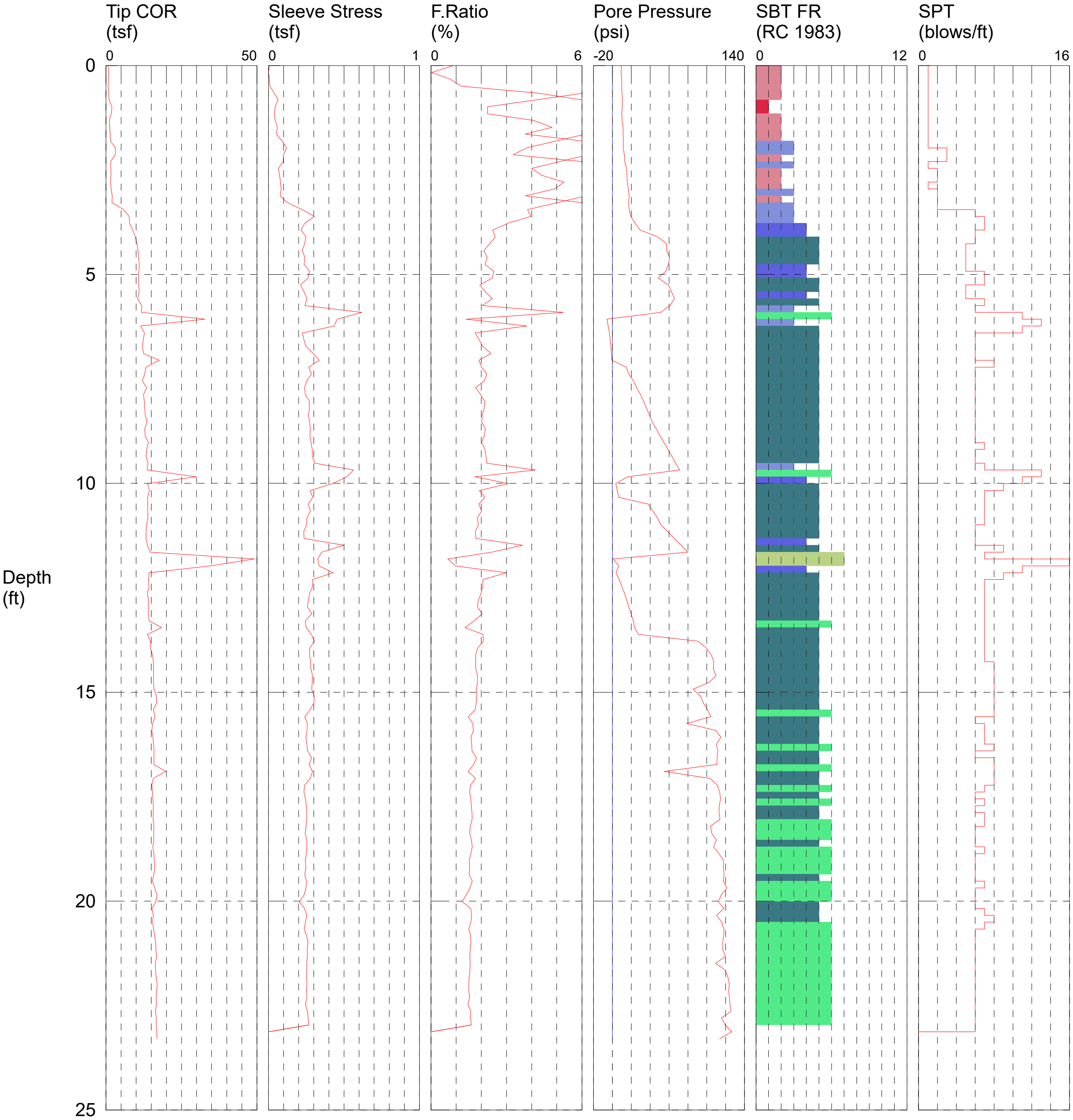
■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

IJW-CPT-3

CPT CONTRACTOR: In Situ Engineering
CUSTOMER: CRETE Consulting
LOCATION: Bellingham
JOB NUMBER: I & J Waterway Site
COMMENT:

OPERATOR: Okbay/Walsh
CONE ID: DDG1394
TEST DATE: 6/23/2020 5:38:13 AM
PREDRILL : 0 ft
BACKFILL: N/A
NOTE: Depth is from Mud-Line



TOTAL DEPTH: 23.294 ft

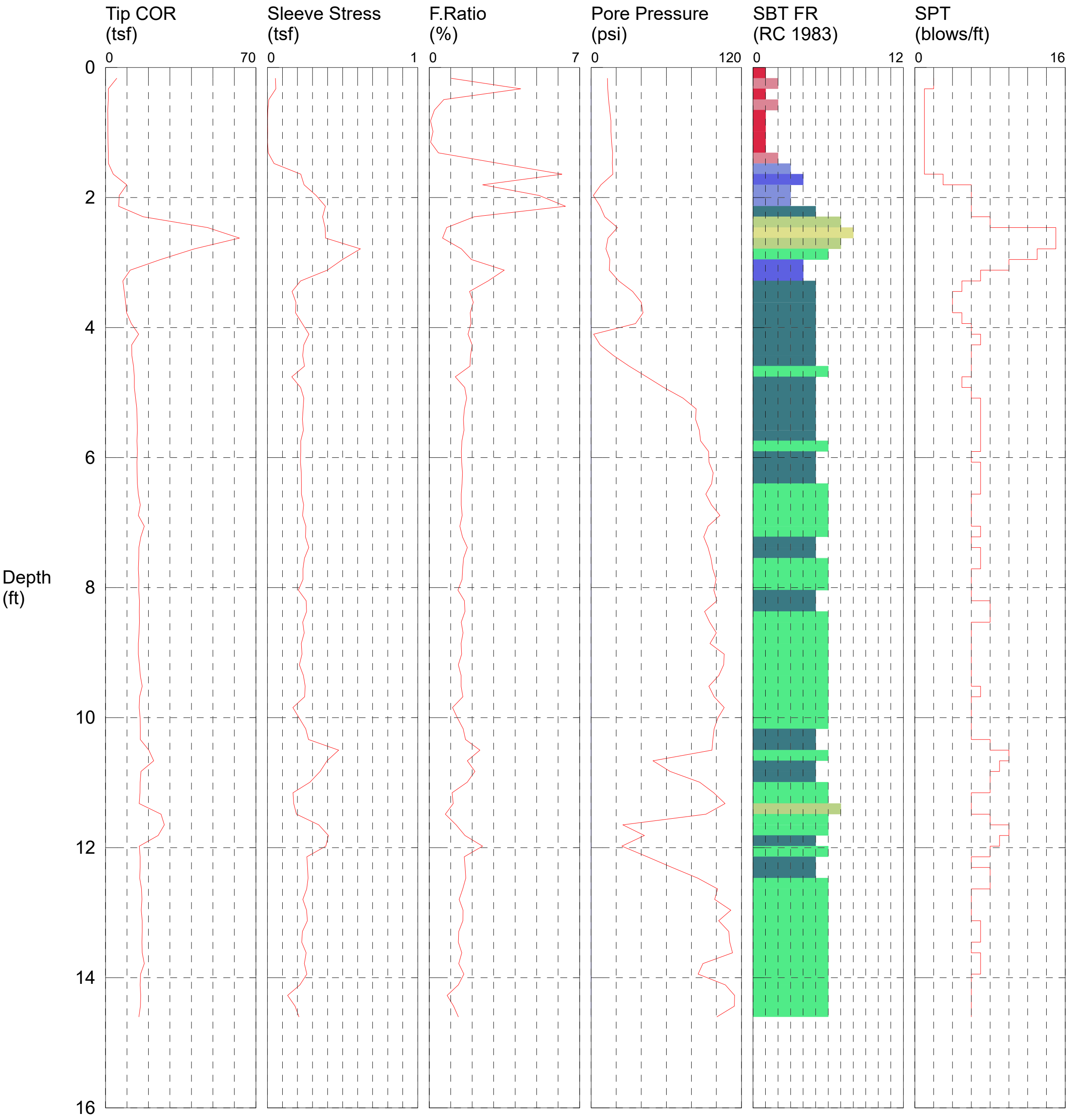
🟥 1 sensitive fine grained
🟥 2 organic material
🟦 3 clay
🟦 4 silty clay to clay
🟦 5 clayey silt to silty clay
🟩 6 sandy silt to clayey silt
🟩 7 silty sand to sandy silt
🟨 8 sand to silty sand
🟫 9 sand
🟧 10 gravelly sand to sand
⬜ 11 very stiff fine grained (*)
⬛ 12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

IJW-CPT-4

CPT CONTRACTOR: In Situ Engineering
CUSTOMER: CRETE Consulting
LOCATION: Bellingham
JOB NUMBER: N/A
COMMENT: I and J Waterway Project

OPERATOR: Okbay/Walsh
CONE ID: DDG1394
TEST DATE: 6/25/2020 8:09:31 AM
PREDRILL : 0 ft
BACKFILL: N/A
NOTE: Depth is from Mud-Line



TOTAL DEPTH: 14.600 ft

■ 1 sensitive fine grained
■ 2 organic material
■ 3 clay

■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt

■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand

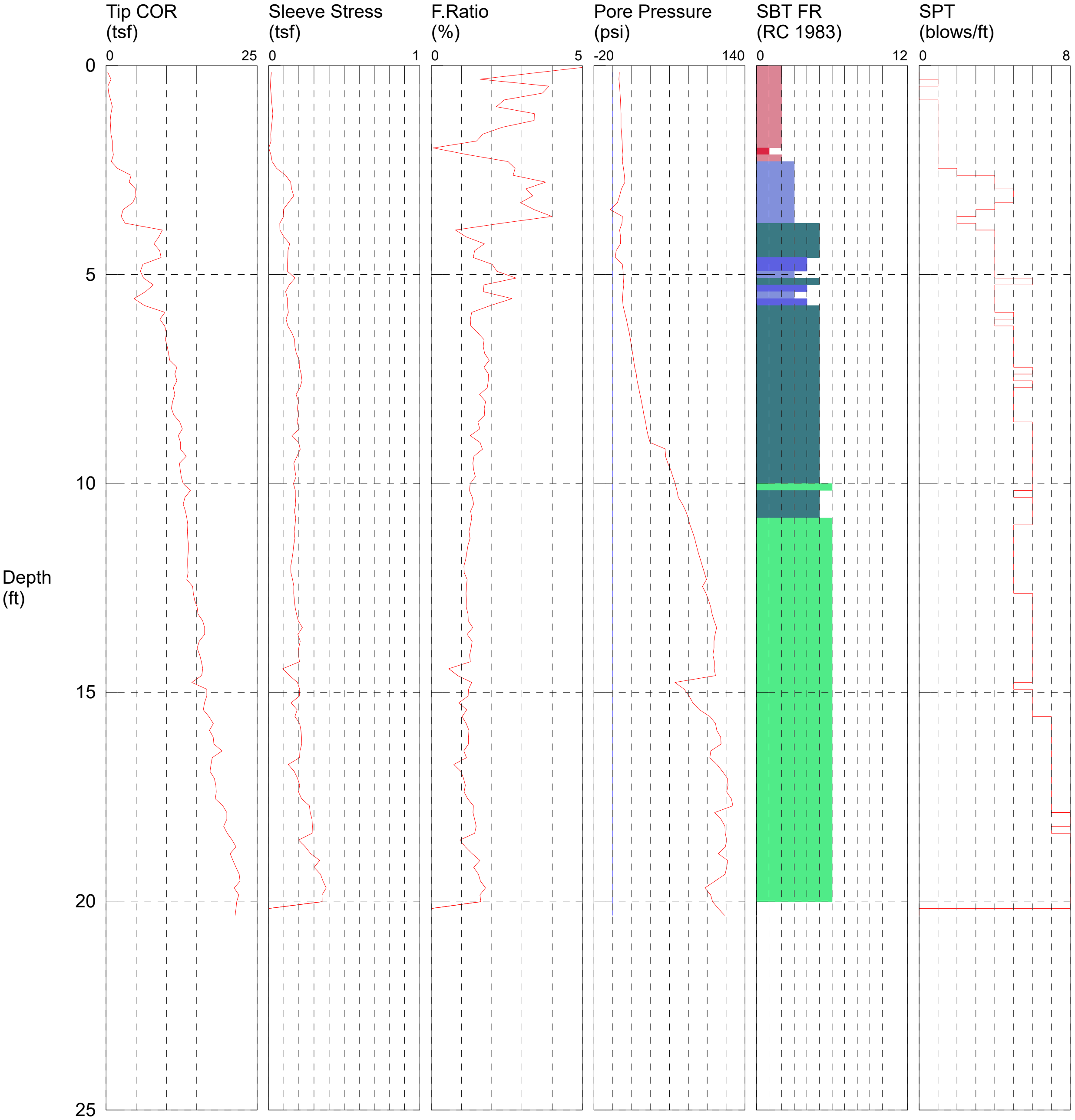
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

IJW-CPT-5

CPT CONTRACTOR: In Situ Engineering
CUSTOMER: CRETE Consulting
LOCATION: Bellingham
JOB NUMBER: I & J Waterway Site
COMMENT:

OPERATOR: Okbay/Walsh
CONE ID: DDG1394
TEST DATE: 6/23/2020 1:20:42 PM
PREDRILL : 0 ft
BACKFILL: N/A
NOTE: Depth is from Mud-Line



TOTAL DEPTH: 20.341 ft

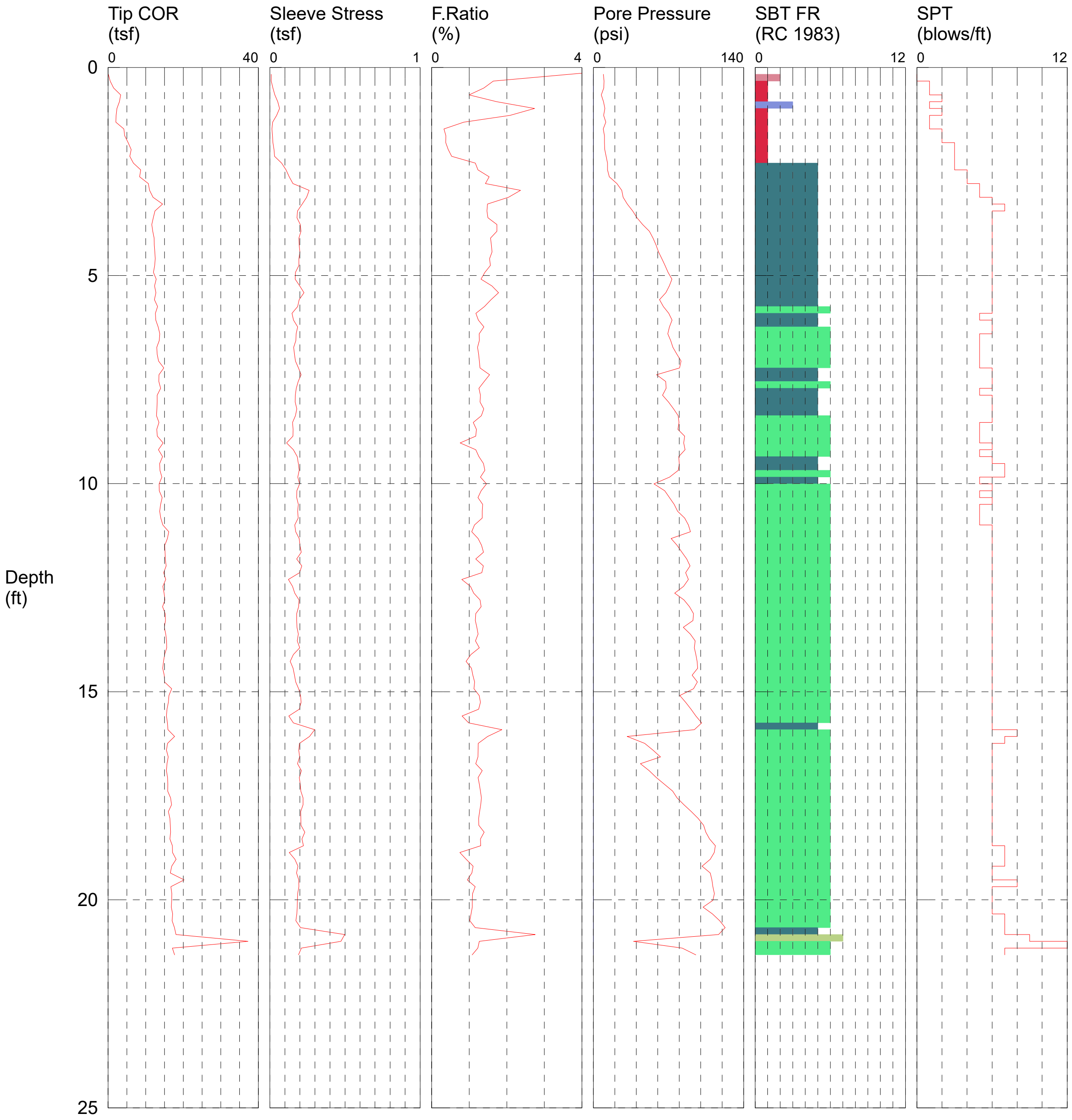
🟥 1 sensitive fine grained	🟦 4 silty clay to clay	🟩 7 silty sand to sandy silt	🟧 10 gravelly sand to sand
🟥 2 organic material	🟦 5 clayey silt to silty clay	🟨 8 sand to silty sand	⬜ 11 very stiff fine grained (*)
🟦 3 clay	🟩 6 sandy silt to clayey silt	🟫 9 sand	⬛ 12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

IJW-CPT-6

CPT CONTRACTOR: In Situ Engineering
CUSTOMER: CRETE Consulting
LOCATION: Bellingham
JOB NUMBER: N/A
COMMENT: I and J Waterway Project

OPERATOR: Okbay/Walsh
CONE ID: DDG1394
TEST DATE: 6/24/2020 2:30:13 PM
PREDRILL : 0 ft
BACKFILL: N/A
NOTE: Depth is from Mud-Line



TOTAL DEPTH: 21.325 ft

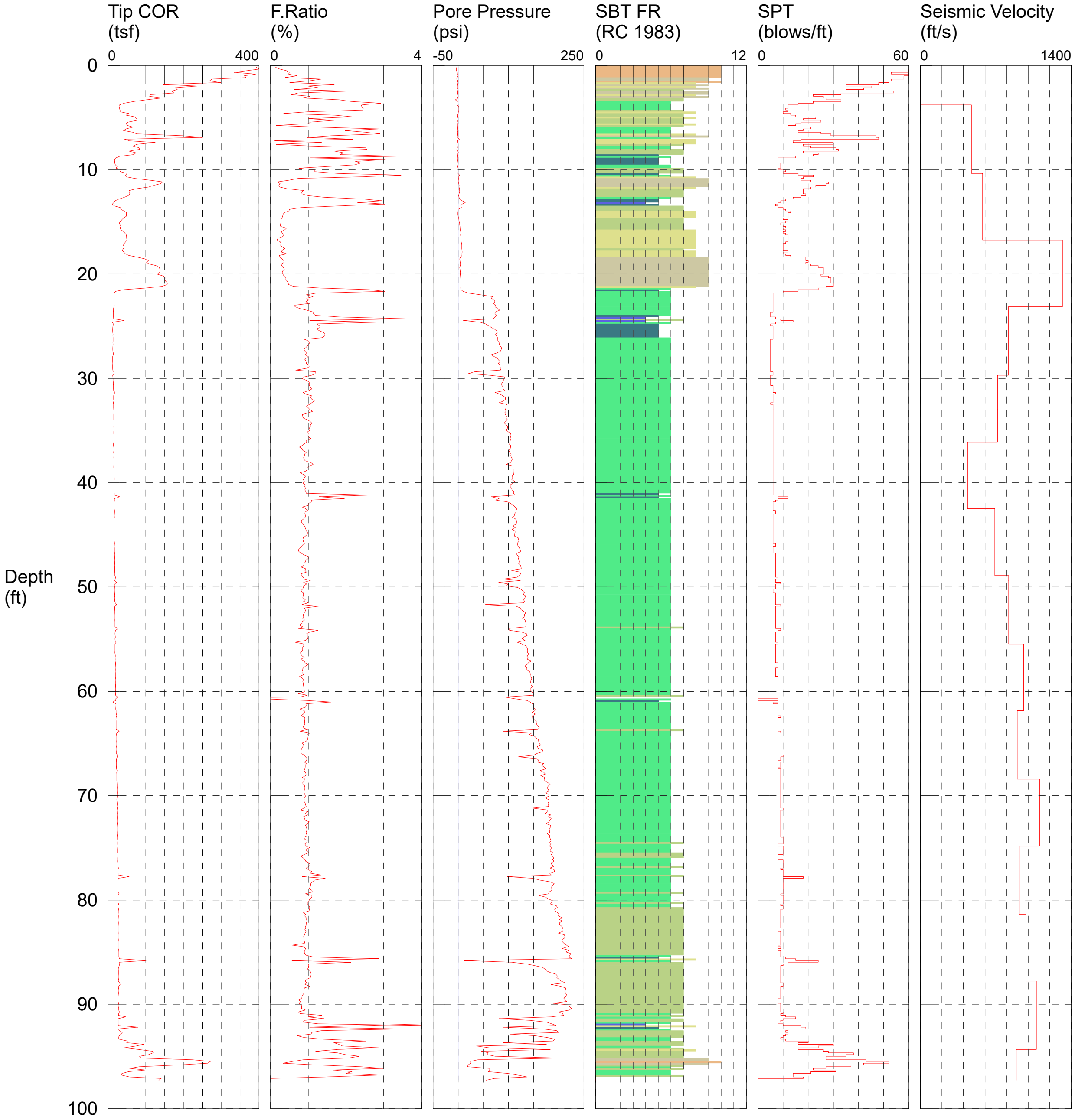
🟥 1 sensitive fine grained	🟦 4 silty clay to clay	🟩 7 silty sand to sandy silt	🟧 10 gravelly sand to sand
🟥 2 organic material	🟦 5 clayey silt to silty clay	🟨 8 sand to silty sand	⬜ 11 very stiff fine grained (*)
🟦 3 clay	🟩 6 sandy silt to clayey silt	🟫 9 sand	⬛ 12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

IJW-sCPT-7

CPT CONTRACTOR: In Situ Engineering
CUSTOMER: CRETE Consulting
LOCATION: Bellingham
JOB NUMBER: N/A
COMMENT: I and J Waterway Project
COMMENT:

OPERATOR: Okbay/Walsh
CONE ID: DDG1263
TEST DATE: 6/24/2020 9:13:27 AM
PREDRILL : 0 ft
BACKFILL: Bentonite Chips
SURFACE PATCH: N/A

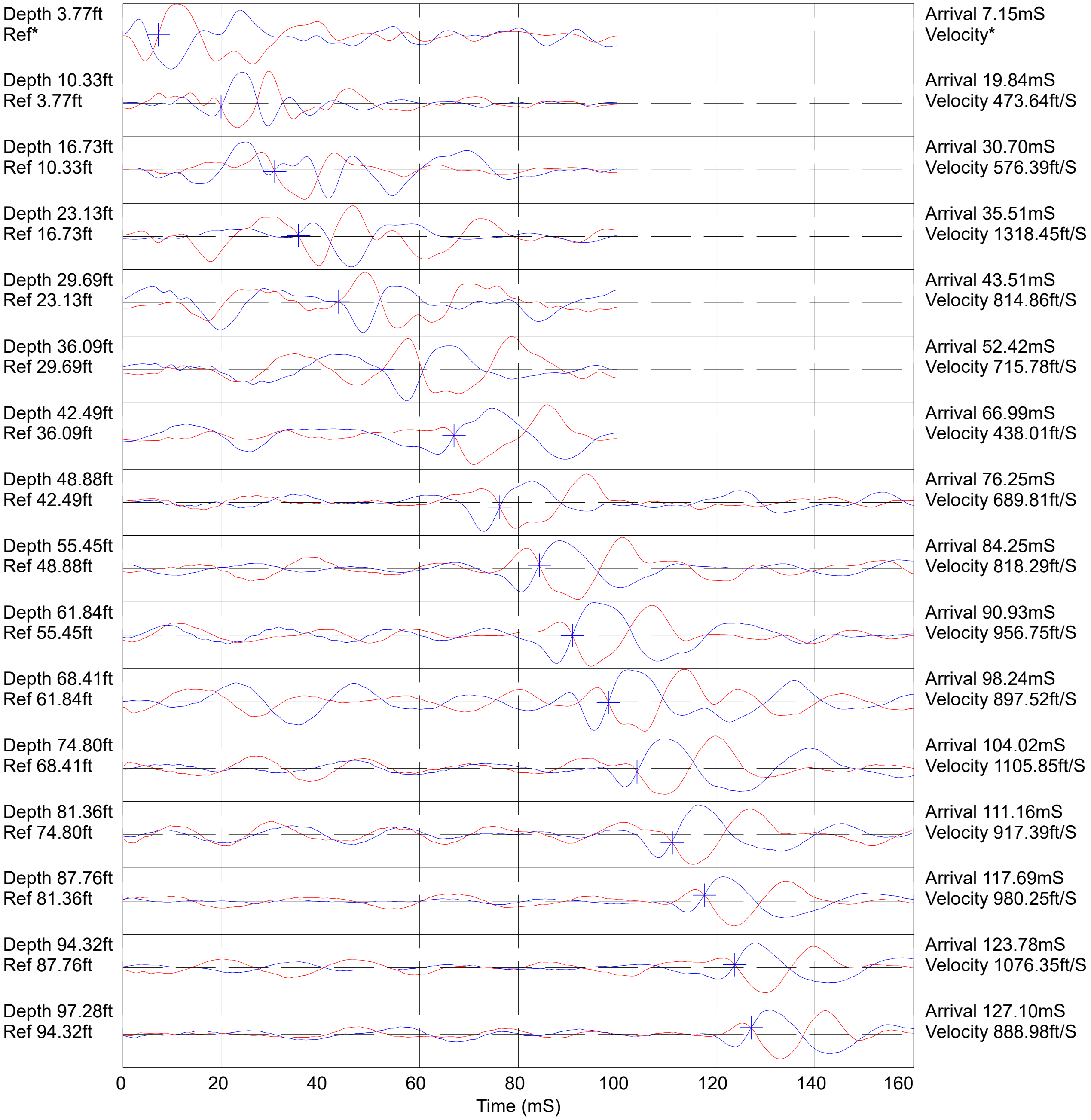


TOTAL DEPTH: 97.277 ft

🟥 1 sensitive fine grained
🟥 2 organic material
🟦 3 clay
🟦 4 silty clay to clay
🟦 5 clayey silt to silty clay
🟩 6 sandy silt to clayey silt
🟩 7 silty sand to sandy silt
🟨 8 sand to silty sand
🟫 9 sand
🟧 10 gravelly sand to sand
⬜ 11 very stiff fine grained (*)
⬛ 12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

HOLE NUMBER: IJW-sCPT-7



Hammer to Rod String Distance (ft): 2.79
* = Not Determined

JOB NUMBER: N/A

Appendix C

Sediment Logs

CRETE Consulting, Inc.
108 S. Washington St., Suite 300
Seattle, WA 98104

SEDIMENT LOG

BORING ID	**IJW-SC-1**
TOTAL DEPTH:	**9.5-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Mike Byers, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**6/16/2020**	PENETRATION DEPTH	**9.5-Feet**
LATITUDE	**48.7541418° N**	CORE LENGTH **9-Feet**	EST. COMPACTION **5%**
LONGITUDE	**122.4938651° W**	WATER DEPTH **15.3-Feet**	TIDE HEIGHT **2.7-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		GC	GRAVELLY FINES (mud) with abundant FISH WASTE, subround to round gravel, loose, saturated, mostly black, minor to some SHELLS (fragmented and intact), trace plastic pieces. 2-ft: BRICK fragments 3.5-ft: WOOD pices, trace SHELLS 4.5-ft: Small BRICK pieces, some spiny FISH BONES					0
5				IJW-SC-1-2	4 to 6 ft	1.7		5
		CL	SILTY CLAY,soft to medium consistency, gray to dark gray. Distubed interface - Glacial Marine Drift sediment with overlying mixed sediments	IJW-SC-1-1	6 to 8 ft	0.9		
			Pocket of BRICK fragments, SHELLS, organic fines, very fine-grained SAND					
		CL	SILTY CLAY,soft to medium consistency, gray to dark gray. Distubed interface - Glacial Marine Drift sediment with overlying mixed sediments					
		CL	SILTY CLAY, soft to medium consistency, low to moderate plasticity, wet, gray, minor round to subround GRAVEL. Refusal. Undisturbed Glacial Marine Drift (GMD).	IJW-SC-1-3	8 to 9 ft	0.9		
10								10

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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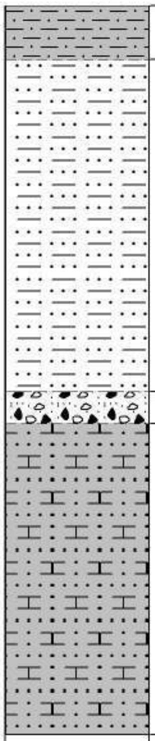
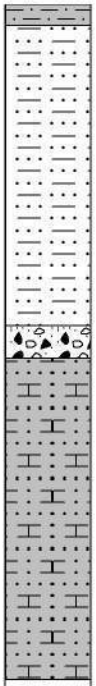
Seattle, WA 98104

SEDIMENT LOG

BORING ID	**IJW-SC-2**
TOTAL DEPTH:	**6.3-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Mike Byers, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**6/17/2020**	PENETRATION DEPTH	**6.3-Feet**
LATITUDE	**48.75459212° N**	CORE LENGTH **6.8-Feet**	EST. COMPACTION **7% Fluff**
LONGITUDE	**122.4931784° W**	WATER DEPTH **5.3-Feet**	TIDE HEIGHT **2.4-Feet**





DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0			FINES/MUD, very looose, saturated, very dark gray.					0
		SM	SILTS and SANDS, very fine-grained to medium-grained, loose, little to no cohesivity, saturated, very dark gray to black, with minor GRAVEL (up to 1.5-inch), some FISH BONES and FISH SCALES, some WOOD chips.	IJW-SC-2-2	0 to 1.8 ft	1.5		
				IJW-SC-2-1	1.8 to 3.8 ft	1.4		
		GP	COBBLE seam, large (up to 3-4-inch), subround to subangular.					
5		CL	SILTY CLAY, medium to stiff, moderate plasticity, wet, gray to dark gray, minor pockets of fine-grained SAND, trace subround GRAVEL and COBBLES. Glacial Marine Drift.	IJW-SC-2-3	3.8 to 5.8 ft	2.0		5
			Refusal.	IJW-SC-2-4	5.8 to 6.8 ft	2.1		
10								10

NOTES: `*Depicted depths are adjusted for estimated fluff.`

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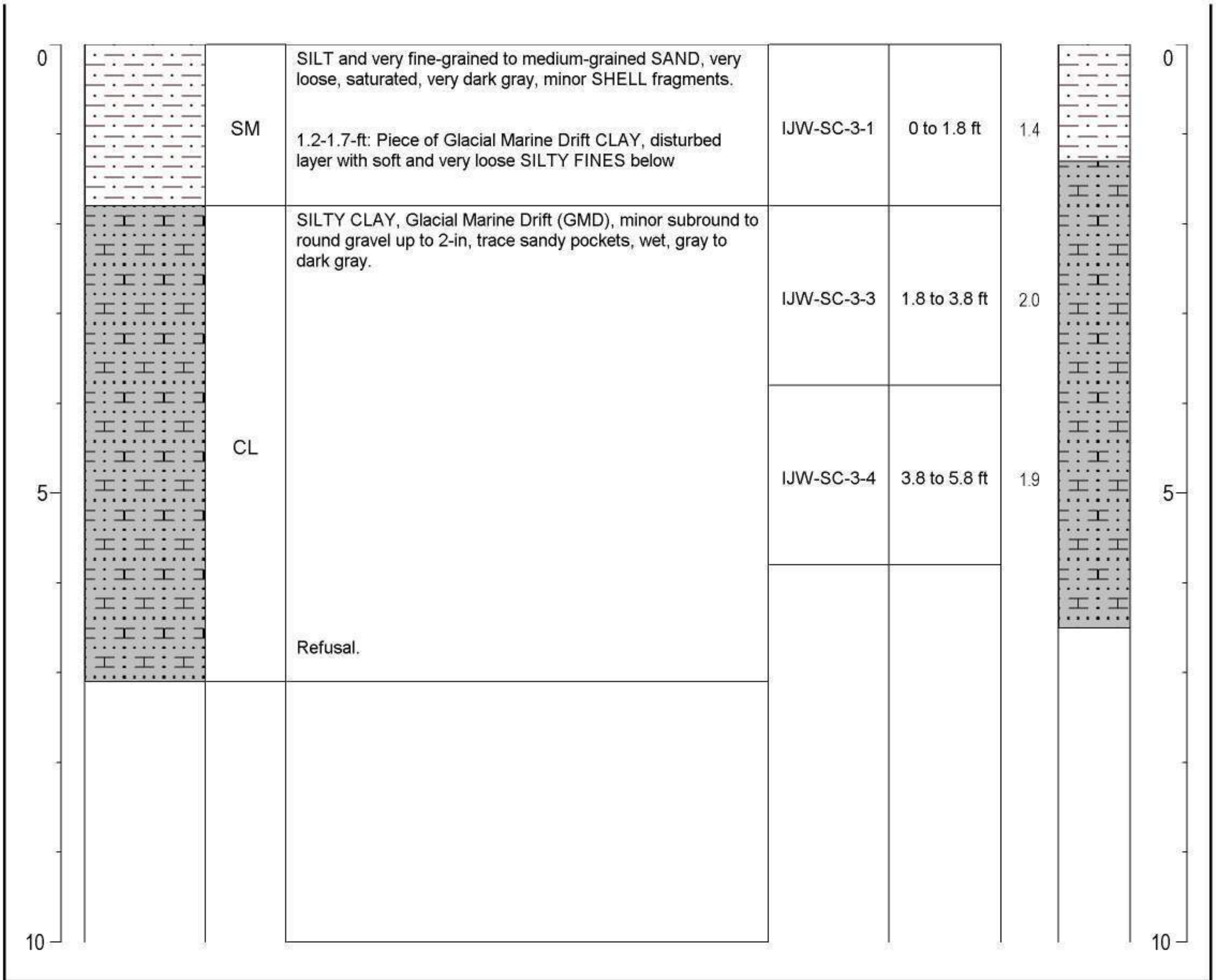
Seattle, WA 98104

SEDIMENT LOG

BORING ID **IJW-SC-3**
TOTAL DEPTH: **6.5-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Mike Byers, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**6/17/2020**	PENETRATION DEPTH	**6.5-Feet**
LATITUDE	**48.75471564° N**	CORE LENGTH **7.1-Feet**	EST. COMPACTION **7% Fluff**
LONGITUDE	**122.4929811° W**	WATER DEPTH **5.1-Feet**	TIDE HEIGHT **1.6-Feet**



DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		SM	SILT and very fine-grained to medium-grained SAND, very loose, saturated, very dark gray, minor SHELL fragments. 1.2-1.7-ft: Piece of Glacial Marine Drift CLAY, disturbed layer with soft and very loose SILTY FINES below	IJW-SC-3-1	0 to 1.8 ft	1.4		0
		CL	SILTY CLAY, Glacial Marine Drift (GMD), minor subround to round gravel up to 2-in, trace sandy pockets, wet, gray to dark gray.	IJW-SC-3-3	1.8 to 3.8 ft	2.0		
5				IJW-SC-3-4	3.8 to 5.8 ft	1.9		5
			Refusal.					
10								10

NOTES: `*Depicted depths are adjusted for estimated fluff.`

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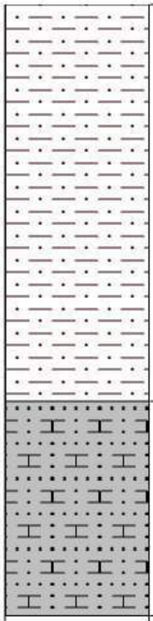
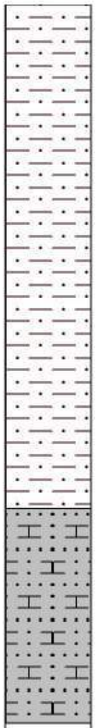
Seattle, WA 98104

SEDIMENT LOG

BORING ID **IJW-SC-4**
TOTAL DEPTH: **6.7-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Mike Byers, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**6/17/2020**	PENETRATION DEPTH	**6.7-Feet**
LATITUDE	**48.75489251° N**	CORE LENGTH **5.7-Feet**	EST. COMPACTION **15%**
LONGITUDE	**122.4929344° W**	WATER DEPTH **12.5-Feet**	TIDE HEIGHT **0.7-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		SM	SANDY SILT, loose to very loose, saturated, black, minor to some SHELLS and FISH BONES. 1.1-ft: Increasing very fine-grained to fine-grained SAND, loose, large SHELLS and BARNACLES.	IJW-SC-4-2	0 to 1.7 ft	1.4		0
			2-3.7-ft: Very loose to soupy consistency.	IJW-SC-4-1	1.7 to 3.7 ft	1.7		
5		CL	SILTY CLAY, Glacial Marine Drift (GMD), medium-stiff to stiff, moderate to high plasticity, minor subround to round gravel up to 1-inch, wet, gray. Refusal.	IJW-SC-4-3	3.7 to 5.7 ft	1.6		5
10								10

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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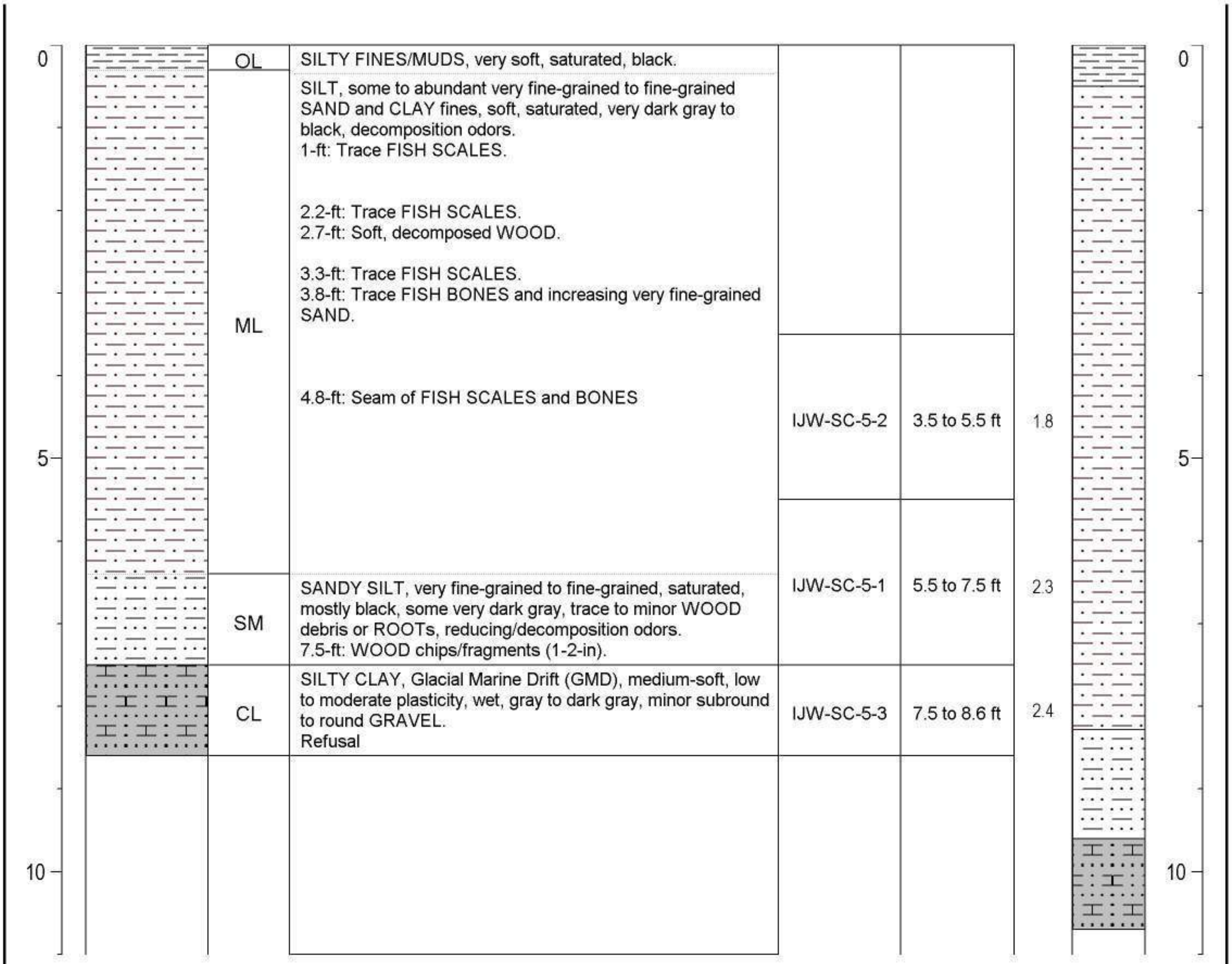
Seattle, WA 98104

SEDIMENT LOG

BORING ID	**IJW-SC-5**
TOTAL DEPTH:	**10.7-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Mike Byers, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**6/16/2020**	PENETRATION DEPTH	**10.7-Feet**
LATITUDE	**48.75483715° N**	CORE LENGTH **8.6-Feet**	EST. COMPACTION **20%**
LONGITUDE	**122.4931618° W**	WATER DEPTH **19.1-Feet**	TIDE HEIGHT **5.9-Feet**



DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		OL	SILTY FINES/MUDS, very soft, saturated, black.					0
		ML	SILT, some to abundant very fine-grained to fine-grained SAND and CLAY fines, soft, saturated, very dark gray to black, decomposition odors. 1-ft: Trace FISH SCALES. 2.2-ft: Trace FISH SCALES. 2.7-ft: Soft, decomposed WOOD. 3.3-ft: Trace FISH SCALES. 3.8-ft: Trace FISH BONES and increasing very fine-grained SAND.					
			4.8-ft: Seam of FISH SCALES and BONES	IJW-SC-5-2	3.5 to 5.5 ft	1.8		
5								5
		SM	SANDY SILT, very fine-grained to fine-grained, saturated, mostly black, some very dark gray, trace to minor WOOD debris or ROOTs, reducing/decomposition odors. 7.5-ft: WOOD chips/fragments (1-2-in).	IJW-SC-5-1	5.5 to 7.5 ft	2.3		
		CL	SILTY CLAY, Glacial Marine Drift (GMD), medium-soft, low to moderate plasticity, wet, gray to dark gray, minor subround to round GRAVEL. Refusal	IJW-SC-5-3	7.5 to 8.6 ft	2.4		
10								10

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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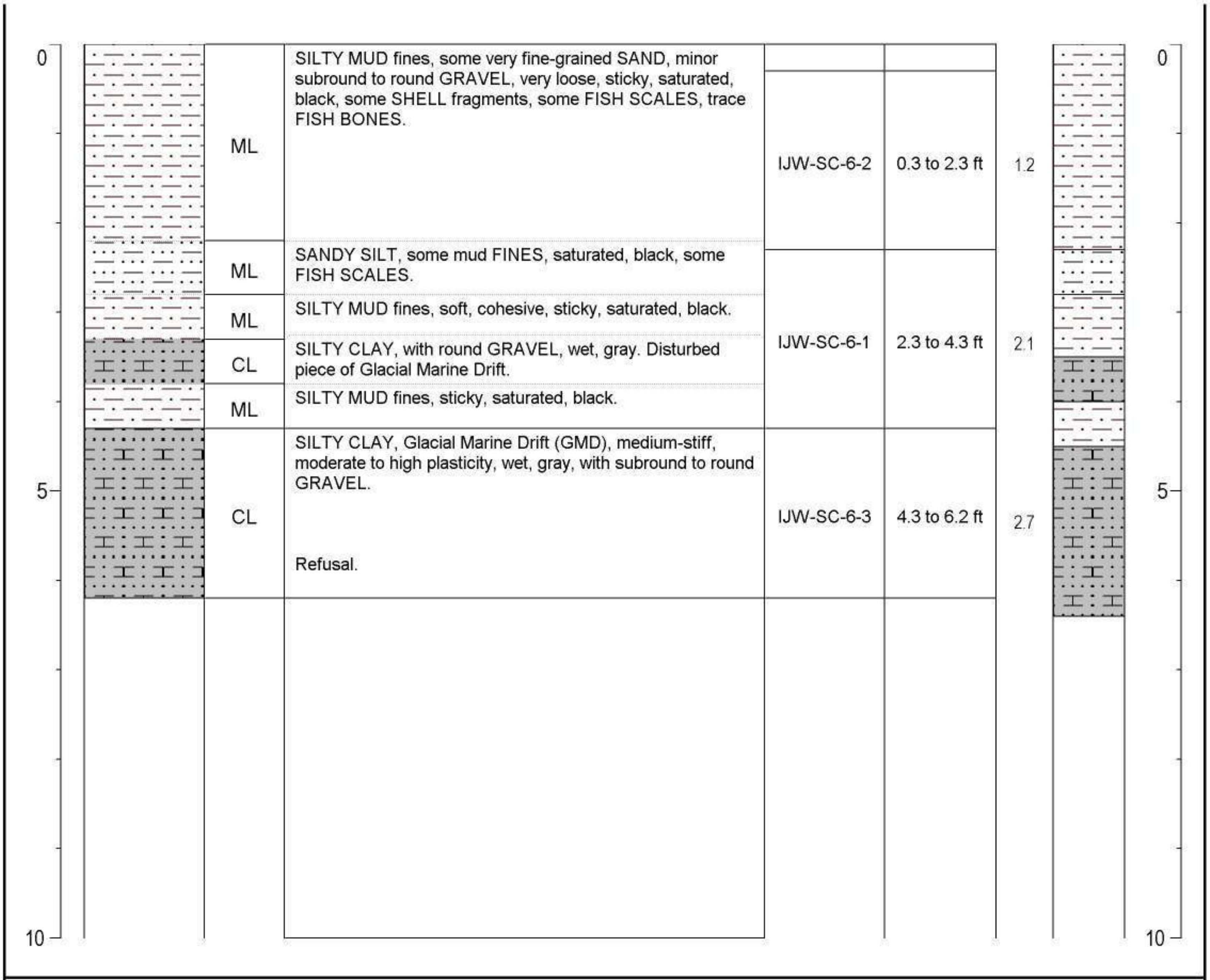
Seattle, WA 98104

SEDIMENT LOG

BORING ID	**IJW-SC-6**
TOTAL DEPTH:	**6.4-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Mike Byers, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**6/17/2020**	PENETRATION DEPTH	**6.4-Feet**
LATITUDE	**48.75459605° N**	CORE LENGTH **6.2-Feet**	EST. COMPACTION **1.5%**
LONGITUDE	**122.4936261° W**	WATER DEPTH **21.1-Feet**	TIDE HEIGHT **5.2-Feet**



DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		ML	SILTY MUD fines, some very fine-grained SAND, minor subround to round GRAVEL, very loose, sticky, saturated, black, some SHELL fragments, some FISH SCALES, trace FISH BONES.	IJW-SC-6-2	0.3 to 2.3 ft	1.2		0
		ML	SANDY SILT, some mud FINES, saturated, black, some FISH SCALES.	IJW-SC-6-1	2.3 to 4.3 ft	2.1		
		ML	SILTY MUD fines, soft, cohesive, sticky, saturated, black.					
		CL	SILTY CLAY, with round GRAVEL, wet, gray. Disturbed piece of Glacial Marine Drift.					
		ML	SILTY MUD fines, sticky, saturated, black.					
5		CL	SILTY CLAY, Glacial Marine Drift (GMD), medium-stiff, moderate to high plasticity, wet, gray, with subround to round GRAVEL. Refusal.	IJW-SC-6-3	4.3 to 6.2 ft	2.7		5
10								10

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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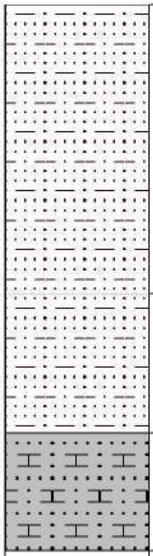
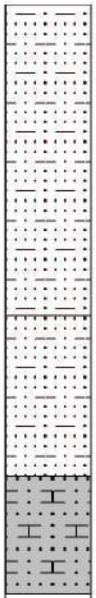
Seattle, WA 98104

SEDIMENT LOG

BORING ID	**IJW-SC-7**
TOTAL DEPTH:	**5.5-Feet**

PROJECT INFORMATION		DRILLING INFORMATION			
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**		
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**		
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**		
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**		
PROJECT MANAGER:	**Mike Byers, P.E.**		**4-inch OD Lexan Tubes**		
DATES CORED/PROCESSED:	**6/17/2020**	PENETRATION DEPTH	**5.5-Feet**		
LATITUDE	**48.75441518° N**	CORE LENGTH	**5.1-Feet**	EST. COMPACTION	**7%**
LONGITUDE	**122.4937586° W**	WATER DEPTH	**17.3-Feet**	TIDE HEIGHT	**1.1-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		SM	SANDY SILT, very fine-grained to fine-grained sand, loose, saturated, black, trace FISH BONES. 1.1-ft: Abundant FISH SCALES, some FISH BONES. More FISH WASTE than SILT. Saturated, black.	IJW-SC-7-2	0 to 2 ft	1.4		0
		SM	SILTY SAND, saturated, black, minor to some FISH SCALES and FISH BONES. 4-ft: Some to abundant FISH WASTE at interface.	IJW-SC-7-1	2 to 4 ft	1.5		
5		CL	SILTY CLAY, Glacial Marine Drift (GMD), medium-stiff, low to moderate plasticity, minor very fine-grained SAND, wet, gray. Refusal.	IJW-SC-7-3	4 to 5.1 ft	1.4		5
10								10

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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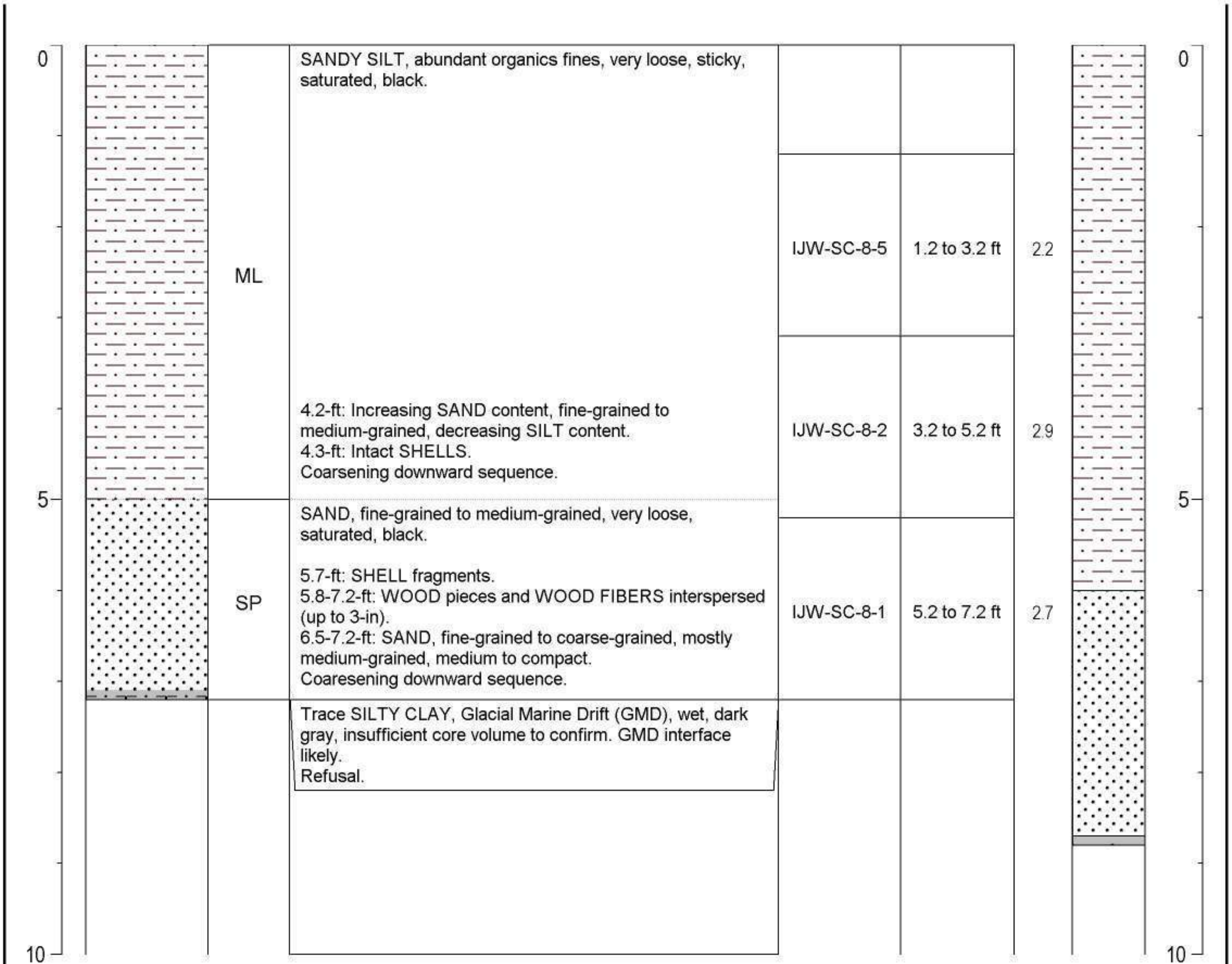
SEDIMENT LOG

BORING ID: **IJW-SC-8**
TOTAL DEPTH: **8.8-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave** **Bellingham, WA**	DRILLING METHOD	**VibraCore Technology**
		EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores** **4-inch OD Lexan Tubes**
PROJECT MANAGER:	**Mike Byers, P.E.**		
DATES CORED/PROCESSED:	**6/17/2020**	PENETRATION DEPTH	**8.8-Feet**
LATITUDE	**48.75466317° N**	CORE LENGTH **7.2-Feet**	EST. COMPACTION **18%**
LONGITUDE	**122.4937835° W**	WATER DEPTH **19.0-Feet**	TIDE HEIGHT **4.1-Feet**



DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		ML	SANDY SILT, abundant organics fines, very loose, sticky, saturated, black. 4.2-ft: Increasing SAND content, fine-grained to medium-grained, decreasing SILT content. 4.3-ft: Intact SHELLS. Coarsening downward sequence.	IJW-SC-8-5 IJW-SC-8-2	1.2 to 3.2 ft 3.2 to 5.2 ft	2.2 2.9		0
5		SP	SAND, fine-grained to medium-grained, very loose, saturated, black. 5.7-ft: SHELL fragments. 5.8-7.2-ft: WOOD pieces and WOOD FIBERS interspersed (up to 3-in). 6.5-7.2-ft: SAND, fine-grained to coarse-grained, mostly medium-grained, medium to compact. Coaresening downward sequence.	IJW-SC-8-1	5.2 to 7.2 ft	2.7		5
			Trace SILTY CLAY, Glacial Marine Drift (GMD), wet, dark gray, insufficient core volume to confirm. GMD interface likely. Refusal.					
10								10

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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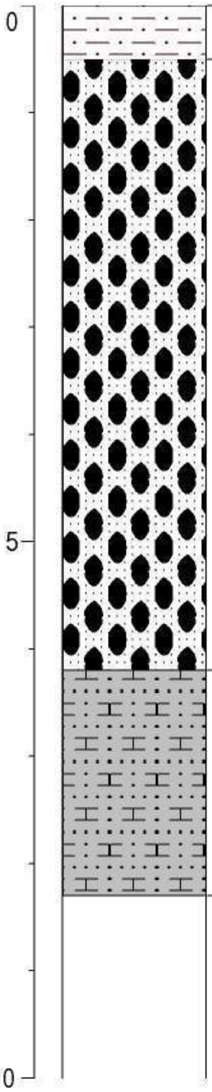
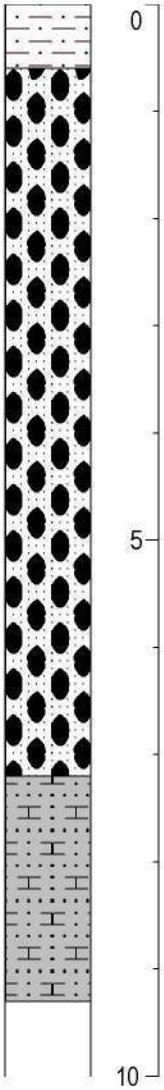
SEDIMENT LOG

BORING ID	**IJW-SC-9**
TOTAL DEPTH:	**9.3-Feet**

PROJECT INFORMATION		DRILLING INFORMATION			
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**		
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**		
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**		
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**		
PROJECT MANAGER:	**Mike Byers, P.E.**		**4-inch OD Lexan Tubes**		
DATES CORED/PROCESSED:	**6/16/2020**	PENETRATION DEPTH	**9.3-Feet**		
LATITUDE	**48.75436542° N**	CORE LENGTH	**8.3-Feet**	EST. COMPACTION	**11%**
LONGITUDE	**122.4936444° W**	WATER DEPTH	**16.9-Feet**	TIDE HEIGHT	**4.4-Feet**





DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		SM	FINES/MUDS/SILTS, very soft, very oose, saturated, black.					0
		SM-OL	Mixed FINES, SILTS, FISH SCALES, minor FISH BONES, saturated, black. 0-3-ft: Minor mediumgrained to coarse-grained SAND.	IJW-SC-9-2	2.2 to 4.2 ft	2.7		
5			4.8-6-ft: Predominantly FISH SCALES with fines, some clear GLASS fragments, saturated.	IJW-SC-9-1	4.2 to 6.2 ft	2.4		5
		CL	SILTY CLAY, medium-soft, moderate plasticity, wet, gray to dark gray, minor subround to round GRAVEL (<1cm size). Glacial Marine Drift (GMD). Refusal.	IJW-SC-9-3	6.2 to 8.2 ft	1.6		
10								10

NOTES: *Depicted depths are adjusted for estimated compaction.

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SEDIMENT LOG

BORING ID	**IJW-SC-10 #1**
TOTAL DEPTH:	**6-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Jamie Stevens, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**1/28/2021**	PENETRATION DEPTH	**6-Feet**
LATITUDE	**48.75406381° N**	CORE LENGTH **4-Feet**	EST. COMPACTION **33%**
LONGITUDE	**122.49383945° W**	WATER DEPTH **10.0-Feet**	TIDE HEIGHT **7.66-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		SM	SILTY SAND, with some MUD FINES, some WOOD chips, soft and loose, saturated.		0 to 1 ft	6.2		0
		SP	SAND, very fine to medium-grained (mostly medium-grained), wet to saturated, well drained, dark gray. At 0.4 to 1.9 ft bgs: Abundant SHELLS, white. At 1.9 to 2.2 ft bgs: Subround to round GRAVEL (<2.5-inch observed).		1 to 2 ft	4.2		
			At 2.8 ft bgs: 0.5-inch thick SILT seam, dark brown. At 3 to 3.5 ft bgs: WOOD pieces.		2 to 3 ft	7.0		
			Refusal.	IJW-SC-10-3.7	3 to 4 ft	7.6		
5								5
10								10

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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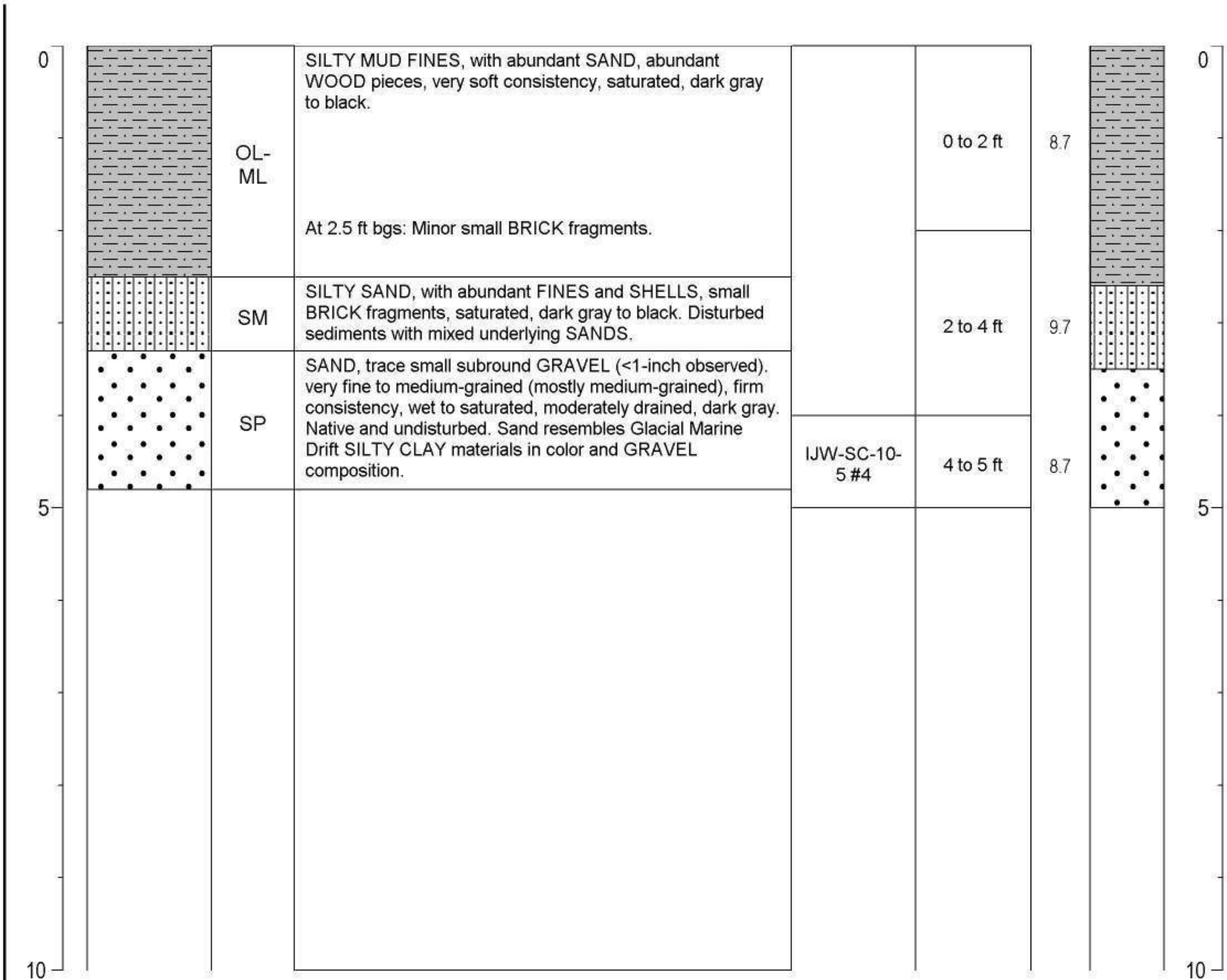
SEDIMENT LOG

BORING ID: **IJW-SC-10 #4**
TOTAL DEPTH: **5.0-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Jamie Stevens, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**1/28/2021**	PENETRATION DEPTH	**5.0-Feet**
LATITUDE	**48.75407586° N**	CORE LENGTH **4.8-Feet**	EST. COMPACTION **4%**
LONGITUDE	**122.49386522° W**	WATER DEPTH **12.9-Feet**	TIDE HEIGHT **7.12-Feet**



DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
		OL-ML	SILTY MUD FINES, with abundant SAND, abundant WOOD pieces, very soft consistency, saturated, dark gray to black. At 2.5 ft bgs: Minor small BRICK fragments.		0 to 2 ft	8.7		
		SM	SILTY SAND, with abundant FINES and SHELLS, small BRICK fragments, saturated, dark gray to black. Disturbed sediments with mixed underlying SANDS.		2 to 4 ft	9.7		
		SP	SAND, trace small subround GRAVEL (<1-inch observed). very fine to medium-grained (mostly medium-grained), firm consistency, wet to saturated, moderately drained, dark gray. Native and undisturbed. Sand resembles Glacial Marine Drift SILTY CLAY materials in color and GRAVEL composition.	IJW-SC-10-5 #4	4 to 5 ft	8.7		

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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SEDIMENT LOG

BORING ID **IJW-SC-11 #3**
TOTAL DEPTH: **4-Feet**

PROJECT INFORMATION		DRILLING INFORMATION			
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**		
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**		
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**		
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**		
PROJECT MANAGER:	**Jamie Stevens, P.E.**		**4-inch OD Lexan Tubes**		
DATES CORED/PROCESSED:	**1/26/2021**	PENETRATION DEPTH	**4-Feet**		
LATITUDE	**48.75421084° N**	CORE LENGTH	**4.8-Feet**	EST. COMPACTION	**17% FLUFF**
LONGITUDE	**122.4941026° W**	WATER DEPTH	**24.4-Feet**	TIDE HEIGHT	**7.36-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0	▨	ML	SILTY MUD (FINES with SILT), minor very fine to fine-grained SAND, very soft to soft consistency, saturated, dark black, very faint sulfur-like odor. Homogeneous.		0 to 1 ft	5.6	▨	0
	▨				1 to 2 ft	2.8	▨	
	▨		At 2.3 to 3.3 ft bgs: Trace WOOD and minor SHELL fragment.	IJW-SC-11-3.4	2.2 to 3.4 ft	4.4	▨	
	▨		Ceased coring. Glacial Marine Drift not encountered.		3.5 to 4.5 ft	4.0		
5								5
10								10

NOTES: `*Depicted depths are adjusted for estimated fluff.`

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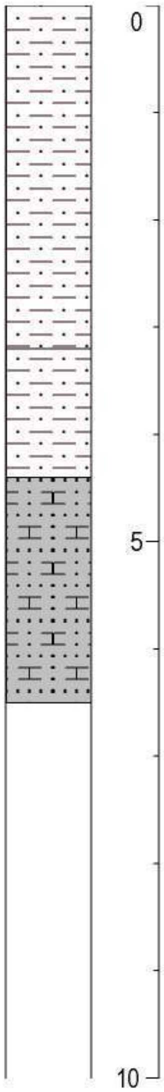
SEDIMENT LOG

BORING ID **IJW-SC-11 #4**
TOTAL DEPTH: **6.5-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Jamie Stevens, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**1/28/2021**	PENETRATION DEPTH	**6.5-Feet**
LATITUDE	**48.75418591° N**	CORE LENGTH **5.3-Feet**	EST. COMPACTION **19%**
LONGITUDE	**122.49381914° W**	WATER DEPTH **24.4-Feet**	TIDE HEIGHT **7.20-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0	▤	ML	MUDDY SILT, abundant FINES, some very fine-grained SAND, minor WOOD debris, very soft consistency, saturated, dark gray to black.		0 to 2.7 ft	5.2		0
	▤	SM	SILTY SAND, with abundant MUD FINES, minor WOOD fibers, very fine to medium-grained, soft to medium consistency, saturated, black.		2.7 to 3.7 ft	4.9		
5	▨	CL	SILTY CLAY, Glacial Marine Drift, trace to minor round to subround GRAVEL (<1-inch observed), medium to stiff, moderate plasticity, moist to wet, gray to dark gray.	IJW-SC-11-4.5	3.7 to 5.3 ft	5.6		5
10								10



NOTES: `*Depicted depths are adjusted for estimated compaction.`

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SEDIMENT LOG

BORING ID	**IJW-SC-12 #1**
TOTAL DEPTH:	**4.1-Feet**

PROJECT INFORMATION		DRILLING INFORMATION			
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**		
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**		
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**		
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**		
PROJECT MANAGER:	**Jamie Stevens, P.E.**		**4-inch OD Lexan Tubes**		
DATES CORED/PROCESSED:	**1/26/2021**	PENETRATION DEPTH	**4.1-Feet**		
LATITUDE	**48.75449548° N**	CORE LENGTH	**3.7-Feet**	EST. COMPACTION	**9%**
LONGITUDE	**122.49416077° W**	WATER DEPTH	**22.8-Feet**	TIDE HEIGHT	**7.55-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0	▨	ML	SILTY MUD FINES, minor to some very fine to fine-grained SAND, trace FISH BONES, soft to very soft consistency, saturated, black, trace fetid/lagoon-like odors, homogeneous.		0 to 1 ft	7.2	▨	0
					1 to 2 ft	4.4		
					2 to 3 ft	6.6		
				IJW-SC-12-3	3 to 4 ft	4.3		
5								5
10								10

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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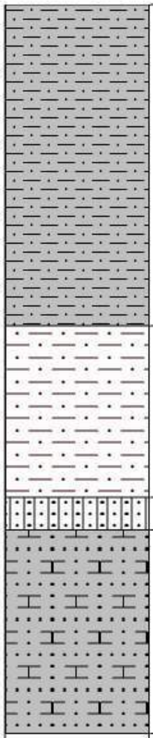
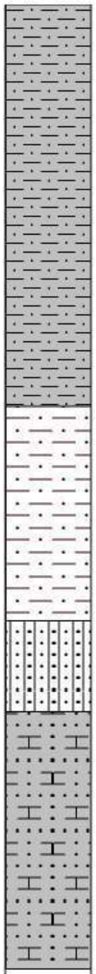
SEDIMENT LOG

BORING ID	**IJW-SC-12 #2**
TOTAL DEPTH:	**9-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Jamie Stevens, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**1/28/2021**	PENETRATION DEPTH	**9-Feet**
LATITUDE	**48.75448897° N**	CORE LENGTH **6.8-Feet**	EST. COMPACTION **25%**
LONGITUDE	**122.49415778° W**	WATER DEPTH **24.4-Feet**	TIDE HEIGHT **7.55-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		ML	MUDDY SILT (SILT with abundant FINES), some very fine-grained SAND, very soft consistency, saturated, dark gray to black. At 2.6 to 2.9 ft bgs: Subround to round GRAVEL		0 to 2 ft 2 to 4 ft	5.0 5.1		0
		ML	SANDY SILT, with abundant FINES, very fine to medium-grained SAND, soft, saturated, dark gray.					
		SM	SAND, minor SHELL fragments, trace round small GRAVEL (<1-cm observed), fine to medium-grained, wet to saturated, dark gray to black.		4.6 to 5 ft	5.8		
5		CL	SILTY SANDY CLAY, Glacial Marine Drift, trace to minor round to subround GRAVEL (<1-inch observed), very fine-grained sand, medium-stiff to stiff, low plasticity, wet, gray.	IJW-SC-12-6	5 to 6 ft	5.1		5
10								10





NOTES: `*Depicted depths are adjusted for estimated compaction.`

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SEDIMENT LOG

BORING ID: **IJW-SC-13 #1**
TOTAL DEPTH: **5-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave** Bellingham, WA	DRILLING METHOD	**VibraCore Technology**
		EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores** **4-inch OD Lexan Tubes**
PROJECT MANAGER:	**Jamie Stevens, P.E.**		
DATES CORED/PROCESSED:	**1/26/2021**	PENETRATION DEPTH	**5-Feet**
LATITUDE	**48.75482928° N**	CORE LENGTH **4.6-Feet**	EST. COMPACTION **8%**
LONGITUDE	**122.49366596° W**	WATER DEPTH **22.0-Feet**	TIDE HEIGHT **7.71-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0	▨	SM	SILTY SAND, very fine to fine-grained, some to abundant mud fines, soft to medium consistency, homogenous, saturated, black.		0 to 1.5 ft	7.4	▨	0
			At 2 ft bgs: Trace FISH SCALES		1.5 to 3 ft	5.0		
			At 4 ft bgs: Minor FISH BONES, soft to very soft consistency	IJW-SC-13-4.1	3 to 4.1 ft	5.5		
			Ceased coring. No Glacial Marine Drift encountered.		4.1 to 4.6 ft	5.5		
5								5
10								10

NOTES: *Depicted depths are adjusted for estimated compaction.

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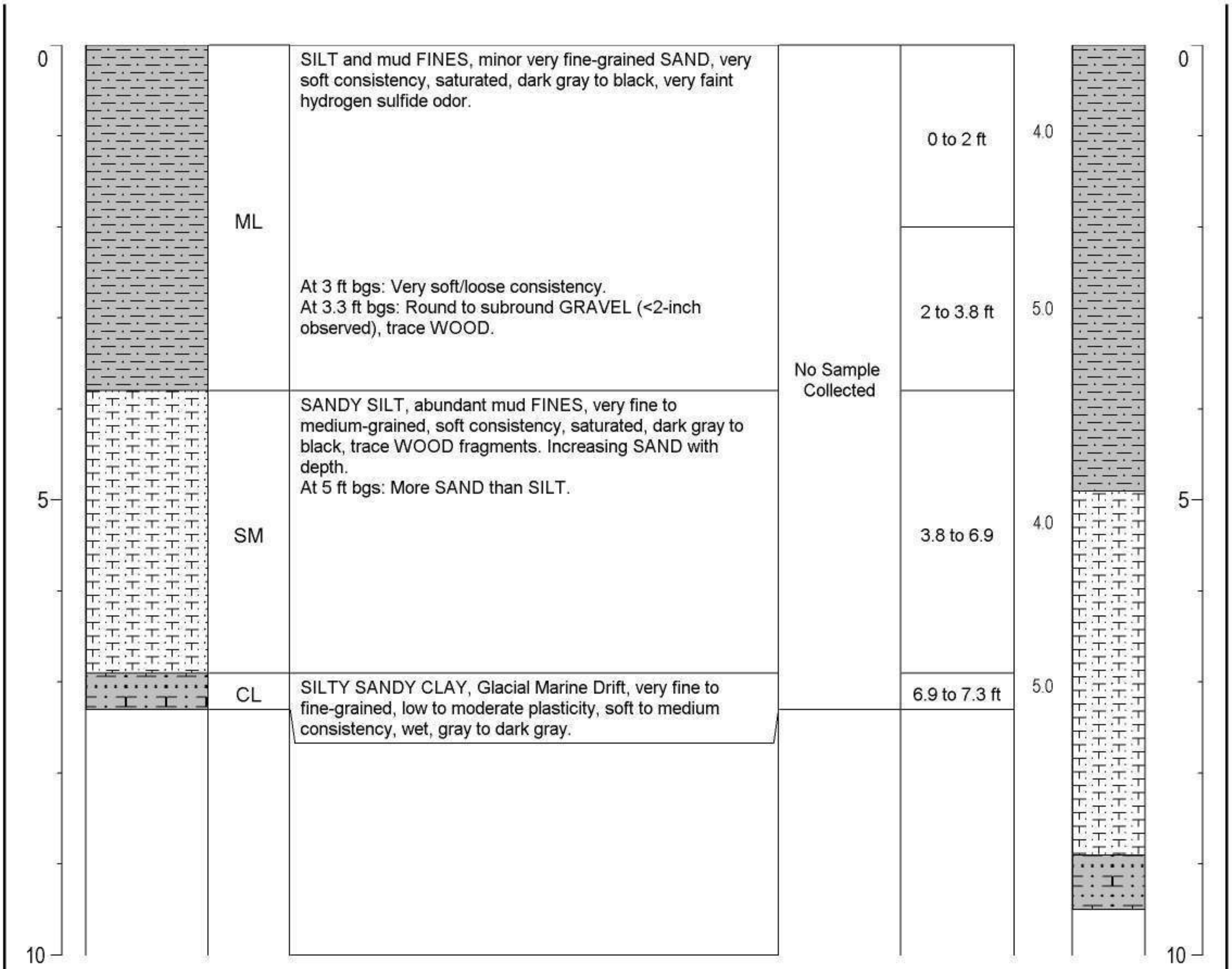
SEDIMENT LOG

BORING ID	**IJW-SC-13 #2**
TOTAL DEPTH:	**9.5-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Jamie Stevens, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**1/28/2021**	PENETRATION DEPTH	**9.5-Feet**
LATITUDE	**48.75482273° N**	CORE LENGTH **7.3-Feet**	EST. COMPACTION **23%**
LONGITUDE	**122.49366595° W**	WATER DEPTH **22.1-Feet**	TIDE HEIGHT **7.66-Feet**



DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		ML	SILT and mud FINES, minor very fine-grained SAND, very soft consistency, saturated, dark gray to black, very faint hydrogen sulfide odor.	No Sample Collected	0 to 2 ft	4.0		0
			At 3 ft bgs: Very soft/loose consistency. At 3.3 ft bgs: Round to subround GRAVEL (<2-inch observed), trace WOOD.		2 to 3.8 ft	5.0		
5		SM	SANDY SILT, abundant mud FINES, very fine to medium-grained, soft consistency, saturated, dark gray to black, trace WOOD fragments. Increasing SAND with depth. At 5 ft bgs: More SAND than SILT.		3.8 to 6.9	4.0		5
		CL	SILTY SANDY CLAY, Glacial Marine Drift, very fine to fine-grained, low to moderate plasticity, soft to medium consistency, wet, gray to dark gray.		6.9 to 7.3 ft	5.0		
10								10

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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SEDIMENT LOG

BORING ID **IJW-SC-14**
TOTAL DEPTH: **5.0-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Jamie Stevens, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**1/26/2021**	PENETRATION DEPTH	**5-Feet**
LATITUDE	**48.75494195° N**	CORE LENGTH **5.6-Feet**	EST. COMPACTION **11% FLUFF**
LONGITUDE	**122.4933277° W**	WATER DEPTH **22.0-Feet**	TIDE HEIGHT **7.19-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		SM	SILTY SAND, with abundant MUD FINES, very fine to fine-grained, saturated, black, strong hydrogen sulfide odor. Trace to minor fish bones intermittent.		0 to 1.5 ft	3.7		0
					1.5 to 3.3 ft	11.4		
			by 4.5 ft bgs: SILTY SAND with mostly fine-grained sands.	IJW-SC-14-4.4	3.3 to 4.4 ft	4.9		
			Coring ceased prior to Glacial Marine Drift.		4.4 to 5 ft	4.4		
5								5
10								10

NOTES: `*Depicted depths are adjusted for estimated fluff.`

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SEDIMENT LOG

BORING ID	**IJW-SC-15**
TOTAL DEPTH:	**5.0-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Jamie Stevens, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**1/26/2021**	PENETRATION DEPTH	**5-Feet**
LATITUDE	**48.75500819° N**	CORE LENGTH **4.75-Feet**	EST. COMPACTION **5%**
LONGITUDE	**122.49299903° W**	WATER DEPTH **21.8-Feet**	TIDE HEIGHT **6.28-Feet**

DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0	▨	ML	SILTY MUD FINES, abundant very fine to fine-grained SAND, very soft to loose consisitency, saturated, black, very faint hydrogen sulfide odor.		0 to 1 ft	4.1	▨	0
					1 to 2 ft	6.6		
	▒	SM	SILTY SAND, with abundant MUD FINES, very fine to fine-grained, very soft to soft consistency, saturated, black, strong hydrogen sulfide odor. Slightly increasing grain size with depth (more fine-grained sand, less mud fines). At 2.9 to 3.7 ft bgs: Some to abundant FISH WASTE (scale and bones), shells. After 4 ft bgs: Trace to minor FISH WASTE. Ceased coring at 5-ft. No Glacial Marine Drift encountered.	IJW-SC-15-3.6	2.6 to 3.6 ft	4.7	▒	
					4 to 5 ft	4.6		
5								5
10								10

NOTES: `*Depicted depths are adjusted for estimated compaction.`

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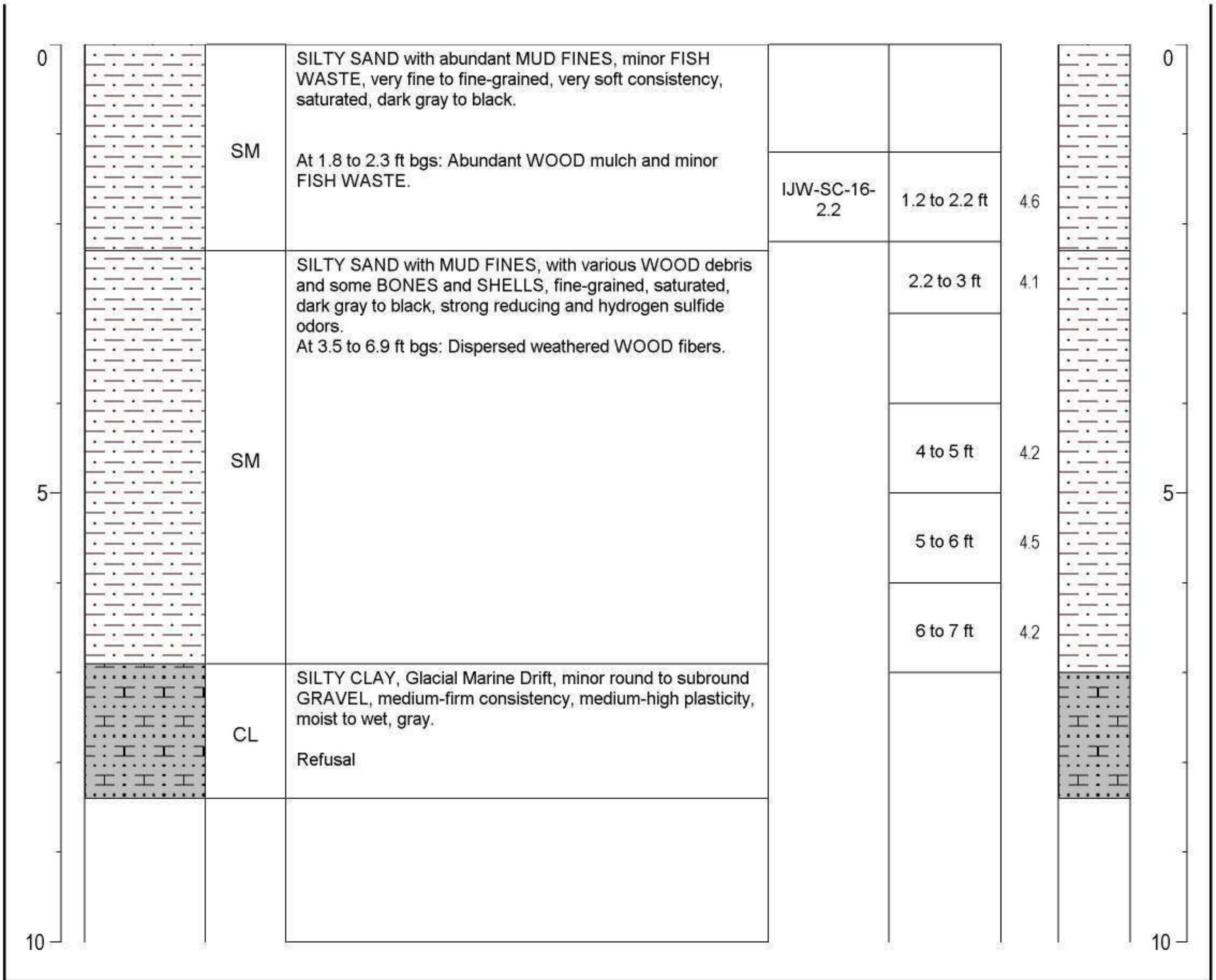
SEDIMENT LOG

BORING ID **IJW-SC-16**
TOTAL DEPTH: **8.3-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Jamie Stevens, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**1/27/2021**	PENETRATION DEPTH	**8.3-Feet**
LATITUDE	**48.75490253° N**	CORE LENGTH **8.4-Feet**	EST. COMPACTION **2% FLUFF**
LONGITUDE	**122.49273778° W**	WATER DEPTH **13.4-Feet**	TIDE HEIGHT **7.73-Feet**



DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
		SM	SILTY SAND with abundant MUD FINES, minor FISH WASTE, very fine to fine-grained, very soft consistency, saturated, dark gray to black. At 1.8 to 2.3 ft bgs: Abundant WOOD mulch and minor FISH WASTE.	IJW-SC-16-2.2	1.2 to 2.2 ft	4.6		
		SM	SILTY SAND with MUD FINES, with various WOOD debris and some BONES and SHELLS, fine-grained, saturated, dark gray to black, strong reducing and hydrogen sulfide odors. At 3.5 to 6.9 ft bgs: Dispersed weathered WOOD fibers.		2.2 to 3 ft	4.1		
					4 to 5 ft	4.2		
					5 to 6 ft	4.5		
					6 to 7 ft	4.2		
		CL	SILTY CLAY, Glacial Marine Drift, minor round to subround GRAVEL, medium-firm consistency, medium-high plasticity, moist to wet, gray. Refusal					

NOTES: `*Depicted depths are adjusted for estimated fluff.`

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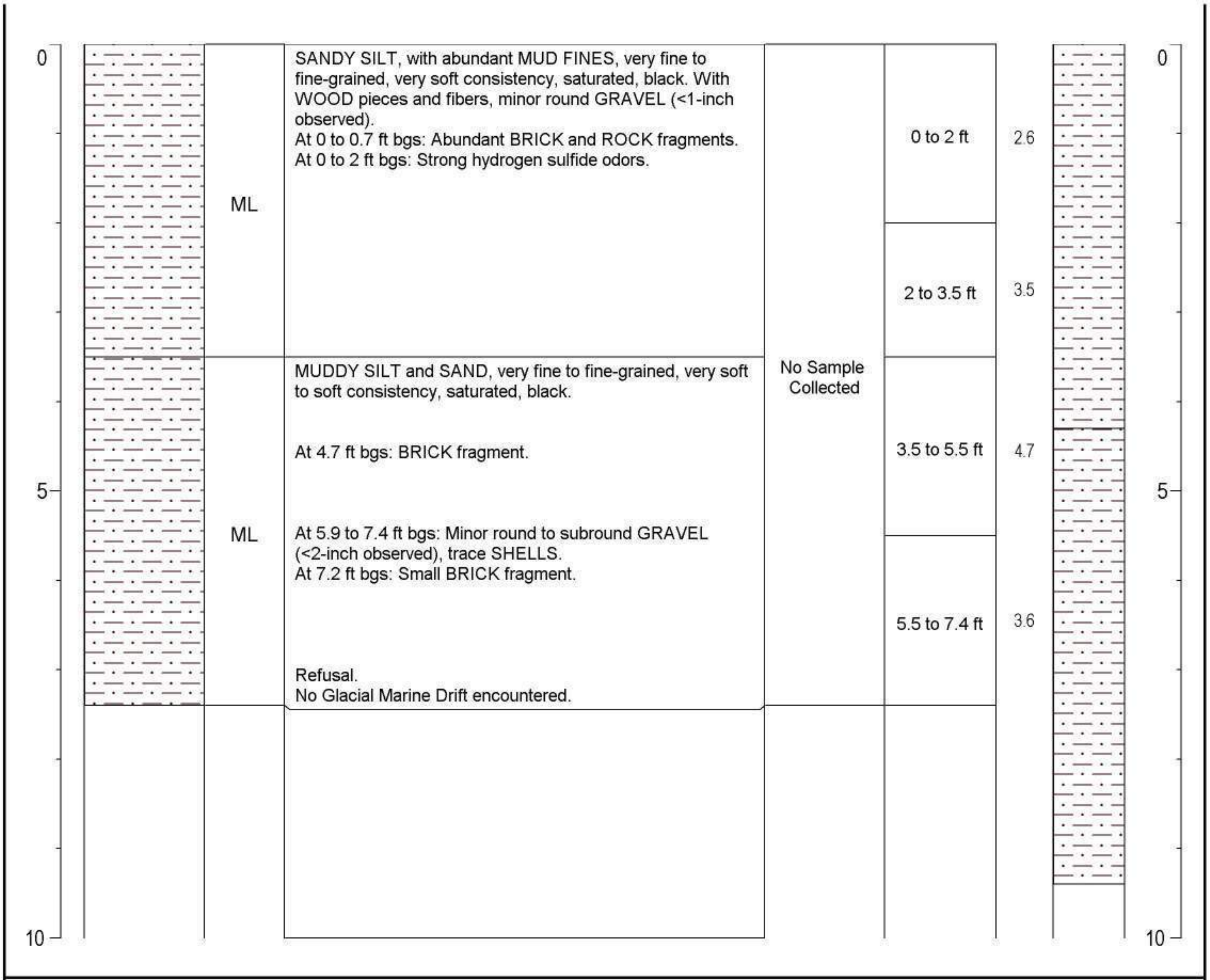
SEDIMENT LOG

BORING ID	**IJW-SC-17**
TOTAL DEPTH:	**9.4-Feet**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**I&J Waterway PRDI**	DRILLING CO.	**Gravity Marine**
SITE LOCATION:	**1001 Hilton Ave**	DRILLING METHOD	**VibraCore Technology**
	Bellingham, WA	EQUIPMENT TYPE	**OI RIC-5500**
LOGGED BY:	**Rusty Jones**	SAMPLING METHOD	**Open Cores**
PROJECT MANAGER:	**Jamie Stevens, P.E.**		**4-inch OD Lexan Tubes**
DATES CORED/PROCESSED:	**1/28/2021**	PENETRATION DEPTH	**9.4-Feet**
LATITUDE	**48.75414196° N**	CORE LENGTH **7.3-Feet**	EST. COMPACTION **22%**
LONGITUDE	**122.49386319° W**	WATER DEPTH **14.7-Feet**	TIDE HEIGHT **8.11-Feet**



DEPTH	SEDIMENT SYMBOLS	USCS	DESCRIPTION	SAMPLE ID	SAMPLE DEPTH (ft bgs)	PID ppm	*LOG	*EST. DEPTH
0		ML	SANDY SILT, with abundant MUD FINES, very fine to fine-grained, very soft consistency, saturated, black. With WOOD pieces and fibers, minor round GRAVEL (<1-inch observed). At 0 to 0.7 ft bgs: Abundant BRICK and ROCK fragments. At 0 to 2 ft bgs: Strong hydrogen sulfide odors.	No Sample Collected	0 to 2 ft	2.6		0
					2 to 3.5 ft	3.5		
		ML	MUDDY SILT and SAND, very fine to fine-grained, very soft to soft consistency, saturated, black. At 4.7 ft bgs: BRICK fragment. At 5.9 to 7.4 ft bgs: Minor round to subround GRAVEL (<2-inch observed), trace SHELLS. At 7.2 ft bgs: Small BRICK fragment. Refusal. No Glacial Marine Drift encountered.		3.5 to 5.5 ft	4.7		
5					5.5 to 7.4 ft	3.6		5
10								10

NOTES: `*Depicted depths are adjusted for estimated compaction.`

Appendix D

Geotechnical Laboratory Testing

EXPLORATION DESIGNATION	TOP DEPTH (feet)	BOTTOM DEPTH (feet)	MOISTURE CONTENT (%)	ORGANIC CONTENT (%)	SPECIFIC GRAVITY	ATTERBERG LIMITS (%)			% GRAVEL	% SAND	% FINES	ASTM SOIL CLASSIFICATION	SAMPLE DESCRIPTION
						LL	PL	PI					
SB-1,S05	12.5	14.0	31.4			NP	NP	NP	3.8	77.9	18.3	SM	Grayish-brown, silty SAND
SB-1,S06	15.0	16.5	27.4						4.4	87.1	8.5	SP-SM	Grayish-brown, poorly graded SAND with silt and shells
SB-1,S07	17.5	19.0	24.1						3.1	87.9	9.0	SP-SM	Dark gray, poorly graded SAND with silt
SB-1,S08	20.0	21.5	17.8						20.2	67.6	12.2	SM	Grayish-brown, silty SAND with gravel
SB-1,S10	25.0	26.5	24.6			38	17	21				CL	Dark gray, lean CLAY
SB-1,S12	40.0	41.5	24.2			34	17	17				CL	Dark gray, lean CLAY
SB-1,S14	50.0	51.5	22.7			34	17	17				CL	Dark gray, lean CLAY
SB-2,S02	5.0	6.5	37.4			57	20	37				CH	Olive-brown, fat CLAY
SB-2,S06	15.0	16.5	34.3			46	28	18	29.1	24.9	46.0	GM	Grayish-brown, silty GRAVEL with sand and trace shells
SB-2,S08	20.0	21.5	25.3						10.6	81.1	8.3	SP-SM	Dark gray, poorly graded SAND with silt
SB-2,S09	22.5	24.0	26.9						1.9	81.8	16.4	SM	Gray, silty SAND
SB-2,S10	25.0	26.5	23.4			40	16	24				CL	Gray, lean CLAY
SB-2,T01	31.5	34.5	21.8									CL	Dark gray, lean CLAY
SB-2,S12	35.0	36.5	24.3			31	16	15				CL	Gray, lean CLAY
SB-2,S15	50.0	51.5	24.0			35	17	18				CL	Very dark gray, lean CLAY
SB-3,S01	2.5	3.0	26.3						19.8	57.5	22.7	SM	Grayish-brown, silty SAND with gravel and trace shells
SB-3,S04	10.0	11.5	18.4						12.7	82.1	5.2	SP-SM	Dark grayish-brown, poorly graded SAND with silt
SB-3,S07	17.5	19.0	24.1			34	17	17				CL	Dark gray, lean CLAY with gravel
SB-3,T01	21.5	24.5	21.7									CL	Dark gray, lean CLAY
SB-3,S10	30.0	31.5	25.2			33	17	16				CL	Gray, lean CLAY with gravel

Notes:
1. This table summarizes information presented elsewhere in the report and should be used in conjunction with the report test, other graphs and tables, and the exploration logs.
2. The soil classifications in this table are based on ASTM D2487 and D2488 as applicable.

HWA GEOSCIENCES INC.

Laboratory Testing for McMillen Jacobs Associates
I & J Waterway
Client Project No.: 1001 Hilton Ave

SUMMARY OF MATERIAL PROPERTIES

PAGE: 1 of 2

PROJECT NO.: 2016-112-23 T700 FIGURE: 1

EXPLORATION DESIGNATION	TOP DEPTH (feet)	BOTTOM DEPTH (feet)	MOISTURE CONTENT (%)	ORGANIC CONTENT (%)	SPECIFIC GRAVITY	ATTERBERG LIMITS (%)			% GRAVEL	% SAND	% FINES	ASTM SOIL CLASSIFICATION	SAMPLE DESCRIPTION
						LL	PL	PI					
SB-3,S17	70.0	71.5	22.0			44	15	29				CL	Dark gray, lean CLAY

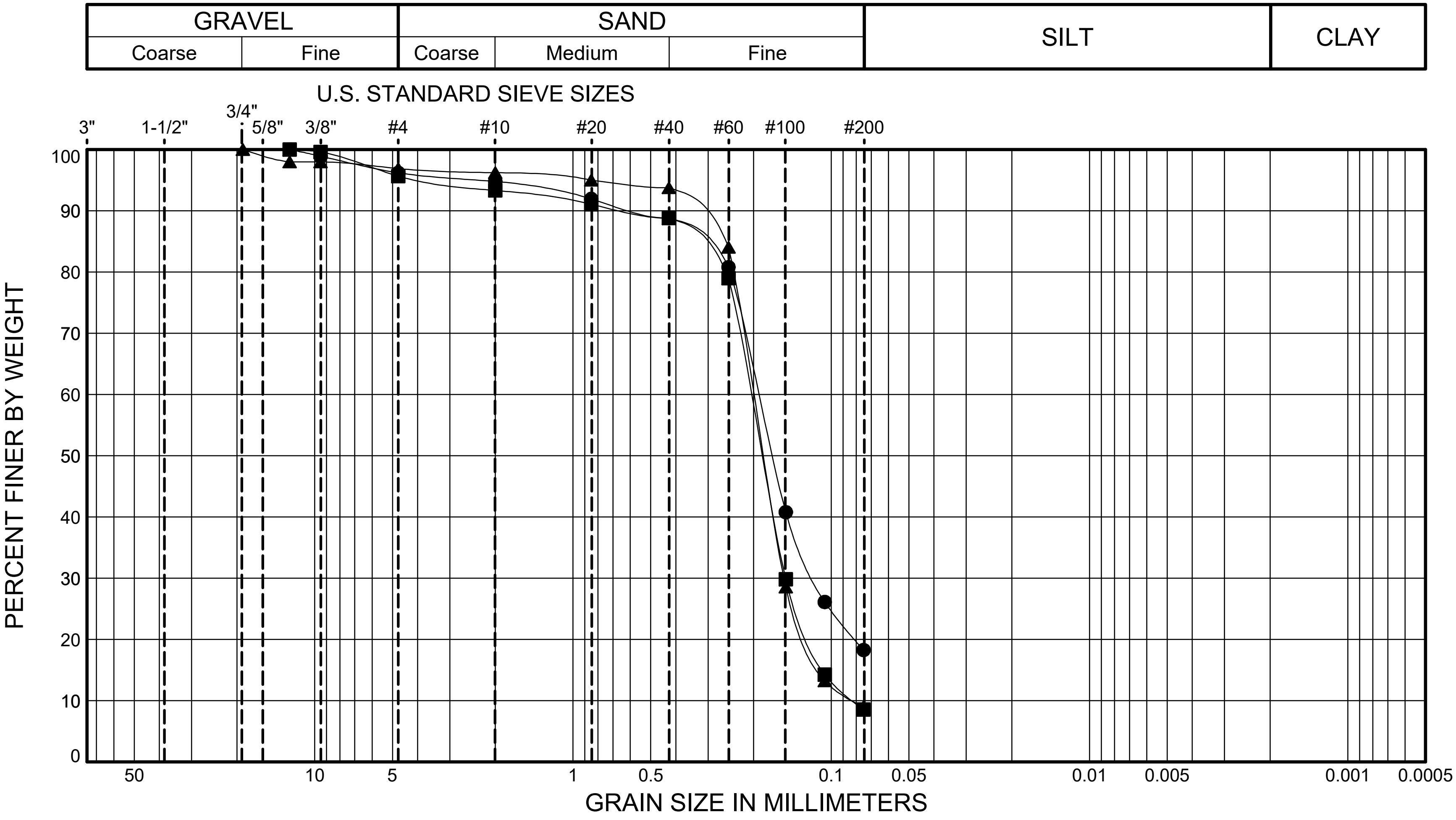
Notes:
1. This table summarizes information presented elsewhere in the report and should be used in conjunction with the report test, other graphs and tables, and the exploration logs.
2. The soil classifications in this table are based on ASTM D2487 and D2488 as applicable.

HWA GEOSCIENCES INC.

Laboratory Testing for McMillen Jacobs Associates
I & J Waterway
Client Project No.: 1001 Hilton Ave

SUMMARY OF MATERIAL PROPERTIES

PROJECT NO.: 2016-112-23 T700 FIGURE: 2



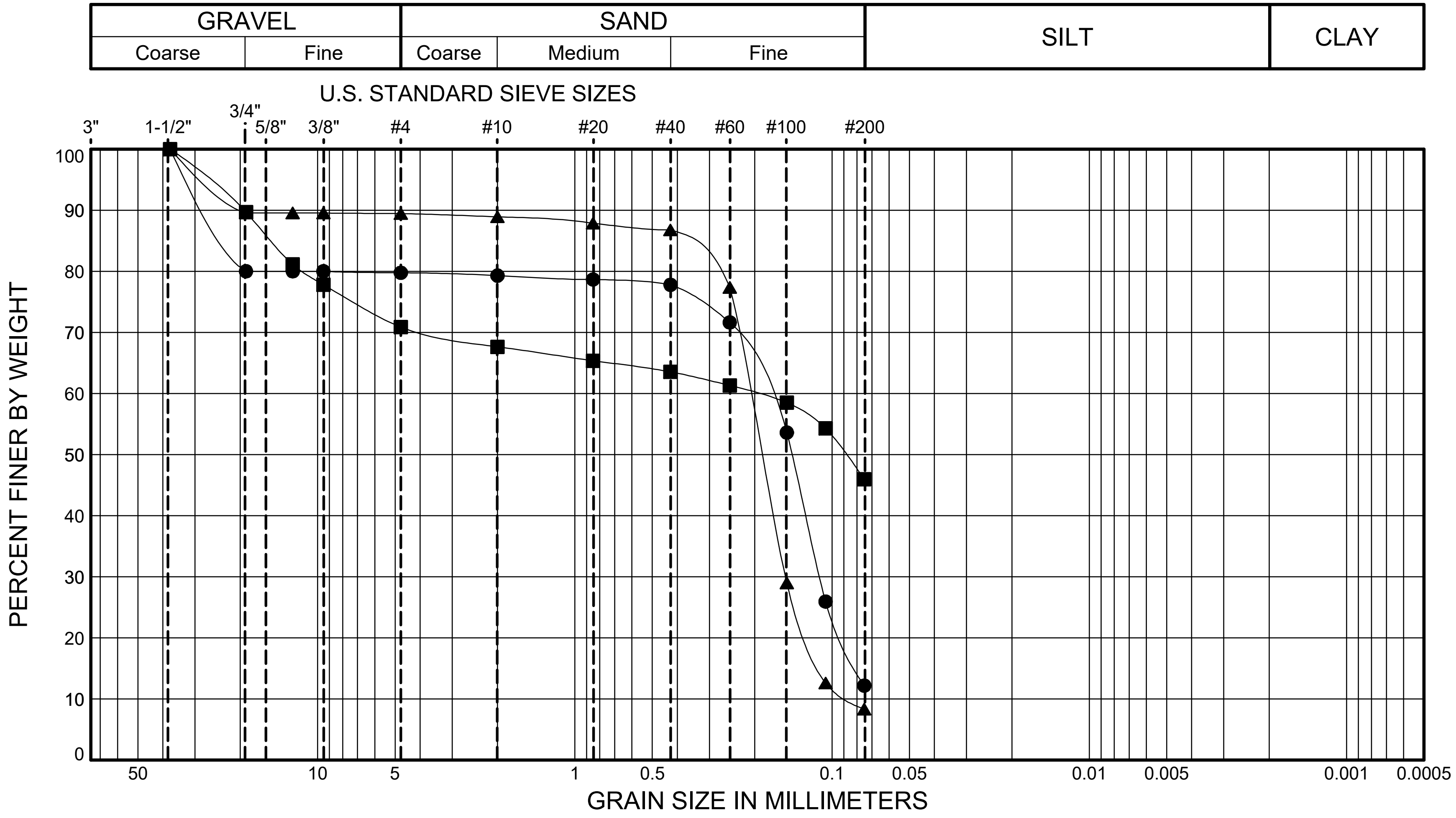
SYMBOL	SAMPLE		DEPTH (ft.)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	SB-1	S05	12.5 - 14.0	(SM) Grayish-brown, silty SAND	31	NP	NP	NP	3.8	77.9	18.3
■	SB-1	S06	15.0 - 16.5	(SP-SM) Grayish-brown, poorly graded SAND with silt and shells	27				4.4	87.1	8.5
▲	SB-1	S07	17.5 - 19.0	(SP-SM) Dark gray, poorly graded SAND with silt	24				3.1	87.9	9.0

GEOSCIENCES INC.

Laboratory Testing for McMillen Jacobs Associates
I & J Waterway
Client Project No.: 1001 Hilton Ave

PARTICLE-SIZE ANALYSIS OF SOILS METHOD ASTM D6913

PROJECT NO.: 2016-112-23 T700 FIGURE: 3



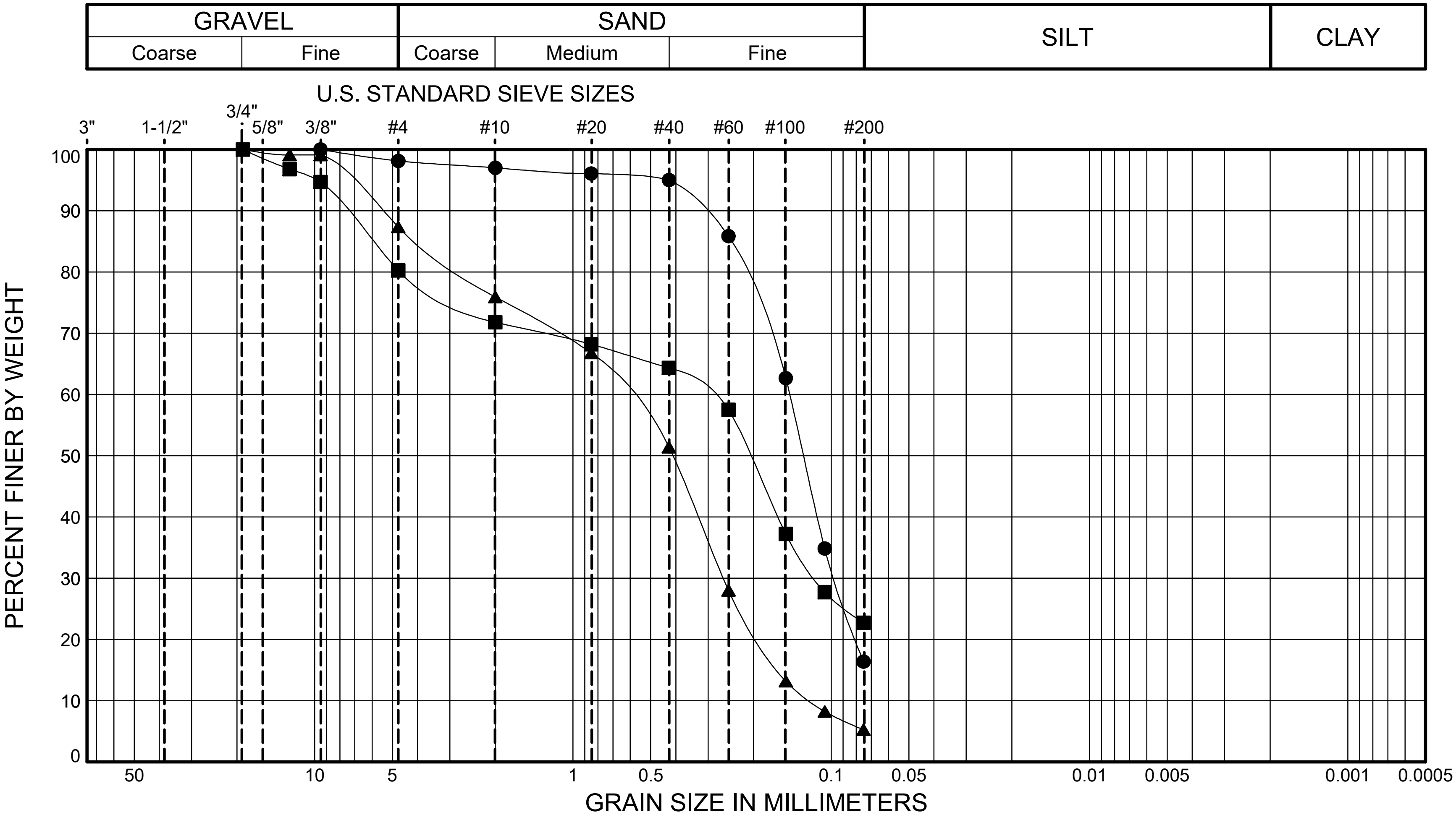
SYMBOL	SAMPLE		DEPTH (ft.)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	SB-1	S08	20.0 - 21.5	(SM) Grayish-brown, silty SAND with gravel	18				20.2	67.6	12.2
■	SB-2	S06	15.0 - 16.5	(GM) Grayish-brown, silty GRAVEL with sand and trace shells	34	46	28	18	29.1	24.9	46.0
▲	SB-2	S08	20.0 - 21.5	(SP-SM) Dark gray, poorly graded SAND with silt	25				10.6	81.1	8.3

HWA GeoSciences Inc.

Laboratory Testing for McMillen Jacobs Associates
I & J Waterway
Client Project No.: 1001 Hilton Ave

PARTICLE-SIZE ANALYSIS OF SOILS METHOD ASTM D6913

PROJECT NO.: 2016-112-23 T700 FIGURE: 4



SYMBOL	SAMPLE		DEPTH (ft.)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	SB-2	S09	22.5 - 24.0	(SM) Gray, silty SAND	27				1.9	81.8	16.4
■	SB-3	S01	2.5 - 3.0	(SM) Grayish-brown, silty SAND with gravel and trace shells	26				19.8	57.5	22.7
▲	SB-3	S04	10.0 - 11.5	(SP-SM) Dark grayish-brown, poorly graded SAND with silt	18				12.7	82.1	5.2

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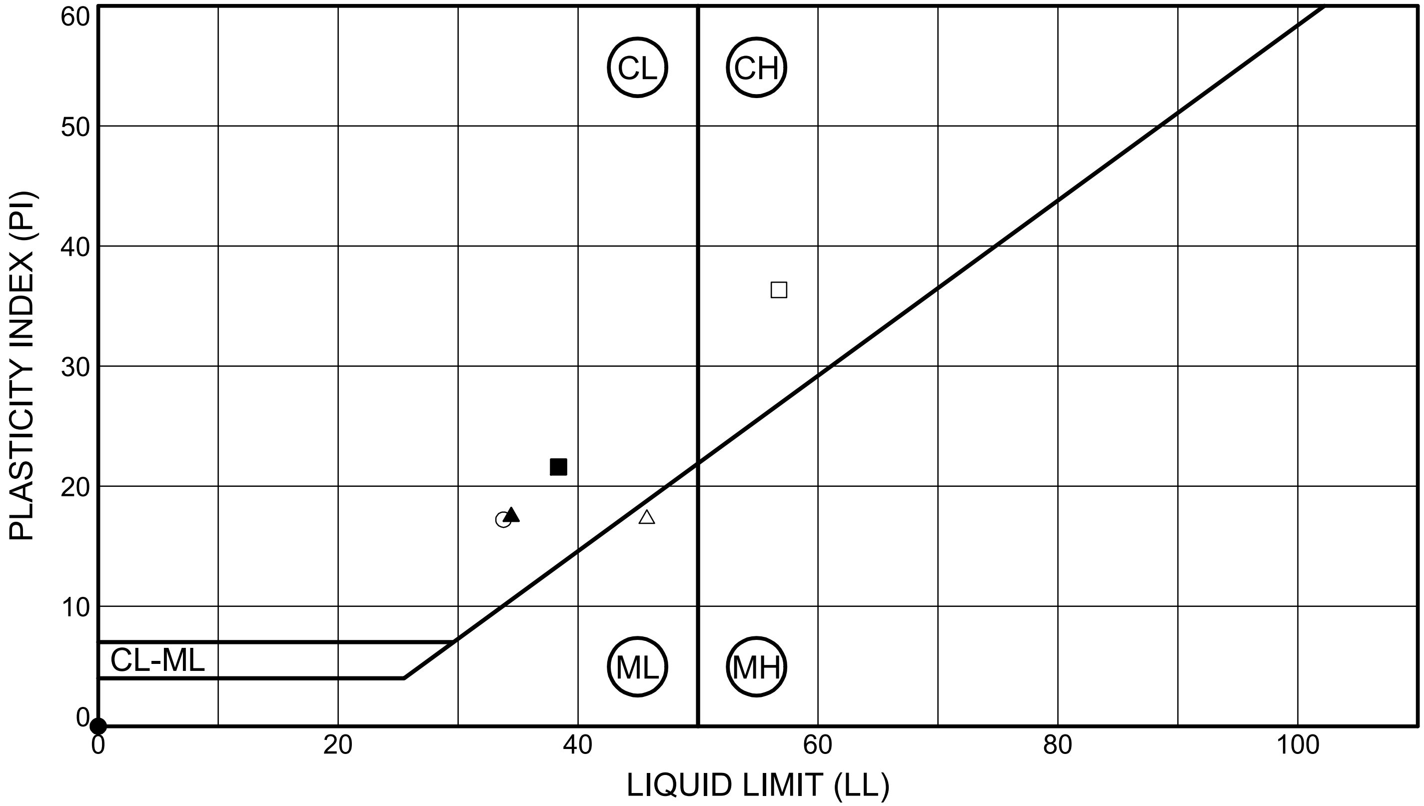
Laboratory Testing for McMillen Jacobs Associates
I & J Waterway
Client Project No.: 1001 Hilton Ave

PARTICLE-SIZE ANALYSIS OF SOILS
METHOD ASTM D6913

PROJECT NO.: 2016-112-23 T700 FIGURE: 5



SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION	% MC	LL	PL	PI	% Fines
●	SB-1	S05	12.5 - 14.0	(SM) Grayish-brown, silty SAND	31	NP	NP	NP	18.3
■	SB-1	S10	25.0 - 26.5	(CL) Dark gray, lean CLAY	25	38	17	21	
▲	SB-1	S12	40.0 - 41.5	(CL) Dark gray, lean CLAY	24	34	17	17	
○	SB-1	S14	50.0 - 51.5	(CL) Dark gray, lean CLAY	23	34	17	17	
□	SB-2	S02	5.0 - 6.5	(CH) Olive-brown, fat CLAY	37	57	20	37	
△	SB-2	S06	15.0 - 16.5	(GM) Grayish-brown, silty GRAVEL with sand and trace shells	34	46	28	18	46.0

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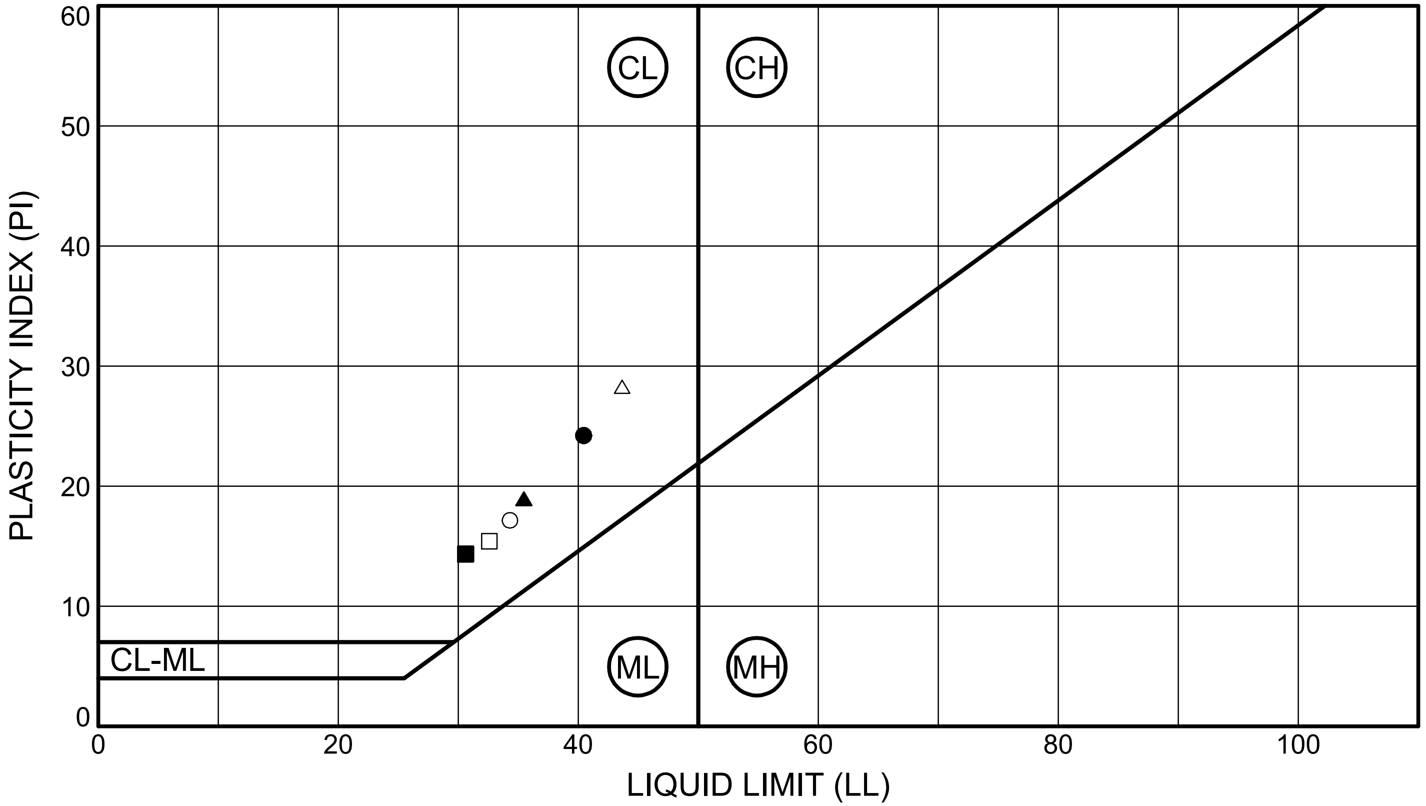
Laboratory Testing for McMillen Jacobs Associates
I & J Waterway
Client Project No.: 1001 Hilton Ave

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS METHOD ASTM D4318

PROJECT NO.: 2016-112-23 T700 FIGURE: 6



SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION	% MC	LL	PL	PI	% Fines
●	SB-2	S10	25.0 - 26.5	(CL) Gray, lean CLAY	23	40	16	24	
■	SB-2	S12	35.0 - 36.5	(CL) Gray, lean CLAY	24	31	16	15	
▲	SB-2	S15	50.0 - 51.5	(CL) Very dark gray, lean CLAY	24	35	17	18	
○	SB-3	S07	17.5 - 19.0	(CL) Dark gray, lean CLAY with gravel	24	34	17	17	
□	SB-3	S10	30.0 - 31.5	(CL) Gray, lean CLAY with gravel	25	33	17	16	
△	SB-3	S17	70.0 - 71.5	(CL) Dark gray, lean CLAY	22	44	15	29	

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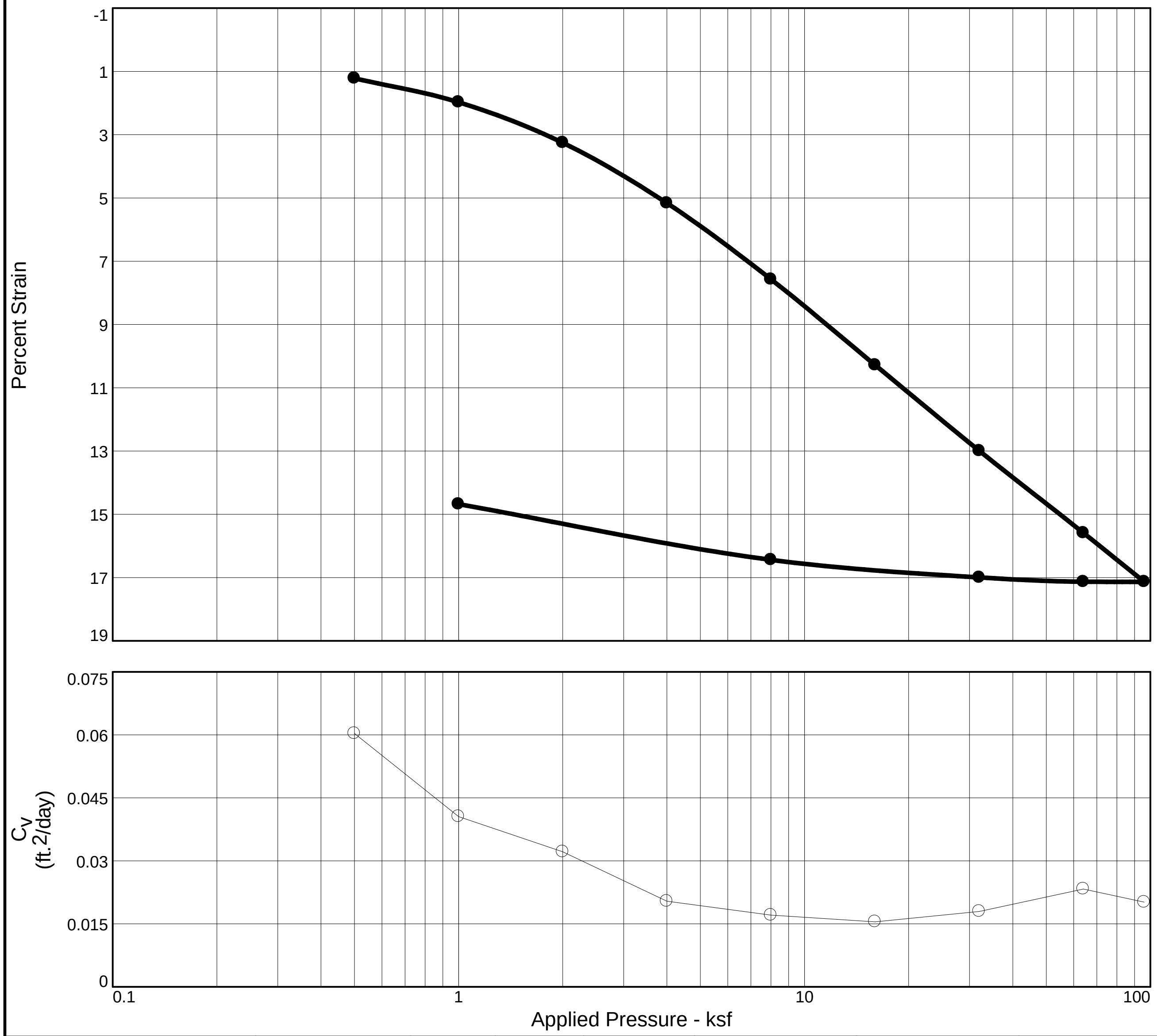
Laboratory Testing for McMillen Jacobs Associates
I & J Waterway
Client Project No.: 1001 Hilton Ave

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS METHOD ASTM D4318

PROJECT NO.: 2016-112-23 T700 FIGURE: 7

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
102.5 %	21.8 %	107.6			2.7	CL		0.575

MATERIAL DESCRIPTION

Dark gray, lean CLAY

Project No. 2016-112 **Client:** McMillen Jacobs

Project: I&J Waterway [1001 Hilton Ave]

Source of Sample: SB-2 **Depth:** 31.5 **Sample Number:** T01

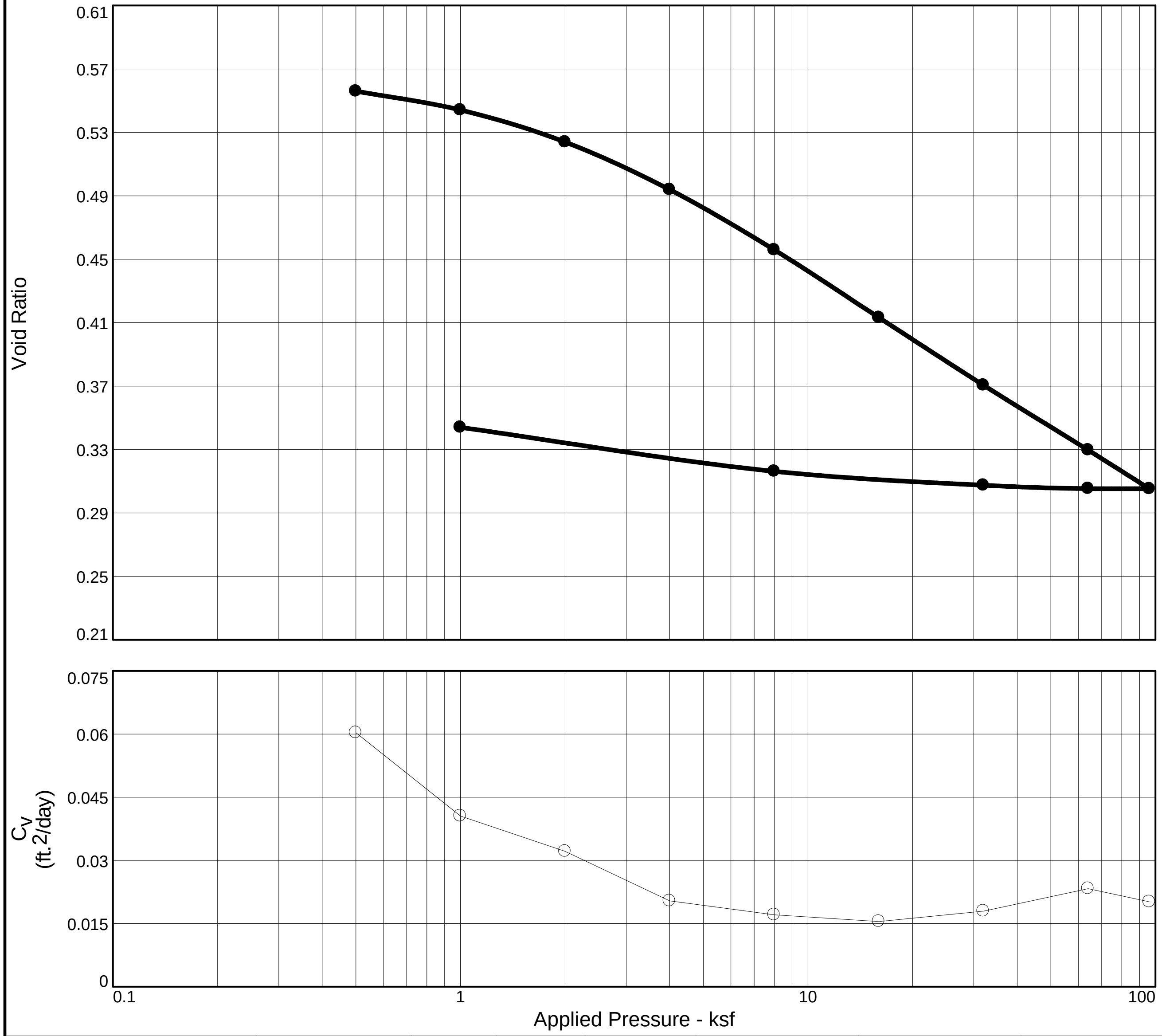
Remarks:

*Specific gravity values are assumed

Figure 8a

Tested By: DW **Checked By:** SEG

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
102.5 %	21.8 %	107.6			2.7	CL		0.575

MATERIAL DESCRIPTION

Dark gray, lean CLAY

Project No. 2016-112 **Client:** McMillen Jacobs

Project: I&J Waterway [1001 Hilton Ave]

Source of Sample: SB-2 **Depth:** 31.5 **Sample Number:** T01

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DBE/MWBE

Remarks:
*Specific gravity values are assumed

Figure 8b

Tested By: DW **Checked By:** SEG

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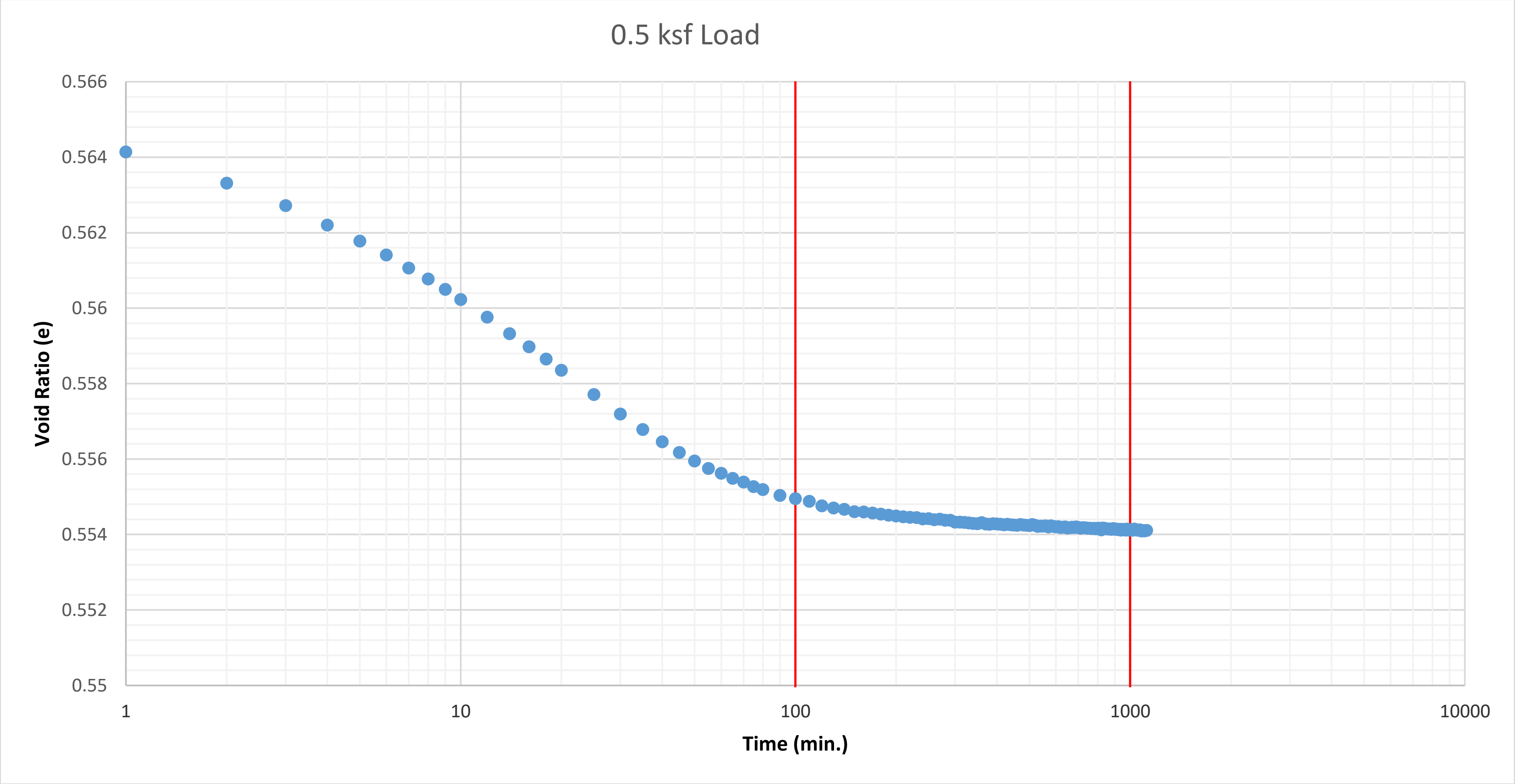
ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	I&J Waterway	Sample Number	T01	Moisture Content	21.8	%
Project Number:	2016-112 T700	Sample Depth	31.5-34.5	Saturation	102.5	%
Exploration Number:	SB-2	Soil Description	CL	Dry Density	107.6	pcf

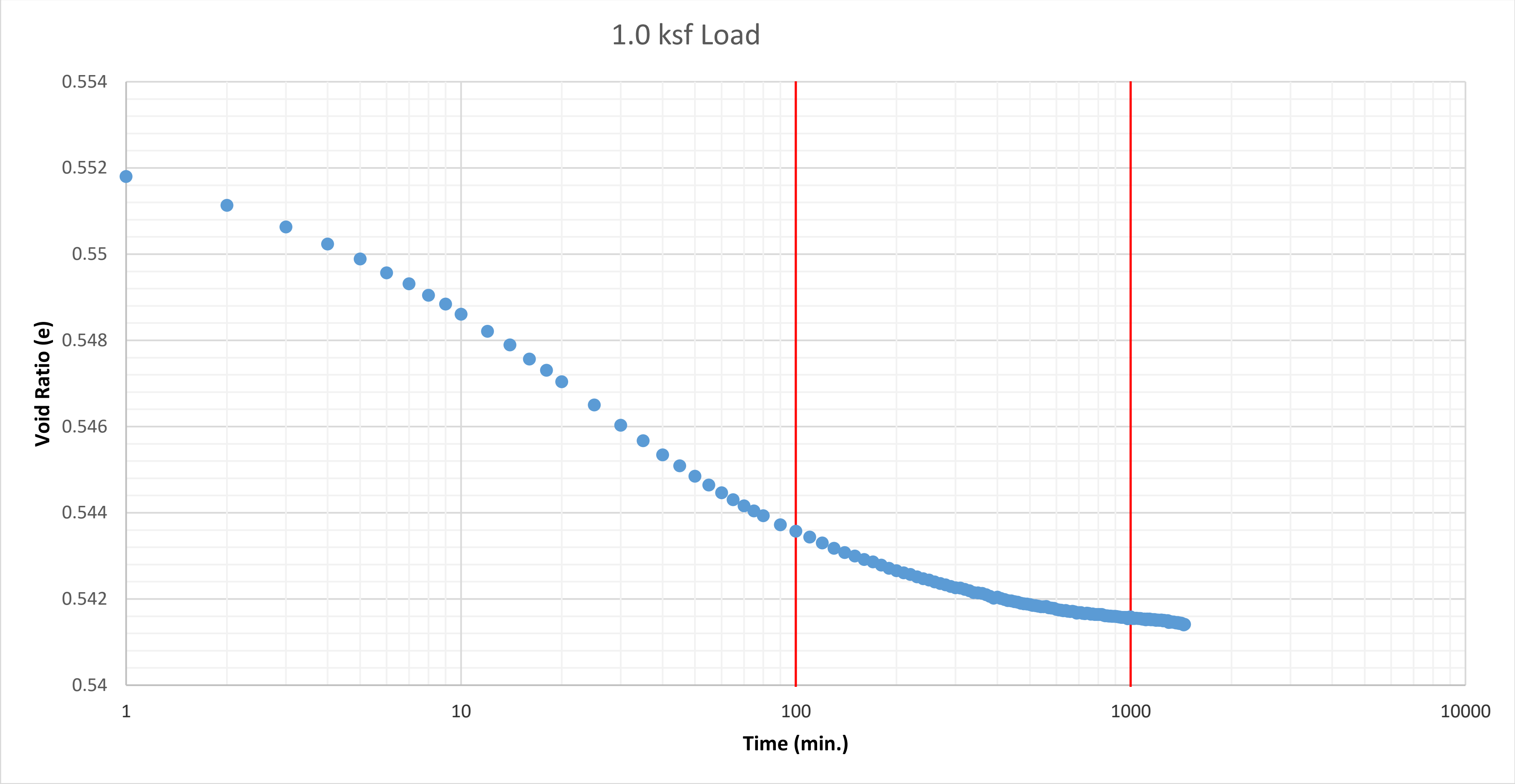


C_α= 0.5549 - 0.5541 = 0.0008

Figure 8c

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	I&J Waterway	Sample Number	T01	Moisture Content	21.8	%
Project Number:	2016-112 T700	Sample Depth	31.5-34.5	Saturation	102.5	%
Exploration Number:	SB-2	Soil Description	CL	Dry Density	107.6	pcf



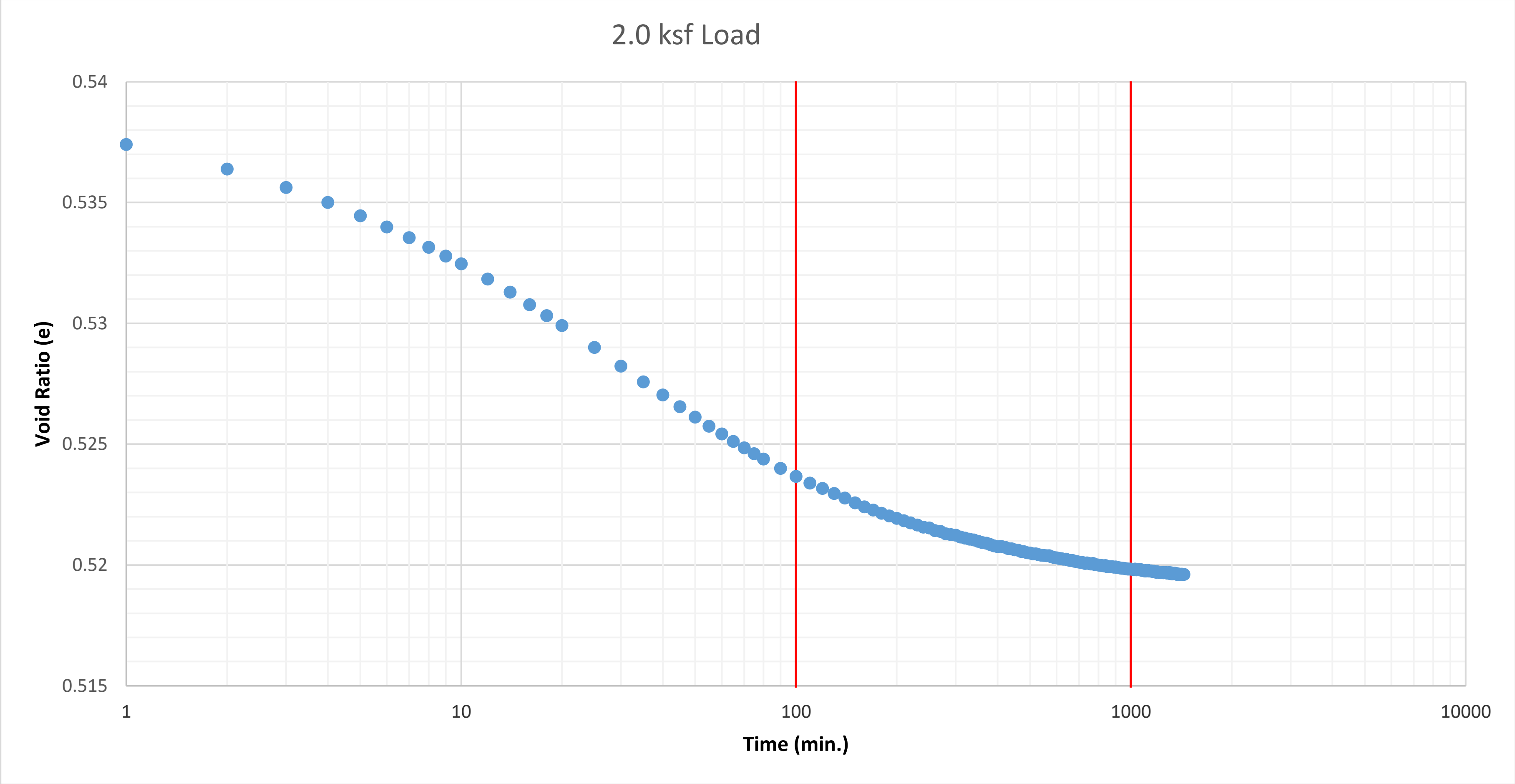
C_α= 0.5436 - 0.5416 = 0.0020

Figure 8d

HWA GEOSCIENCES INC.

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	I&J Waterway	Sample Number	T01	Moisture Content	21.8	%
Project Number:	2016-112 T700	Sample Depth	31.5-34.5	Saturation	102.5	%
Exploration Number:	SB-2	Soil Description	CL	Dry Density	107.6	pcf



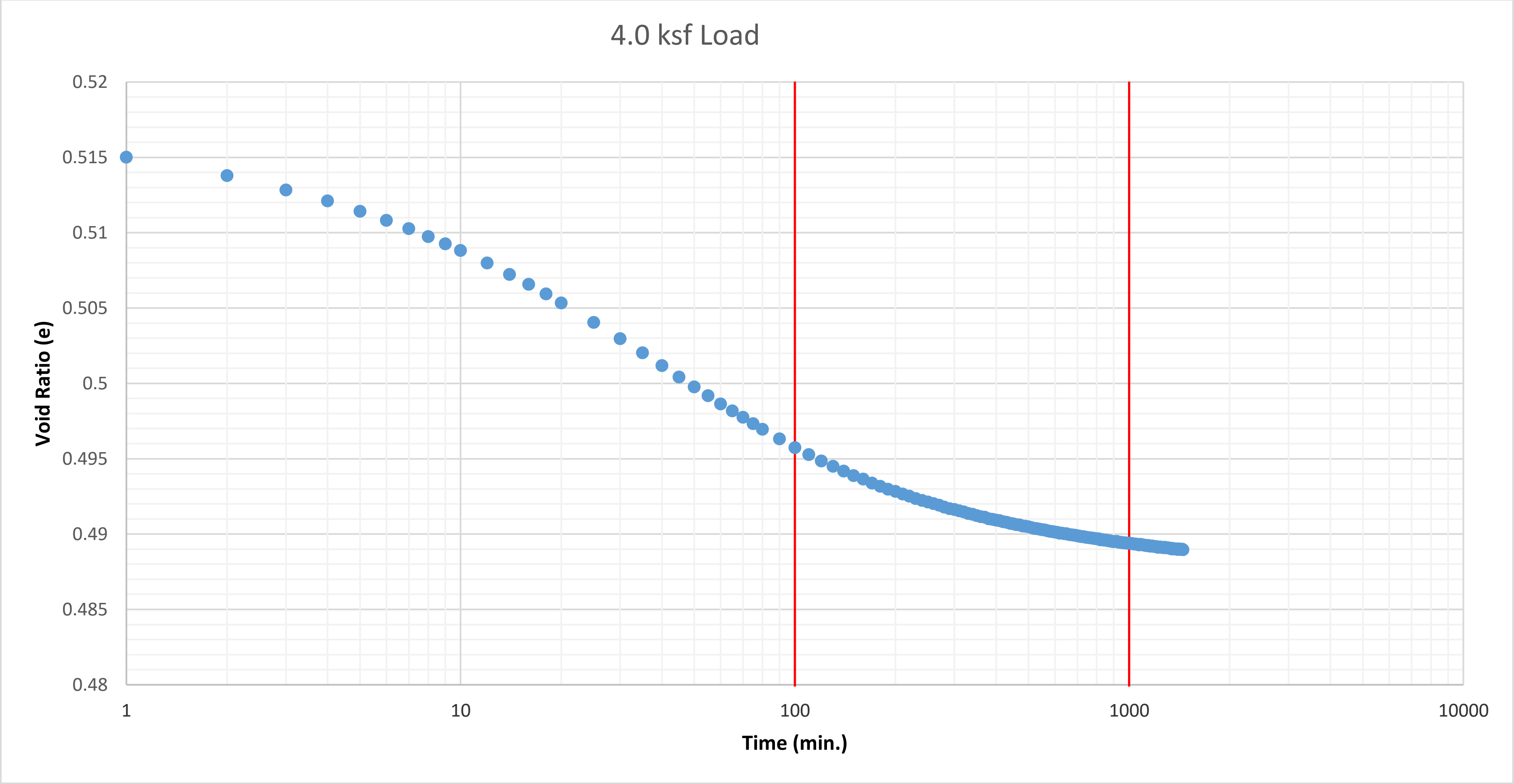
C_α= **0.5237** - **0.5198** = **0.0038**

Figure 8e

HWA GEOSCIENCES INC.

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	I&J Waterway	Sample Number	T01	Moisture Content	21.8	%
Project Number:	2016-112 T700	Sample Depth	31.5-34.5	Saturation	102.5	%
Exploration Number:	SB-2	Soil Description	CL	Dry Density	107.6	pcf



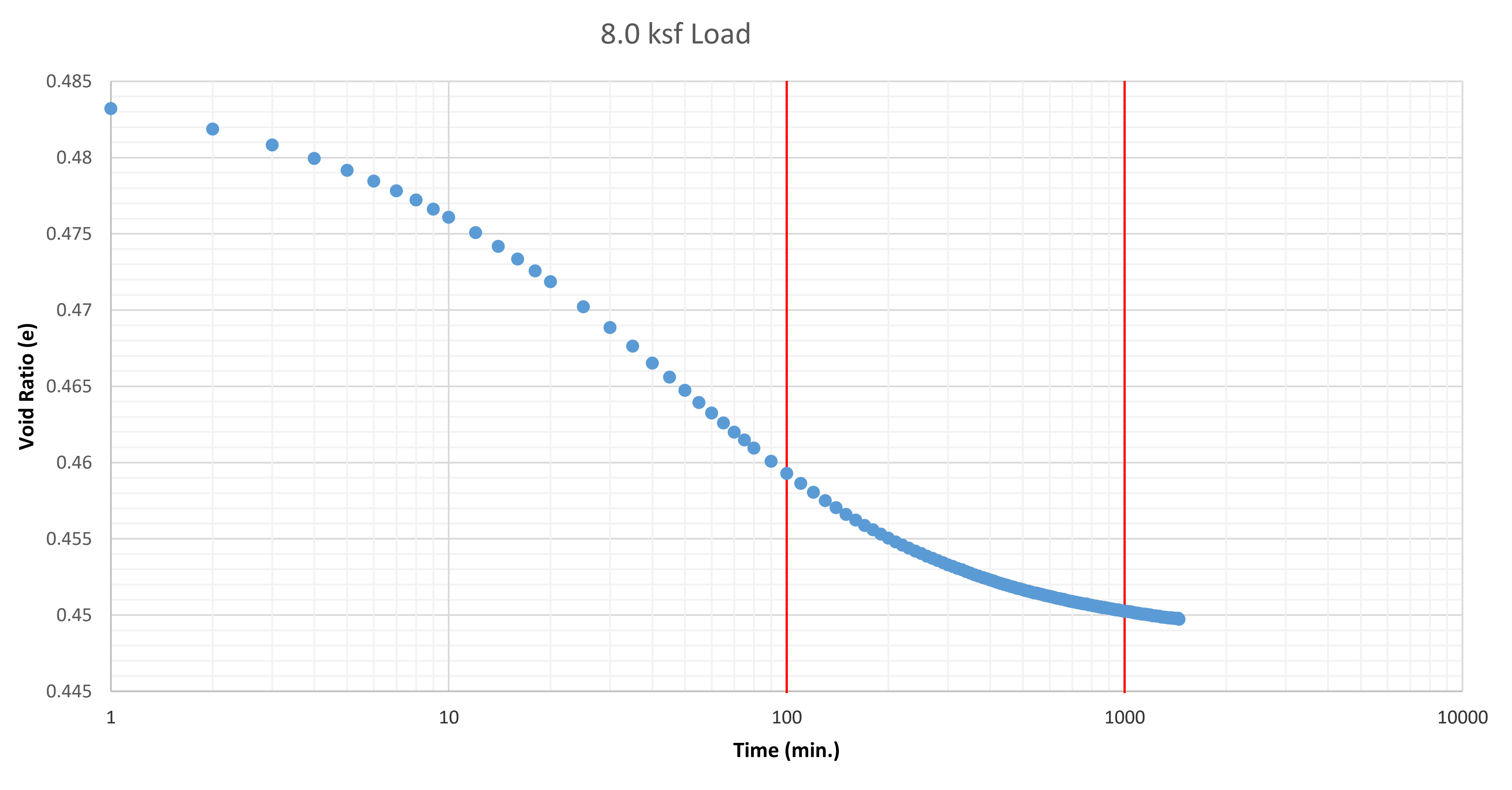
C_α= 0.4957 - 0.4894 = 0.0063

Figure 8f

HWA GEOSCIENCES INC.

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	I&J Waterway	Sample Number	T01	Moisture Content	21.8	%
Project Number:	2016-112 T700	Sample Depth	31.5-34.5	Saturation	102.5	%
Exploration Number:	SB-2	Soil Description	CL	Dry Density	107.6	pcf



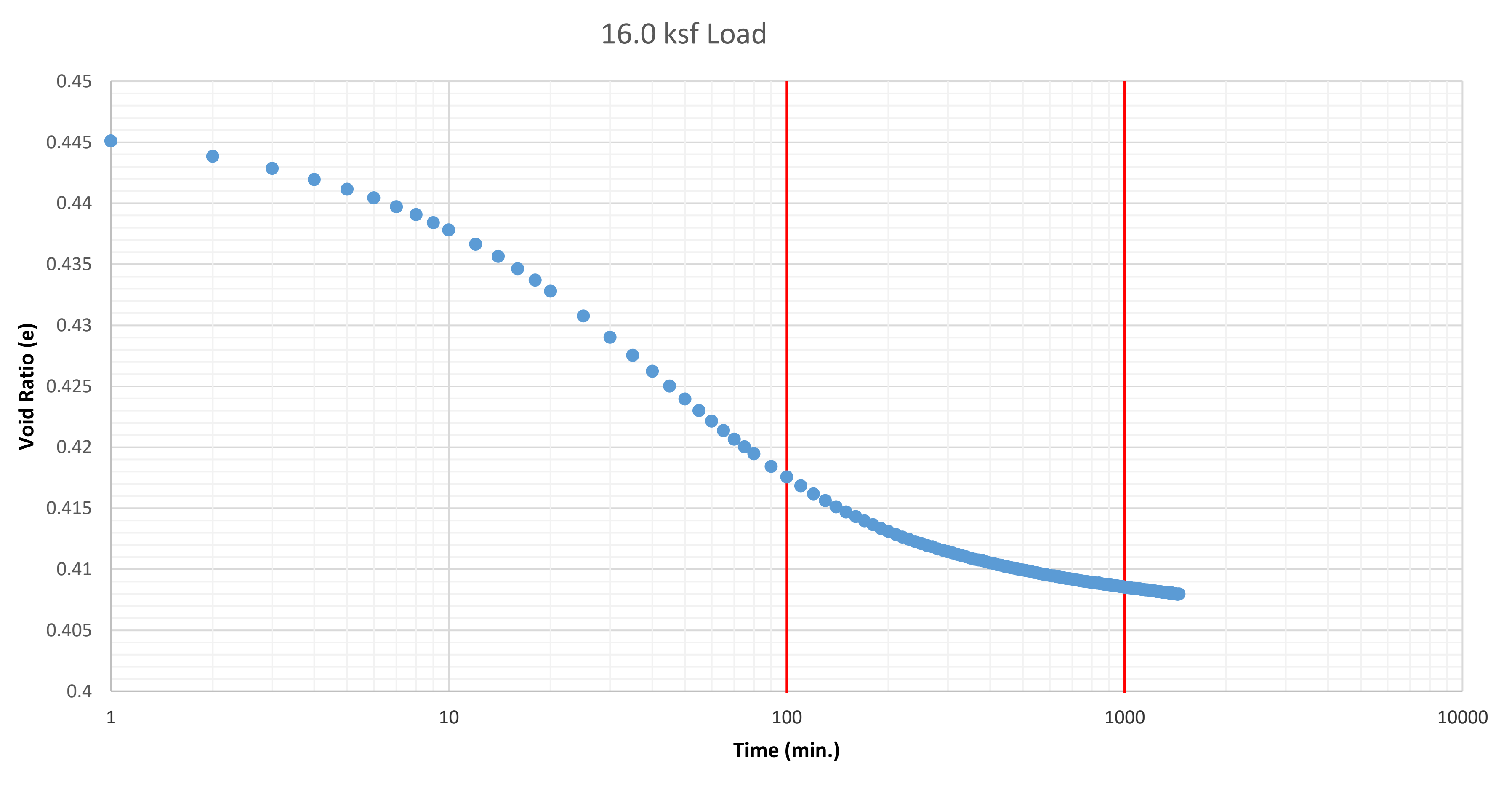
C_{α}= 0.4593 - 0.4502 = 0.0091

Figure 8g

HWA GEOSCIENCES INC.

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	I&J Waterway	Sample Number	T01	Moisture Content	21.8	%
Project Number:	2016-112 T700	Sample Depth	31.5-34.5	Saturation	102.5	%
Exploration Number:	SB-2	Soil Description	CL	Dry Density	107.6	pcf



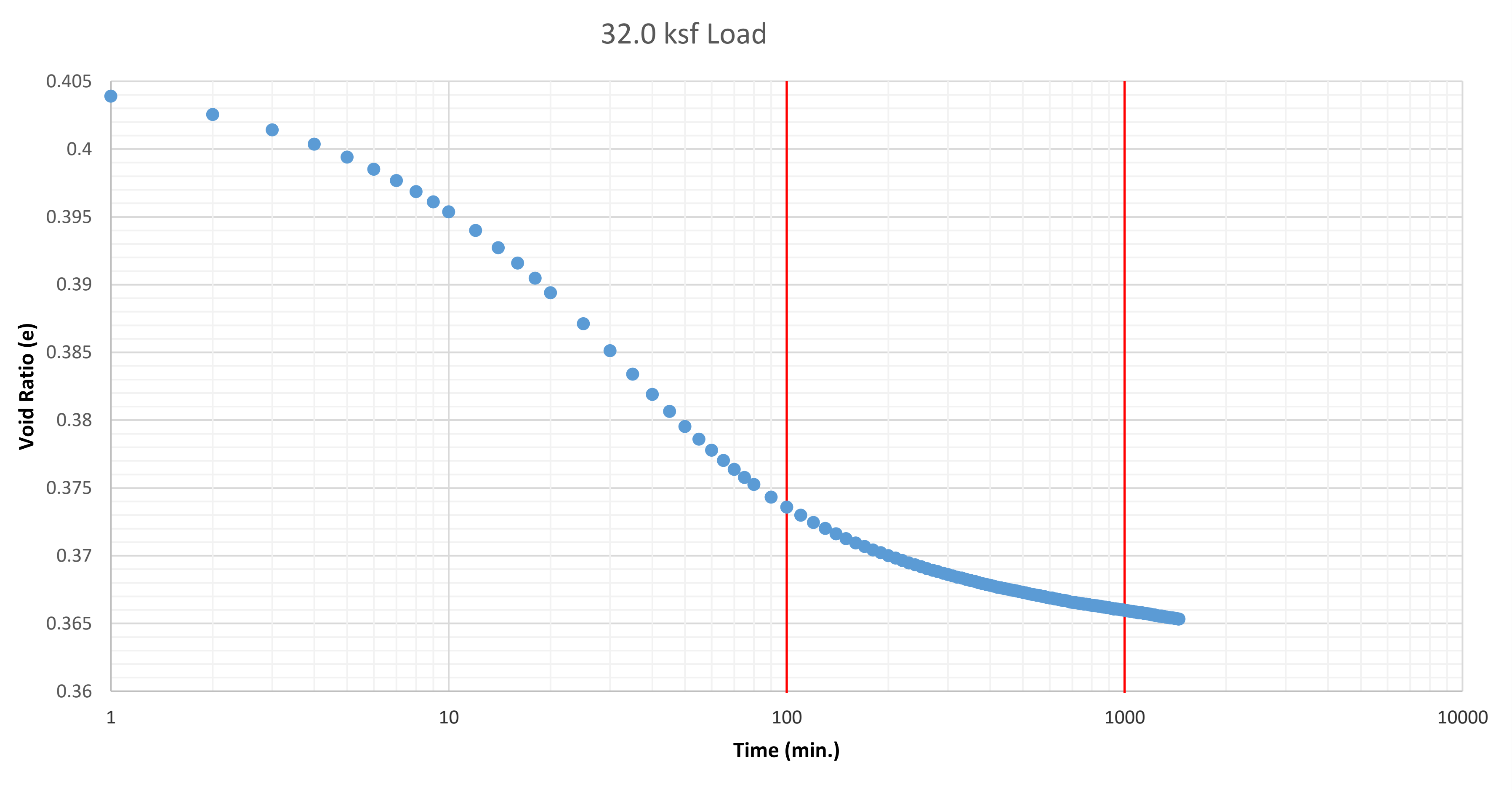
C_α=	**0.4176**	**-**	**0.4085**	**=**	**0.0090**

Figure 8h

HWA GEOSCIENCES INC.

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	I&J Waterway	Sample Number	T01	Moisture Content	21.8	%
Project Number:	2016-112 T700	Sample Depth	31.5-34.5	Saturation	102.5	%
Exploration Number:	SB-2	Soil Description	CL	Dry Density	107.6	pcf



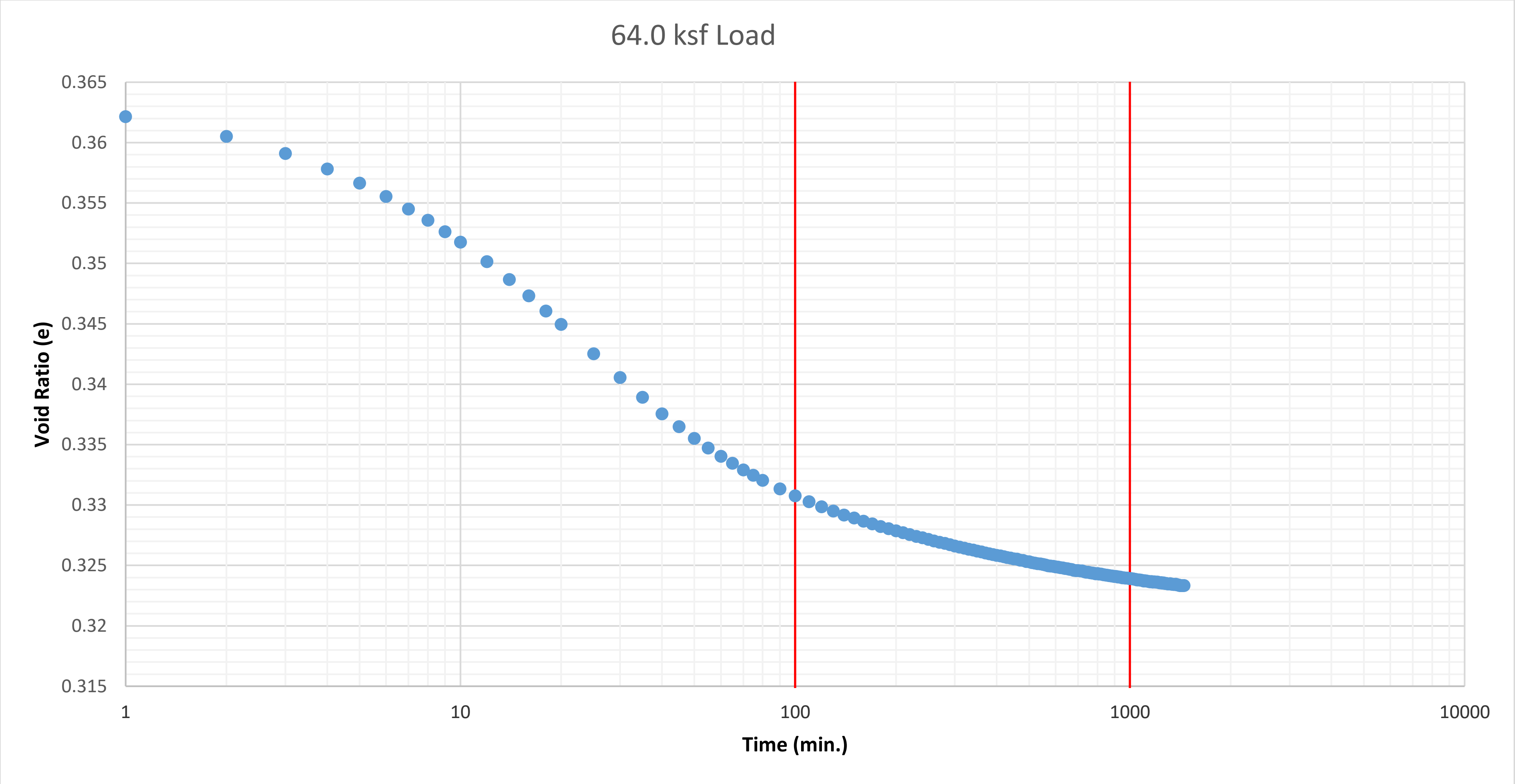
C_α= 0.3736 - 0.3660 = 0.0076

Figure 8i

HWA GEOSCIENCES INC.

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	I&J Waterway	Sample Number	T01	Moisture Content	21.8	%
Project Number:	2016-112 T700	Sample Depth	31.5-34.5	Saturation	102.5	%
Exploration Number:	SB-2	Soil Description	CL	Dry Density	107.6	pcf



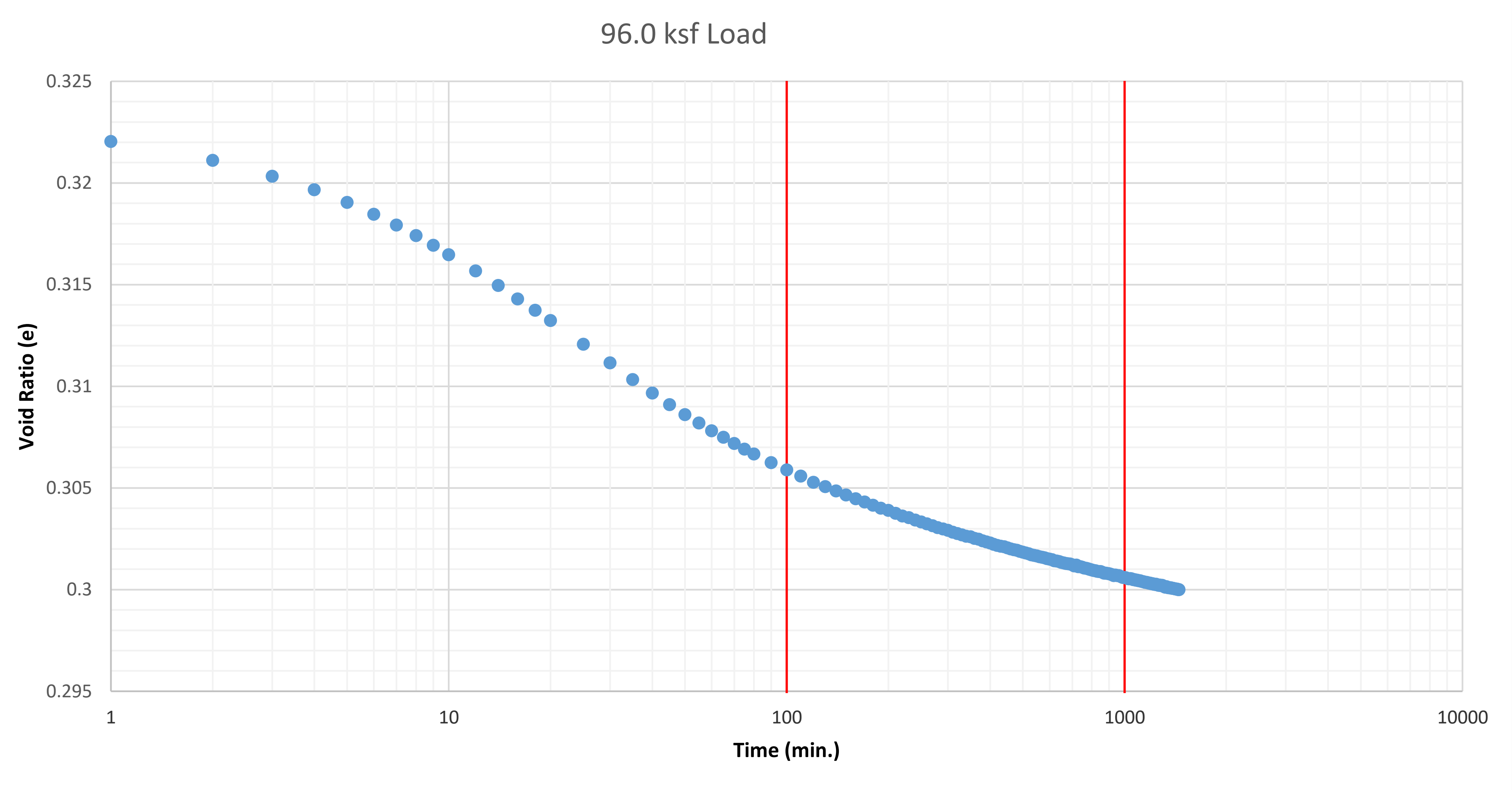
C_α= 0.3308 - 0.3239 = 0.0069

Figure 8j

HWA GEOSCIENCES INC.

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

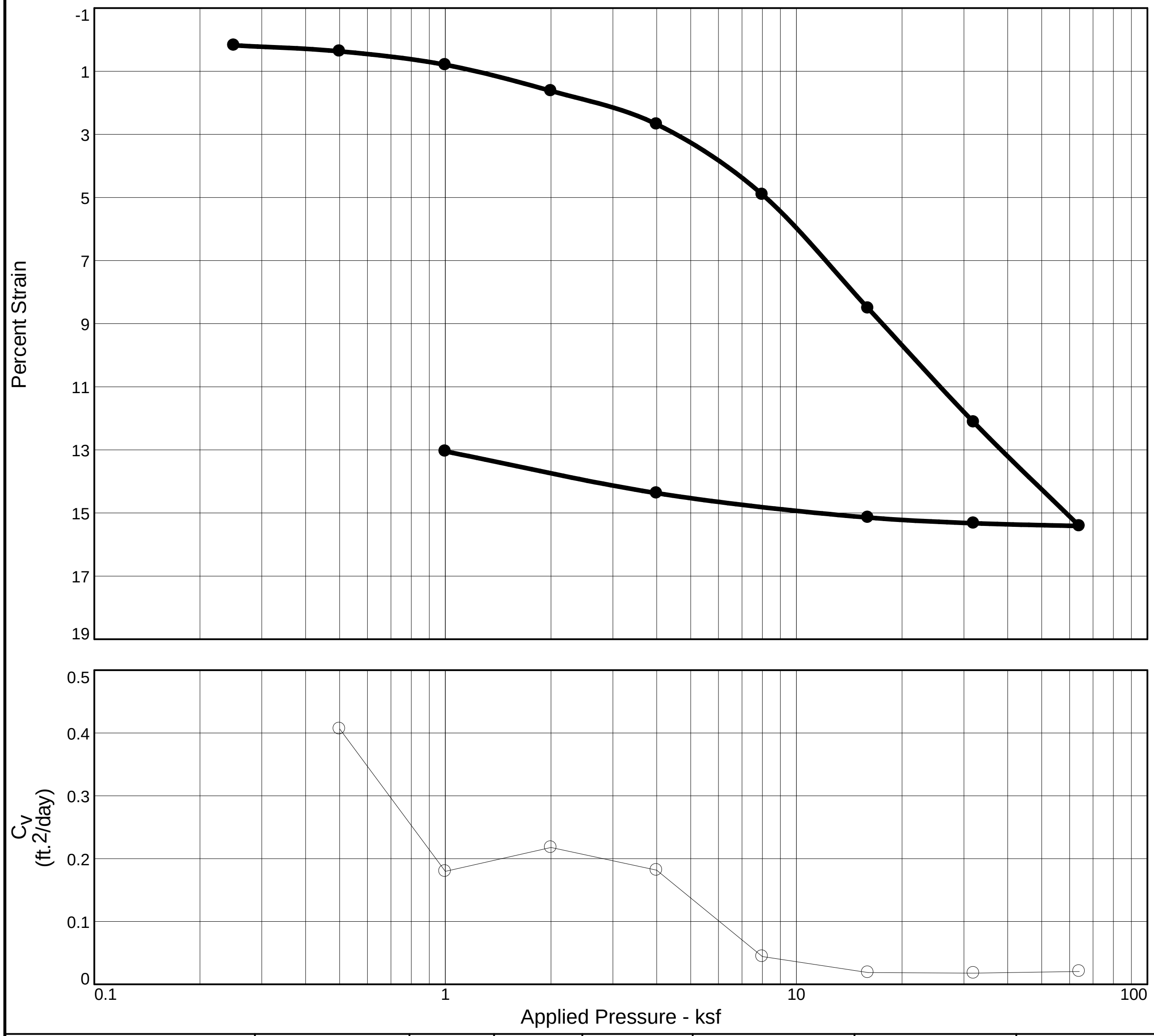
					Natural	
Project Name:	I&J Waterway	Sample Number	T01	Moisture Content	21.8	%
Project Number:	2016-112 T700	Sample Depth	31.5-34.5	Saturation	102.5	%
Exploration Number:	SB-2	Soil Description	CL	Dry Density	107.6	pcf



C_α= **0.3059 - 0.3006 = 0.0053**

Figure 8k

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
96.8 %	21.7 %	105.3			2.7	CL		0.606

MATERIAL DESCRIPTION

Dark gray, lean CLAY

Project No. 2016-112 **Client:** McMillen Jacobs

Project: I&J Waterway [1001 Hilton Ave]

Source of Sample: SB-3 **Depth:** 21.5 **Sample Number:** T01

HWA GEOSCIENCES INC. DBE/MWBE

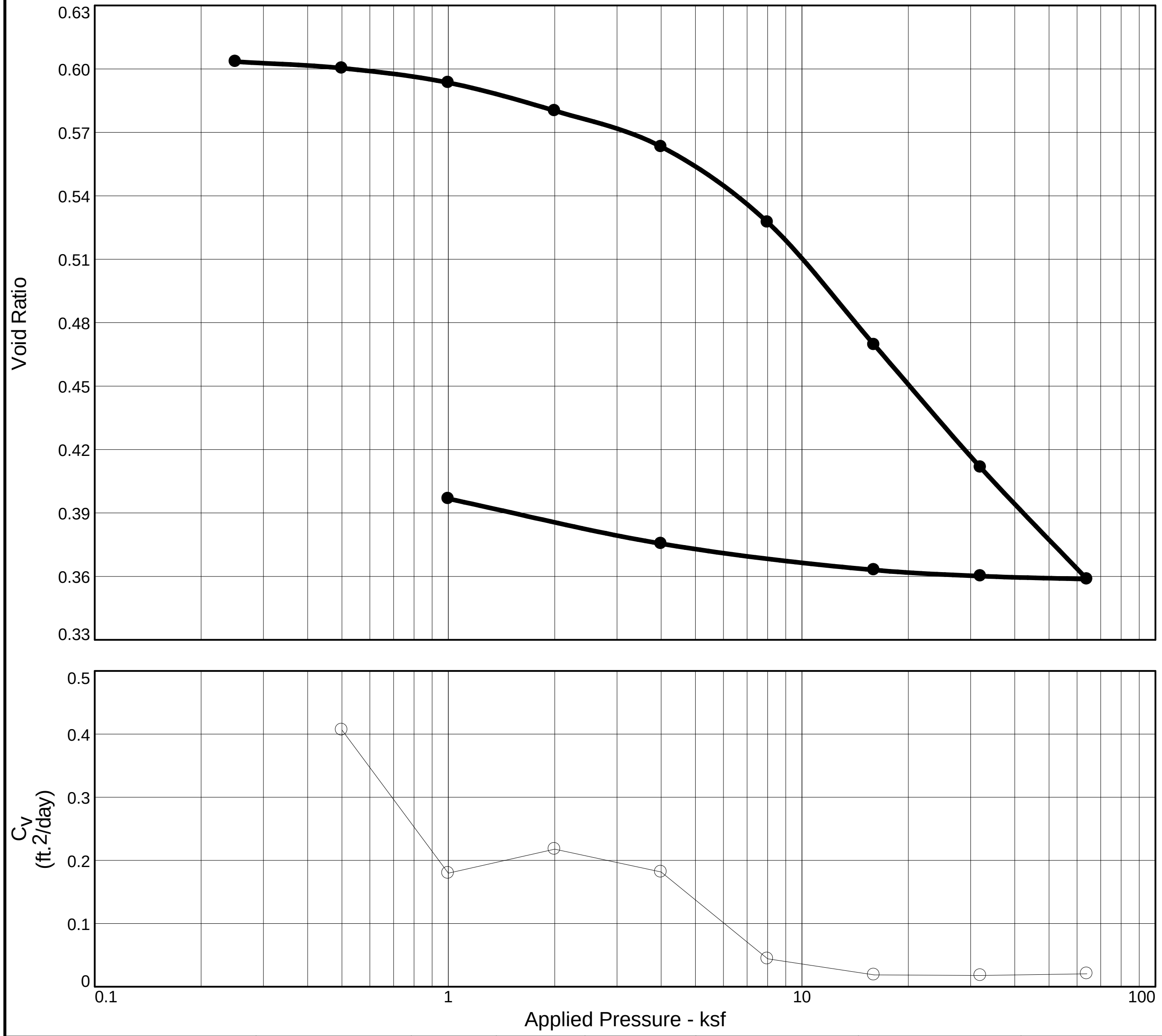
Remarks:

*Specific gravity values are assumed

Figure 9a

Tested By: DW **Checked By:** SEG

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
96.8 %	21.7 %	105.3			2.7	CL		0.606

MATERIAL DESCRIPTION

Dark gray, lean CLAY

Project No. 2016-112 **Client:** McMillen Jacobs

Project: I&J Waterway [1001 Hilton Ave]

Source of Sample: SB-3 **Depth:** 21.5 **Sample Number:** T01

HWA GEOSCIENCES INC.
DBE/MWBE

Remarks:
*Specific gravity values are assumed

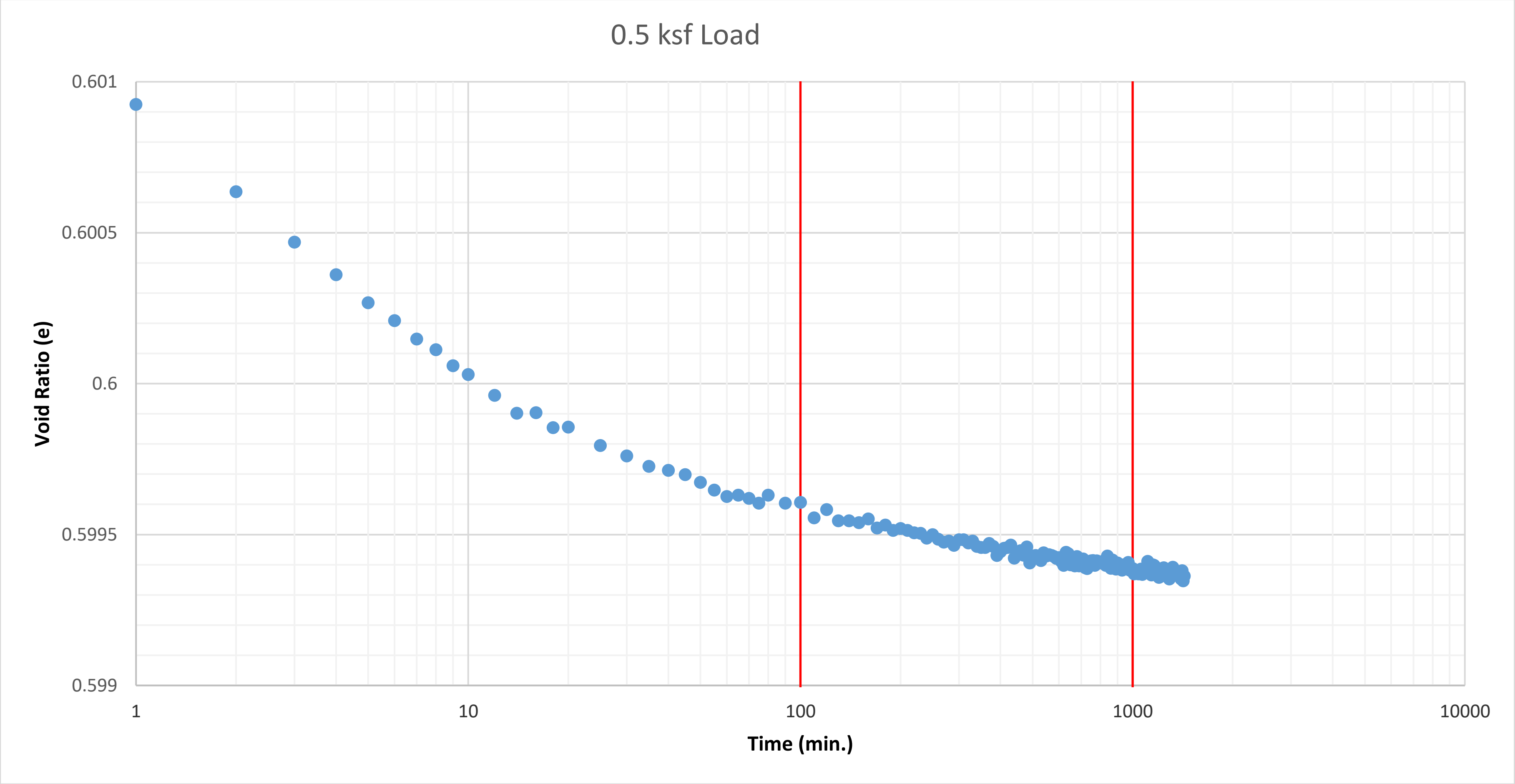
Figure 9b

Tested By: DW **Checked By:** SEG

HWA GEOSCIENCES INC.

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	I&J Waterway	Sample Number	T01	Moisture Content	21.7	%
Project Number:	2016-112 T700	Sample Depth	21.5-24.5	Saturation	96.8	%
Exploration Number:	SB-3	Soil Description	CL	Dry Density	105.3	pcf



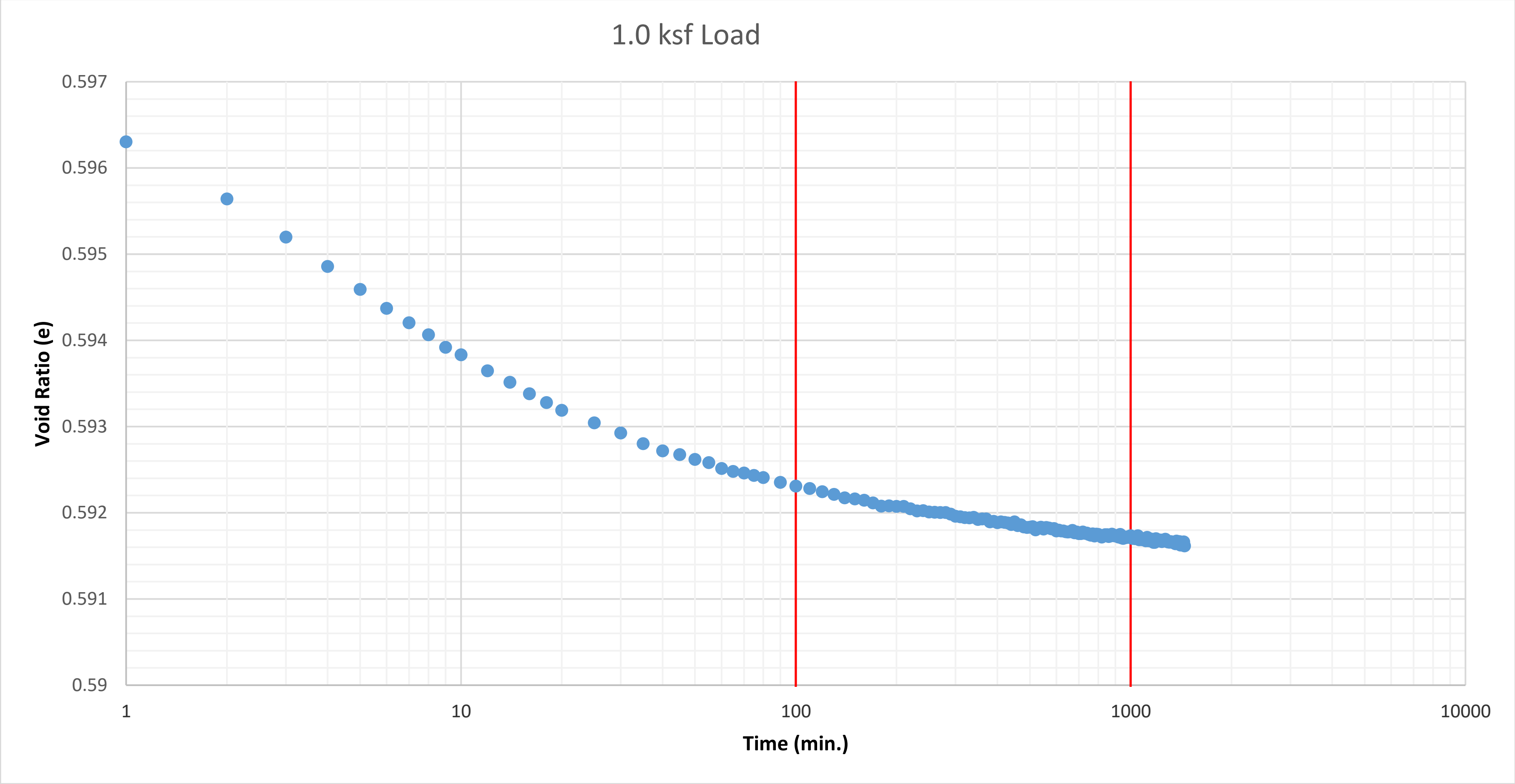
C_{α}=	0.5996	-	0.5994	= 0.0002

Figure 9c

HWA GEOSCIENCES INC.

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	I&J Waterway	Sample Number	T01	Moisture Content	21.7	%
Project Number:	2016-112 T700	Sample Depth	21.5-24.5	Saturation	96.8	%
Exploration Number:	SB-3	Soil Description	CL	Dry Density	105.3	pcf



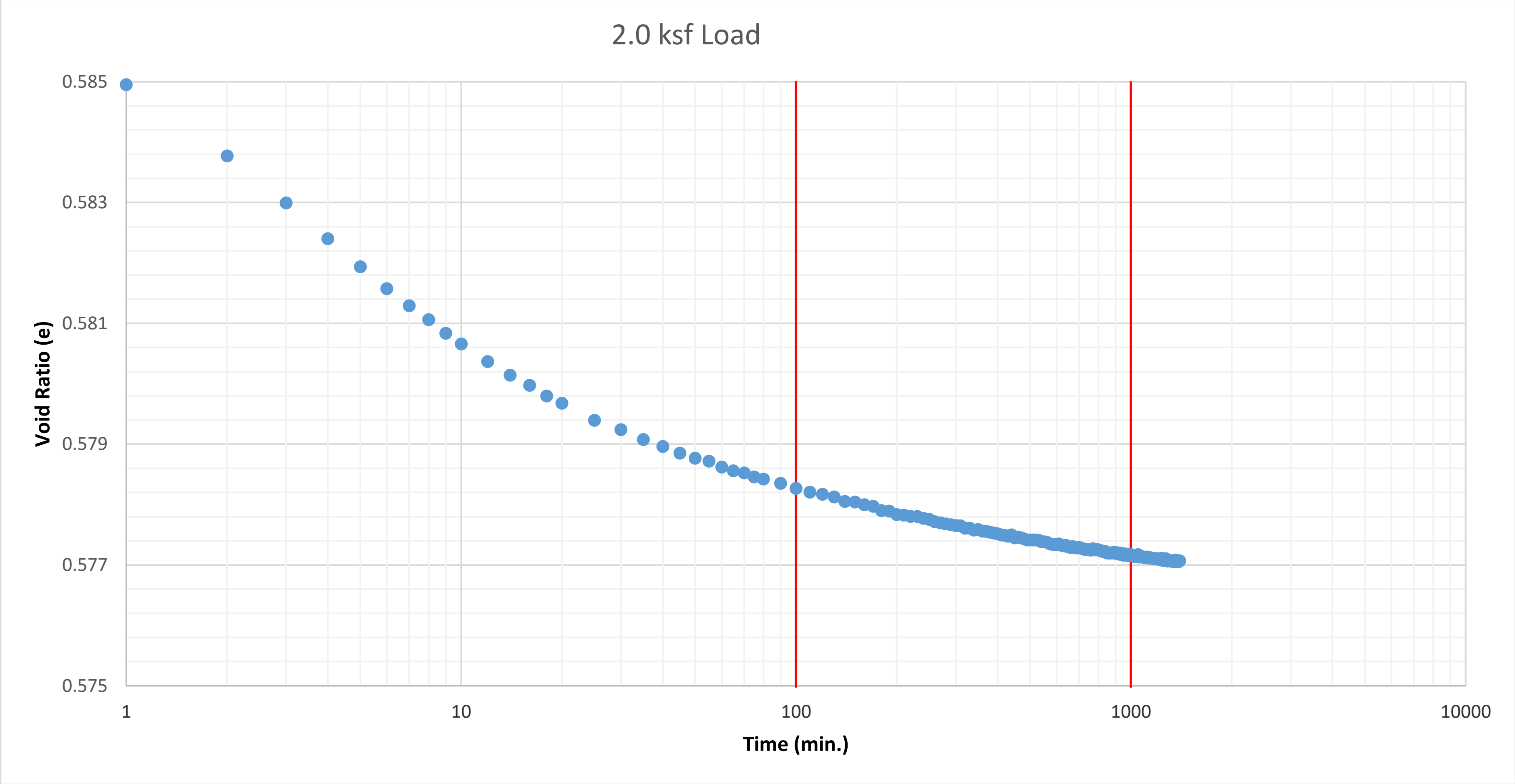
C_α=	0.5923	-	0.5917	=	0.0006	

Figure 9d

HWA GEOSCIENCES INC.

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	I&J Waterway	Sample Number	T01	Moisture Content	21.7	%
Project Number:	2016-112 T700	Sample Depth	21.5-24.5	Saturation	96.8	%
Exploration Number:	SB-3	Soil Description	CL	Dry Density	105.3	pcf



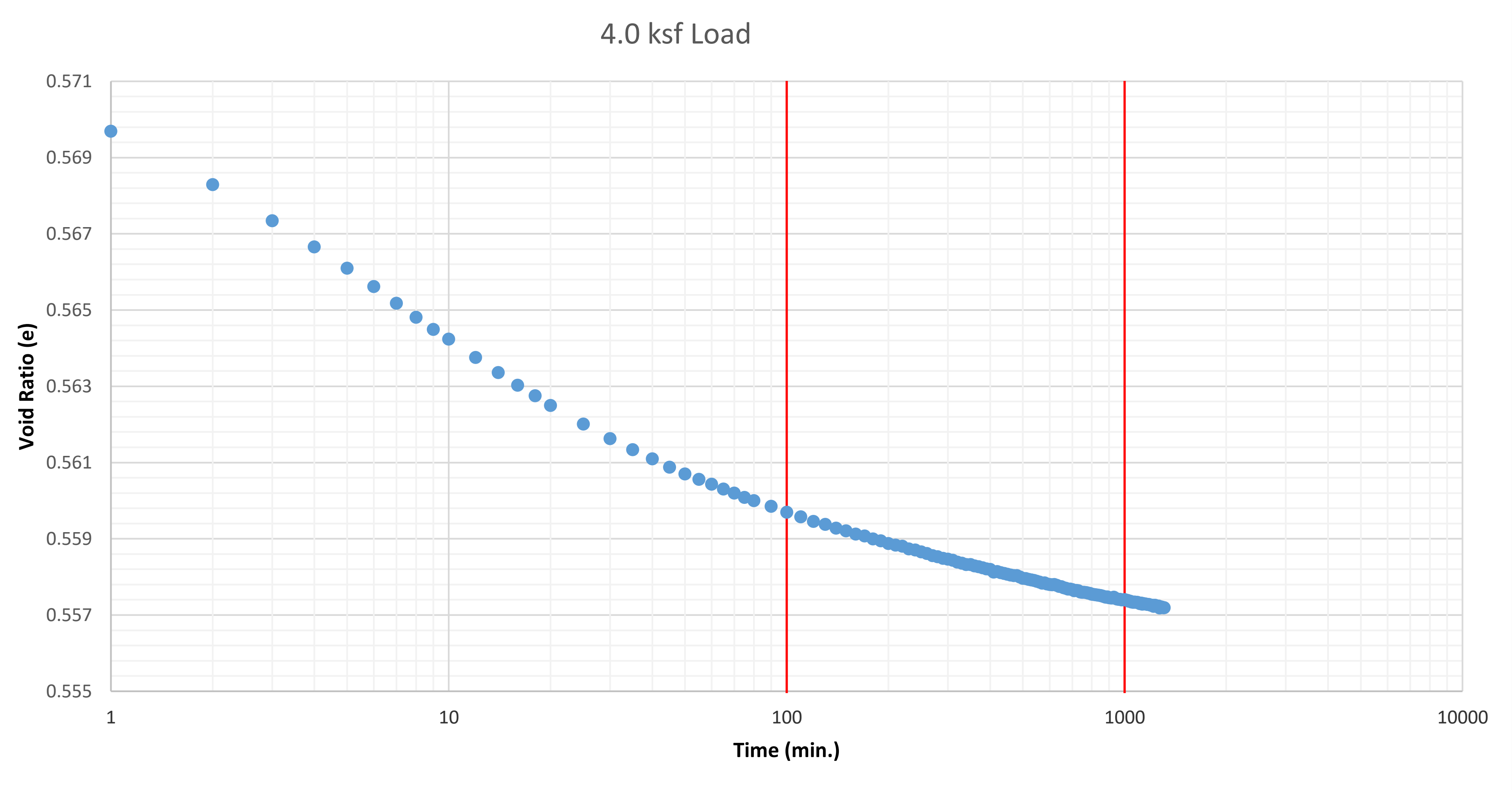
C_α=	0.5783	-	0.5772	=	0.0011

Figure 9e

HWA GEOSCIENCES INC.

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	I&J Waterway	Sample Number	T01	Moisture Content	21.7	%
Project Number:	2016-112 T700	Sample Depth	21.5-24.5	Saturation	96.8	%
Exploration Number:	SB-3	Soil Description	CL	Dry Density	105.3	pcf



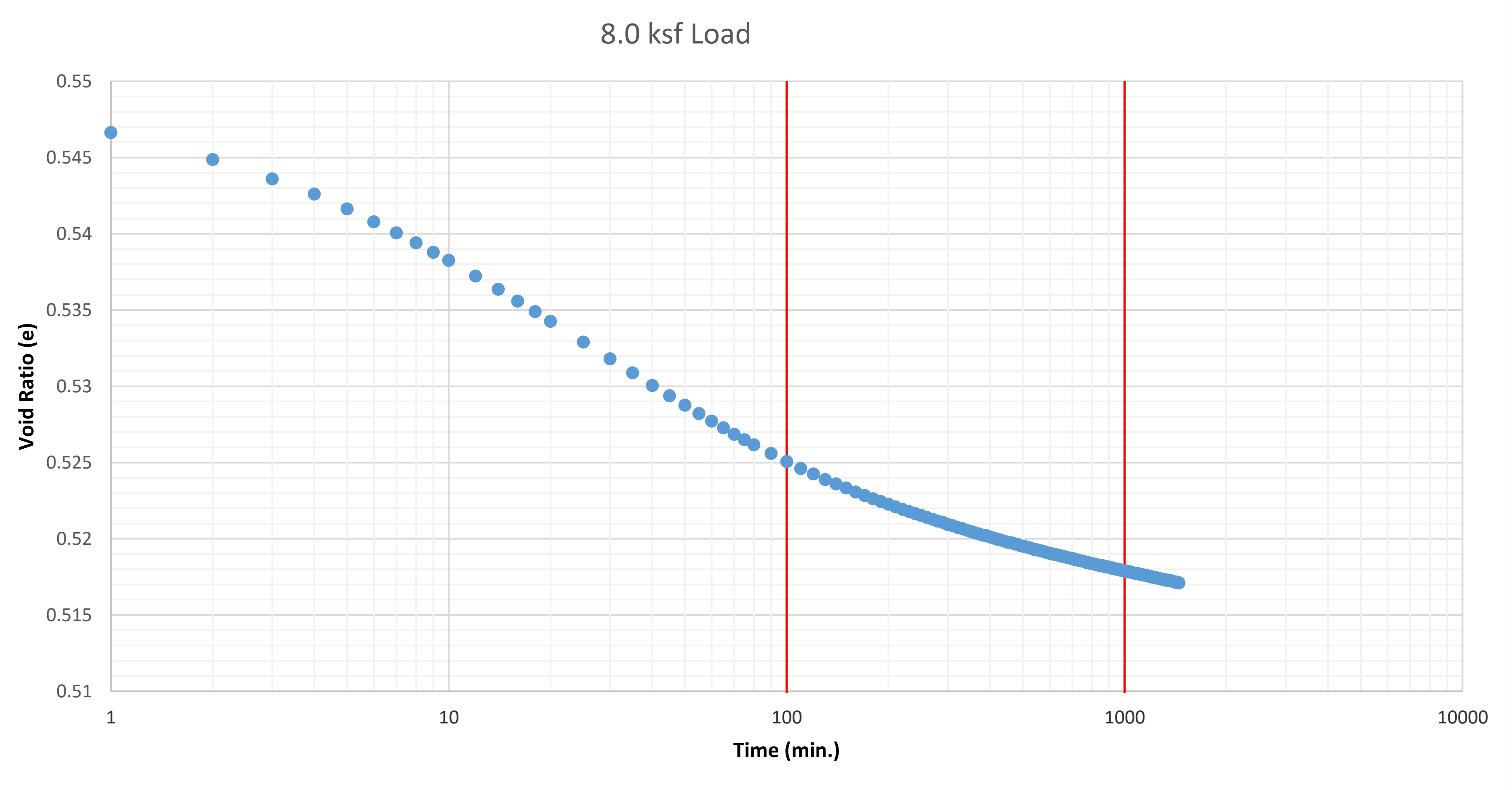
C_α= 0.5597 - 0.5574 = 0.0023

Figure 9f

HWA GEOSCIENCES INC.

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	I&J Waterway	Sample Number	T01	Moisture Content	21.7	%
Project Number:	2016-112 T700	Sample Depth	21.5-24.5	Saturation	96.8	%
Exploration Number:	SB-3	Soil Description	CL	Dry Density	105.3	pcf



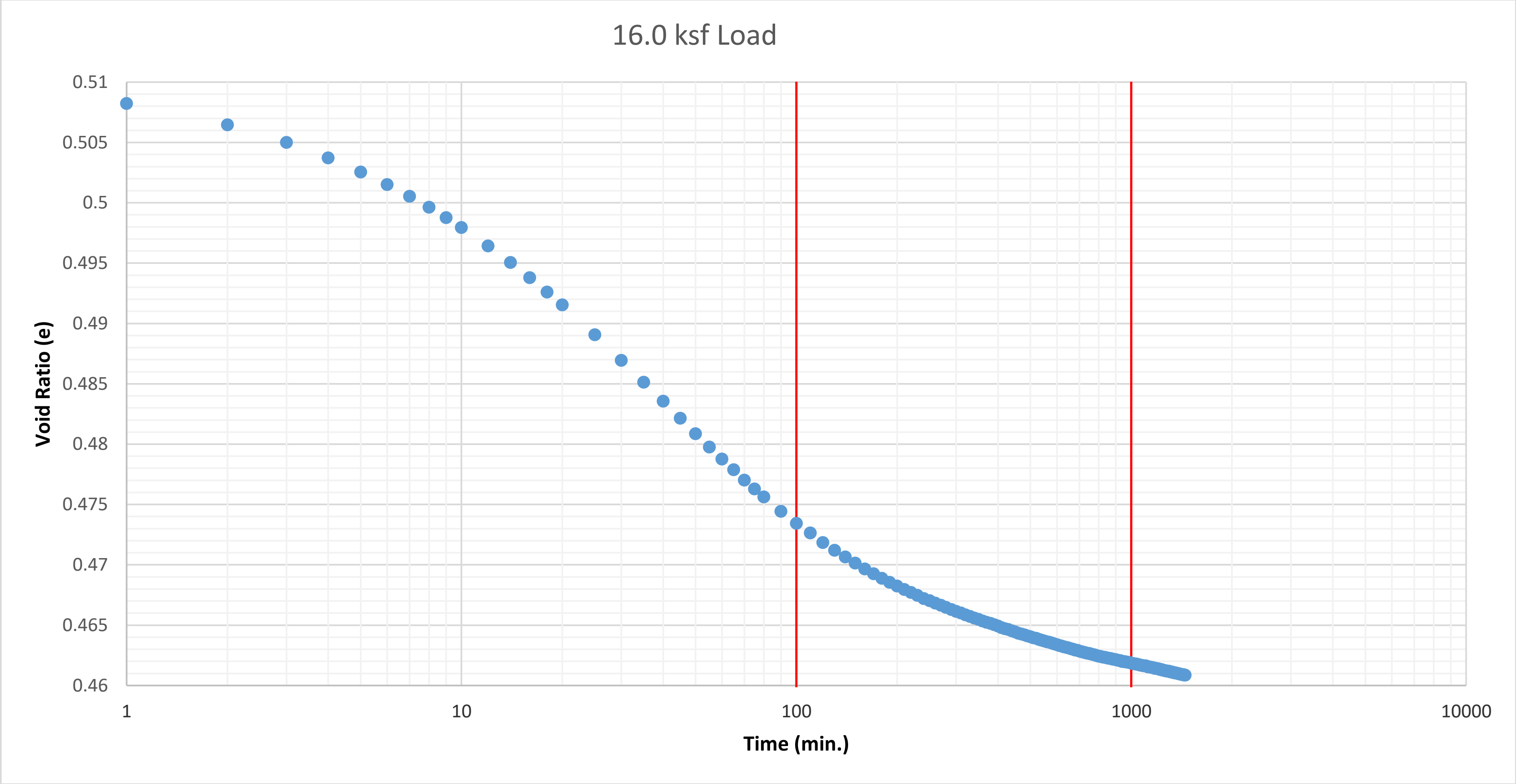
C_α= **0.5251 - 0.5179 = 0.0072**

Figure 9g

HWA GEOSCIENCES INC.

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	I&J Waterway	Sample Number	T01	Moisture Content	21.7	%
Project Number:	2016-112 T700	Sample Depth	21.5-24.5	Saturation	96.8	%
Exploration Number:	SB-3	Soil Description	CL	Dry Density	105.3	pcf



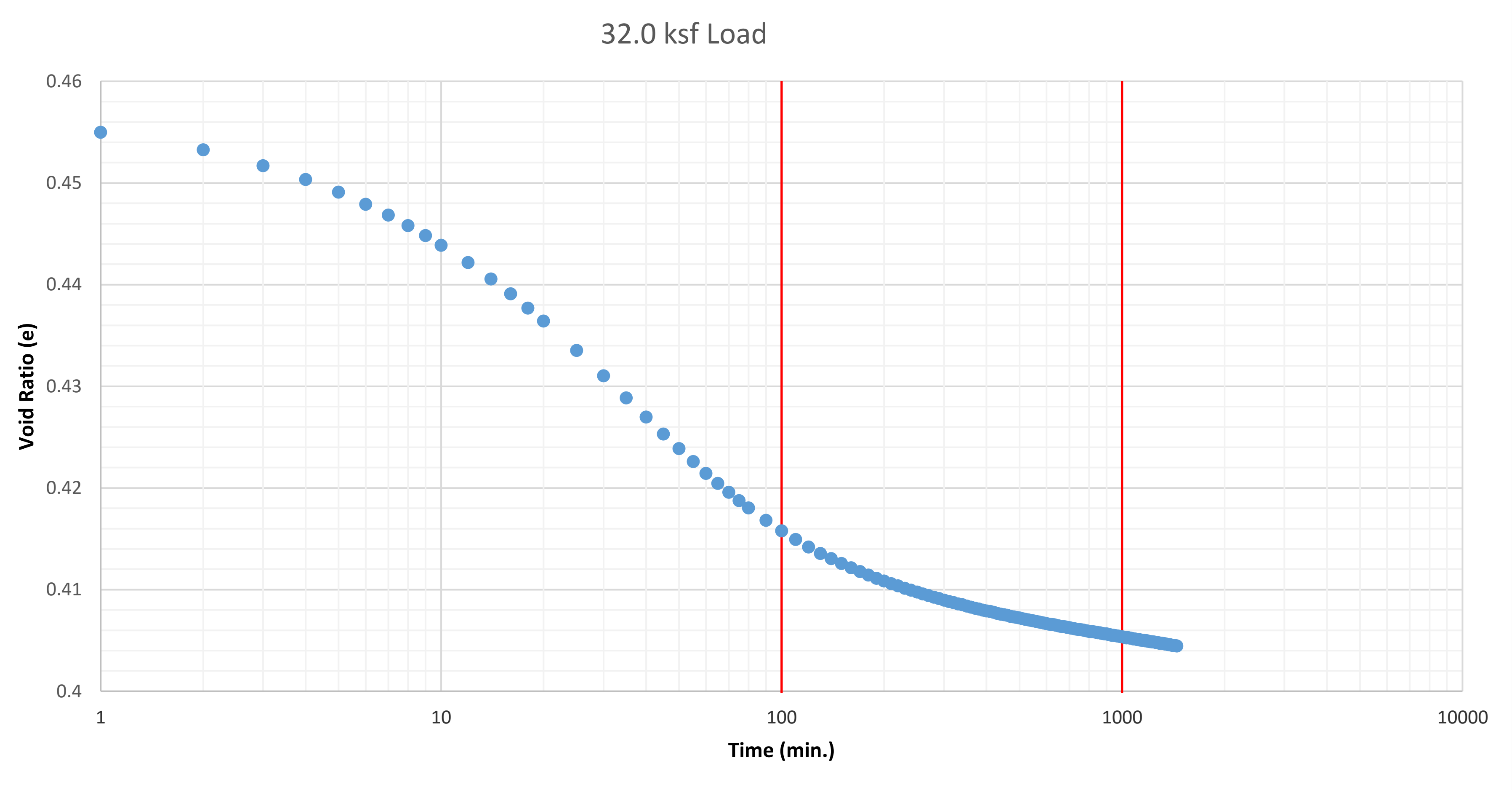
C_α= 0.4734 - 0.4618 = 0.0116

Figure 9h

HWA GEOSCIENCES INC.

ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	I&J Waterway	Sample Number	T01	Moisture Content	21.7	%
Project Number:	2016-112 T700	Sample Depth	21.5-24.5	Saturation	96.8	%
Exploration Number:	SB-3	Soil Description	CL	Dry Density	105.3	pcf



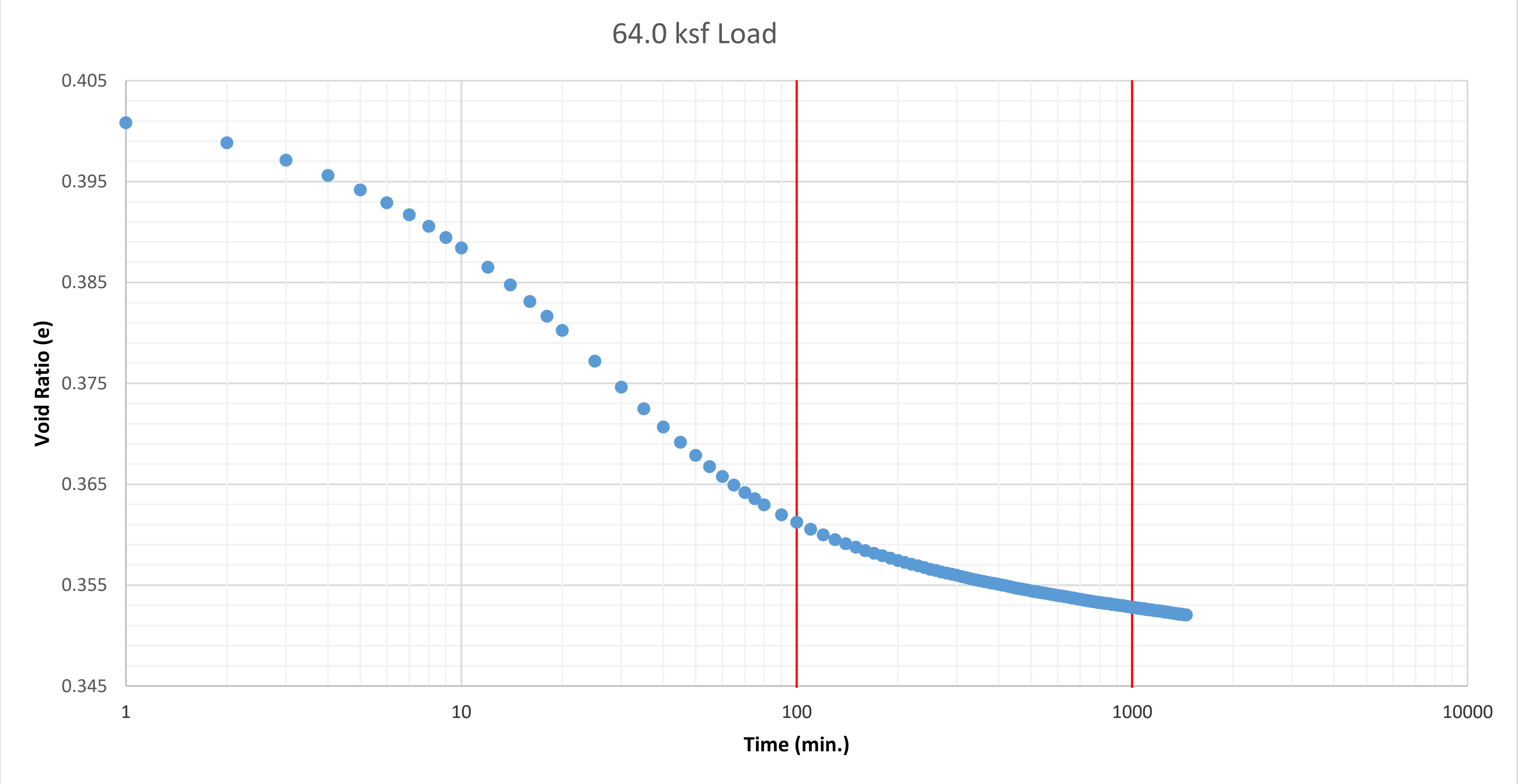
C_{α}=	**0.4158**	-	**0.4053**	=	**0.0104**

Figure 9i

HWA GEOSCIENCES INC.

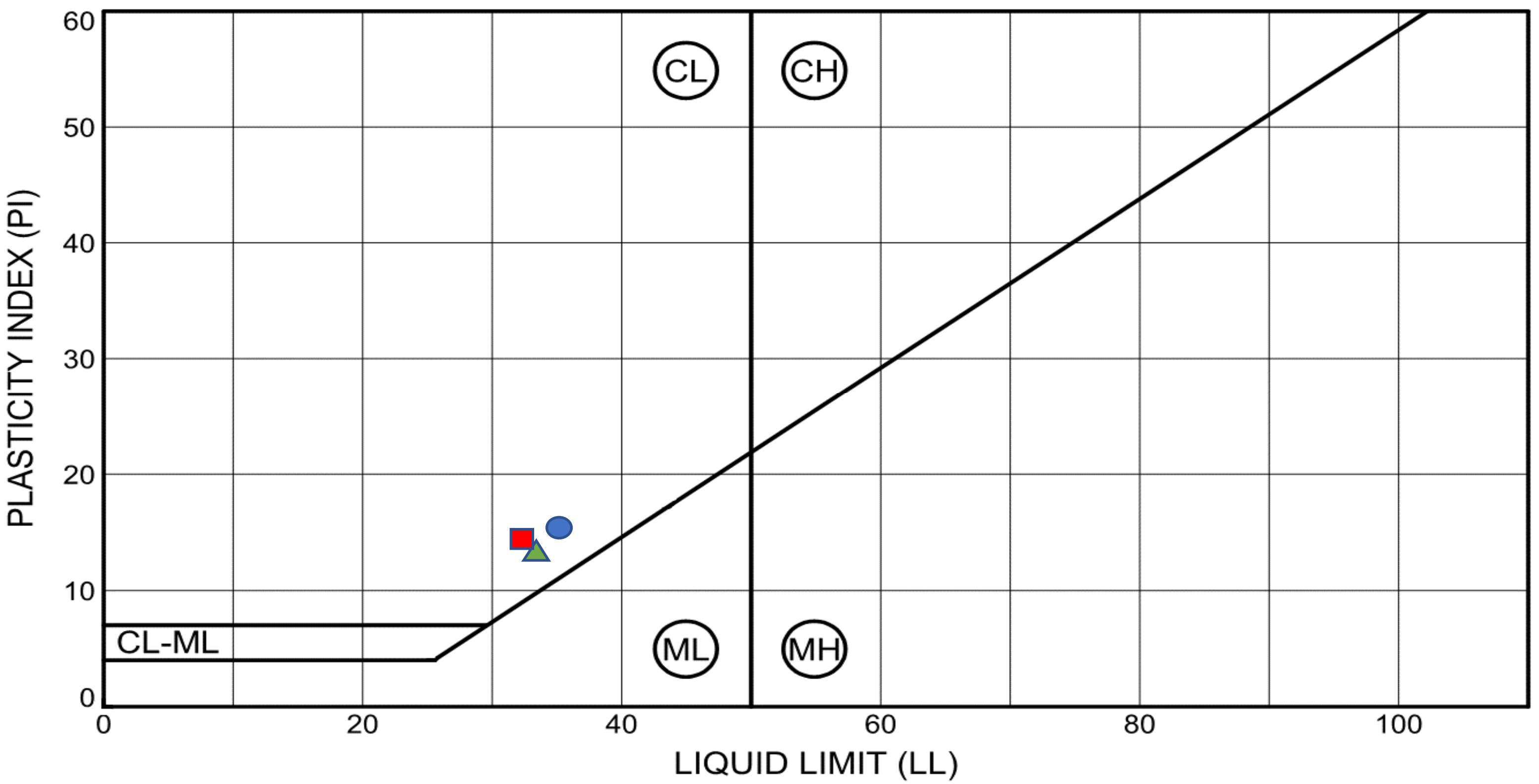
ONE DIMENSIONAL CONSOLIDATION OF SOIL ASTM D2435
SECONDARY COMPRESSION

					Natural	
Project Name:	I&J Waterway	Sample Number	T01	Moisture Content	21.7	%
Project Number:	2016-112 T700	Sample Depth	21.5-24.5	Saturation	96.8	%
Exploration Number:	SB-3	Soil Description	CL	Dry Density	105.3	pcf



C_{α}= 0.3612 - 0.3528 = 0.0084

Figure 9j

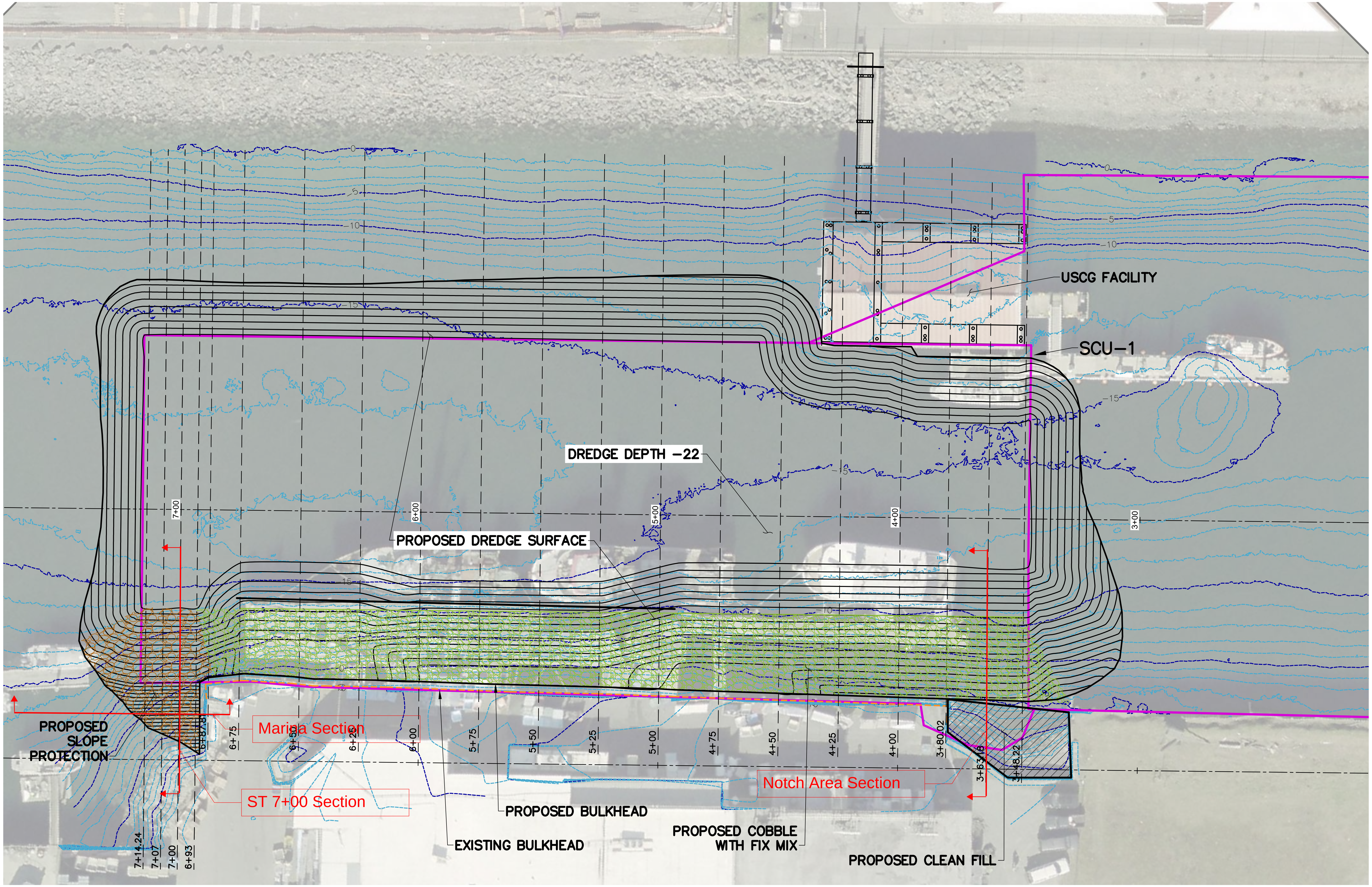


SYMBOL	SAMPLE	DEPTH (ft)	CLASSIFICATION	LL	PL	PI
🔵	IJW-SC-3-3	1.8 - 3.8	Gray to dark gray, silty CLAY (CL)	35	20	15
▲	IJW-SC-4-3	3.7 - 5.7	Gray, silty CLAY (CL)	33	20	13
🟥	IJW-SC-9-3	6.2 - 8.2	Gray to dark gray, silty CLAY (CL)	32	18	14

*Testing data from Eurofins Analytical Report, dated 7/31/2020

Appendix E

Slope Stability Models



NOTES:
1. EXISTING SURVEY:
BATHY JUNE 2020, NW HYDRO
UPLAND SURVEY, JUNE 2020, WILSON ENGINEERING
2. AERIAL: 2019, WHATCOM COUNTY.

Figure E.1 Dredge Plan with Slope Stability Sections

.EVATIONS IN FEET MLLW

20' 0' 20' 40'
SCALE: 1"=20'

PORT OF BELLINGHAM
Washington State

Mark	Description	Date	Appr.
###	###	###	###
###	###	###	###
###	###	###	###
###	###	###	###
###	###	###	###
###	###	###	###
###	###	###	###
###	###	###	###
		###	###

PORT OF BELLINGHAM
I&J WATERWAY CLEANUP & DESIGN

SCU-1 DREDGE PLAN

Designed by: K. LANDON
Date:
Rev. –
Dwn by: KCL
Ckd by:
M&N Project No. 10680
Reviewed by: W. GERKEN
Drawing code:
Submitted by: MOFFATT & NICHOL CRETE CONSULTING, INC.
Drawing Scale:
Plot scale: 1:1 (D SHEET)

moffatt & nichol
600 UNIVERSITY STREET
SUITE 610
SEATTLE, WA 98101

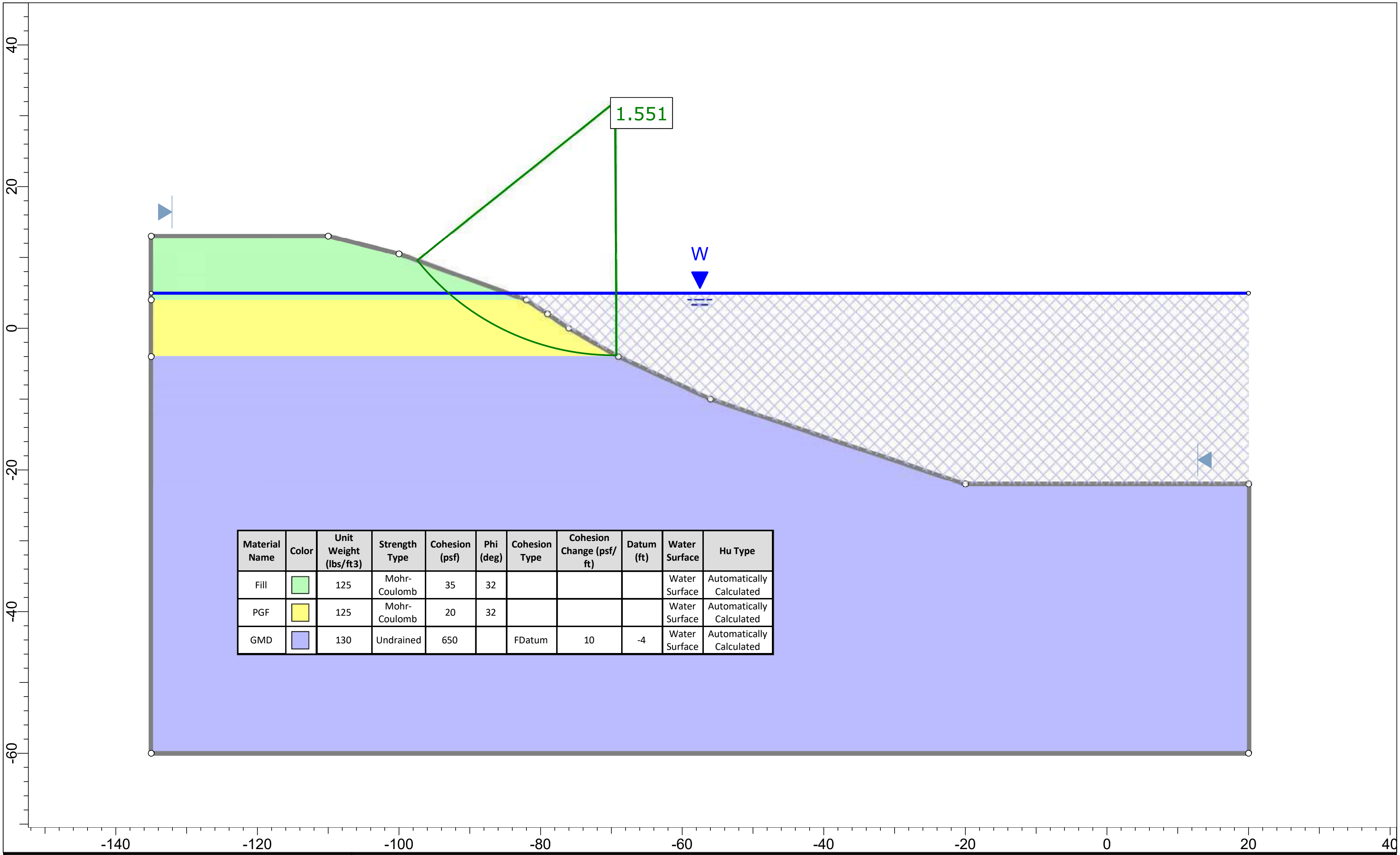
CRETE CONSULTING, INC.

SEAL

Sheet Reference No.

INDEX: OF ####

File: Q:\SEA\10680\CADD\Z–Working\klandon\DredgeDesign_KCL; Plotted: 3/12/2021 5:08 PM by LANDON, KYLE; Saved: 3/12/2021 3:16 PM by KLANDON



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)	Datum (ft)	Water Surface	Hu Type
Fill	🟩	125	Mohr-Coulomb	35	32				Water Surface	Automatically Calculated
PGF	🟨	125	Mohr-Coulomb	20	32				Water Surface	Automatically Calculated
GMD	🟦	130	Undrained	650		FDatum	10	-4	Water Surface	Automatically Calculated

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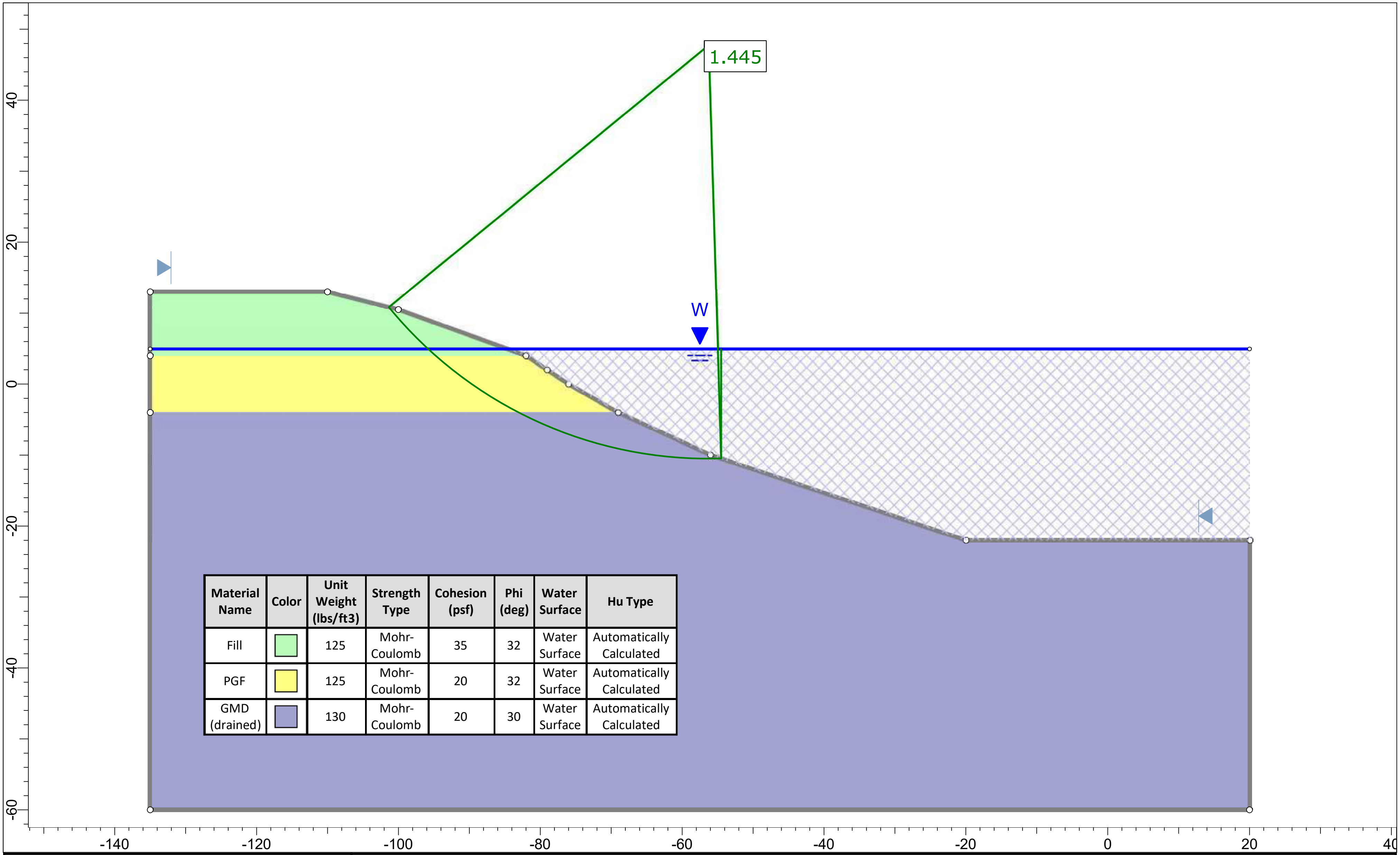
Figure E.2 Existing Notch Area (ST3+63)- Static (GMD undrained)



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type
Fill	🟩	125	Mohr-Coulomb	35	32	Water Surface	Automatically Calculated
PGF	🟨	125	Mohr-Coulomb	20	32	Water Surface	Automatically Calculated
GMD (drained)	🟪	130	Mohr-Coulomb	20	30	Water Surface	Automatically Calculated

Project

SLIDE - An Interactive Slope Stability Program

Figure E.3 Existing Notch Area (ST3+63)- Static (GMD drained)

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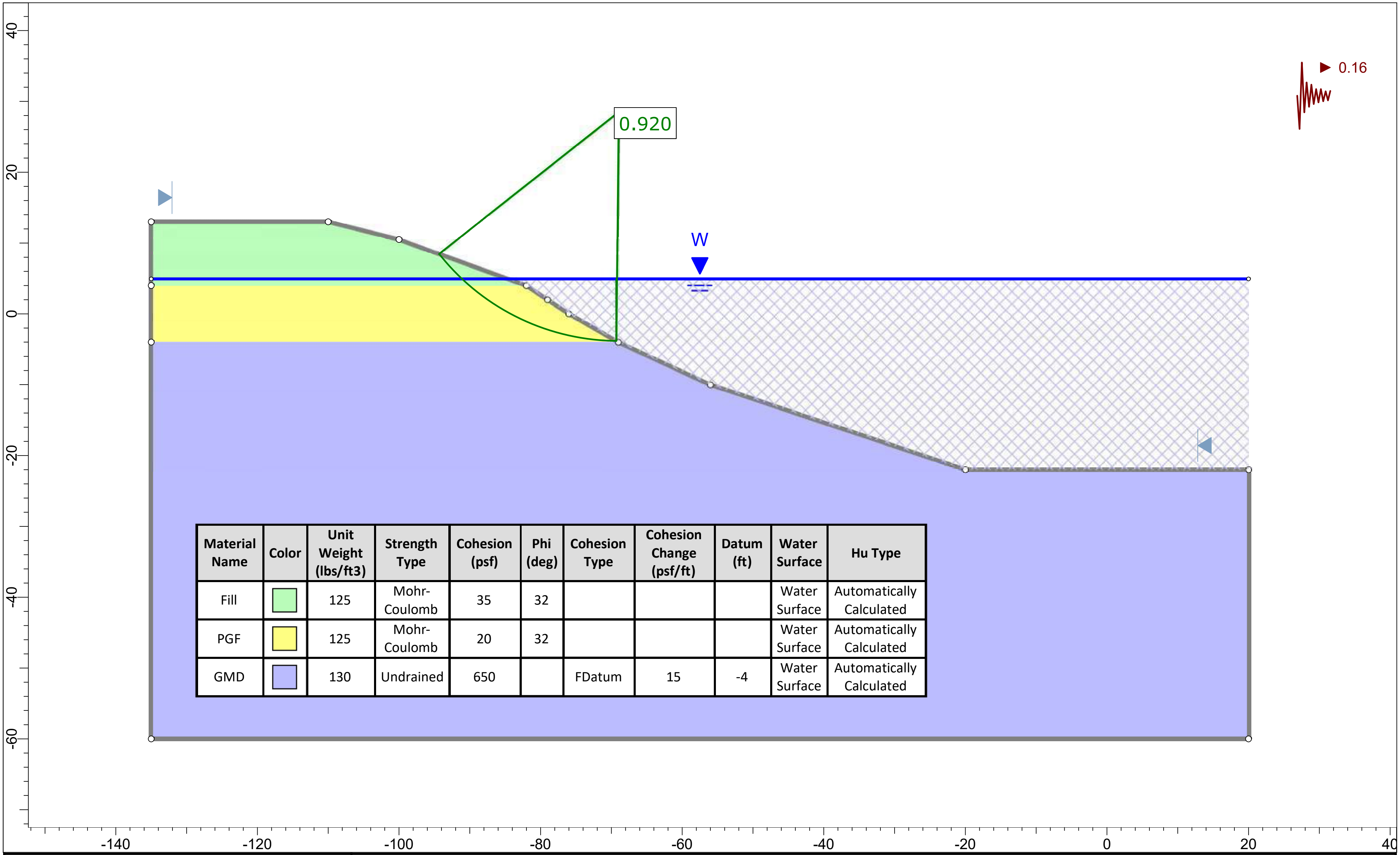

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)	Datum (ft)	Water Surface	Hu Type
Fill	🟩	125	Mohr-Coulomb	35	32				Water Surface	Automatically Calculated
PGF	🟨	125	Mohr-Coulomb	20	32				Water Surface	Automatically Calculated
GMD	🟦	130	Undrained	650		FDatum	15	-4	Water Surface	Automatically Calculated

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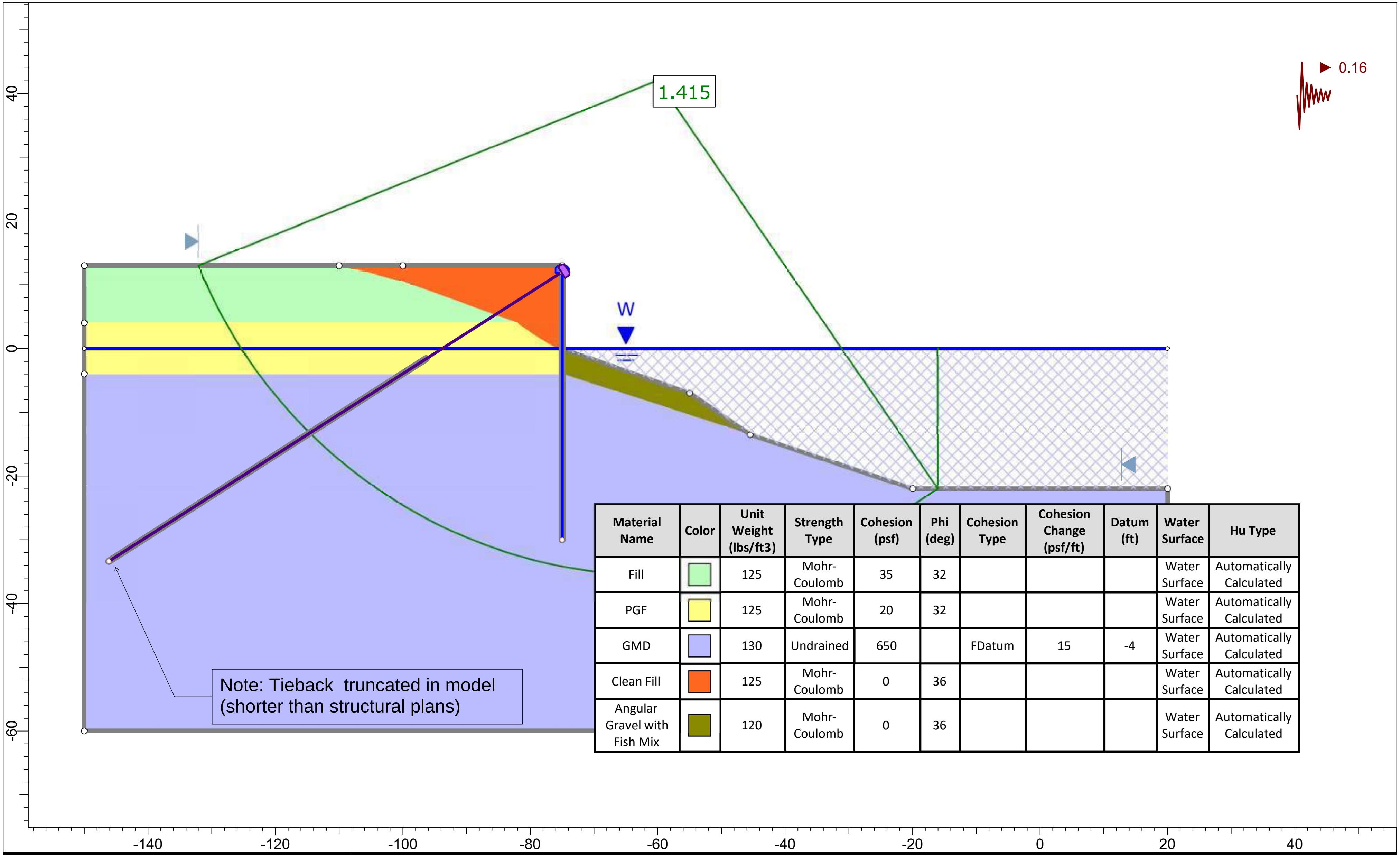
Project

SLIDE - An Interactive Slope Stability Program

Figure E.4 Existing Notch Area (ST3+63)- Seismic



Note: Tieback truncated in model (shorter than structural plans)

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)	Datum (ft)	Water Surface	Hu Type
Fill	🟩	125	Mohr-Coulomb	35	32				Water Surface	Automatically Calculated
PGF	🟨	125	Mohr-Coulomb	20	32				Water Surface	Automatically Calculated
GMD	🟦	130	Undrained	650		FDatum	15	-4	Water Surface	Automatically Calculated
Clean Fill	🟧	125	Mohr-Coulomb	0	36				Water Surface	Automatically Calculated
Angular Gravel with Fish Mix	🟫	120	Mohr-Coulomb	0	36				Water Surface	Automatically Calculated

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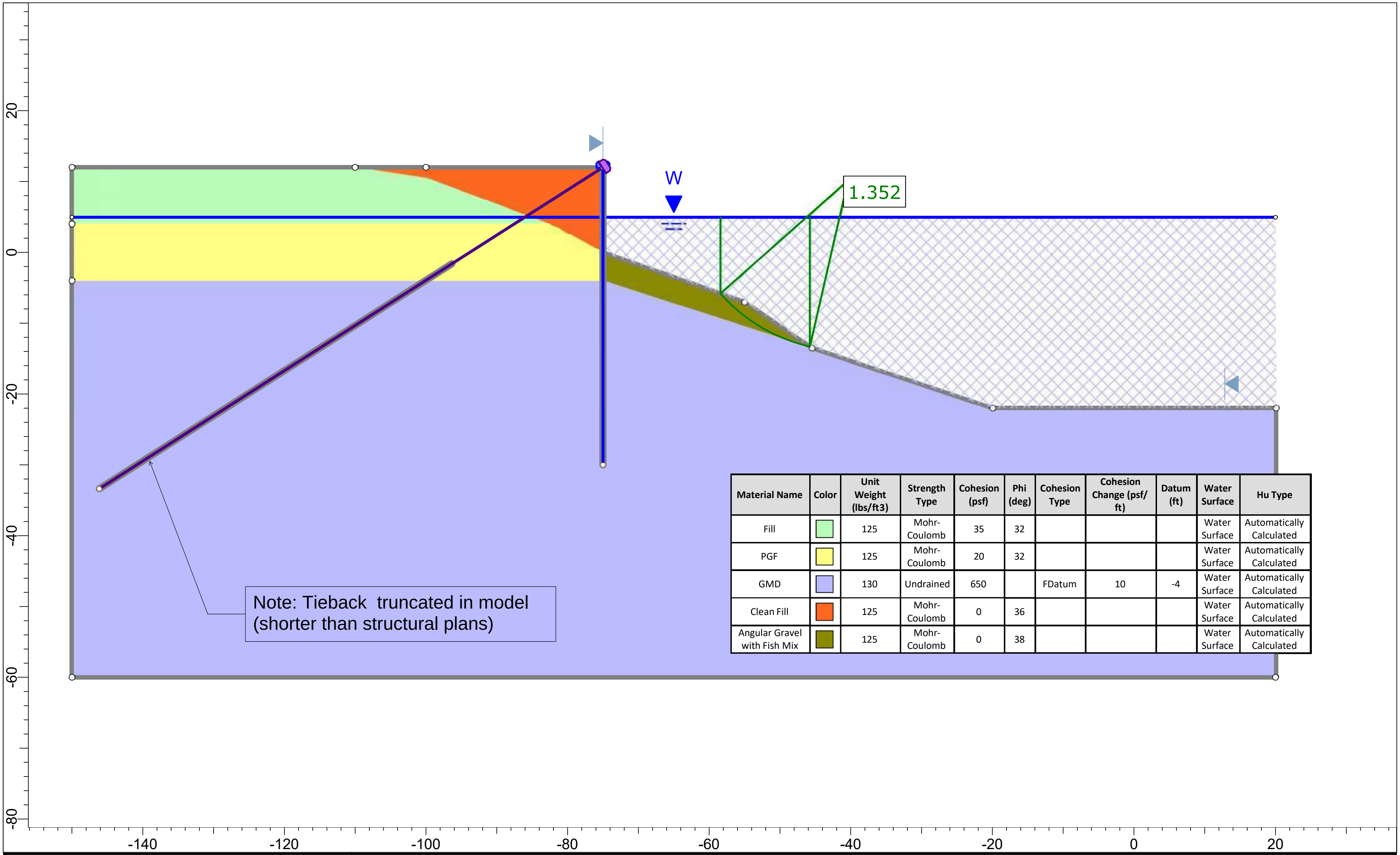
SLIDE - An Interactive Slope Stability Program

Figure E.5 Notch Area with Bulkhead (ST3+63)- Seismic



Note: Tieback truncated in model (shorter than structural plans)

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ ft)	Datum (ft)	Water Surface	Hu Type
Fill	🟩	125	Mohr-Coulomb	35	32				Water Surface	Automatically Calculated
PGF	🟨	125	Mohr-Coulomb	20	32				Water Surface	Automatically Calculated
GMD	🟪	130	Undrained	650		FDatum	10	-4	Water Surface	Automatically Calculated
Clean Fill	🟧	125	Mohr-Coulomb	0	36				Water Surface	Automatically Calculated
Angular Gravel with Fish Mix	🟫	125	Mohr-Coulomb	0	38				Water Surface	Automatically Calculated

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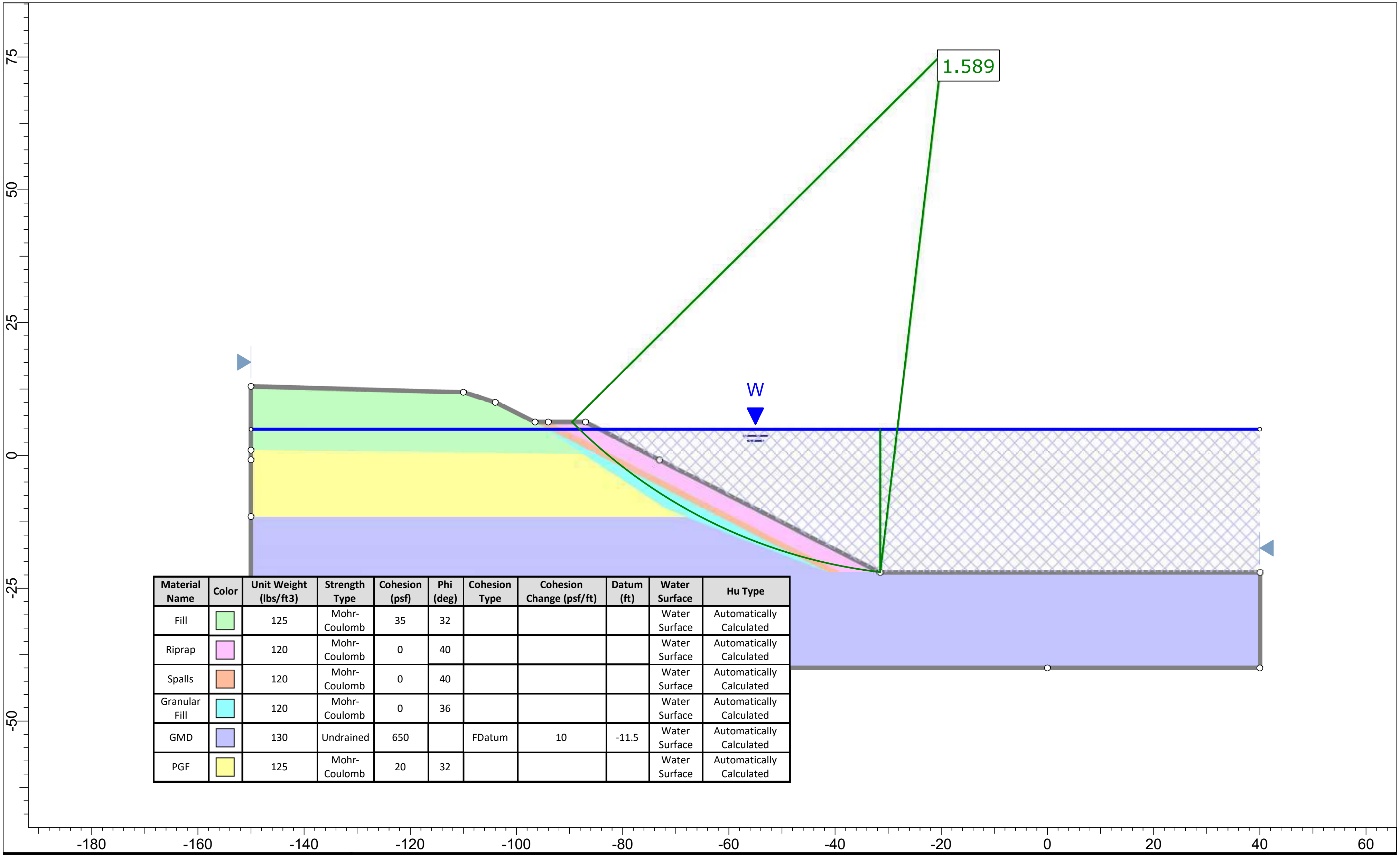
Figure E.6 Notch Area with Bulkhead (ST3+63) Slope Protection - Static



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)	Datum (ft)	Water Surface	Hu Type
Fill	🟩	125	Mohr-Coulomb	35	32				Water Surface	Automatically Calculated
Riprap	🟪	120	Mohr-Coulomb	0	40				Water Surface	Automatically Calculated
Spalls	🟧	120	Mohr-Coulomb	0	40				Water Surface	Automatically Calculated
Granular Fill	🟦	120	Mohr-Coulomb	0	36				Water Surface	Automatically Calculated
GMD	🟪	130	Undrained	650		FDatum	10	-11.5	Water Surface	Automatically Calculated
PGF	🟨	125	Mohr-Coulomb	20	32				Water Surface	Automatically Calculated

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Figure E.7 ST 7+00 - Static (GMD undrained)

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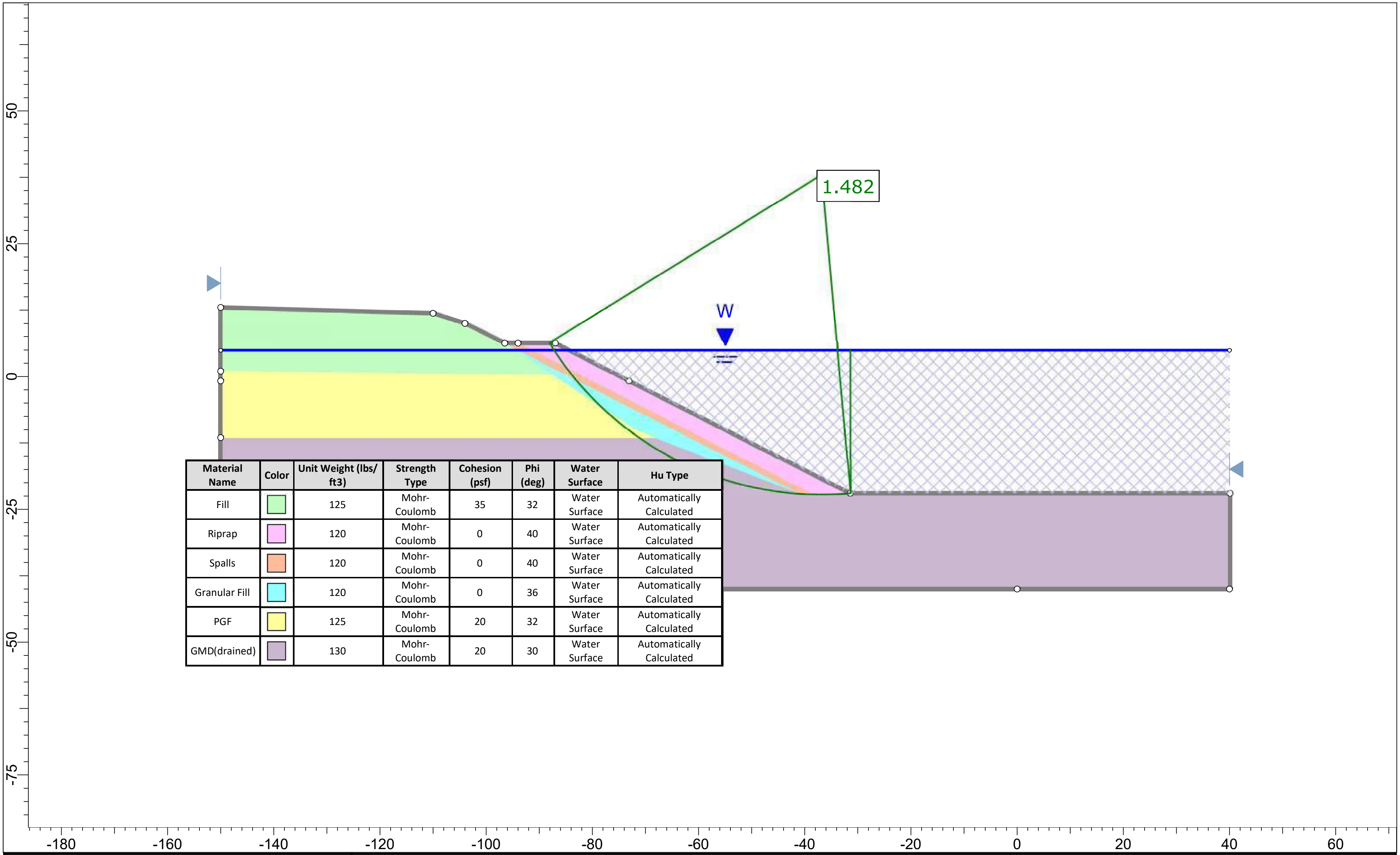

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type
Fill	🟩	125	Mohr-Coulomb	35	32	Water Surface	Automatically Calculated
Riprap	🟪	120	Mohr-Coulomb	0	40	Water Surface	Automatically Calculated
Spalls	🟧	120	Mohr-Coulomb	0	40	Water Surface	Automatically Calculated
Granular Fill	🟦	120	Mohr-Coulomb	0	36	Water Surface	Automatically Calculated
PGF	🟨	125	Mohr-Coulomb	20	32	Water Surface	Automatically Calculated
GMD(drained)	🟪	130	Mohr-Coulomb	20	30	Water Surface	Automatically Calculated

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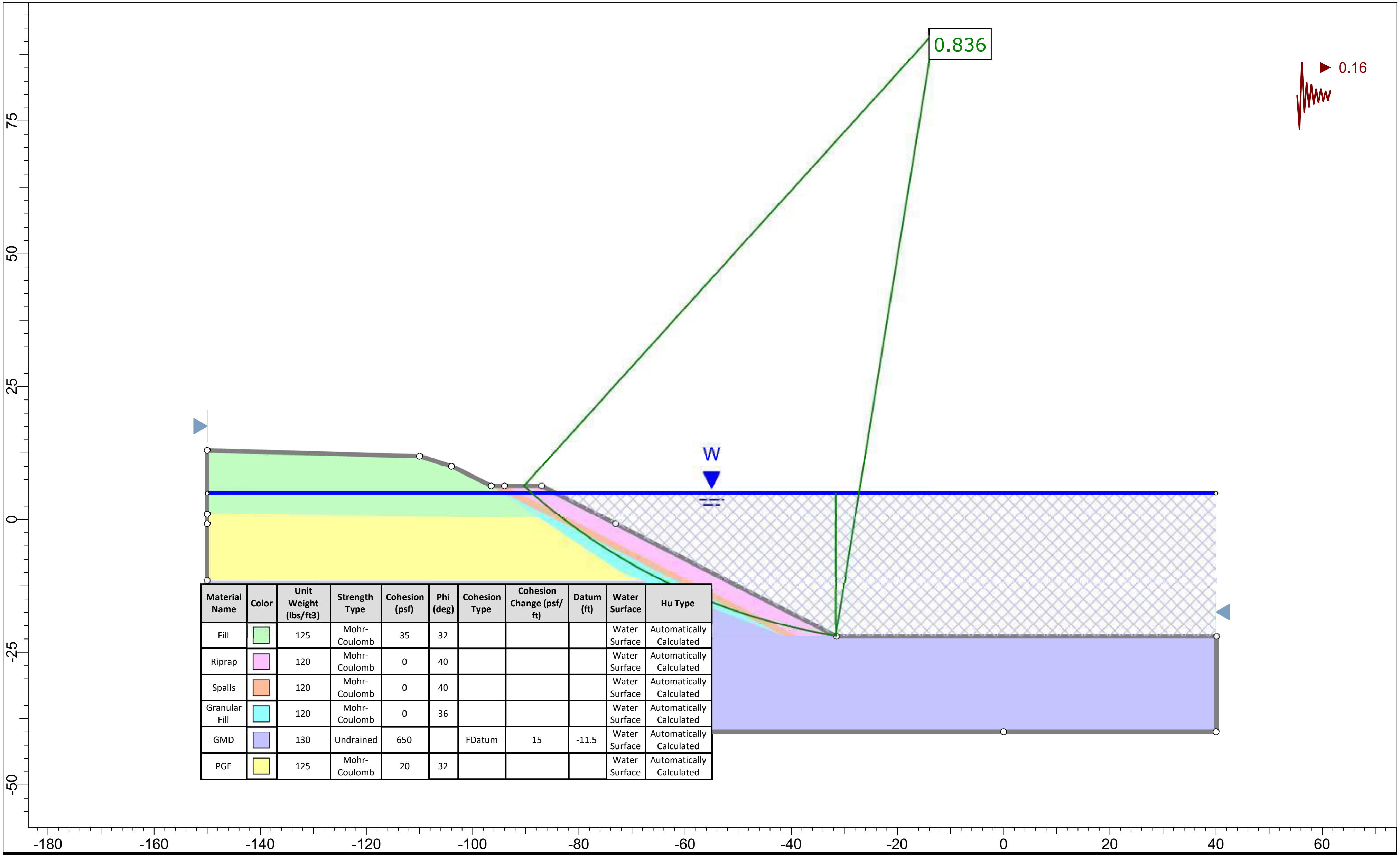
Project

Figure E.8 ST 7+00 - Static (GMD drained)



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)	Datum (ft)	Water Surface	Hu Type
Fill	🟩	125	Mohr-Coulomb	35	32				Water Surface	Automatically Calculated
Riprap	🟥	120	Mohr-Coulomb	0	40				Water Surface	Automatically Calculated
Spalls	🟧	120	Mohr-Coulomb	0	40				Water Surface	Automatically Calculated
Granular Fill	🟦	120	Mohr-Coulomb	0	36				Water Surface	Automatically Calculated
GMD	🟪	130	Undrained	650		FDatum	15	-11.5	Water Surface	Automatically Calculated
PGF	🟨	125	Mohr-Coulomb	20	32				Water Surface	Automatically Calculated

Project

Figure E.9 ST 7+00- Seismic

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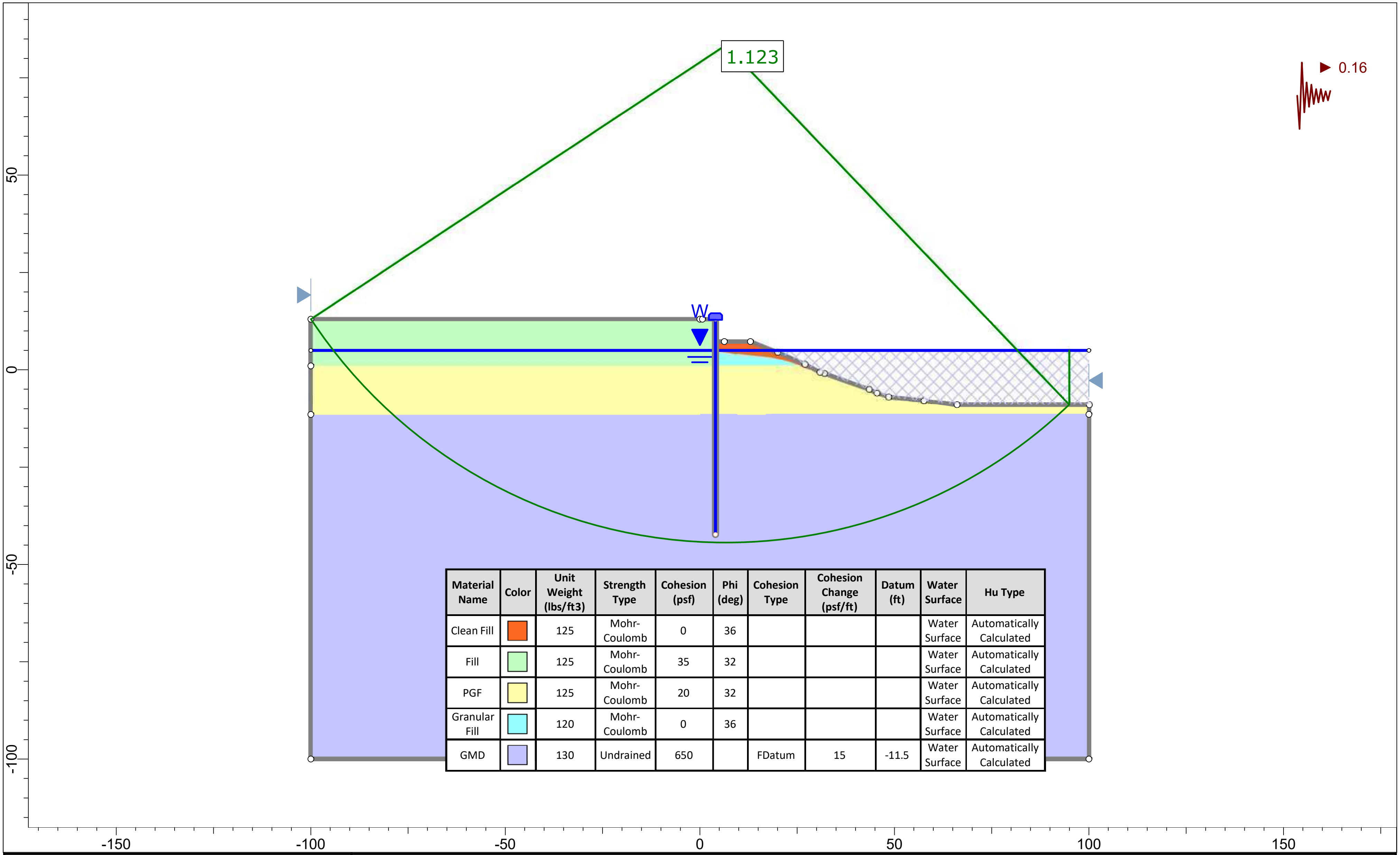

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)	Datum (ft)	Water Surface	Hu Type
Clean Fill	🟧	125	Mohr-Coulomb	0	36				Water Surface	Automatically Calculated
Fill	🟩	125	Mohr-Coulomb	35	32				Water Surface	Automatically Calculated
PGF	🟨	125	Mohr-Coulomb	20	32				Water Surface	Automatically Calculated
Granular Fill	🟦	120	Mohr-Coulomb	0	36				Water Surface	Automatically Calculated
GMD	🟪	130	Undrained	650		FDatum	15	-11.5	Water Surface	Automatically Calculated

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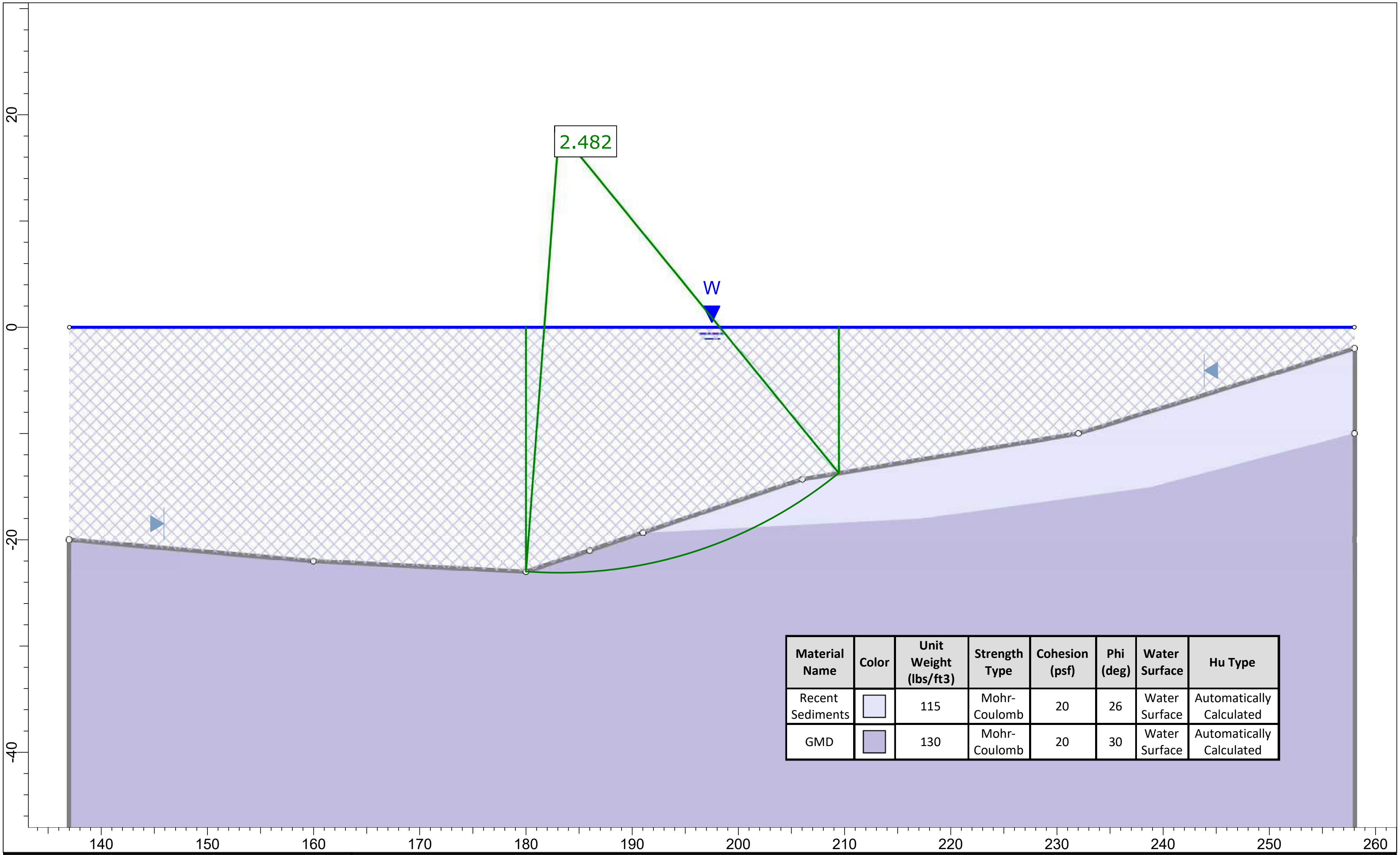
Figure E.10 Marina Section- Seismic



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type
Recent Sediments	□	115	Mohr-Coulomb	20	26	Water Surface	Automatically Calculated
GMD	■	130	Mohr-Coulomb	20	30	Water Surface	Automatically Calculated

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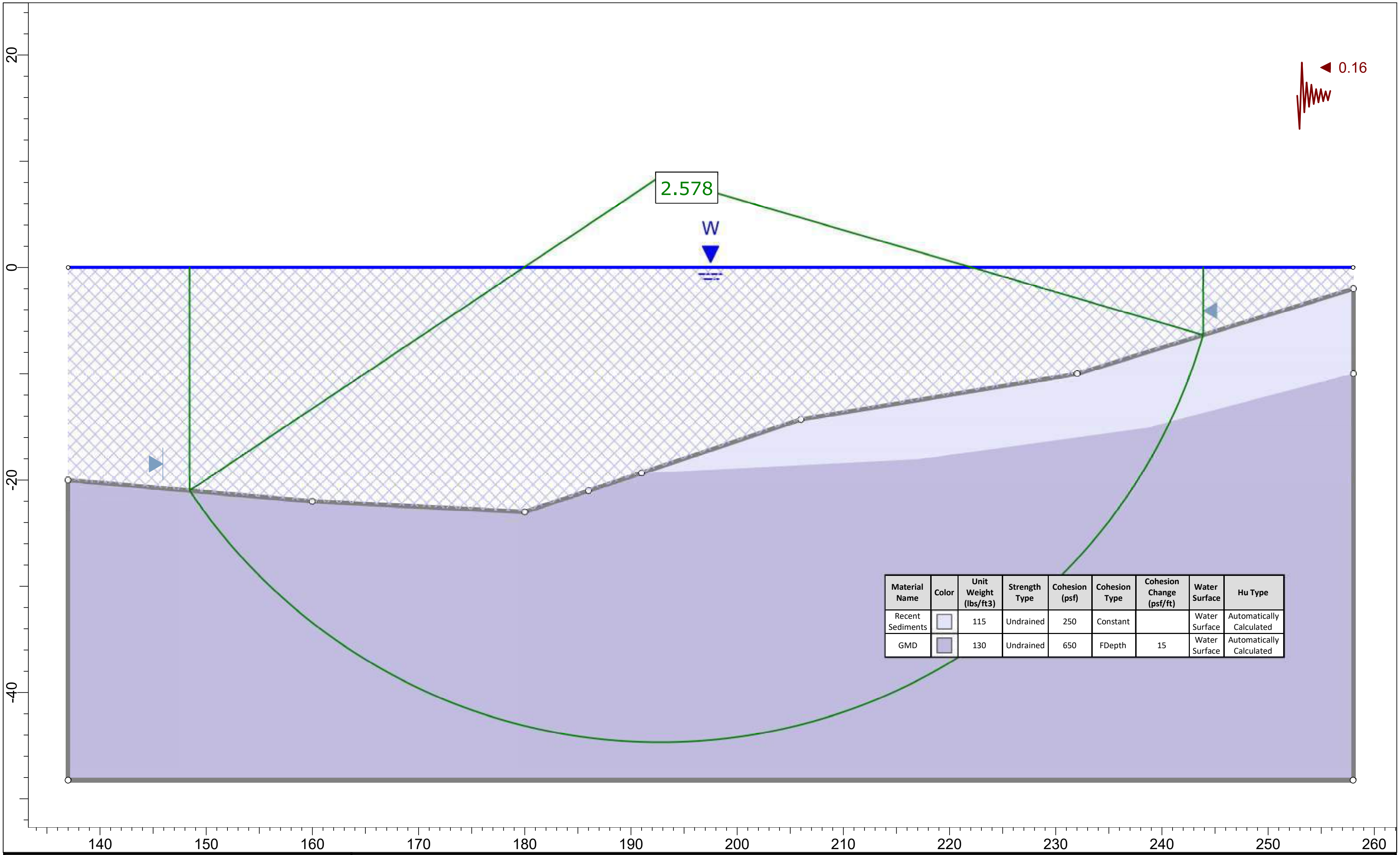
Project

SLIDE - An Interactive Slope Stability Program

Figure E.11 North Slope, 3H:1V Dredge Cut, Static



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Cohesion Type	Cohesion Change (psf/ft)	Water Surface	Hu Type
Recent Sediments	☐	115	Undrained	250	Constant		Water Surface	Automatically Calculated
GMD	▨	130	Undrained	650	FDepth	15	Water Surface	Automatically Calculated

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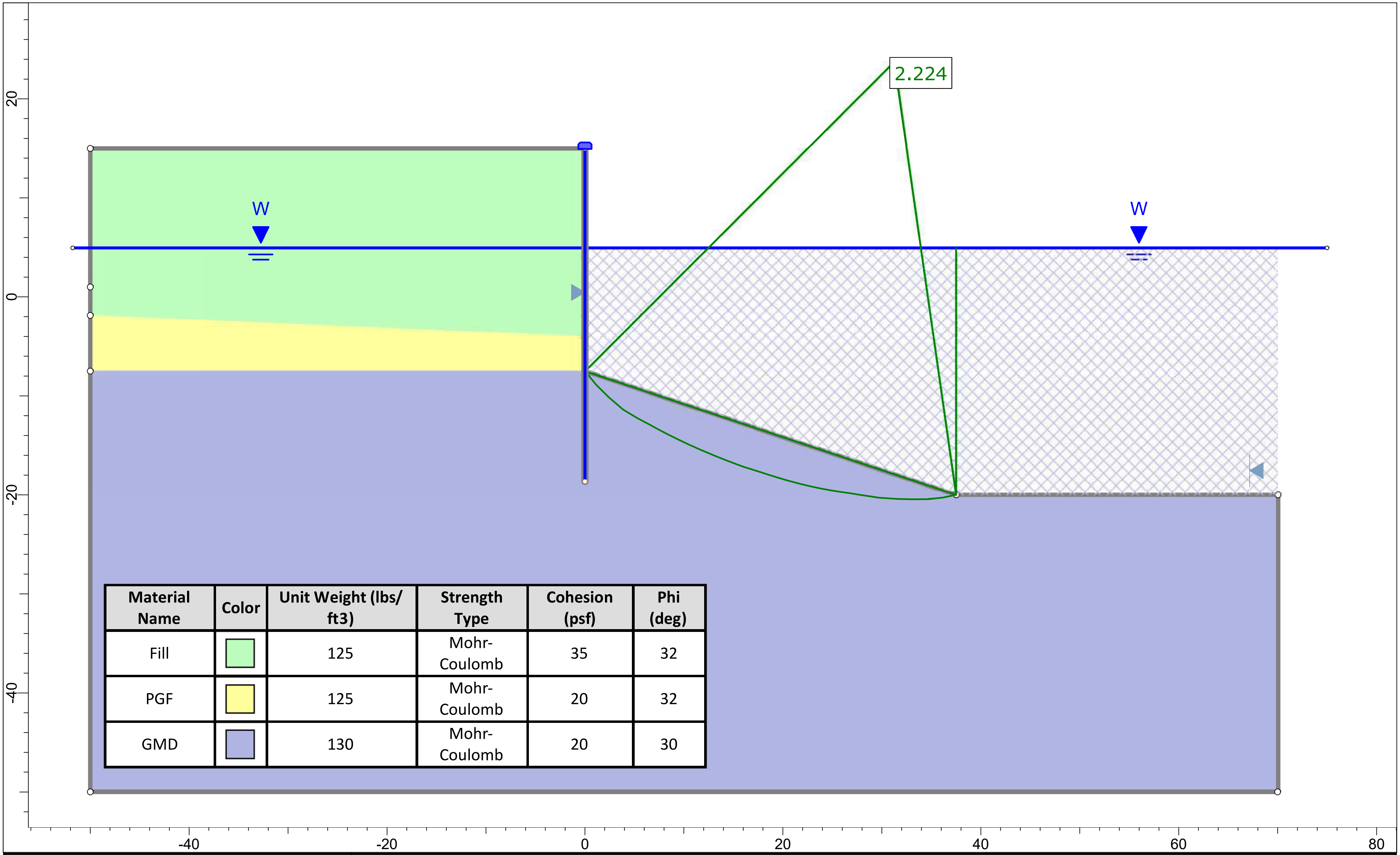
SLIDE - An Interactive Slope Stability Program

Figure E.12 North Slope, 3H:1V Dredge Cut, Seismic



Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Fill	🟩	125	Mohr-Coulomb	35	32
PGF	🟨	125	Mohr-Coulomb	20	32
GMD	🟦	130	Mohr-Coulomb	20	30

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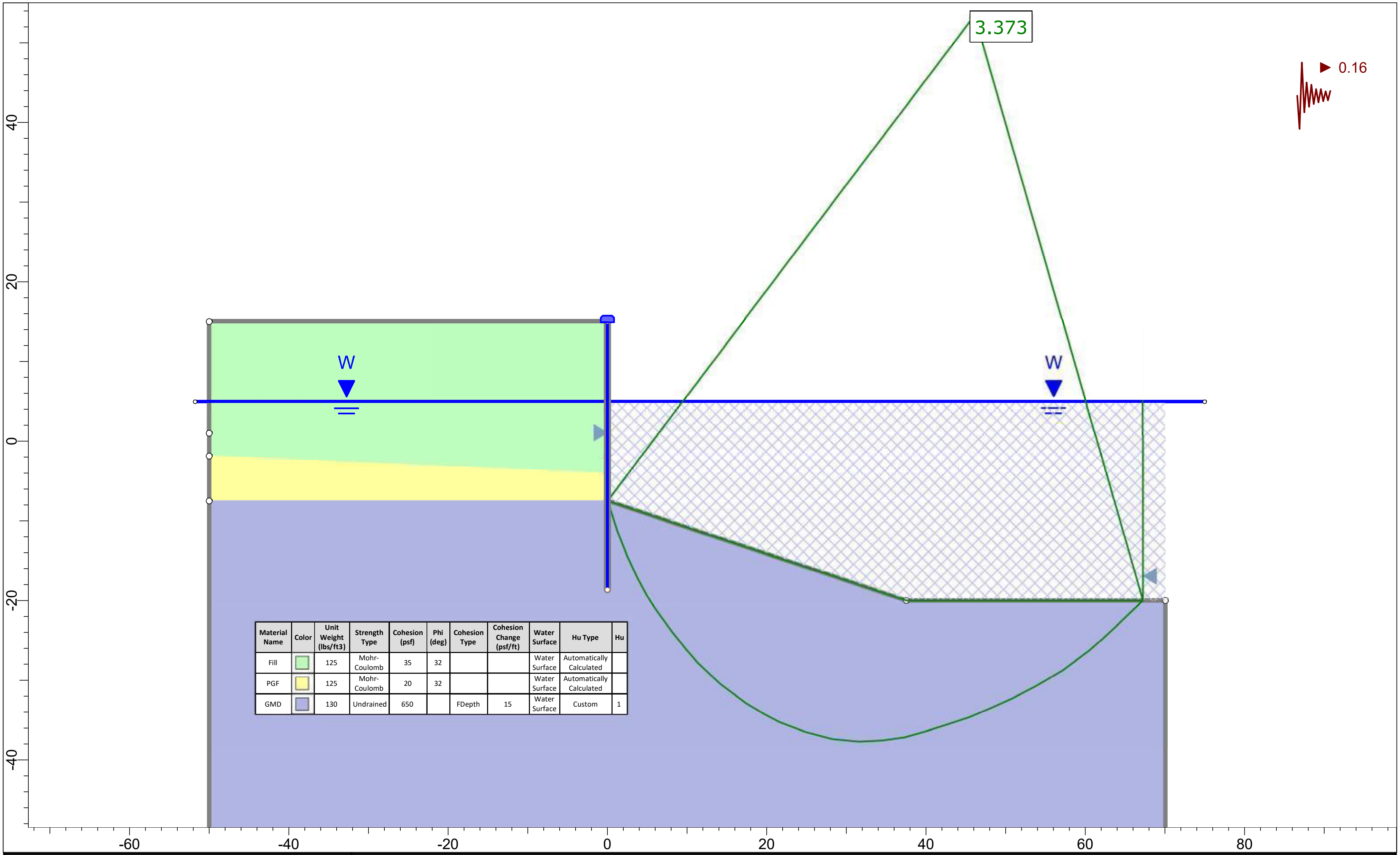
Figure E.13 South Slope, 3H:1V Dredge Cut, Static

SLIDEINTERPRET 9.008



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)	Water Surface	Hu Type	Hu
Fill	🟩	125	Mohr-Coulomb	35	32			Water Surface	Automatically Calculated	
PGF	🟨	125	Mohr-Coulomb	20	32			Water Surface	Automatically Calculated	
GMD	🟦	130	Undrained	650		FDepth	15	Water Surface	Custom	1

rocscience

SLIDEINTERPRET 9.008

Project

SLIDE - An Interactive Slope Stability Program

Figure E.14 South Slope, 3H:1V Dredge Cut, Seismic

Appendix C

Dock and Bulkhead Basis of Design

moffatt & nichol

Basis of Design

Port of Bellingham I&J Waterway Cleanup (Sediment Cleanup Unit 1)

10680

Location:	**Bellingham, Washington**
Client Name:	Port of Bellingham
Submittal Stage	90% Design
Issue Date:	17 January 2022

Rev. #	Issue Date	Originated	Reviewed	Reviewed Date	Description
0	12-11-2020	TTS	B. Ostbo	07 DEC 2020	30% QAQC
1	9-22-2021	TTS	S. Branlund	22 SEP 2021	60% QAQC
2	1-17-2022	TTS	S. Branlund		90% QAQC

Table of Contents

1. General

The following lists the basis-of-design requirements for the replacement and new construction of a fishing vessel dock located on the I&J Waterway. This replacement dock is in conjunction with the State of Washington Department of Ecology Agreed Order No. DE 16186.

1.1. Project Description

The Bornstein Seafoods fish dock and bulkhead, originally constructed in 1946, modified and expanded in 1962, is situated on the southern bank of the I&J Waterway within the Port of Bellingham across, the waterway from United States Coast Guard Station Bellingham. See Figure 1-1 for location of facilities. Per the Washington State Department of Ecology Agreed Order No. DE16186, the existing dock and bulkhead wall are required to be demolished and reconstructed.

The existing dock is a 24-feet-wide by 180-feet-long timber structure with concrete-topped timber decking supported by timber stringers spanning to timber pile caps supported by timber piles. All timber elements are creosote-treated. Dock operations include the temporary mooring of commercial fishing vessels for loading and off-loading cargo. There is an icehouse located on the east end of the dock used to produce ice for vessel loading operations. To the east of the dock is a 120-feet long segmental concrete marina float attached to three, 3-pile timber guide pile clusters. Access to the marina float is provided by an aluminum gangway extending from the top of bulkhead wall.

Figure 1-1 I&J Waterway Aerial View

The existing bulkhead has timber lagging spanning between timber piles. Lateral support is provided by timber piles bearing on the earth below and timber tie-back anchors extending to a deadman anchor system under the existing upland operation area.

1.2. Design and Construction Assumptions

Bornstein Seafood is an active facility with ongoing operations, but operations throughout construction will be limited to inside and immediately around the building. No dock access will be needed by Bornstein. Dredging, bulkhead replacement, and dock construction will be completed in one in-water work window (Mid-August to Mid-February). Work completed after the in-water work window expiration date will be limited to work above the High Tide Line (HTL) elevation.

1.3. Construction Sequence

Construction sequencing will begin with the demolition of the existing dock and extraction of all timber piles. The floating dock will be removed and stored off-site for future reinstallation. After completion of demolition, the new bulkhead wall and tie backs will be installed in front of the existing timber bulkhead while dredging operations commence away from the existing bulkhead face. After the new bulkhead has been installed, the void space between the new steel sheet piles and the existing timber bulkhead will be filled with controlled density fill (CDF). Once the wall is complete and stable, dredging adjacent to the sheet pile face will be completed. With the completion of dredging, riprap protection will be placed on the slope followed by the construction of the new dock.

1.4. Design Life & Service Life

The dock will be designed for a minimum 25-year service life as required by UFC 4-151-10, General Criteria for Waterfront Construction, Section 5-1, Service Life.

1.5. Resiliency and Sea Level Rise

See Coastal Engineering Basis of Design for sea level rise information. For the design of the bulkhead and dock, 50 inches maximum will be used for sea level rise.

1.6. Tidal Elevations

Tidal information is from Station 9449211 NOAA/NAS Tidal Epoch 1983-2001, in units of feet.

• Highest Observed Water Level (HOWL)	10.42
• High Tide Line (HTL)	9.77
• Mean Higher High Water (MHHW)	8.51
• Mean High Water (MHW)	7.79
• Mean Tidal Level (MTL)	5.07

Mean Sea Level (MSL)	4.95
Mean Low Water (MLW)	2.36
NAVD88	0.48
Mean Lower Low Water (MLLW)	0.00
Lowest Observed Water Level (LOWL)	-3.47

1.7. Codes & Standards

American Concrete Institute, ACI 318-19, Building Code Requirements for Structural Concrete

American Institute of Steel, ANSI/AISC 360-16: Specifications for Structural Steel Buildings

American Society of Civil Engineers, ASCE 7-16: Minimum Design Loads and Associated Criteria for Buildings and Other Structures

American Society of Civil Engineers, ASCE 61-14: Seismic Design of Piers and Wharves

American Wood Council, ANSI/AWC NDS-2018: National Design Specifications (NDS) for Wood Construction – with 2018 NDS Supplement

American Welding Society, D1.4/D1.4M-2017: Structural Welding Code – Steel Reinforcing Bars

International Code Council, IBC-2018: International Building Code

Unified Facilities Criteria, UFC 4-151-10 with Change 1 (1 September 2012): General Criteria for Waterfront Construction

UFC 4-152-01 (24 January 2017) Design: Piers and Wharves

UFC 4-152-07 with Change 1 (1 September 2012) Design: Small Craft Berthing Facilities

UFC 4-159-03 (12 March 2020) Moorings

1.8. References

Documents & Reports:

State of Washington, Department of Ecology, Agreed Order No. DE 16186

Exhibit B, Cleanup Action Plan, I&J Waterway Site, April 2019

I&J Waterway Site Sediment Cleanup Unit 1, Geotechnical Engineering Report, Preliminary Draft 30%, McMillen Jacobs & Associates, August 7, 2020

United States Coast Guard Bellingham, Bellingham, WA, Figure 3.1-1, 2003 Waterfront Facility Inspection and Assessment, Appledore Engineering Inc.

Dock Drawings:

M-BBN-328, Port of Bellingham, "Proposed Three Step Bulkhead and Pile and Timber Dock on the I&J Waterway, Dwg No. 02-0400-2

M-BBN-332 & 333, Port of Bellingham, Dock Approach & Earth Fill for I.D.D.#2 – Bornstein, Drawing DK-18, 4May62

Bulkhead Drawings:

Port of Bellingham, Squalicum I&J Waterway Bulkhead, Bellingham, WA, (Preliminary Set 16Sept99), Drawings S-1 through S-3.

Port of Bellingham, Terminal Pier Upgrades; I&J Waterway Bulkhead Restoration, Bellingham, WA (Construction Set 9-04-05), Drawings G-1 & C-1.

1.9. Specifications

Specifications will be provided in MasterSpec format.

2. Design Disciplines/ Sections

2.1. Structural

2.1.1. General Description and Discussion of Design Components

The dock will be constructed over the same footprint as the existing demolished dock. The new dock will consist of concrete-topped, precast, prestressed concrete deck panels spanning to precast concrete pile caps supported by driven steel pipe piles. Provisions for a 60 ton icehouse will be provided on the dock in the similar location as the existing unit.

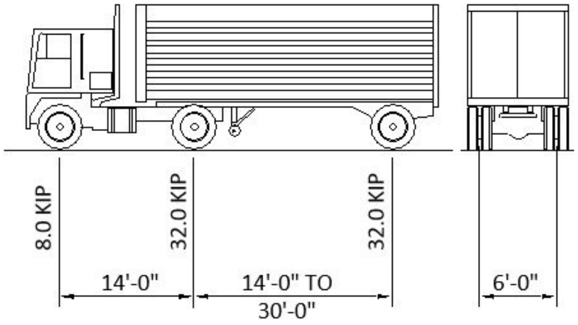
The new bulkhead wall will be constructed in-front (waterside) of the existing timber bulkhead wall. Steel sheet piles will be driven to the required tip elevation. A continuous steel wale connected to pressure grouted tie-back anchors will be used near the top of the wall to provide additional lateral support. The existing bulkhead wall will be abandoned in-place and the space between the existing and new walls will be filled with controlled density fill (CDF).

2.1.2. Loads/Demands

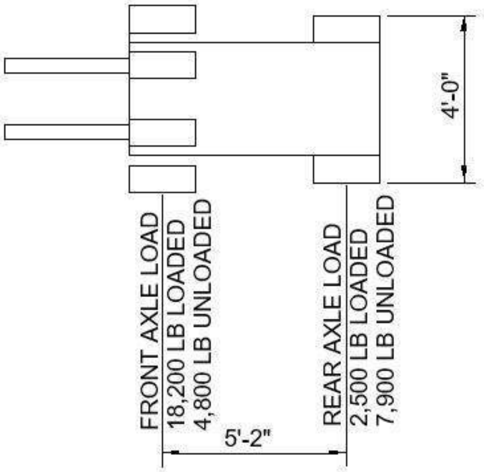
1. Dead Loads = Self-weights of all elements
    a. Unit Weights of Materials:
        i. Hot-Mix Asphalt = 145 pounds per cubic foot (pcf)
        ii. Cast-in-Place Concrete = 150 pcf
        iii. Controlled Density Fill (CDF) = 120 pcf
        iv. Precast/Prestressed Concrete = 160 pcf

        v. Steel = 490 pcf
        vi. Sea Water = 64 pcf
        vii. Fresh Water = 62.4 pcf

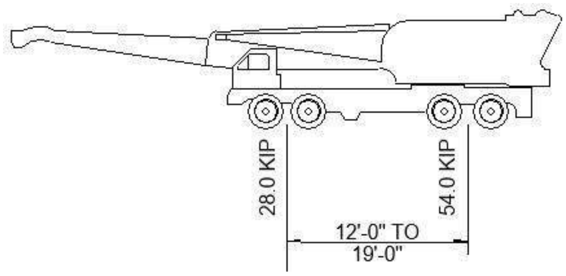
2. Super Imposed Dead Load = 200 pounds per square foot at Icehouse location
3. Live Loads
    a. Dock Uniform = 300 (400 at icehouse) pounds per square foot (psf)
    b. Bulkhead Wall Surcharge
        i. Static = 250 psf maximum
        ii. Seismic = 100 psf
        iii. Post-Seismic = 0 psf liquefaction
    c. Fixed Jib Cranes = 5 Tons with 18-foot minimum radius
    d. Vehicular w/ Impact: (1.15 impact factor applied to axle loads)
        i. HS 20 (For bulkhead design only, cannot physically fit on dock)



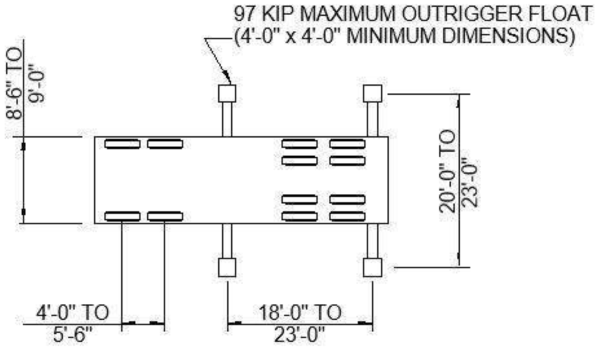
        ii. Forklift = 4 ton



        iii. Mobile Crane = 50 ton (for bulkhead, moving axle loads only)



CRANE TRAVELING - BOOM OVER FRONT



PLAN VIEW

4. Snow Loads: 20 psf Ground
5. Berthing (Recommendations from UFC 4-152-07)
    a. Vessel (dimensions and displacement are approximate for the typical vessel)
        i. Displacement = 400 Tons
        ii. Length Over All = 70 feet
        iii. Beam = 30 feet
        iv. Draft = 15 feet
        v. Approach Velocity = 0.6 feet per second
        vi. Approach Angle = 15 degrees
6. Mooring (Wind, Wave, and Current use Type IIB storm per UFC 4-159-03). Waves will be applied at the highest water level for potential impact on the structure.
    a. Wind: 64 knots (30-second gust)
    b. Wave:
        i. Significant Height = 3.1 feet
        ii. Period = 5.1 seconds
    c. Current: 2 knots maximum
7. Wind on Structure
    a. Ultimate Design Wind Speed (3-Second Gust) = 110 miles per hour

b. Exposure = D

8. Tsunami

a. Not a design consideration

9. Seismic (Site Specific Parameters)

a. Spectral Accelerations (g)

i. Short period spectral response, S_s = 1.00

ii. One-second period spectral response, S_1 = 0.35

b. Site Class = D

c. Site Coefficients

i. F_a = 1.2

ii. F_v = 1.95

d. Design Spectral Response (g)

i. SDS = 0.8

ii. SD1 = 0.46

e. Peak Ground Acceleration adjusted for site effects, PGAm = 0.515g

f. Seismic Design Classification = Low (Life Safety Protection)

g. Seismic Hazard and Performance Requirements

	Operating Level EQ (OLE)		**Contingency Level EQ (CLE)**		**Design EQ (DE)**	
	Ground Motion P.o.E.	Performance Level	Ground Motion P.o.E.	Performance Level	Ground Motion P.o.E.	Performance Level
Low	N/A	N/A	20% in 50 years (224-year return period)	Controlled and Repairable Damage	Design EQ per ASCE 7	Life Safety Protection

h. Analysis Procedure = Force-Based Model Response Spectrum Analysis meeting requirements of ASCE 61-14 Section 3.5-c (R = 1)

2.1.3. Load Combinations

Load combinations will be applied based on the requirements of UFC 4-152-01. Load combinations are provided for both Load Resistance Factored Design (LRFD) and Allowable Stress Design (ASD) in the UFC. LRFD combinations will be used to design structural elements for strength considerations. ASD combinations will be used to design structural elements for serviceability (deflection, vibration) and for soil-structure interaction.

All lateral loads will be applied in two orthogonal directions. Additionally, seismic lateral loads will be applied at 100% in one direction coupled with 30% in the other orthogonal direction. For determination of the values k and k', the following will be used.

$$k = 50\% \text{ of PGAm (LRFD Application)}$$

$$k' = 0.7k = (0.7)*(0.5)*\text{PGAm (ASD Application)}$$

LRFD - UFC 4-152-01 Table 3-7

	U0	U1	U2	U3	U4	U5	U6	U7	U8	U9
Dead, D[a]	1.4	1.2	1.2	1.2	1.2	1.2	1.0+k	1.0-k	1.2	1.2
Live + Impact, L	-	1.6[b]	-	1.6[b]	-	1.6[b]	0.1	-	1.6[b]	1.6
Buoyancy, B	1.4	1.2	1.2	1.2	1.2	1.2	1.2	0.9	1.2	1.2
Berthing, Be	-	-	1.6[c]	-	-	-	-	-	-	-
Current, C	-	-	1.2	1.2	1.2	1.2	-	-	-	1.2
Lateral Earth, H	-	1.6	1.6	1.6	1.6	1.6	1.0	1.0	1.6	1.6
Earthquake, Eq	-	-	-	-	-	-	1.0	1.0	-	-
Wind/Wave in Structure, W	-	-	-	-	1.0	-	-	-	-	1.0
Mooring & Breasting, M	-	-	-	-	-	1.6	-	-	-	-
Creep, Shrinkage, Temp, R, S, T	-	-	-	1.2	-	-	-	-	-	-
Ice & Snow, S	-	-	-	0.5	-	-	-	-	1.0	1.0

ASD - UFC 4-152-01 Table 3-8

	S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
Dead, D[a]	1.0	1.0	1.0	1.0	1.0	1.0	1.0+k’	1.0-k’	1.0	1.0
Live + Impact, L	-	1.0	-	1.0	-	1.0	0.1	-	1.0	0.75
Buoyancy, B	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.6	1.0	1.0
Berthing, Be	-	-	1.0	-	-	-	-	-	-	-
Current, C	-	-	1.0	1.0	1.0	1.0	-	-	-	1.0
Lateral Earth, H	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Earthquake, Eq	-	-	-	-	-	-	0.7	0.7	-	-
Wind/Wave in Structure, W	-	-	-	-	0.6	-	-	-	-	0.6
Mooring & Breasting, M	-	-	-	-	-	1.0	-	-	-	-
Creep, Shrinkage, Temp, R, S, T	-	-	-	1.0	-	-	-	-	-	-
Ice & Snow, S	-	-	-	0.2	-	-	-	-	0.7	0.7

a) 0.9 (0.6 ASD) for checking members for minimum axial load and maximum moment.
b) 1.3 for maximum outrigger float load from a truck crane.
c) Accidental berthing: 1.2 support structure, 1.0 fender system components.
d) Where the effect of H resists the primary variable load effect, a load factor of 0.9 (0.6 for ASD) shall be included with H where H is permanent, and H shall be set to zero for all other conditions.

2.1.4. Materials

1. Concrete
    a. Cast-in-Place Concrete: f'_c=5000 pounds per square inch (psi) minimum compressive strength at 28-days
    b. Precast Concrete: f'_c=6000 psi minimum compressive strength at 28-days.
2. Mild Reinforcing Steel:
    a. ASTM A615 Grade 60, F_y = 60 kips per square inch (ksi)
    b. ASTM A706 Grade 60, F_y = 60 ksi (Weldable)
3. Prestressing Steel: ASTM A416, Grade 270, 7-Wire, Low Relaxation
4. Structural and Miscellaneous Steel
    a. Pipe Piles: ASTM A252, Grade 3 (Modified to 50 ksi)
    b. Sheet & King Piles: ASTM A572, Grade 60, Fy = 60 ksi
    c. Wide Flange: ASTM A992, F_y = 50 ksi
    d. Angles and Channels: ASTM A36, F_y = 36 ksi
    e. HSS Rectangular: ASTM A500, Grade C, F_y = 50 ksi
    f. HSS Round: ASTM A500, Grade C, F_y =46 ksi
    g. Plates: ASTM A572, Grade 50, F_y = 50 ksi
    h. Pipe: ASTM A53, Grade B, F_y =35 ksi
    i. High Strength Bolts: ASTM F3125 Grade 325
    j. Machine Bolts: ASTM A307
    k. Anchor Bolts: ASTM F1554, Grade as specified on drawings
    l. Stainless Steel: AISI Type 316

2.1.5. Coatings

Steel pile piles and sheet piles will be coated with a marine grade coating from the top cut-off elevation to a minimum of 10-feet below the estimated over-dredge mudline.

Unless noted otherwise all structural steel will be hot-dip galvanized per the requirements of ASTM A123.

Unless noted otherwise all structural fasteners will be hot-dip galvanized per the requirements of ASTM A153 and ASTM F2329.

2.1.6. Statement of Special Inspections as required by IBC Chapter 17

Special inspection will be required during the new dock and bulkhead construction. The following statement and referenced tables will be shown on the drawings.

1. The items checked with an "X" must be inspected in accordance with IBC Chapter 17 by an inspector meeting the minimum qualifications outlines in the specifications. For material sampling and testing requirements, refer to the project specifications, the specific general notes sections, and the code sections referenced. Send copies of all structural testing and inspection reports directly to the engineer. Any materials which fail to meet the project specifications must immediately be brought to the attention of the engineer. Special inspection testing requirements apply equally to all bidder design components.
2. Continuous special inspection is defined as the special inspector on site at all times observing the work requiring special inspection. Periodic special inspection is defined as the special inspector on site at time intervals necessary to confirm that all work requiring periodic special inspection is in compliance.
3. Visually inspect all welds.
4. All complete penetration welds must be tested ultrasonically or by use of a comparable approved method.
5. Continuous special inspection by a registered deputy inspector in required for all field welding, concrete with 28-day compressive strength f'_c>2500 psi, high strength bolting, and prestressed concrete.
6. Continuous special inspection of tie-back anchor installation and testing is required. Contractor to submit inspection plan.

Table 1705.3 Required Special Inspection and Test of Concrete Construction

Table 1705.6 Required Special Inspection and Test of Soils

Table 1705.7 Required Special Inspection and Tests of Driven Deep Foundation Elements

AISC 360 Quality Assurance Inspection Requirements for Structural Steel (2010 Edition)

2.2. Electrical

2.2.1. General Description and Discussion of Design Components

A new main Dockside electrical cabinet will be installed at dock and fed by existing area switchboard with 480V 3PH through electrical conduit direct-buried.

Electrical service from Dockside electrical cabinet will provide power to new 5 tons Jib Cranes 1&2 at dock through 3" rigid aluminum conduits (RAC) along dock perimeter.

Two main shore power connections 480V 3PH for vessel will be installed at dock sides and fed by safety GFIC circuit breakers at Dockside main cabinet through same 3" conduit for Jib cranes above.

LED floodlights at top of 30" or 40" poles (see electrical plan view for locations) fed by lighting distribution center with photocell control will be responsible for dock and floating dock areas lighting.

Total of 2x 110VAC and 4x 220VAC GFIC outlets will be distributed at dock sides and fed by a GFIC breakers from 120/220V Outlets Panel.

Total of 7x 240VAC 3PH outlets will be distributed at dock sides and fed by a GFIC breakers from 240V Outlets Panel.

Stain steel junction boxes will be installed along dock perimeter and will connect the 3" RAC conduits for 480VAC 3PH loads services and the 2" RAC conduits for loads as lighting and outlets.

Conduits for 480VAC 3PH feeders and outlets & lighting wiring will be distributed in two main runs conduits along dock perimeter (3" for 480VAC and 2" for outlets & lighting). See Electrical Dockside Plan View.

Stainsteel junction boxes will be installed along dock perimeter and will connect the 3" RAC for 480VAC 3PH and the 2" RAC for loads as lighting and outlets.

2.2.2. Codes, Standard & References

See Electrical Specs for Odes, Standard & References.

2.2.3. Loads/Demands

The loads & demands table are included as part of electrical drawings.

2.2.4. Special Design Criteria

2.2.5. Materials

2.2.6. Assumptions

2.2.7. Sustainable Features

2.2.8. Demolition Requirements

2.2.9. Statement of Special Inspections as required by IBC Chapter 17

2.3. Utilities

2.3.1. General Description and Discussion of Design Components

A new potable water system will be installed in lieu of the existing system. The new system will be upgraded to provide the Bornstein Seafoods fish dock with potable water. The new potable water system will consist of 2-inch Type K Copper tubing and 2-inch schedule 80 PVC, below the deck, 1-inch galvanized steel aboveground, and 1-inch hose bibbs. The dock will be equipped with a total of four hose bibb connections throughout the fishing dock.

The potable water system will not be winterized. The system will be equipped with drains to remove water from the system during the wintertime to prevent it from freezing.

2.3.2. Codes, Standard & References

Bellingham Municipal Code, 2021

Unform Plumbing Code, 2021

2.3.3. Loads/Demands

The flow rate was determined per the Uniform Plumbing Code (UPC). The UPC assigns a fixture unit of 2.5 to the first hose bibb and a fixture unit of 1 for each additional hose bibb in the same water distribution segment. Referencing Table A 103.1 and Chart A 103.1(2) the flow rate required for the potable system is 5 gallons per minute (gpm). Table 2-1 below indicates the water supply fixture units and demand required.

Table 2-1 Water Supply Fixture Units and Demand

Number of Hose Bibbs	Fixture Units	Demand Load (gpm)
4	5.5	5

The system is sized for a minimum residual pressure of 8 pounds per square inch gauge (psig) at the hydraulically most remote hose bibb and for the fluid velocity not to exceed 10 feet per second.

2.3.4. Materials

Piping

- ASTM D1784 (2020) Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
- ASTM D1785 (2015; E 2018) Standard Specification for Poly (Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
- ASTM D2467 (2015) Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
- ASTM B88 (2020) Standard Specification for Seamless Copper Water Tube
- ASME B16.18 (2018) Cast Copper Alloy Solder Joint Pressure Fittings
- ASTM A53/A53M (2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
- ASME B16.3 (2016) Malleable Iron Threaded Fittings Classes 150 and 300
- ASME B16.4 (2016) Standard for Gray Iron Threaded Fittings; Classes 125 and 250

2.3.5. Demolition Requirements

All piping, fittings, valves, hose bibbs and appurtenances will be removed throughout the existing fish dock downstream of the existing bulkhead penetration.

Appendix A: Geotechnical Engineering Report

[Insert Appendix]

moffatt & nichol

Appendix D

Construction Quality Assurance Plan

APPENDIX D
CONSTRUCTION QUALITY ASSURANCE PLAN

Final

I&J Waterway Site
Sediment Cleanup Unit 1
Bellingham, Washington

Project Number: 036-001

Prepared for:

Port of Bellingham and
Bornstein Seafoods, Inc.

October 20, 2023

Prepared by:

CRETE
CONSULTING, INC.

Table of Contents

Figures

Acronyms and Abbreviations

ARAR	Applicable or Relevant and Appropriate Requirement
BMP	best management practice
Bornstein	Bornstein Seafoods, Inc.
CAP	Cleanup Action Plan
CDL	Commercial Driver's License
CESCL	Certified Erosion and Sediment Control Lead
CFR	Code of Federal Regulations
Contractor	prime construction contractor
CQAP	Construction Quality Assurance Plan
CQCP	Construction Quality Control Plan
CS	Contractor Superintendent
CWA	Clean Water Act
CWP	Construction Work Plan
cy	cubic yard
DOT	Department of Transportation
Ecology	Washington Department of Ecology
EPA	United States Environmental Protection Agency
EDR	Engineering Design Report
ESA	Endangered Species Act
HAZWOPER	Hazardous Waste and Emergency Operation
HASP	Health and Safety Plan
HLT	High Tide Line
MLLW	mean lower low water
NPDES	National Polluant Discharge Elimination System
PE	Project Engineer
PM	Project Manager
Port	Port of Bellingham
PPC	Port Project Coordinator
PPM	Port Project Manager
Project	SCU-1 cleanup
QA	quality assurance
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	quality control
QCR	Quality Control Representative
RACL	Resource Agency Consultation Lead
RAO	remedial action objective
RCW	Revised Code of Washington
RE	Resident Engineer

RML	Residuals Management Layer
RPM	Remedial Project Manager
SAP	Sampling and Analysis Plan
SCU-1	Sediment Cleanup Unit 1
SHSS	Site Health and Safety Supervisor
SMS	Sediment Management Standard
SQS	Sediment Quality Standard
SWPPP	Stormwater Pollution Prevention Plan
TL	Technical Lead
TBD	To Be Determined
WAC	Washington Administrative Code
WQC	Water Quality Certification
WQMP	Water Quality Monitoring Plan
WQS	Water Quality Specialist

1 Introduction

This draft Construction Quality Assurance Plan (CQAP) describes the means that will be used to confirm that the goals for the cleanup action have been achieved for Sediment Cleanup Unit 1 (SCU-1) of the I&J Waterway site in Bellingham, Washington.

The CQAP has been prepared to satisfy the requirements of Agreed Order No. DE 16186 (Agreed Order) and the Cleanup Action Plan (CAP) issued by Washington Department of Ecology (Ecology) (Ecology 2019a, 2019b). The CQAP, together with the Compliance Monitoring and Contingency Response Plan (CMCRP, Appendix E of the Engineering Design Report [EDR; CRETE 2022]) and the Water Quality Monitoring Plan (WQMP, Appendix F of EDR) are intended to satisfy the overall compliance monitoring requirements set forth in WAC 173-340-410.

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. Implementation of the cleanup action will be performed under a future separate legal agreement.

The CQAP also incorporates guidance and standard practices identified in the Washington Department of Ecology's (Ecology) *Sediment Cleanup Standards User Manual* (Ecology 2019c), the United States Environmental Protection Agency's (EPA) *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (EPA 2005), EPA's *Methods for Evaluating the Attainment of Cleanup Standards* (EPA 1989), and considers all Applicable or Relevant and Appropriate Requirements (ARARs).

The CQAP will be finalized in coordination with the contractor in the development of its Construction Work Plan (CWP), incorporating site-specific plans for the various remedial construction activities.

1.1 Overview of Cleanup Action

The I&J Waterway site is located within Bellingham Bay between Hilton Avenue and Bellwether Way on the Bellingham waterfront. 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.

The CAP describes the cleanup action objectives for SCU-1 as follows:

- Surface Sediment: Use appropriate technologies including active and/or passive measures to ensure compliance with Site cleanup levels in the bioactive zone of subtidal sediment, and in the clamming/beach play zone of intertidal sediment

- Subsurface Sediment: Where subsurface sediment has the potential to become exposed, use appropriate technologies including active and/or passive measures to ensure long-term compliance with Site cleanup levels in the bioactive zone
- Applicable Laws: Ensure that implementation of the cleanup action complies with other applicable laws.

The cleanup action includes removal of contaminated sediment in the Dock, Floating Dock, Berthing Area, and Navigation Channel West site units. Details of the cleanup action are described in the EDR.

Dredged sediments will be disposed in an upland permitted facility. Contaminated sediment within the authorized navigational channel will be removed by dredging to a clean surface, to the extent technically feasible. Removal activities will incorporate best practices to limit sediment resuspension. Stable post-dredge side slopes will be established between SCU-1 and SCU-2, and adjacent areas around the perimeter of the dredge footprint. Removal of contaminated sediment from the Dock and Floating Dock units will require removal and replacement of the existing dock and bulkhead.

1.2 Activities Addressed by this Plan

This CQAP describes the cleanup confirmation methods for the SCU-1 cleanup action. It describes the collection and analysis of data used to determine and document the adequacy/completeness of sediment removal and backfilling. As described in the EDR, approximately 17,300 cubic yards (cy) of sediment, plus associated shoreline debris, will be dredged from the waterway. To facilitate removal of contaminated sediments and debris beneath the existing Bornstein dock and floating dock, these structures will be demolished and removed, including removal of supporting pilings. Dredged sediment will be dewatered on dredging scows within the dredge prism, prior to shipping to an offsite transloading facility for transfer to trucks and/or trains and disposal at an approved Subtitle D landfill.

Following dredging, a thin layer of sand (4 to 6 inches) will be placed over the dredge prism footprint to address potential dredge-generated “residuals” that cannot be removed due to the practical limitations of the dredging equipment. Rock armoring will then be placed on the shoreline slope adjacent to the Bornstein dock berthing area and the transition slope at the west end of the dock to protect against vessel scour and wave erosion. The slope armor adjacent to the berthing areas (scour protection area) will be covered with 6-18 inches of fish mix. The docks will then be reconstructed, including installation of piling foundation support and a bulkhead structure immediately adjacent to the existing bulkhead, which will remain in place.

1.2.1 Work Sequence and Schedule

Construction sequencing will begin with the demolition of the existing dock and extraction of timber piles. The Bornstein floating dock will be removed and stored off-site at a location to be determined for future reinstallation. After completion of demolition, the new bulkhead wall and tie backs will be installed in front of the existing timber bulkhead while dredging operations commence away from the existing bulkhead face. Once the wall is complete and stable, dredging adjacent to the sheet pile face will be completed. With the completion of dredging, residuals management layer (RML) and riprap slope protection will be placed followed by construction of the replacement dock.

Bornstein is an active facility, but Bornstein operations throughout construction will be limited to inside and immediately around the building. No dock access will be needed by Bornstein. All dredging, bulkhead replacement, and dock construction will be completed in one in-water work window (mid-August to mid-February). Select work that is determined to be acceptable may occur between mid-February through March 14. Work completed after the in-water work window expiration date will be limited to work above the High Tide Line (HTL) elevation, currently assumed to be 9.8 feet mean lower low water (MLLW).

The overall sequence for the project will be refined after the contractor is selected. The general construction schedule includes:

- Contractor mobilization in Summer 2022, pending receipt of all permits and approvals
- Shoring and upland site preparation will occur with in water work starting August 1, 2022
- Work will continue through the end of the 2022/2023 fish window with upland completion extending to May 2023
- Site restoration, pre-certification inspections, and demobilization will be complete by approximately summer of 2023.

1.3 Document Organization

This CQAP contains the following sections: Project Organization and Responsibilities (Section 2), Reporting (Section 3), and Cleanup Action Construction Elements with associated quality assurance monitoring (Section 4). Section 4 also discusses the criteria for confirmation of successful sediment removal and the data that will be used to assess completeness of the construction elements. Sediment grab samples will be collected to measure baseline chemical concentrations for long-term compliance monitoring. Sampling and analyses will be performed in accordance with the Quality Assurance Project Plan developed for the site.

2 Project Organization and Responsibilities

2.1 Personnel Responsibilities

The project team organization chart and roles are presented in Figure 2-1 and briefly described in the following sections.

2.1.1 Washington Department of Ecology

Ecology is the regulatory authority responsible for authorizing and overseeing the cleanup action design and implementation. In this capacity, Ecology will review the design documents, construction work plans, and other contractor submittals to verify consistency with the CAP, Agreed Order, and ARARs. The Ecology Site Manager (ESM; Lucy McInerney), or designee, will provide construction oversight on behalf of Ecology, review related construction deliverables, coordinate with other agencies in response to input and/or concerns, and coordinate with the Port and Bornstein, as necessary to ensure that the cleanup meets the remedial action objectives and is implemented in accordance with the CAP and Agreed Order. Ecology, the Port, and Bornstein will work jointly to resolve issues and unforeseen problems that may develop during implementation of the cleanup.

2.1.2 Port of Bellingham and Bornstein Seafoods

The Port and Bornstein are responsible for implementation of the cleanup actions in accordance with the Agreed Order and CAP. The Project Coordinator for Bornstein is Jay Bornstein. Serving on behalf of these parties, the Port will be responsible for developing and executing the construction contract for the cleanup action and will oversee the implementation of this CQAP. The Port Project Manager (PPM; Ben Howard) will be responsible for executing the Port's responsibilities and will serve as the point of contact with Ecology. The Port will retain the remedial construction contractor and review its work products to verify consistency with the approved design. The Port will coordinate with Ecology throughout the cleanup, proactively communicate any concerns that may arise, and work cooperatively to address unforeseen conditions.

2.1.3 Project Engineer

The Project Engineer (PE; Reid Carscadden) will represent the Port's design team responsible for preparation of the cleanup action design documents. For the implementation phase of the cleanup, the PE will review and respond to contractor inquiries and submittals, provide construction engineering support, and serve as the engineer of record for the cleanup action implementation phase. The PE will be responsible for verifying that the cleanup action is completed in accordance with the Ecology-approved design documents. In the event that deviations from the approved design are proposed or otherwise required to address unforeseen conditions during construction, the PE will assess the related details and coordinate with the contractor, the Port, and Ecology to identify an acceptable response or design modification, as appropriate.

The PE will also serve as the Construction Quality Assurance Officer (CQAO), responsible for implementation and oversight of the CQAP and associated field monitoring, sampling, and testing activities. The CQAO will also be responsible for CQA reporting and maintaining the integrity of data generated during cleanup actions. The PE/CQAO may rely on inspectors and technicians with the requisite experience to help perform the duties described above, including Port of Bellingham staff.

2.1.4 Contractor

The contractor will be selected through a competitive bidding process consistent with Port of Bellingham and Washington State contracting protocols. Qualified contractors, personnel, and supporting subcontractors shall have demonstrated experience and expertise performing the work set forth in the cleanup action design documents, including, but not limited to, demolition and reconstruction of docks and marine structures, removal of piles and debris, sediment dredging and dewatering, transporting and disposal of dredge material and debris, and placement of backfill materials. Key contractor personnel will be required to satisfy the minimum qualification requirements for their respective roles and responsibilities, as defined in the specifications, and a requirement element of the contractor's CWP.

All contractor and subcontractor personnel will also be required to have current health and safety training required by the Washington State Department of Labor and Industries (Chapter 296-2 Washington Administrative Code [WAC], Subpart P, Hazardous Waste Operations and Emergency Response [HAZWOPER]), including specific onsite training. The exception to this may include truck drivers and third-party surveyors if their roles do not place them in potential contact with contaminated materials. Per the Revised Code of Washington (RCW) 46.25.070 through -085, truck drivers transporting hazardous (TSCA-level) soil, sediment, or debris from the site must have a Commercial Driver's License (CDL) with a hazardous materials ("H") endorsement issued by the state of Washington.

The contractor's Project Manager (CPM; TBD) will report directly to the PPM. The CPM will provide management of and direction to all contractor and subcontractor personnel, and will have overall responsibility for executing the work in compliance with the contract, Ecology-approved design documents, and the CWP. Depending on the Contractor staff organization, some of the following roles may be filled by the same individual.

The contractor Site Superintendent (SS; TBD) will provide day-to-day onsite management of and direction to contractor and subcontractor personnel. The SS will be responsible for executing the work in full compliance with the contract drawings and specifications. In addition, the SS will verify proper operation and maintenance of equipment, manage subcontractors, and provide daily progress reports to the PPM. The SS may use one or more foremen to directly supervise major construction activities.

The Contractor Quality Control Representative (QCR; TBD) will be responsible for preparation and implementation of the contractor's Construction Quality Control Plan

(CQCP). The QCR will report to the CPM. Responsibilities of the QCR will include, but not be limited to:

- Providing and maintaining an effective QC system for all construction tasks
- Ensuring conformance with specified QC performance criteria and testing procedures defined in the construction contract documents and the contactor's approved CWP
- Conducting informational meetings with contractor personnel to review QC field testing and documentation procedures
- Coordinating and monitoring QC inspection and testing activities, including acceptance and performance testing of installed equipment, materials, and systems in accordance with the specifications
- Identifying and resolving potential construction deficiencies or non-conformance issues and documentation of response actions
- Responding to action level exceedances identified in key project documents (including the Health and Safety Plan [HASP], Water Quality Monitoring Plan [WQMP], and others)
- Preparing daily construction QC reports
- Conducting weekly construction progress meetings in coordination with the CPM, PPM, and PE

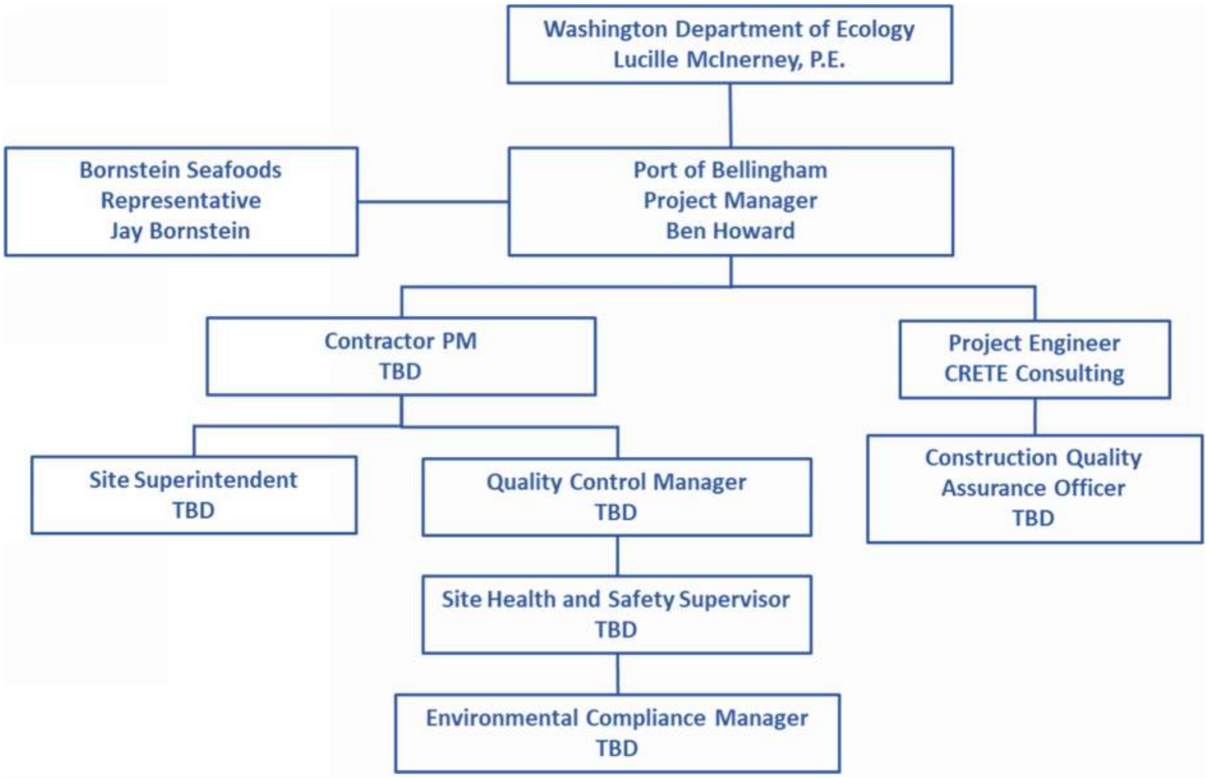
The contractor Site Health and Safety Supervisor (SHSS; to be determined [TBD]) will ensure that operations are performed in compliance with applicable client and site-specific requirements and the contractor's site-specific Construction HASP. The SHSS will report to the QCM and will be responsible for:

- Implementation and oversight of contactor's approved HASP
- Ensuring that construction team members are appropriately trained and understand the health and safety requirements for the project
- Monitoring worker health and safety metrics and compliance with HASP requirements and procedures
- Conducting daily health and safety briefings
- Exercising stop work authority when warranted
- Coordinating with the CPM and QCM and assisting with response to accidents, complaints, and incidences.

It is anticipated that the contractor team will also include dredging and support vessel supervisors and operators, hydrographic surveyors, marine structural personnel, and other specialized trades. Other site personnel (craft labor) may be added as deemed necessary by the contractor. Additional responsibilities of the contractor personnel will be determined by the contractor.

The Construction Work Plan (CWP; Section 3.1.1) will identify any subcontractors the contractor intends to employ in the work. The subcontractors are responsible to the contractor for the quality of their work, protection of the environment, and the health and safety of their personnel to the same level that the contractor is responsible. The subcontractor's principals will designate a job site foreman who will coordinate with the contractor and will be responsible for the quality of the work.

Figure 1 Construction Management Team Organization Chart



3 Reporting Activities

Prior to the start of construction, various documents will be prepared by the Port, the design team, and the contractor to support the design, implementation, and quality of construction activities. The contractor will generate additional documents during construction and will be responsible for quality control (QC). The Port and its team will be responsible for quality assurance (QA), involving oversight of the contractor's QC activities and verification that the work has been completed in accordance with the design, CAP, and Agreed Order.

The following sections provide an overview of the documentation that will be prepared to support planning, implementation, and QA/QC of the cleanup.

3.1 Pre-Construction Documentation

3.1.1 Construction Work Plan

The CWP will be prepared in accordance with the EDR, drawings, and specifications. The CWP will outline the implementation of the cleanup action, including how the construction activities will be coordinated with the Port and Ecology. The CWP and its accompanying plans will be written by the contractor. The Port and Ecology will review the contractor's CWP and provide input as appropriate to ensure that the plan is consistent with the intent of the design, this CQAP, and applicable regulatory requirements.

The CWP will include specific plans for completing the work, including, but not limited to the following elements:

- Project Team and Approach including a Baseline Schedule
- Site-specific Construction Health and Safety Plan
- Traffic Control Plan
- Pollution Prevention Plan
- Stormwater Pollution Prevention Plan
- Contractor's Quality Control Plan
- Transportation and Disposal Plan
- Survey Plan
- Earthwork and Utility Plan
- Dredging Plan
- Demolition Plan
- Bulkhead and Dock Reconstruction Plan
- Vessel Management Plan
- Construction Water Quality Monitoring Plan
- Construction Water Management Plan

- Contractor’s Daily Construction Report Form.

Specific requirements for the work plan elements of the CWP are provided in the specifications and briefly summarized in the following sections.

3.1.2 Project Team and Approach and Baseline Schedule

The CWP will include a description of the project team, including qualifications and experience for key contractor personnel, subcontractors to be used, and team organizational chart indicating lines of communication and authority. The project approach will describe the methods to be employed in the cleanup action, including equipment types, modes of operation, general schedules, sequence of activities, proposed personnel and subcontractors, disposal facilities and materials suppliers, transloading location, and other aspects necessary to describe how and when the specified work will be performed. The Project Approach will also describe all temporary facilities and stockpile, staging, and access areas, including work areas, on-site equipment and material storage areas, transloading, access and haul routes, and parking areas.

A detailed initial critical path project schedule will be submitted by the contractor showing the deliverables and each construction element. Project schedule updates will be submitted by the contractor following progress meetings.

3.1.3 Site-specific Construction Health and Safety Plan

The contractor will prepare a site-specific construction HASP describing the health and safety requirements for the job site activities, and the measures and procedures to be employed for protection of onsite personnel. The plan will cover the controls, work practices, personal protective equipment, decontamination procedures for personnel, equipment and materials, and other health and safety requirements that will be implemented by the contractor during the cleanup action construction activities.

3.1.4 Traffic Control Plan

The traffic control plan will describe protection and control of pedestrian and vehicle traffic during construction operations, parking for onsite workers, and haul route needs. The plan will address any traffic control issues on nearby rights-of-way (e.g., if temporary lane closures or traffic flaggers are needed for trucks entering and leaving the site), onsite traffic control measures, and any special provisions related to time restrictions on the use of haul route roadways such as when children are entering/leaving schools.

3.1.5Pollution Prevention Plan

The Pollution Prevention Plan will describe the environmental protection measures and monitoring activities that will accompany all construction activities. It will describe monitoring and corrective actions related to potential spills as a result of the construction operations. The plan will address spill prevention, containment, and cleanup.

3.1.6 Stormwater Pollution Prevention Plan

A Stormwater Pollution Prevention Plan (SWPPP) will be developed by the Contractor in compliance with the City of Bellingham regulatory requirements. The SWPPP will describe the temporary erosion and sedimentation control (TESC) measures to be used during all aspects of the upland work, as appropriate to the scope and nature of the work. It will describe the contractor's plan for installing, maintaining, and inspecting all stormwater and erosion control structures/activities, including silt fences, berms, catch basin protection, and grading, as may be necessitated by upland work activities.

3.1.7 Construction Quality Control Plan

The CQCP will present the system through which the contractor ensures that construction activities are being implemented in compliance with the requirements of the contract. This plan will identify personnel, procedures, methods, instructions, inspections, records, and forms to be used in the QC system. This plan will address procedures for maintaining and updating activity logs; reporting emergencies; responding to unforeseen conditions or construction deficiencies; record-keeping procedures for personnel, equipment, maintenance, and calibration; and daily and monthly reporting requirements. The CQCP will also include the contractor's QAPP for any analytical testing to be conducted by the contractor, including analysis of imported backfill materials, waste materials (as required by the landfill), treated stormwater, or other wastes generated during construction.

3.1.8 Transportation and Disposal Plan

The Transportation and Disposal Plan will address the handling, storage, transportation, and disposal of non-hazardous and hazardous wastes excavated from the site. The plan will comply with regulations administered by EPA, the U.S. Department of Transportation (DOT), and Ecology. The Transportation and Disposal Plan will describe the types and quantities of each waste stream, the approved transloading and disposal facilities for each waste stream, subcontractors, transportation methods, and equipment. The plan will also describe all haul routes, estimated hours and days of operation, and estimated number of trucks traveling to and from the project site.

3.1.9 Survey Plan

The Survey Plan will describe the methods to perform hydrographic and topographic surveying to accurately layout, control, and document dredging, excavation, backfilling, and associated QA/QC activities. The plan will provide the name and qualifications of the independent surveyor and the contractor's survey crew, the equipment and methods to be used, and the schedule and format for survey-related submittals.

3.1.10 Earthwork Plan

The Earthwork Plan will describe land-based excavation and backfilling of upland notch area soil, sediment, and debris, including material handling, stockpiling, and offsite transportation and disposal, as applicable. The sequencing of excavation and any necessary shoring requirements will also be described. The Earthwork Plan also describes backfilling of the site, including material selection, placement, and compaction methods for utility trenches (if required) and land-based placement of armor protection materials (if required). The plan will identify location and dimensions of temporary stockpile areas for excavated and import materials, construction details of the stockpile cells, and plans for segregating materials and for managing and disposing of impacted stormwater and other construction contact water. The plan will describe any necessary controls required to protect and maintain the stability of adjacent slopes and structures (e.g., shoring, benching). Additionally, all earthwork and dredging activities will be conducted in accordance with the Archeological Monitoring and Inadvertent Discovery Plan for the I&J Waterway Cleanup (CRC 2020)

3.1.11 Dredging and Backfill Plan

The object of the dredging is to remove all impacted sediments exceeding cleanup levels, to the lines and grades indicated on the construction drawings, with field adjustments as needed to dredge to the Glacial Marine Drift (GMD). The Dredging Plan and Backfill Plan will specify the construction approaches, labor, and equipment for dredging and backfill placement of intertidal and subtidal sediment, including methods to achieve the specified dredge depth and backfill placement tolerances. This work will involve dredging the navigational channel and adjacent banks, barge dewatering, transporting dredge material to an approved transloading facility, offloading sediment, debris, and residual dredge water, and shipment of the wastes to approved disposal facilities. All in-water activities will be accomplished in a manner that maintains compliance with applicable water quality criteria.

Following sediment removal, the dredge footprint will be covered with a thin layer of clean sand to address the thin layer of “residual” sediment that is commonly redeposited within the work area during dredging. In addition, rock armoring will be replaced on the waterway bank for scour and erosion protection. The armoring will be covered with sand and gravel “Fish Mix”. The Dredging Plan will include the physical and chemical qualities properties of the RML, as well as placement and verification methods.

3.1.12 Demolition Plan

The Demolition Plan will describe the demolition of the Bornstein dock and associated decking, utilities, pilings, and surface structures to allow dredging of the underlying bank area. The adjacent floating dock will also be removed and relocated for future use; supporting piling will be removed for offsite disposal. Other demolition activities include limited asphalt and concrete removal along utility corridors to facilitate power and water connections to the replacement dock.

The plan will describe the sequencing and coordination of land-based and in-water demolition activities, access requirements, protection of adjacent structures and waterway users, environmental protection, and means and methods for physical removal of the dock, and segregation, management, and disposal of waste materials. Any hazardous building materials generated during demolition activities will be managed and disposed of in accordance with applicable regulatory requirements.

3.1.13 Bulkhead and Dock Reconstruction Plan

This plan will describe the contractor's approach for construction of the new bulkhead retaining wall and dock adjacent to the Bornstein facility. The workplan will describe the material, equipment, methods, and sequencing that will be used for installation of the steel sheet pile retaining wall and tie-backs, and dock piling, decking, and infrastructure. The location of upland and in-water staging areas for materials and equipment will be identified. The plan will also describe environmental protection measures that will be used to protect water quality and aquatic life.

3.1.14 Vessel Management Plan

The Vessel Management Plan will describe the methods for controlling vessel traffic during the work. The plan will document the proposed vessels, navigation routes, mooring areas, timing and frequency of vessel traffic, and coordination of activities with other waterway users, including commercial, recreational, and government vessel operators. It will also document the sea-worthiness of vessels to be used, and waterway safety and navigational measures (e.g., USCG notifications, buoys, and lights). Considerations for working adjacent to the operating marina at the west end of the site and the USCG dock will also be discussed.

3.1.15 Water Quality Monitoring Plan

The design team has prepared a draft WQMP describing the proposed approach for monitoring the quality of water within the I&J Waterway during in-water construction activities, including demolition, dredging, and backfill activities. The plan describes field monitoring for turbidity and dissolved oxygen. The contractor will prepare a final WQMP as a part of the CWP. The final WQMP will incorporate all substantive requirements of the draft WQMP (e.g., the frequency of monitoring, criteria, analytes, and corrective actions).

3.1.16 Construction Water Management Plan

The Construction Water Management Plan will describe the methods that will be used to collect, treat, and discharge potentially contaminated contact water, including stormwater runoff and/or drainage from potentially impacted soil or debris stockpiles constructed in the upland area of the site. Contaminated soil and debris stockpiles will be covered, to the extent practicable, to prevent contact with rainwater. The contractor will have the option to contain and treat water on-site or transport it to an approved offsite treatment facility.

3.1.17 Contractor's Daily Construction Report Form

The contractor will prepare a form that will be used to transmit the Daily Construction Report. The form will be included in the CWP. The form will be used to transmit information/data pertinent to the specific activities performed each day (e.g., equipment and crew, materials removed and placed, surveying and QC data). The daily reports will be used by the Port to inform its reporting to Ecology and other stakeholders.

3.2 Construction Documentation

The following sections describe key data collection and documentation activities that will occur during construction.

- **Contractor's Daily Construction Report -** The contractor will prepare a Daily Construction Report and submit it to the Port. At a minimum, the reports will summarize the following:
  - Work performed by the contractor,
  - Equipment used,
  - Daily accounting of demolition/dredging/excavation/backfill material quantities removed or replaced,
  - Results of any QC inspections, tests, or other monitoring activities, such as water quality monitoring.
  - Any noncompliant conditions and actions taken to attain compliance.
  - Bulkhead and dock construction details, such as pile driving equipment performance data, piling penetration rate data, piling dimensions, and top and bottom elevations. A sample sheet pile driving record will be submitted to the PPM for approval, prior to the start of pile driving.
- **Water Quality Monitoring Summaries** - Water quality data will be generated by the contractor in accordance with the sampling protocols and performance standards identified in the WQMP.
- **Hydrographic and Topographic Survey Reporting -** Pre- and post-hydrographic and topographic surveys that are used to establish baseline site conditions, final documentation of sediment removal and backfill conditions, and/or for measurement and payment will completed by an independent professional surveyor under contract to the contractor.
- **Waste Characterization Testing Reports and Manifests -** The contractor will submit Waste Characterization Testing Reports documenting chemical analysis of any waste materials which require additional characterization prior to disposal or recycling. Existing sediment chemistry data will be utilized to the extent possible to develop the waste manifest for proposed dredge materials, to facilitate transport and disposal to an approved landfill facility. The contractor will submit all transportation-related shipping documents in accordance with the specifications, including draft manifests for waste; draft bills of lading; lists of proposed labels, packages, markings, and placards to be used for shipment; and any waste profiles

and/or supporting waste analysis documents. The contractor will not allow any waste to leave the site until shipping documents have been approved by the Port.

- **Import Material Characterization Reports -** The contractor will submit a Pre-Construction Testing Report for chemical and physical analysis of import fill materials based on the schedule included in the specifications.   Chemical and physical testing will be completed by the contractor or the material suppliers in accordance with the specifications, which require one gradation and one chemical sample of any one source and type of import material. If the source of the material changes, an additional sample (analyzed for both gradation and chemistry) will be required. Chemical analysis will not be performed on coarse grain filled materials (e.g., rip rap, cobbles, gravel). No material will be brought onsite until approved by the Port.
- **Weekly Quality Assurance Summary -** The Port team will prepare a Weekly QA summary email for submittal to Ecology. The QA Summary will include a brief description of construction events, as well as any delays and their causes, results of water quality monitoring and confirmatory surveys to document successful completion of sediment removal and backfill activities. If Port QA inspections reveal out-of-specification conditions, the PPM will immediately contact the contractor CPM and/or the SS to determine what action(s) will be taken to correct the condition. Instructions to the contractor for any work that deviates from the specifications will be given in writing, subject to Ecology review and approval.

3.3 Post-Construction Documentation

The following documentation will be prepared following completion of the construction phase of the cleanup.

- **Record Drawings and Certifications -** The contractor will be required to submit record drawings and data documenting successful completion of the cleanup action, including complete removal of the contaminated sediment, RML placement, and associated bulkhead and dock demolition and replacement activities. The contractor will also submit certificates of conformance for import materials, including, sand and gravel, riprap, pilings, and dock infrastructure materials. Certificates will be submitted to the Port, and included in the Construction Completion Report.
- **Pre-Final Inspection and Punch List -** In coordination with the Port, the contractor will coordinate a pre-final inspection of the completed work. Following the pre-final inspection the contractor will prepare a consolidated list of any remaining items to be completed or corrected (i.e., pre-final punch list).

- **Final Inspection Report -** A final inspection will be performed by the Port and Contractor to verify completion of the punch list items. The contractor will then prepare a final inspection report documenting completion of the work.

4 QA/QC Program Execution

This section summarizes the execution of quality assurance (QA)/quality control (QC) activities for the project, including monitoring, inspection, testing, and reporting that will be performed to ensure compliance with the CAP, Agreed Order, and project design documents. The presentation is organized by the cleanup action construction elements, as follows:

- Survey controls and project limits
- Demolition and debris management
- Sediment dredging, transport, and disposal
- Shoreline armoring and residuals management
- Dock and Bulkhead Replacement
- Water Quality Compliance

4.1 Survey Control and Project Limits

The contractor will employ an independent licensed surveyor to perform hydrographic and topographic surveys for the following:

- Pre-Construction Baseline—to establish the layout of work and baseline conditions
- Final Dredging and Excavation Acceptance—to obtain data for final dredge and excavation volume calculations and to verify that final dredged grades and excavation grades are acceptable, to identify when confirmation sampling can occur or backfilling can begin.
- Final Backfill Acceptance—to verify that final grades and backfill thicknesses are acceptable
- Record Document Survey—to document all final conditions after any required corrective actions.

Progress hydrographic surveys will be performed by the contractor as a way of accurately monitoring dredging activities. Topographic surveys will be performed to tie in the hydrographic survey to the top of the slope and provide verification of hydrographic survey data. All hydrographic and topographic surveys will be conducted in accordance with the specifications.

All topographic survey, layout, and related work will be performed and signed by a professional land surveyor registered in the state of Washington. All hydrographic surveying will be performed by a surveyor who will have been actively engaged in hydrographic survey operations during the past four years, and all surveys will be performed in accordance with the standards given in United States Army Corps of Engineers Engineering Manual 1110-2-1003 (USACE 2004).

The Port will provide QA of the contractor surveys by reviewing all topographic data generated by the contractor. The Port reserves the right to retain an independent surveyor (or use a Port surveyor) to periodically conduct independent surveys, if deemed necessary. The contractor will protect survey control points prior to starting site work and preserve Port-established reference points (benchmarks) during construction. The contractor will establish any needed benchmarks, as described in the specifications.

The contractor will not relocate site reference points without prior written approval from the Port RE. The contractor will promptly report to the Port the loss, damage, or destruction of any reference point or relocation required because of changes in grades or other reasons. The contractor will replace dislocated survey control points based on original survey control at no additional cost to the Port. Replacement of dislocated survey control points will be done by a Professional Land Surveyor licensed in the state of Washington.

Hydrographic survey procedures (positioning modes, electronic positioning system, and/or global positioning system) calibration, data reduction, adjustment, processing, and plotting will conform to industry standards. Horizontal location observations will compensate for errors, geodetic corrections, and atmospheric variations.

Data recording, annotation, and processing procedures will be consistent with recognized hydrographic survey standards. Failure to perform and process such surveys in accordance with recognized standards will result in a rejection of the survey results.

4.2 Demolition and Debris Management

The project includes demolition removal of various structures at the site to facilitate the cleanup action. Structures that will be permanently removed and replaced include:

- Bornstein dock and supporting piling
- Bornstein dock utility infrastructure, ice house, and other appurtenances
- Marine piling and mooring dolphins supporting the adjacent floating dock (which will be temporarily relocated)
- Miscellaneous debris located along the shoreline.

The following procedures will be implemented to ensure debris and materials are removed and disposed of properly. Additional details for each activity are provided in the project specifications.

4.2.1 Waste Handling Requirements

Contractor requirements and best management practices (BMPs) for handling, recycling, and/or disposal of the debris and waste that are generated during the demolition activities will include, but not be limited to:

- Contain effluent water to prevent discharge to the waterway
- Immediately remove or contain floating debris
- Maintain a silt curtain or floating boom around the demolition work area

- Maintain absorbent booms around the demolition work area to contain potential sheens resulting from the demolition activities
- Recycle or dispose of soil, debris, and wastes per applicable regulations.

4.2.2 Removal Operations and Documentation

Removal of piles and debris throughout the work area is necessary for dredging operations. Every practicable effort will be made to extract the entire length of each pile prior to dredging. Other debris may need to be removed if encountered during excavation and dredging operations. Piles and debris must be removed from soil and dredged material (or cut/broken to acceptable lengths and disposed with the soil and sediment) if required by the disposal or recycling facility. Debris removed using land-based equipment staged on the bank, will be stored in a designate stockpile location in the upland area. Debris removed with in-water equipment will be placed on barges.

The contractor will detach, move, and store the floating dock floats at a predetermined location to provide dredging access. The contractor will remove the supporting piles and install replacement piles when the dredging and backfilling are completed.

Materials, such as concrete and metal to be sent to a recycling facility must be acceptable to the recycling facility. Cleaning may be required prior to transport offsite. The contractor will coordinate with recycling facilities to ensure that debris is acceptable.

To ensure that the structures have been adequately removed, the contractor will maintain a daily record of the materials removed from the site, including approximate location of the structures removed for that day, volume estimate of material removed, daily weight certifications of material removed from the site, and tonnage weight certifications of disposal records at the landfill or recycling facility. Structures that are not removed completely (i.e., timber piles broken or cut at the mudline) will be documented in a set of as-built drawings maintained by the contractor. Waste manifests will be prepared for all materials that have been removed from the site. Daily observations by the Port team will also be performed. Visual observations and compliance with the technical specifications and regulatory permits will be documented in the contractor’s Daily Construction Report.

4.3 Sediment Dredging, Transport, and Disposal

Dredging of contaminated material will occur within the I&J Waterway Federal Navigation Channel and adjacent locations shown on the design drawings. Dredging will occur in open water following debris and pile removal and temporary relocation of the floating dock. Dredged material will be dewatered on the dredge barges as needed to allow safe transport to an approved transloading facility for offloading and shipment to a permitted Subtitle D landfill facility.

The following procedures will be implemented to ensure that dredging, transport, and disposal is in accordance with the design.

4.3.1 Dredge Positioning and Control

To ensure that the required dredging elevations are accurately determined, the contractor will be required to identify its vertical and positioning control methods for dredging. An automatic electronic tide recording system will be required for all dredging and surveying operations, as well as tide boards or gages for contractor use during construction.

The contractor will be required to demonstrate that contaminated materials have been removed to the elevations and horizontal extents shown on the drawings (e.g., to the contact with the GMD geologic unit). Pre- and post-dredge bathymetric surveys will be performed by the contractor's independent licensed surveyor to confirm the specified grades have been achieved. Additionally, the Port team will conduct sediment profile imaging (SPI) to document the post-dredge sediment surface. The contractor will also be required to perform and submit daily progress surveys so that the Port can continuously monitor dredging progress and compliance with the specifications and drawings.

The Port will perform QA monitoring of the contractor's work and survey documentation to verify the dredging extents have been achieved. This may involve evaluating the contractor's daily QC progress surveys and positioning data and/or conducting independent QA surveys. In the event of apparent discrepancies, the Port will immediately notify the contractor's superintendent to correct the situation. Any such direction and corrective action will be documented on that day's Daily Construction Report.

4.3.2 Transport and Disposal of Dredged Materials

Dredged materials will be transported by scow or barge to an approved transloading facility, where the contaminated materials will be stockpiled and dewatered, as needed, in preparation for off-site disposal to permitted landfill facility. Once sufficiently dewatered, the dredged material will be transferred to trucks or railcars and hauled to the landfill. All transporters will be required to follow applicable federal and state guidelines for waste hauling. The Port will also monitor the contractor's activities to ensure that materials are transported to and disposed at the appropriate locations and facilities. The contractor will be required to submit certified weigh tickets and other waste manifest information to the Port to document the proper disposal. Debris that can be appropriately segregated from contaminated sediment may be managed at appropriately permitted construction debris recycling or disposal facilities, subject to Port approval. Following dredging and marine construction, the contractor will be required to remove all equipment and materials from the site and to return the area to its pre-construction condition.

4.3.2.1 Dredged Material Handling

The contractor will be required to filter barge effluent to retain suspended solids and limit the release of suspended solids back into the I&J Waterway. Uncontrolled releases of dredged material into receiving waters during transport of the material from the dredging area to the transloading facility or during offloading activities will not be permitted. Scows or haul barges that transport dredged material to the transloading facility for disposal will be sealed to prevent leakage during transport. Overtopping of the scows or barges will also not be allowed.

At the transloading facility, dewatering from the barge is not allowed unless covered specifically under the facility permit. In addition, the contractor will be required to install a spill prevention apron (if not already present) to prevent material spillage during the transfer of the dredged material to the transloading facility. Any spillage outside of the enclosed transloading facility will be required to be promptly cleaned up. The Port will monitor work activities to ensure that the contractor is complying with design and permit requirements.

Before sediments are transported from the transloading facility, the contractor will be required to demonstrate that all sediments have passed the paint filter test and have been sufficiently dewatered, unless the facility and transporter is otherwise exempt from this requirement. At the contractor’s discretion, and if approved by the Port and Ecology, an additive may be mixed in with the sediment to bind available water and decrease the dewatering time.

4.3.2.2 Environmental Protection

Any potentially impacted stormwater or runoff generated during upland construction activities will be contained and managed in accordance with the contractor’s Construction Work Plan, including all necessary BMPs to protect the adjacent waterbody and adjacent stormwater catch basin. Upon project completion, the contractor will remove all vestiges of potentially impacted materials from areas used for temporary staging of soil or debris and to clean up the site to pre-project conditions. The Port will inspect the contractor's work activities to ensure that the contractor is complying with the final design and permit requirements.

4.4 Shoreline Armoring and Residuals Management

Rock armoring and bedding materials will be placed on the shoreline bank adjacent to the Bornstein facility, as well as the bank areas immediately west of the facility to protect against wave and tidal erosion and vessel scour. Sand and gravel “Fish Mix” will be placed over the armoring to enhance its habitat value. Additionally, a thin layer of sand will be placed over the SCU-1 remedial footprint to manage sediment that may have been suspended and redeposited during dredging.

The following QA procedures will be implemented to ensure that the armor material and RML is completed in accordance with the design.

4.4.1 Import Material Quality

Import material must meet chemical and physical (grain size) characteristics. Individual loads will be visually monitored by the contractor and the Port to ensure compliance with the specifications. If necessary, the Port may obtain representative samples for chemical and physical testing to confirm compliance. The Port will have the right to refuse any loads that do not comply with the specifications.

4.4.2 Placement Control and Documentation

To ensure that proper horizontal coverage and thickness of the engineered armored slope and RML materials are achieved, the contractor will perform daily progress surveys. Where multiple layers are required for the armored slopes, post-placement bathymetric surveys will be performed after each layer has been placed.

The Port will monitor and verify compliance with the design by evaluating the contractor's daily QC progress surveys and positioning data and/or conducting independent QA surveys.

For the RML, the extent and thickness of placement will be documented by bathymetric surveying and will be verified by tracking of the volumetric application rates (correlated to predetermined placement depths). Immediately following placement of the cover material, the Port will collect grab samples to document baseline chemical concentrations for long-term compliance monitoring, and may collect additional grab samples as necessary to confirm that the minimum thickness of cover material has been achieved.

The contractor will be required to report, on a daily basis, the area and quantity materials placed during that day, and the cumulative volume and tonnage of material placed to date. These quantities will be monitored by the Port to verify consistency with the estimated quantities. If at any time it is determined that the contractor is not placing cover materials in the correct location or to the prescribed minimum thickness, the contractor will be notified to correct the situation.

4.5 Soil Excavation and Backfill

As part of the cleanup actions, it is anticipated that upland soils may need to be excavated and backfilled to facilitate installation of the shoreline bulkhead and tie-backs, and replacement dock utilities. Soils that are excavated to facilitate the cleanup actions will be subject to the following QC requirements during construction:

- Excavation location and quantity of material will be documented by the contractor using topographic survey and recorded by the contractor on the as-built plans
- Material will be properly segregated
- Profiling will be performed to classify the material for either re-use or off-site landfill disposal or recycling
- For all material requiring removal and off-site landfill disposal, the contractor will be required to submit waste manifest certificates documenting their final disposal location
- Retention of soils or debris on-site for re-use is subject to the written approval of the Port.

4.6 Dock and Bulkhead Replacement

The cleanup action in SCU-1 requires removal and replacement of existing dock structure to accomplish the required dredging and backfilling activities. A replacement sheet pile bulkhead will also be constructed along the shoreline to replace an existing timber bulkhead. The existing dock is a 24-feet-wide by 180-feet-long timber structure with concrete-topped timber decking supported by timber stringers spanning to timber pile caps supported by timber piles. The existing bulkhead is timber lagging spanning to timber piles.

The replacement dock will be constructed over the same footprint as the existing demolished dock and will consist of concrete-topped precast concrete deck panels spanning to precast concrete pile caps supported by driven steel pipe piles. The replacement bulkhead wall will be constructed in-front (waterside) of the existing timber bulkhead wall and will extend across the notch at the southeast corner of SCU-1 and will be integrated with the bulkhead at the adjoining property. The existing bulkhead wall will be abandoned in-place and the space between the existing and new wall will be filled with controlled density fill (CDF).

The specifications define QA/QC requirements and procedures that will be implemented to ensure that the sheet pile wall and pipe piling are fabricated and installed in accordance with the final design. These requirements address piling and tieback material quality and installation methods and equipment. QA/QC procedures for reconstruction of the dock decking and infrastructure are provided in the specifications, including temporary environmental controls for protection of water quality (e.g., containment boom). . Final as-built details of the dock construction will be included in the Construction Completion Report.

4.7 Water Quality Compliance

The contractor’s CWP will identify BMPs, operational controls, and equipment options available for minimizing water quality concerns. It will also discuss potential contingencies for addressing water quality exceedances. These elements will be implemented, if necessary, to control for turbidity/water quality impacts. The WQMP describes how water quality impacts will be identified. Operational or engineering controls may include:

- Dredging during lower tidal stages or during slack tides, as practical
- Decreasing the rate of dredging; this may include decreasing the speed of the ascending or descending bucket as it moves through the water column, pausing the bucket before digging, or pausing the bucket for longer periods at the water surface to facilitate drainage
- Modifying the positioning of barge(s)
- Modifying bucket movement to dislodge adhering material
- Additional filtration BMPs for handling sediment dewatering liquid on the barge before it flows back into the I&J Waterway

- Controlled placement of fill materials to minimize generation of turbidity plumes, including slow bottom placement of initial fill lifts to establish a stable base for subsequent lifts
- Stopping work

In addition to WQ monitoring, oil spill control measures will be implemented during all in-water activities. The contractor will continuously visually monitor for sheens or floatable materials whether they originate from sediments, piling/debris, or the contractor's equipment. At the first indication of any oil sheen originating from construction activities, the contractor will contain the sheen with appropriate sorbent and containment materials. If the sheen escapes the work area, the contractor will cease in-water work until the problem is rectified to the satisfaction of the Port and Ecology.

As discussed in Section 3, the contractor will be required to meet water quality criteria during all in-water cleanup activities. Monitoring will be performed by the Contractor in accordance with the WQMP. Block nets will be used so that fish cannot become entrained behind the sheet pile wall before the area is enclosed. The Port will conduct QA oversight of the contractor's field and QC procedures, raw data, and interpretation to verify adherence to the WQMP and compliance with water quality criteria.

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Appendix E

Compliance Monitoring and Contingency Response Plan

APPENDIX E
COMPLIANCE MONITORING AND CONTINGENCY RESPONSE PLAN

Final

I&J Waterway Site
Sediment Cleanup Unit 1
Bellingham, Washington

Project Number: 036-001

Prepared for:

Port of Bellingham and
Bornstein Seafoods, Inc.

October 20, 2023

Prepared by:

CRETE CONSULTING, INC.

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1 Introduction and Background

The I&J Waterway Site (Site), is comprised of two separate and distinct Sediment Cleanup Units (SCUs). This Compliance Monitoring and Contingency Response Plan (CMCRP) describes the performance and confirmation monitoring and associated contingency response actions for the cleanup of SCU-1. The CMCRP meets the requirements of the Cleanup Action Plan (CAP, Ecology 2019b), and will be implemented in accordance with Washington Administrative Code (WAC) 173-340-410, Compliance Monitoring Requirements.

Cleanup and design of SCU-2 will occur in the future with development of separate documents, including a separate CMCRP.

1.1 Purpose

The purpose of this document is to describe the environmental monitoring activities that will be used to ensure that cleanup standards are met and long-term effectiveness of the cleanup is maintained.

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. SCU-1 totals 1.3 acres and 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 (SOAL). The federally authorized navigation channel has an authorized channel depth of 18 feet below mean lower low water (MLLW). The upland areas near the I&J Waterway site include the Hilton Avenue upland area and the property to its southwest that is currently leased to Bornstein. The federal government 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 Cleanup Action

The cleanup action footprint for the I&J Waterway site is shown on Figure 1. The cleanup action for SCU-1 includes removal of contaminated sediment from the Dock, Floating Dock, Berthing Area, and Navigation Channel West Units. Dredged sediment will be disposed in a permitted upland facility. SCU-1 will be dredged to the Glacial Marine Drift (GMD) layer with the exception of a small area where the CAP allowed for an offset from the Coast Guard facility to maintain structural stability. In addition, a limited area in the southwest corner of SCU-1 and in the transition slope area outside the southwest corner of SCU-1, the base of the dredge prism may be defined by clean native past-glacial fluvial deposits (PGF; silty sand) rather than the GMD. The GMD and PGF are not impacted by site indicator hazardous substances (IHSs) or bay-wide contaminants. IHSs include polynuclear aromatic hydrocarbons (PAHs), semi-volatile organic compounds (SVOCs; including bis(2-ethylhexyl)phthalate[BEHP]), and nickel.

The stable post-dredge side slopes were designed to account for physical effects (e.g. propeller wash) and seismic effects on sediment stability. The projected surface of these side slopes was sampled during Phase 2 of the Pre-Remedial Design Investigation (PRDI). The sample collected from the dredge side slope within SCU-1 (IJW-SC-14) had IHS concentrations below cleanup levels. Two of the other six samples (IJW-SC-13 and 16) had low level cleanup level exceedances of BEHP and nickel, respectively. In order to address these impacts, a residuals management layer of sand will be placed on the side slopes and base of the dredge prism in areas where other armoring or habitat fill will not be placed.

Sediment will also be removed from the notch area. Following removal of sediment and installation of the new sheet pile bulkhead across the notch, the notch will be backfilled to match the surrounding upland grade.

1.4 Compliance Monitoring Requirements

The three types of compliance monitoring in accordance with WAC 173-340-410 are as follows:

- **Protection monitoring:** This type of monitoring is used to confirm that human health and the environment are adequately protected during the construction period of the cleanup action. As part of the SCU-1 cleanup activities, protection monitoring will encompass water quality monitoring to ensure water quality protection during dredging, construction, and demolition activities. Water quality monitoring is described in the Water Quality Monitoring Plan (Appendix F of the Engineering Design Report [EDR; CRETE 2022]). Protection of human health for workers will be addressed in the Contractor's HASP.
- **Performance monitoring:** Performance monitoring is used to confirm that the cleanup action has attained cleanup standards and other performance standards. Section 2 describes the performance monitoring activities to be conducted following completion of SCU-1 cleanup activities. Performance monitoring will include bathymetric surveys and sediment profile imaging (SPI).
- **Confirmation monitoring:** Confirmation monitoring is used to confirm the long-term effectiveness of the cleanup action once performance standards have been attained. Section 3 describes the long-term confirmation monitoring to be performed following completion of the SCU-1 cleanup activities.

2 Performance Monitoring Sampling and Analysis Plan

As described in the following subsections, performance monitoring will be conducted following dredging. Performance monitoring activities described in this section include bathymetric surveys and SPI surveys to confirm that dredging was performed down to the GMD, and collection of surface sediment samples following RML placement for comparison to the SCOs. A soil sample will also be collected from the base of the Notch area excavation to document compliance with applicable upland cleanup standards.

Dredging in SCU-1 is designed to achieve full removal of contaminated sediment by dredging down to the underlying clean GMD. During dredge activities, the dredge operator and oversight personnel will be evaluating both elevation data and physical resistance of the sediment to dredging to assess the location of the surface of the GMD.

Specific quality assurance protocols are presented in the Quality Assurance Project Plan (QAPP), included as Attachment 1.

2.1 Bathymetric Surveys

Bathymetric surveys will be used during construction to verify that dredging to target elevations has been achieved and to verify that the target thickness and extent of armoring material and habitat enhancement fill material have been achieved at the completion of construction activities. Allowable tolerances for these cleanup construction activities are provided in the Construction Quality Assurance Plan (CQAP; Appendix D of the EDR).

Surveys will be conducted by a licensed surveyor and will meet or exceed the accuracy standards for a U.S. Army Corps of Engineers (USACE) Navigation and Dredging Support Survey as referenced in the USACE Hydrographic Survey Manual (EM) 1110-2-1003 (Latest Edition). The bathymetric survey sounding density will be approximately 1 sounding per square foot. The multibeam sonar head will be mounted on the survey vessel and coupled with motion sensors, a positioning system, and a gyro to geo-reference each sounding. The multibeam will be used in a tilted configuration with 20 degrees of tilt to collect soundings to the waterline.

2.2 Sediment Profile Imaging (SPI)

SPI is an optical technique that will be used during post-dredge monitoring to observe surficial sediment conditions. SPI provides a cross-sectional image of the sediment/water interface and near-surface sediment (15 by 20 cm area). The consolidated nature of the GMD layer should be discernable by looking at features in the upper sediment bed. Due to the density of the GMD in some locations, refusal of the SPI to penetrate the GMD may occur. Only a thin distance of penetration is required to verify the presence of the GMD, but additional attempts or the use of a hydraulic system to push the SPI into the GMD may be required. After two attempts at a location, refusal will be accepted as an indication that dredging to the GMD has been successful.

The SPI camera consists of a wedge-shaped prism with a Plexiglas faceplate and a back mirror mounted at a 45-degree angle. Light is provided by an internal strobe. The mirror reflects the image of the sediment profile to a digital camera mounted horizontally on top of the prism. Collected images are then processed with image analysis and interpretation software to measure multiple physical and biological parameters. For performance monitoring of dredging to the GMD, the following physical factors will be interpreted:

- Sediment type and color
- Prism penetration depth
- Grain size

Measurement of these parameters will provide data to discern the GMD contact in post-dredge conditions and determine whether an additional dredge pass may be required. Figure 1 shows the proposed SPI locations. An additional dredge pass will be required where dredging has not been performed down to the GMD layer.

2.3 Surface Sediment Chemical Analyses

Surface sediment will be collected using a hydraulic Van Veen sampling device at the two locations shown in Figure 1. Locations were selected based on the results of the previous sediment sampling completed during the Phase 2 Pre-Remedial Design Investigation (PRDI; Appendix A of the EDR). These 2 locations represent dredge side slope samples with detected compounds above the Sediment Cleanup Objective (SCO), as summarized below:

- Bis(2-ethylhexyl)phthalate was detected in sediment from IJW-SC-13 at a concentration of 2.1 mg/kg, exceeding the SCO of 1.3 mg/kg. The TOC-normalized result for this sample is 67 mg/kg, which exceeds the carbon-normalized SCO of 47 mg/kg.

- Nickel was detected in sediment from IJW-SC-16 at a concentration of 235 mg/kg, exceeding the SCO of 211 milligrams per kilogram (mg/kg).

At each location, chemistry samples will be collected after placement of the residuals management layer (RML). Each sample will be analyzed for the COC that failed during the Phase 2 PRDI as indicated in Table 1. Chemical concentrations will be compared to the SCOs specified in the CAP.

Analytical methods, data quality objectives (DQOs), and performance criteria for these analytes are summarized in Tables 1 and 2, below. Attachment 1 includes the QAPP which presents the project organization, objectives, activities, and quality assurance (QA) procedures to be implemented during data collection activities associated with performance monitoring.

Table 1 Performance Monitoring Sampling Design

Sample ID	Sample Depth(s) bml	Analyses	Collection Method	SCO Cleanup Level mg/kg
Post Placement of Residuals Management Layer				
IJW-SS-13-Post	0-12 cm	Bis(2-ethylhexyl)phthalate (EPA Method 8070)	Surface Grab	1.3
IJW-SS-16-Post	0-12 cm	Nickel (EPA Method 6020B)	Surface Grab	211 [a]

Notes:
bml = below sediment/mud line surface
Cm = centimeters
mg/kg = milligram per kilogram
SCO = Sediment Quality Objective
a. See Appendix A of the Cleanup Action Plan for the derivation of this value

Table 2 Data Quality Objectives

Parameter	Precision	Accuracy	Completeness
Total metals	+/- 20% RPD	75-125% R	95%
Semivolatile organic compounds (includes Bis(2-ethylhexyl)phthalate and cPAH)	+/- 35% RPD	50-150% R	95%
Dioxins/Furans (See Section 3.1)	+/- 35% RPD	50-150% R	95%

Notes:
RPD = Relative percent difference
R = Recovery
cPAH = carcinogenic polycyclic aromatic hydrocarbons

2.3.1 Surface Sediment Collection Methods

A hydraulic Van Veen sampling device will be used to collect sediment samples from the 0 to 12 cm depth interval. 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.

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)

2.3.2 Positioning and Navigation

Sediment sampling stations 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 will be input and 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.

2.3.3 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.

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.

2.4 Notch Area Soil Quality Monitoring

Dredging will include removal of potentially contaminated surface soil within the Notch Area. Following dredging in this area, a performance sample will be collected to document compliance with applicable upland soil cleanup criteria. Sampling will include one bottom (floor) sample at the location shown on Figure 1. The sample will be collected as a non-sieved, grab sample from the bottom directly.

Soil will be spooned into a stainless steel bowl (or other similar clean container) and homogenized. The soil within the container will be transferred to the laboratory-supplied sample jars. The sample jars will be placed in a cooler and delivered to the laboratory for analyses. Soil descriptions, field screening readings (e.g., photoionization detector [PID]), and other observations during collection will be recorded in the field on a sample collection form.

The Notch Area soil sample will be analyzed for compounds listed on Table 3. Notch soil samples will be compared to upland soil criteria, Model Toxics Control Act (MTCA) Method A soil levels for unrestricted land use, if no Method A level is available, Method B levels will be used.

Table 3 Soil Performance Monitoring Sampling Design

Sample ID	Sample Depth	Analyses	Collection Method	Performance Criteria	DQO
IJW-Notch-C1	0-0.5 ft	PAHs (EPA Method 8270), SVOCs (EPA Method 8270), and nickel (EPA Method 6020B))	Surface Grab	MTCA Method A soil for Unrestricted Land Use *	See Table 2

Notes:
ft = feet
cPAH = carcinogenic polycyclic aromatic hydrocarbon
SVOC = semi-volatile organic compound
DQO = Data Quality Objectives
MTCA = Model Toxics Control Act
*MTCA Method A soil levels for unrestricted land use will be used for the performance criteria, if no Method A level is available, MTCA Method B levels will be used.

2.5 Contingency Response Actions

If the bathymetric survey or SPI data indicate that dredging to the GMD has not been achieved, an additional dredge pass will be completed. Additional SPI and bathymetry data will then be collected to evaluate whether the additional dredging accomplished the project goals.

If chemical criteria exceed specified cleanup levels an additional lift of the RML will be placed. For location IJW-SS-13-Post, the additional RML will be placed from the toe of the slope to the top of the slope and extend to the coast guard dock to the east and 75 feet to the west, which is half way between IJW-SC-13 and IJW-SC-1 (Figure 2). For location IJW-SS-16-Post, the additional RML will be placed from the top of the slope to the navigation channel boundary to the north and to the SCU-1 boundary to the west (Figure 2).

If performance criteria goals are not achieved for the Notch soil removal area, additional excavation activities will be completed within the Notch. Any additional excavation activities will result in collection of new soil samples at the bottom of the excavation.

3 Confirmation Monitoring Sampling and Analysis Plan

Confirmation monitoring will be initiated within the dredge area footprint following placement of the residuals management layer to confirm the long-term effectiveness of the cleanup action after performance standards have been attained.

3.1 Surface Sediment Quality Monitoring

Compliance monitoring will occur at Years 0, 1, 3, and 5 following completion of cleanup in SCU-1. Additional monitoring may be required by Ecology based on prior monitoring results. Compliance monitoring may be integrated into monitoring for SCU-2, if appropriate, as determined by Ecology.

Surface sediment will be collected using a hydraulic Van Veen sampling device at the four locations shown in Figure 2. Surface sediment will be collected from the 0-12 cm depth interval at three locations to support performance monitoring for sediment cleanup action. The fourth sample will be collected from the 0-2 cm depth interval to target stormwater solids near the outfall located at the southeast corner of the SCU-1.

Samples will be analyzed for total solids, total organic carbon, and the IHSs. Chemical concentrations will be compared to the SCOs for the analytes indicated in Table 2 and specified in the CAP. Analytical methods, DQOs, and performance criteria for these analytes are summarized in Table 4, below. The QAPP (Attachment 1) presents the project organization, objectives, activities, and QA procedures to be implemented during data collection activities associated with confirmation monitoring.

Surface sample collection methods, including positioning and navigation and handling of investigation derived waste, will follow the protocols defined in Section 2.3.

Table 4 Sediment Confirmation Monitoring Sampling Design

Sample ID	Sample Depth	Analyses	Collection Method	Performance Criteria	DQO
IJW-SS-C1	0-12 cm	PAHs (EPA Method 8270), SVOCs (EPA Method 8270), and nickel (EPA Method 6020B))	Surface Grab	SMS criteria	See Table 2
IJW-SS-C2					
IJW-SS-C3					
IJW-SS-SW1	0-2 cm	PAHs (EPA Method 8270), SVOCs (EPA Method 8270), nickel (EPA Method 6020B)) and Dioxin/Furans (EPA Method 1613B)	Surface Grab	SMS criteria	See Table 2

Notes:
cm = centimeters
cPAH = carcinogenic polycyclic aromatic hydrocarbon
SVOC = semi-volatile organic compound
SMS = Sediment Management Standards
DQO = Data Quality Objectives

3.2 Contingency Response Actions

Cleanup of SCU-1 will be verified during performance monitoring. Any observed increases in concentrations during confirmation monitoring will be evaluated to assess whether those increases are due to:

- Sampling and analytical variability
- Impacted sediment remaining in SCU-2
- Another source.

Due to this uncertainty, no specific contingency response actions are included in this CMCRP. If concentrations exceed cleanup levels, additional coordination will be conducted with Ecology and other parties to determine appropriate response measures based on the contaminants and the locations and concentrations of contamination observed.

4 Reporting

Performance monitoring data will be reported in the Cleanup Action Completion Report prepared following cleanup of SCU-1.

Confirmation monitoring data from a given year will be summarized in a compliance monitoring report to be prepared and submitted to Ecology.

The reports will include the following sections:

- Site background and context for the current report
- Monitoring objective(s) and methods
- Method deviations in sampling and/or analysis from the CMCRP
- Results of monitoring, including data validation and sediment testing results
- Comparison of monitoring results to site cleanup levels and previous testing results
- Identification of any areas of concern, including any recommended contingency response measures or areas for supplemental testing.

Reports will be submitted to Ecology within 90 days of data validation. Chemistry results will be entered into the EIM database.

5 References

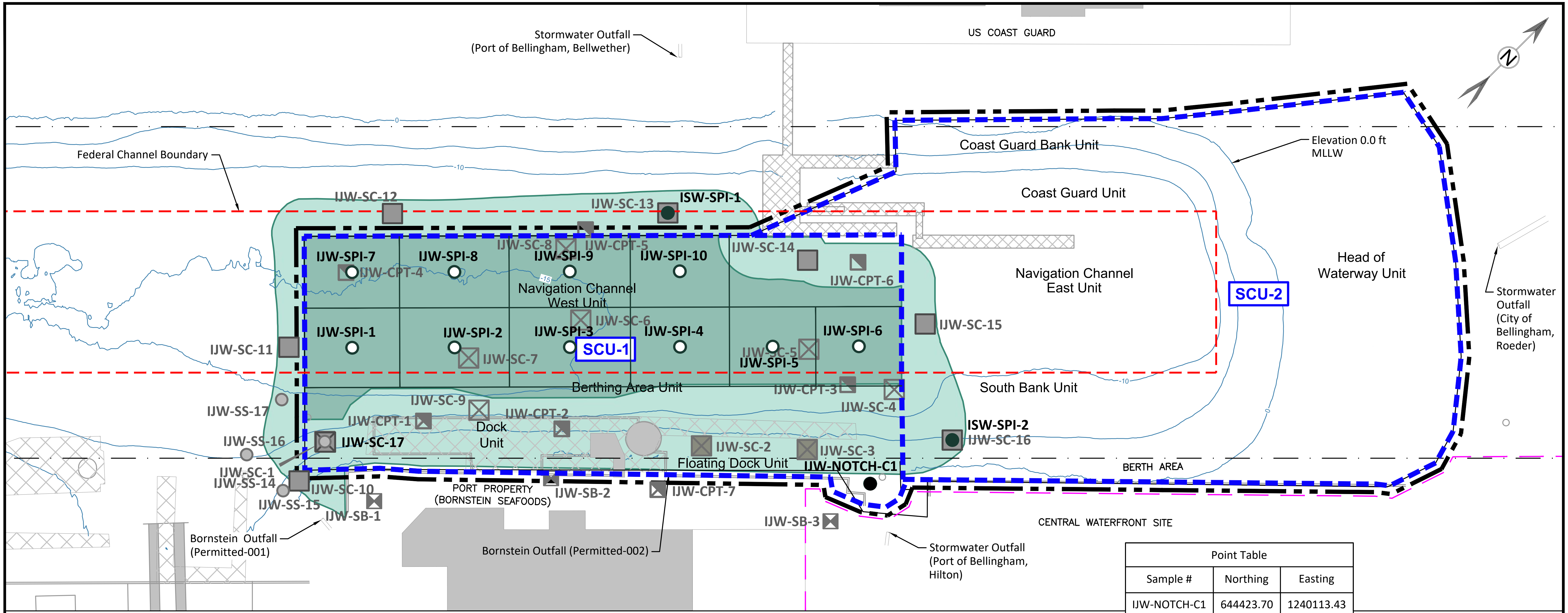
CRETE 2022. I&J Waterway Site Cleanup Action Draft Engineering Design Report. May 2022.

Ecology 2019a. Agreed Order DE 16186. April 29, 2019.

Ecology 2019b. I&J Waterway Site Cleanup Action Plan. Agreed Order DE 16186 Exhibit B. April 2019.

USACE 2004. Hydrographic Survey Manual, April 2004 Revision

Figures



Point Table		
Sample #	Northing	Easting
IJW-NOTCH-C1	644423.70	1240113.43
IJW-SPI-1	644260.45	1239824.71
IJW-SPI-2	644304.77	1239870.03
IJW-SPI-3	644354.76	1239921.10
IJW-SPI-4	644402.41	1239969.86
IJW-SPI-5	644442.51	1240010.89
IJW-SPI-6	644479.84	1240049.02
IJW-SPI-7	644293.92	1239791.98
IJW-SPI-8	644338.24	1239837.29
IJW-SPI-9	644388.24	1239888.36
IJW-SPI-10	644435.88	1239937.12

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
- 🟩 Proposed Dredge Surface
- 🟩 Proposed Dredge Surface Side Slope Area

Pre-Remedial Design Sampling Station

- ◪ CPT - Coast Guard Setback, Sediment Properties, GMD (Crete 2020)
- ◪ CPT - Bulkhead and Dock, GMD (Crete 2020)
- ☒ Mud Rotary - Bulkhead and Dock, GMD (Crete 2020)
- ☒ Vibracore - Dredge Prism, Subsurface Chemistry, GMD (Crete 2020)
- ☒ Vibracore - Dredge Prism, GMD (Crete 2020)
- ● Surface Grab - Dredge Prism, Chemistry (Crete 2020)
- ■ Vibracore - Dredge Prism Side Slope, Collected during Phase 2 of Sampling Activities
- ☒ Vibracore - Dredge Prism, GMD, Collected during Phase 2 of Sampling Activities

Design Sampling Station

- ○ Performance Monitoring Sample - Sediment Profile Imaging
- ● Performance Monitoring Sample - Sediment and Soil Chemical Analysis

Point Table		
Sample #	Northing	Easting
ISW-SPI-1	644456.66	1239906.57
ISW-SPI-2	644478.55	1240131.01

0 60 120
SCALE IN FEET

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CONSULTING, INC.

Port of Bellingham
I&J Waterway Site, Sediment Cleanup Unit 1
Engineering Design Report

Performance Monitoring Surface
Sediment Sampling Locations
Figure 1

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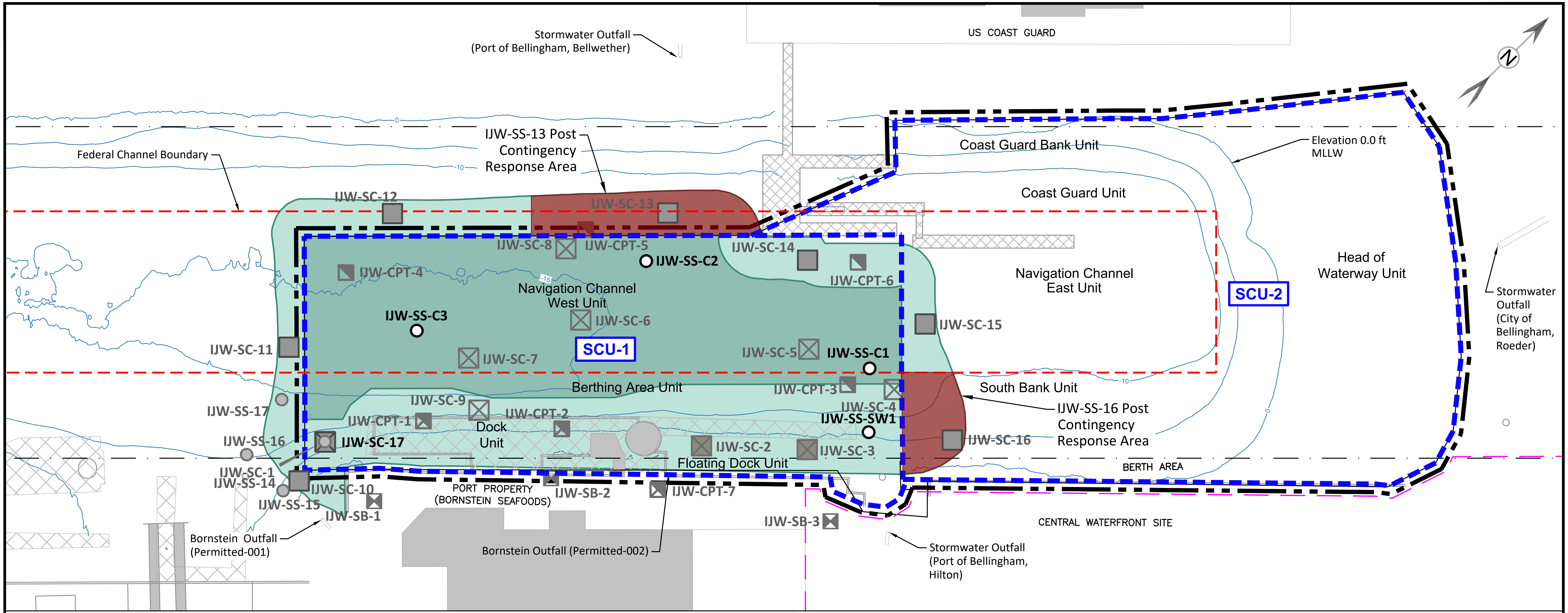

LEGEND:

- ▨ 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
- 🟩 Proposed Dredge Surface
- 🟩 Proposed Dredge Surface Side Slope Area

Pre-Remedial Design Sampling Station

- ◪ CPT - Coast Guard Setback, Sediment Properties, GMD (Crete 2020)
- ◪ CPT - Bulkhead and Dock, GMD (Crete 2020)
- ☒ Mud Rotary - Bulkhead and Dock, GMD (Crete 2020)
- ☒ Vibracore - Dredge Prism, Subsurface Chemistry, GMD (Crete 2020)
- ☒ Vibracore - Dredge Prism, GMD (Crete 2020)
- ● Surface Grab - Dredge Prism, Chemistry (Crete 2020)
- ■ Vibracore - Dredge Prism Side Slope, Collected during Phase 2 of Sampling Activities
- ☒ Vibracore - Dredge Prism, GMD, Collected during Phase 2 of Sampling Activities

Design Sampling Station

- ○ Confirmation Monitoring Surface Sediment Sample Location

Point Table

Sample #	Northing	Easting
IJW-SS-C1	644474.67	1240063.33
IJW-SS-C2	644425.89	1239917.83
IJW-SS-C3	644295.91	1239845.99
IJW-SS-SW1*	644445.92	1240090.51

* Sample location may be adjusted in the field, as needed to target stormwater outfall solids.

0 60 120
SCALE IN FEET

CRETE CONSULTING, INC.

Port of Bellingham
I&J Waterway Site, Sediment Cleanup Unit 1
Engineering Design Report

Confirmation Monitoring Surface
Sediment Sampling Locations
Figure 2

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Attachment 1
Quality Assurance Project Plan

COMPLIANCE MONITORING AND CONTINGENCY RESPONSE PLAN

Attachment 1: Quality Assurance Project Plan

I&J Waterway Site
Sediment Cleanup Unit 1
Bellingham, Washington

Project Number: 036-001

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

October 20, 2023

Prepared by:

CRETE
CONSULTING, INC.

Table of Contents

List of Tables

1 Introduction

This Compliance Monitoring and Contingency Response Plan (CMCRP) Quality Assurance Project Plan (QAPP) presents the project organization, objectives, activities, and quality assurance (QA) procedures to be implemented during performance and confirmation monitoring data collection activities following cleanup of sediment cleanup unit 1 (SCU-1) of the I&J Waterway Site (Site) in Bellingham, Washington. The specific data collection activities are detailed in the CMCRP. All components of this work are being conducted under the supervision of the Washington State Department of Ecology (Ecology).

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 CMCRP.

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 Sections 2 and 3 of the CMCRP.

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 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.

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	Rusty Jones (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)	Rusty Jones (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.

Role	Contact	Roles and Responsibilities
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 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.

2.2 Project Definition and Background

The CMCRP describes the environmental monitoring activities that will be used to ensure that cleanup standards are met, and long-term effectiveness of the cleanup is maintained. The cleanup action for SCU-1 includes removal of contaminated sediment in defined areas (see Figure 1 of the CMCRP), including soil in the Notch Area. Removed material will be disposed in a permitted upland facility. Site indicator hazardous substances (IHSs) include polynuclear aromatic hydrocarbons (PAHs), semi-volatile organic compounds (SVOCs, including bis(2-ethylhexyl) phthalate) [BEHP]), and nickel.

2.3 Project Description and Schedule

Sampling activities and timing are described in the CMCRP. This QAPP includes work associated with the following collection of sediment and soil chemistry 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.

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.

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

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 and soil 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 and Table 3.

Table 2 Laboratory Testing Program – Sediment Samples

Analytes	CUL - dwt	Analytical Method	RL	MDL	Sample Size	Container	Units	Preser-vative	Holding Times
Conventional Parameters (pct)									
Total organic carbon (Sediment only)	---	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
Polycyclic Aromatic Hydrocarbons (µg/kg)									
cPAH TEQ - surface sediment	229	8270D/E	--	--	150 g	8-oz glass	ug/kg dry wt	Cool/4o C	14 days until extraction, 40 days to analyze
			--	--					
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					

Analytes	CUL - dwt	Analytical Method	RL	MDL	Sample Size	Container	Units	Preser-vative	Holding Times
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					
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					

Analytes	CUL - dwt	Analytical Method	RL	MDL	Sample Size	Container	Units	Preser-vative	Holding Times
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					
1,2,3,4,7,8,9-HpCDF		1613B	2.5	2.5					
OCDF		1613B	5	5					

Notes:

na - not applicable

SVOC - semi-volatile organic compound

g – grams

oz – ounce

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 2021, prepared by the Washington State Department of Ecology (SCUM).

Table 3 Laboratory Testing Program – Soil Samples

Analytes	Analytical Method	RL	MDL	Sample Size	Container	Units	Preser-vative	Holding Times
Metals (mg/kg)								
Nickel	6020B	200	44	50 g	4-oz glass	ug/kg dry wt	Cool/4o C	6 months
Polycyclic Aromatic Hydrocarbons (µg/kg)								
2-Methylnaphthalene	8270D/E	2	0.33	150 g	8-oz glass	ug/kg dry wt	Cool/4º C	14 days until extraction, 40 days to analyze
Acenaphthene	8270D/E	2	0.37					
Anthracene	8270D/E	2	0.46					
Benzo(a)anthracene	8270D/E	2	0.43					
Benzo(a)pyrene	8270D/E	2	0.48					
Benzofluoranthenes (b,k)	8270D/E	4	0.98					
Chrysene	8270D/E	2	0.53					
Dibenzo(a,h)anthracene	8270D/E	2	0.91					
Fluoranthene	8270D/E	2	0.53					
Fluorene	8270D/E	2	0.37					
Indeno(1,2,3-c,d)pyrene	8270D/E	2	0.56					
Phenanthrene	8270D/E	2	0.59					
Pyrene	8270D/E	2	0.37					
Total HPAH (SMS) (U = 0)	8270D/E							
Total LPAH (SMS) (U = 0)	8270D/E							
bis(2-Ethylhexyl)phthalate*	8270D/E	160	2.3					
Dibenzofuran	8270D/E	10	0.76					
Dimethyl phthalate	8270D/E	50	5.5					
n-Nitrosodiphenylamine	8270D/E	10	3.6					

Analytes	Analytical Method	RL	MDL	Sample Size	Container	Units	Preser-vative	Holding Times
				Semivolatile Organics (µg/kg)				
2,4-Dimethylphenol	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)	8270D/E	50	8.2					
3- & 4-Methylphenol (m, p-Cresol)	8270D/E	200	8.3					
Benzoic acid	8270D/E	500	81					
Benzyl alcohol	8270D/E	50	9.1					

Notes:

cPAH = carcinogenic polycyclic aromatic hydrocarbon

SVOC = semi-volatile organic compound

DQO = Data Quality Objectives

MTCA = Model Toxics Control Act

Soil cleanup levels are MTCA Method A soil levels for unrestricted land use will be used for the performance criteria, if no Method A level is available, MTCA Method B levels will be used

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 using 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 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.

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 CMCRP. The methods and procedures for collection of field samples are also provided in the CMCRP. All sampling will be conducted following standard procedures documented in the CMCRP.

3.2 Analytical Sampling Methods, Handling and Custody

3.2.1 Sediment and Soil Samples

Sediment and soil samples will be submitted for analysis as detailed in the CMCRP and described in Tables 2 and 3. 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 4.

Table 4 Data Quality Objectives

Parameter	Precision	Accuracy	Completeness
Total metals	+/- 20% RPD	75-125% R	95%
Semivolatile organic compounds (includes Bis(2-ethylhexyl)phthalate) and cPAH))	+/- 35% RPD	50-150% R	95%
Dioxin/Furan	+/- 35% RPD	50-150% R	95%

Notes:
RPD = Relative percent difference
R = Recovery
cPAH = carcinogenic polycyclic aromatic hydrocarbons

3.2.2 Sampling Handling

Soil (from the Notch Area) 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 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 EDR (CRETE 2022). 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 due to 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
- Collection 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 validated table 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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Appendix F

Water Quality Monitoring Plan

APPENDIX F
WATER QUALITY MONITORING PLAN
Final

I&J Waterway Site
Sediment Cleanup Unit-1
Bellingham, Washington

Project Number: 036-001

Prepared for:

Port of Bellingham and
Bornstein Seafoods, Inc.

October 20, 2023

Prepared by:

CRETE
CONSULTING, INC.

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Abbreviations and Acronyms

BMP	best management practice
BG	Background Station
CFR	Code of Federal Regulations
CS	Compliance Station
DO	dissolved oxygen
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
EW	Early Warning Station
HAZWOPER	Hazardous Waste Operations and Emergency Response
mg/L	milligram per liter
NTU	nephelometric turbidity unit
OSHA	Occupational Safety and Health Administration
Port	Port of Bellingham
RML	Residuals Management Layer
QC	quality control
SCU-1	Sediment Cleanup Unit 1
WAC	Washington Administrative Code
WQMP	Water Quality Monitoring Plan

1 Introduction

This Water Quality Monitoring Plan (WQMP) is part of the construction monitoring submittal for Sediment Cleanup Unit 1 (SCU-1) of the I&J Waterway Site (Site) in Bellingham, Washington. This WQMP is an appendix to the Engineering Design Report (EDR; CRETE 2022), which describes the construction activities and their schedule and associated Best Management Practices (BMPs). The water quality monitoring will be used during in-water work to assess the contractor's adherence to permit conditions and federal, state, and local regulations pertaining to water quality. The contractor is responsible for providing quality control of its work to meet applicable and relevant water quality criteria. This water quality monitoring program is intended to provide assurance that the contractor's operations are in compliance with water quality criteria.

This plan describes conventional monitoring to be used to verify compliance with applicable water quality criteria. Contingency measures to be implemented based on the monitoring findings are also described.

2 Water Quality Criteria

The waters of Bellingham Bay are designated as excellent quality marine waters by the State of Washington (Washington Administrative Code [WAC] 173-201A). Applicable criteria exist for conventional parameters as described in Sections 2.1.

2.1 Conventional Criteria

Turbidity and dissolved oxygen (DO) will be monitored as the primary indicators of water quality. For marine waterbodies classified as excellent, turbidity shall not exceed 5 nephelometric turbidity units (NTU) over background turbidity when the background turbidity is 50 NTU or less, or there shall not be more than a 10% increase in turbidity when the background turbidity is more than 50 NTU. The lowest 1-day minimum for DO in marine waterbodies designated as excellent is 6.0 milligrams per liter (mg/L) or 0.2 mg/L less than background if background is less than 6 mg/L [WAC 173-201A-200(1)(d) and (e)].

DO will be monitored because it can fluctuate greatly in Inner Bellingham Bay due to turnover effects that can bring water with lower dissolved oxygen to the surface.

3 Monitoring Plan

The dredging design aims to minimize the dispersion of contaminated sediment and development of dredge-related residuals. The use of appropriate BMPs is required in the Specifications and will be addressed during development and review of the Contractor’s Dredge Plan.

Water quality monitoring will be performed at points located at specific distances from the respective construction activities, measured using radii of 100 feet (Early Warning Station; EW) and 150 feet (Compliance Station; CS). Monitoring will also be performed at a Background Station (BG) located at least 500 feet from the respective construction activities. Typical water quality monitoring locations are shown in Figure 1.

The actual positions of EW, CS, and BG Stations will be adjusted in the field using the best professional judgment of the monitoring crew. These adjustments will be based on the location of active in-water work, the tidal cycle, and observations of the current. The actual positions will be recorded in the field documentation.

Monitoring sequence for each cycle will start with BG, followed by CS and then EW Stations.

3.1 Early Warning Station

Turbidity and DO measurements at the 100-foot distance serve as an indicator of water quality closer to the construction activity. EW Station monitoring results will allow the contractor to modify the construction operation to potentially avoid water quality exceedances at the compliance boundary and the resulting stoppage of work.

3.2 Compliance Station

Compliance monitoring will include evaluation of water quality criteria at the CS Station located 150 feet from the construction activity. Example stations are shown on Figure 1.

A confirmed water quality exceedance at the compliance boundary will require work stoppage and implementation of contingency response actions by the contractor prior to resuming work. A description of the contingency measures that will be implemented if exceedances are confirmed is provided in Section 6.

3.3 Background Stations

One or more representative BG Stations will be sampled during each monitoring event. BG Stations will be located a minimum of 500 feet from active in-water work in an area unaffected by the active work.

The BG Stations may be positioned toward the inner or outer part of the waterway depending on tidal flows (i.e., flood versus ebb tides; Figure 1). Samples will be collected prior to construction activities to represent normal undisturbed conditions which will be used to establish background conditions for the waterway.

3.4 Conventional Monitoring Depths

At each station monitored for turbidity and DO, measurements will be made at three depths in the water column:

- Surface (1 meter below the surface)
- Middle (mid-point of the water column)
- Bottom (within 2 meters of the sediment surface)

Water depth will be determined using either a lead line or fathometer at the monitoring location, which will be recorded onto the field data log sheet. DO results in the construction area will be compared to DO measurements at the BG Station to determine if DO at the construction site meets the minimum 6 mg/L DO or 0.2 mg/L less than background if background is less than 6 mg/L. The range of turbidity measurements in the construction area will be compared to the range of turbidity measurements at the BG Station to determine if the turbidity at the construction site exceeds the background range by more than 5 NTU (if less than 50 NTU background) or more than 10% (if greater than 50 NTU background).

4 Field Sampling Plan

4.1 Conventional Monitoring Methods

In situ turbidity and DO will be measured with a Hydrolab water quality meter (or equivalent) or turbidometer and DO meter. Continuous in situ profiling tools are preferred to retrieving water samples and measuring parameters on deck. Turbidity and DO data for each monitoring event and respective location will be recorded on a field data sheet, as well as weather and tidal observations. An example data sheet is included as Figure 2.

4.2 Special Training Requirements and Certifications

Monitoring will be conducted by experienced field staff. All water quality field monitoring personnel shall have successfully completed a 40-hour training course (with current annual 8-hour refresher training, as necessary) for Hazardous Waste Operations and Emergency Response (HAZWOPER) to comply with Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120(e)(3). Documentation of OSHA training shall be maintained in each worker’s personnel files and be available for review at the Site. Personnel must also be enrolled in a medical surveillance program, and must have passed an occupational physical in the last 12 months. Monitoring staff must also have extensive knowledge, skill, and demonstrated experience in the execution of the sampling methods.

5 Monitoring Frequency and Schedule

The frequency and schedule of the turbidity and DO monitoring during the in-water work is divided into two levels of intensity, as described below:

- Intensive – Collection of turbidity and DO measurements every 4 hours during in-water work
- Routine – Collection of turbidity and DO measurements twice a day, one time per week

During dredging activities, monitoring will be conducted on an intensive schedule for the first 5 days of in-water work. If no exceedances at the Compliance Station occur during the intensive monitoring, monitoring will be reduced to a routine schedule, unless otherwise directed by the Washington State Department of Ecology (Ecology). In addition, visual inspections will be performed hourly during the course of dredging activities. Visual plumes that are observed to extend at least 100 ft from the in-water activity will trigger metered monitoring to determine if there is an elevation or exceedance of water quality criteria.

During in-water structure removal activities, monitoring will be conducted on an intensive schedule for 2 days. If no exceedances occur during intensive monitoring, monitoring will be reduced to a routine schedule for the remaining days, unless otherwise directed by Ecology.

During placement of shoreline armor/habitat material and residuals management layer (RML), monitoring will be conducted on an intensive schedule for 2 days. If no exceedances occur during intensive monitoring, monitoring will be reduced to a routine schedule for the remaining days, unless otherwise directed by Ecology.

The occurrence of turbidity or DO exceedances, a significant change in construction equipment or operations (e.g., dredging, armor placement, structure removal), or extended breaks in activity (greater than 1 week) will trigger a transition back to intensive monitoring to confirm that no water quality impacts are occurring.

6 Contingency Measures and Response Actions

6.1 Stop Work Criteria

The following conditions require a stop work response:

- Evidence of a significant oil sheen
- Evidence of distressed or dying fish
- Confirmed water quality criteria failure at the 150-foot CS Station

If distressed or dying fish are observed, the monitoring crew will report immediately to Ecology's Northwest Regional 24-hour Spill Response Office at (206) 594-0000.

6.2 Contingency Measures

If a turbidity or DO measurement does not achieve water quality criteria at the EW Station contingency measures will be taken to mitigate the result. If a turbidity or DO measurement does not achieve water quality criteria at the CS Station work will stop and mitigation measures will be identified through consultation with the Port and Ecology prior to re-starting work. For the proposed dredging and related in-water construction work, these measures are largely focused on reducing sediment resuspension and turbidity in the water column and include but are not limited to:

- Operational best management practices (BMPs):
  - Slowing the speed of the dredge bucket through the water column
  - Avoiding overfilling of the bucket
  - Allowing water to drain from the bucket at the surface
  - Not overfilling the dredge scow
  - Avoiding critical tidal or current conditions
- Structural BMPs:
  - Modification of equipment to better control sediment resuspension
  - Installation of a sediment barrier such as a silt curtain.

6.3 Water Quality Criteria Not Met at Early Warning Station

If turbidity or DO do not meet water quality criteria at the 100-foot EW Station, the following sequence of responses will be initiated:

1. The water quality monitoring crew will wait 10 minutes and retake measurements at the station. The water quality monitoring crew will visually

assess the station vicinity for potential outside influences, including malfunctioning dredging or backfill equipment, non-dredging or backfill-related activities, and/or storm drain discharges.

   a. If the retake measurements meet water quality criteria, the water quality monitoring crew will resume the normally scheduled monitoring program.
   b. If the retake measurements do not meet water quality criteria, the contractor will be notified and requested to modify work activity using BMPs. The contractor will assess the current work methodology to determine if adjustments can be made to correct the problem. Potential contractor BMPs are listed in Section 6.2.

2. The water quality monitoring crew will wait at least 30 minutes to 1 hour after contractor BMPs are implemented, and retake measurements at the station.
   a. If the retake measurements meet water quality criteria, the monitoring crew will continue sampling at normal 4-hour increments.
   b. If the retake measurements do not meet water quality criteria, the contractor will be notified that additional enhancements to BMPs are warranted. The monitoring crew will continue monitoring on 30-minute to 1-hour intervals until the water quality impact dissipates.

6.4 Water Quality Criteria Not Met at Compliance Station

If water quality criteria (turbidity or DO; see Section 1.1) are exceeded at the 150-foot CS Station, the following sequence of responses will be initiated.

1. The water quality monitoring crew will wait 10 minutes and retake measurements at the station. The water quality monitoring crew will visually assess the station vicinity for potential outside influences, including malfunctioning dredging or backfill equipment, non-dredging or backfill related activities, and/or storm drain discharges.
   a. If the retake measurements meet water quality criteria, the water quality monitoring crew will resume the normally scheduled monitoring program.
   b. If the retake measurement exceeds water quality criteria (exceedance is confirmed) the contractor will be notified to stop work. The monitoring crew will monitor the plume downstream to determine the extent of the exceedance. The monitoring crew will monitor the CS Station and any impacted downstream locations on 1-hour intervals until water quality criteria are met or until sunset.
   c. As an exception to b. above, if an exceedance occurs during placement of the RML, BMPs can be implemented, and retake measurements

    performed 30 min to 1 hour after BMP implementation. If retake measurement still exceeds water quality criteria, then stop work and monitor until criteria is met before implementing additional BMPs.
   d. Work may resume only after water quality criteria are met.

2. After stopping work due to a confirmed exceedance, the contractor will submit its planned contingency response action(s) to the Port within 1 hour. The contractor will be required to implement its contingency measures after Port and Ecology Toxics Cleanup Program acceptance of the planned actions.

3. Following contractor implementation of contingency response actions, the intensive monitoring phase will re-start.

7 Quality Control

The quality control (QC) objective for this water quality monitoring effort is to verify that the data collected are of known and acceptable quality so that the goals of the water quality program can be achieved. Appropriate field QC procedures will be followed. These procedures include performing routine field instrument calibration and following standard instrument operation procedures.

8 Documentation

8.1 Daily Construction Quality Control Report

The Contractor will prepare a Daily Construction Quality Control Report for the Port. It will include a description of water quality monitoring and in-water activities conducted, field measurements taken, laboratory data received, and any corrective actions conducted as a result of the field measurements. In the event of a confirmed exceedance, the Port will provide the Contractor's Daily Construction Quality Control Report to Ecology within 24 hours of the exceedance. This report will include the purported cause of the exceedance, specific corrective measures initially taken, the rationale behind those measures, and the results of follow-up sampling.

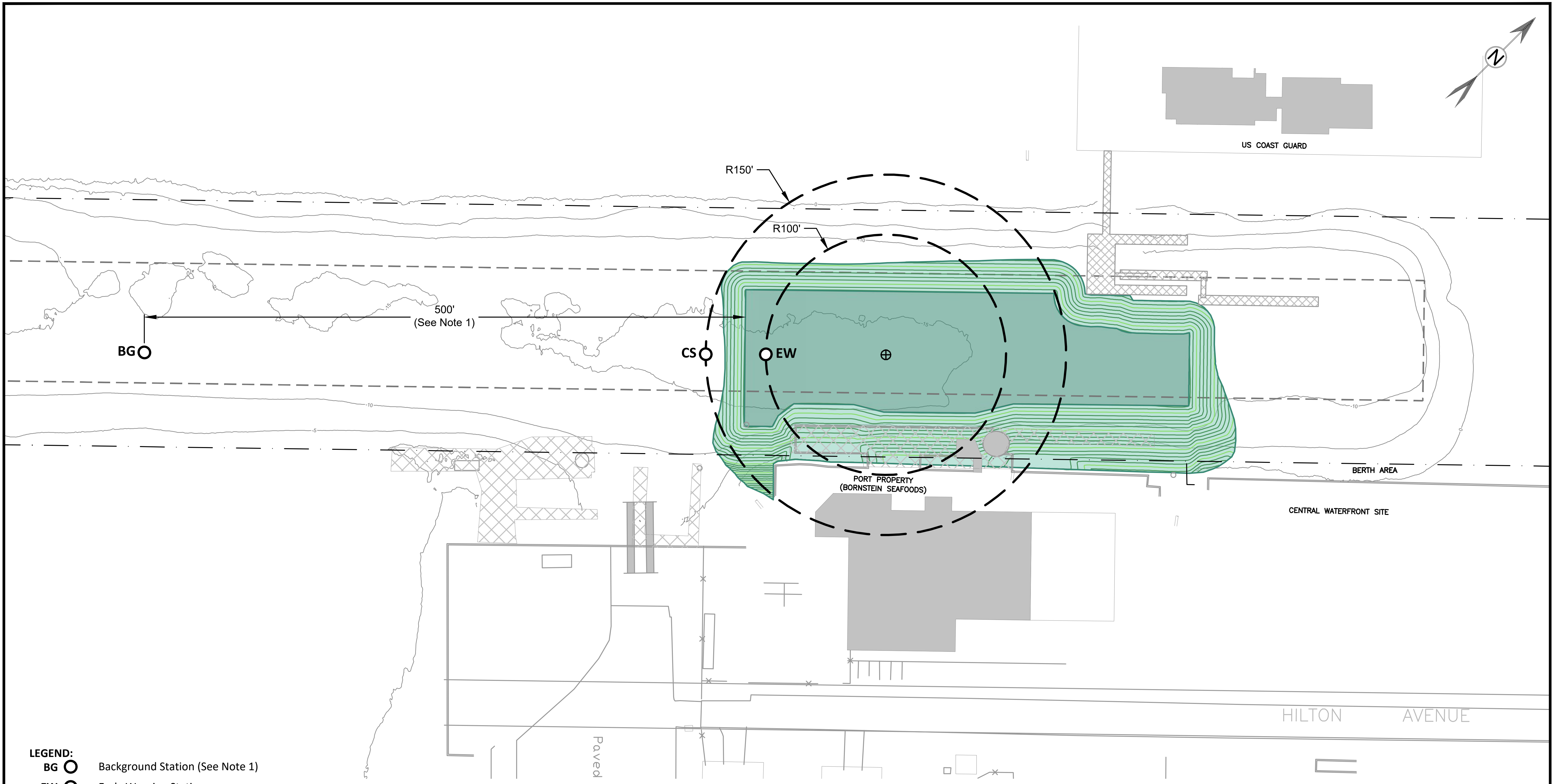
8.2 Water Quality Monitoring Completion Summary

A summary of the water quality monitoring program results will be included in the completion report prepared to document cleanup activities. This summary will include a description of the field sampling effort (e.g., procedures, sample locations and depths, observations), descriptions and rationale for any deviations from the WQMP, a detailed discussion of any data quality issues, tabulated field and laboratory data with comparisons to criteria and to background levels, and any corrective actions (e.g., change in BMPs, stopped work) taken as a result of these data. A final electronic data package will be provided to Ecology once all analyses and validation activities have been completed.

9 References

CRETE 2022. I&J Waterway Site Cleanup Action Draft Engineering Design Report. May 2022.

Figures



LEGEND:

BG	○	Background Station (See Note 1)
EW	○	Early Warning Station
CS	○	Compliance Station
	⊕	Location of Dredging Activities

Notes

1. Location will be 500 ft away from dredging footprint, background sampling will be conducted prior to starting any work.
2. Water quality monitoring locations are shown relative to location of work and will move with project progress.
3. Bathymetry shown is for dredging conditions.
4. Contour interval is 1 foot.

Horizontal Datum: Washington State Plane North, NAD83, U.S. Feet
Vertical Datum: Mean Lower Low Level (MLLW)

CRETE
CONSULTING, INC.

Port of Bellingham
I&J Waterway Site, Sediment Cleanup Unit
Engineering Design Report

Water Quality Monitoring Plan

Figure 1

File: D:_Projects\Crete\PRDI\PRDI Sediment Cleanup Map.dwg   Date: 4/28/2022 | Cabryn

I&J Waterway Cleanup Action – Sediment Cleanup Unit 1

Figure 2 – WATER QUALITY MONITORING EVENT DATA SHEET

Project:					
Date:					
Monitoring Personnel:					
Weather Conditions:					
Construction Activities in Progress:					
Monitoring Level (Routine/Intensive)?					
Meter Type/Calibration Notes:					
		Monitoring Stations			
		Background Station	Early Warning Station	Compliance Station	Notes
Station Location	Northing:				
	Easting:				
Distance from In-Water Activity (Feet)		500 Feet (Min.)	100 Feet	150 Feet	
Station Monitoring Time					
Tidal Status (Ebb, Flood, Slack)					
Visual Turbidity Evident?					
Sheen/Oil Evident?					
Other WQ Observations?					
Turbidity (NTU)					
Surface Depth (1 Meter Below Surface)					
Middle (Mid-Point of Water Column)					
Bottom (Within 2 Meters of Bottom)					
Dissolved Oxygen (mg/L)					
Surface Depth (1 Meter Below Surface)					
Middle (Mid-Point of Water Column)					
Bottom (Within 2 Meters of Bottom)					
Water Quality Criteria Exceeded? (Y/N)					
Response Actions Taken? (Describe)					

Appendix G

Substantive Requirements of Procedurally Exempt Permits

Planning and Community Development Department
210 Lottie Street, Bellingham, WA 98225
Phone: (360) 778-8300 Fax: (360) 778-8301 TTY: (360) 778-8382
Email: planning@cob.org Web: www.cob.org

SHORELINE PERMIT EXEMPTION #SHR2023-0019
SUBSTANTIVE COMPLIANCE FOR I & J WATERWAY

Type of Action:		Permit No: **SHR2023-0019**
_	Permit	Action: **Approval with Conditions**
_	Variance	Decision Date: **10/10/2023**
X	**Exemption**	

Pursuant to Chapter 90.58 RCW, this **SHORELINE EXEMPTION** is hereby **GRANTED** to **Project Applicant**: Grant Hainsworth, Crete Consulting, LLC, 253-797-6323 or grant.hainsworth@creteconsulting.com on behalf of Ben Howard, Environmental Project Manager, Port of Bellingham, 360-676-2500.

I. PROJECT

Conduct a remedial action (RA) within the I & J Waterway pursuant to the Model Toxics Control Act (MTCA) in RCW 70A.305. There are two cleanup units: SCU-1 and SCU-2. SCU-1 is included in a consent decree issued by the Department of Ecology to the Port of Bellingham and Bornstein Seafoods. SCU-2 is an agreed order between the Department of Ecology and the Port of Bellingham. Each cleanup unit is distinct and the activities within each unit will occur sequentially, i.e., SCU-1 first and SCU-2 second. Generally, the remedial actions in both units include:

- The removal of approximately 17,300 cubic yards of contaminated sediment from an approximate 1.6-acre area in SCU-1;
- Removal of existing marine infrastructure include concrete decking, creosote and derelict timber piles;
- Installation of new sheet pile bulkhead waterward of the existing creosote bulkhead structure;
- Backfill of a small upland area and reconfiguration of an existing stormwater outfall;
- Replacement of the existing marine infrastructure with no expansion beyond the existing footprint;
- Small extensions of existing stormwater conveyance pipes in order to outfall through the new sheet-pile bulkhead;
- Placement of layer of sand and gravel mix over disturbed area to allow for natural recovery; and
- Capping an area at the head of the I & J Waterway as well as continued monitoring for natural recovery in SCU-2.

A detailed description is provided in the Technical / Shoreline Compliance Memorandum provided on Exhibit A. The project drawings are provided on Exhibit A-1. This exemption includes the RA taken under the Consent Decree and Agreed Order including the removal and replacement of the marine infrastructure specified herein. Unless specified otherwise herein, the term “RA” refers to the elements of all the proposed action listed above. This exemption is issued pursuant to RCW 70A.305.090.

II. LOCATION

Generally located at the I & J Waterway between 1001 Hilton Avenue and 1225 Roeder Avenue and within marine reach #5, Waterfront District shoreline designation – shoreline mixed use sub-area. Exhibit B.

III. EXHIBITS

A	Technical and Shoreline Compliance Memorandum and site plans by Crete dated 4/26/23
A-1	Plan set by Crete Consulting dated 9/22/2022
B	Aerial photograph and Cleanup Action Area Vicinity Map
C	Cleanup Action Plan dated July 2023
D	SEPA Determination of Non-Significance and Checklist
E	JARPA dated 4/28/22

IV. CHRONOLOGY

A detailed chronology and history are provided in section 1 and section 2.1 within the Cleanup Action Plan (CAP) provided on Exhibit C. More recently:

1. On February 19, 2019, the Department of Ecology issued a SEPA Determination of Non-Significance. The DNS and corresponding checklist are provided on Exhibit D.
2. In April 2019, a Cleanup Action Plan (CAP) was issued that specifies alternative #4 to be the preferred cleanup action for the I & J Waterway.
3. The DOE initiated an opportunity for public review and comment on the I & J Waterway Cleanup. The public review and comment period was open between August 28 to September 26, 2023.
4. At the time of this substantive compliance analysis no public or agency comments were received.
5. On October 10, 2023, the PCDD issued this shoreline exemption for the proposed RA.

V. SMP COMPLIANCE. (BMC Title 22, Shorelines, applicable sections only)

22.02.020: Shoreline Goals

A. Shoreline Use. The shoreline use element considers the proposed general distribution and general location and extent of the use of shorelines and adjacent land areas for housing, business, industry, transportation, agriculture, natural resources, recreation, education, public buildings and grounds, utilities and other categories of public and private land use.

1. Goal.
    a. Coordinate shoreline uses to insure uses that result in long-term over short-term benefit, protect and restore the shoreline resources and ecological functions, increase public access to the shoreline, and promote economic development and accommodate water-dependent uses.

2. Objectives.
    a. Upland areas adjacent to waters with appropriate depth shipping channels should be preserved for water-dependent and water-related uses unless otherwise stated. Water-

enjoyment uses should be provided where substantial numbers of citizens can enjoy access to the water, physical or visual.

B. Restoration and Conservation. The restoration and conservation element provides for the preservation of existing and rehabilitation of degraded natural resources, ecosystem processes and functions, scenic vistas, and aesthetics.

1. Goal.
   a. Restoration and conservation should occur via comprehensive restoration planning, public land acquisition, placing of conservation easements, site design and as development/redevelopment occurs. Activities that restore and enhance ecological functions of our shorelines should be emphasized. This master program's regulations and policies are required to achieve no net loss of shoreline ecological function on a reach and watershed scale. The restoration priority goals and objectives in the restoration plan (Appendix B) are intended to restore and improve ecological functions of our shorelines citywide.

C. Economic Development. The economic development element provides for the location and design of industries, transportation facilities, port facilities, tourist facilities, commerce and other developments that depend on the shorelines of the state for their location or use.

1. Goal.
   a. Preserve the federal shipping channels and their adjacent upland areas for water-oriented uses. Priority should be given for water-dependent and water-related uses in these areas because they have appropriate depth for a variety of vessels including commerce, tourism, transient and permanent moorage and transportation linkages.

I. Water Quality. All development actions taken citywide affect water quality. This program should implement policies and regulations that improve the water quality of our shorelines.

1. Goal.
   a. All development along the shorelines of the city should include measures to protect and/or improve water quality.

2. Objectives.
   a. Improvements to water quality within the city of Bellingham should be achieved via the restoration plan in Appendix B. The restoration plan specifies priority goals, objectives, management recommendations and restoration projects that are intended to achieve an improvement to water quality within the city. The restoration plan is not intended to take the place of or have priority over existing water quality improvement programs already underway by the city of Bellingham or as required by the state.

STAFF RESPONSE: The remedial action (RA) is consistent with the shoreline goals and objectives specified above and the overall result is expected to result in no net loss of existing shoreline ecological function. The proposed cleanup, over-dredge and replacement and upgrade of existing marine infrastructure allow for continued use of the navigation channel which supports a long-standing water-oriented use. The RA is also consistent with the SMP's Restoration Plan that identifies improving water quality as its overall priority goal.

22.03.030 E: Aquatic

1. Purpose. Protect, restore and manage the unique characteristics of the aquatic environment.

2. Management Policies.
    a. Aquatic uses should not adversely impact critical saltwater and freshwater habitats or their connectivity for salmonids and other aquatic and terrestrial species that migrate within the near-shore environment.

    f. Dredging and dredge spoils disposal operations should be accomplished in such a manner that results in no net loss of ecological function and should restore, enhance and/or improve ecological function wherever appropriate.

5. Regulations.
    h. When dredge disposal of contaminated materials occurs within aquatic areas the standards within Chapter 173-204 shall apply.

22.03.030 F: Waterfront District – Shoreline Mixed Use Sub-Area

1. Purpose. To plan for, protect and implement restoration of the shoreline ecological function, reserve areas for water-dependent and water-related uses, maximize public access to the shoreline and accommodate shoreline mixed uses and non-water-oriented uses where appropriate.

2. Management Policies.
    a. The city should coordinate with state, federal and local agencies, organizations, and institutions, including the Lummi Nation and Nooksack Tribe, to improve the ecological function of the shorelines.

    b. Opportunities for cooperative projects and joint funding for shoreline restoration, habitat enhancement, environmental remediation and public access improvements should be identified.

6. Regulations within the waterfront district mixed-use sub-area are as follows
    a. Development shall result in no net loss of shoreline ecological functions.

STAFF RESPONSE: The RA is consistent with the applicable policies and regulations above. The proposed removal of contaminated sediment and significant dilapidated marine infrastructure including creosote treated structures is expected to result in no net loss of existing shoreline ecological function.

22.04.010: Shorelines of Statewide Significance.

A. The following management and administrative policies are hereby adopted for all shorelines of statewide significance in Bellingham, as defined in RCW 90.58.030(2)(e) and identified in this section and as shown in Chapter 22.11 BMC.

B. This master program gives preference in the following order to uses that:
1. Recognize and protect the statewide interest over local interest;
2. Preserve the natural character of the shoreline;
3. Result in long-term over short-term benefit;
4. Protect the resources and ecology of the shoreline;
5. Increase public access to publicly owned areas of the shoreline;
6. Increase recreational opportunities for the public in the shoreline; and

7. Provide for any other element as defined in RCW 90.58.100 deemed appropriate or necessary.

C. Conversely, uses that are not generally consistent with these policies should not be permitted on such shorelines.

STAFF RESPONSE: The RA is consistent with the policy enumerated above which is also reflected in RCW 90.58.030 (2)(e). Removal of contaminated sediments improves water quality and the overall health of species and organisms that support listed species present in all of Puget Sound and the Salish Sea such as Puget Sound Chinook and steelhead salmonids, certain rockfish and resident killer whales. This provides a long-term benefit to state-wide interests of species recovery. The RA design and cleanup plan have been determined to be protective of the resource and ecology of the shoreline. The RA preserves the existing opportunities for public access and recreation to / within the aquatic areas of the I & J Waterway. Finally, the RA preserves the waterway for a well-established long-standing water-dependent and related use that maintains and strengthens the marine industry in northern Puget Sound.

22.05.020: Exemptions.

B. Exempt Developments.

1. The following activities shall be considered exempt from the requirement to obtain a shoreline substantial development permit:

b. Normal maintenance or repair of existing structures or developments, including damage by accident, fire or elements. “Normal maintenance” includes those usual acts to prevent a decline, lapse or cessation from a lawfully established condition. “Normal repair” means to restore a development to a state comparable to its original condition within a reasonable period after decay or partial destruction except where repair causes substantial adverse effects to the shoreline resource or environment. Replacement of a structure or development may be authorized as repair where such replacement is the common method of repair for the type of structure or development and the replacement structure or development is comparable to the original structure or development including but not limited to its size, shape, configuration, location and external appearance and the replacement does not cause substantial adverse effects to shoreline resources or environment. **(This subsection pertains to the replacement of the existing marine infrastructure)**

q. Hazardous Substance Remedial Actions. The procedural requirements of Chapter 90.58 RCW shall not apply to a project for which a consent decree, order or agreed order has been issued pursuant to Chapter 70.105D RCW or to the Department of Ecology when it conducts a remedial action under Chapter 70.105D RCW. The Department of Ecology shall, in consultation with the city, assure that such projects comply with the substantive requirements of Chapter 90.58 RCW, and Chapter 173-26 WAC and the local master program. **(This subsection addresses the RA)**

STAFF RESPONSE: The overall RA includes two different elements; removal and replacement of marine infrastructure and the removal (dredging) of contaminated materials. Both actions are eligible for this exemption. The removal and replacement of marine infrastructure is necessary to conduct certain elements of the RA and does not result in additional marine infrastructure or over-water coverage. The RA is to be conducted pursuant to a consent decree and an agreed order. This exemption demonstrates compliance with applicable goals, objectives and regulations.

22.06.050: Conditional Uses.

A. The purpose of the conditional use provision is to provide more control and flexibility for implementing the regulations of the master program in a manner consistent with the policies of the Act. In authorizing a conditional use, special conditions may be attached to the permit by the city or department to prevent undesirable effects of the proposed use and/or to assure consistency of the project with the Act and this program.

B. An applicant for a substantial development permit which also requires a conditional use permit shall submit applications for both permits simultaneously pursuant to Chapter 21.10 BMC.

C. Prior to the granting of a conditional use permit, as specifically required by this program or for uses which are not classified as such by this program, the applicant shall demonstrate all of the following:

1. The provisions spelled out in the master program have been met and the proposed use is consistent with the policies of the Act;

2. The proposed use will cause no significant, adverse impacts to the shoreline environment, ecological functions, or other uses;

3. The proposed use will not interfere with the normal public use of public shorelines;

4. That the proposed use of the site and design of the project is compatible with other authorized uses within the area and with uses planned for the area under the comprehensive plan and the program;

5. The proposed use will not be contrary to the purpose and intent of the environment designation in which it is located and the general intent of the master program;

6. The proposed use(s) shall provide a long-term public benefit in terms of providing public access or implementing habitat restoration that is consistent with the goals of this program; and

7. That the public interest shall suffer no substantial detrimental effect.

E. In the granting of conditional use permits, consideration shall be given to the cumulative environmental impact of additional requests for like actions in the area. For example, if conditional use permits were granted for other developments in the area where similar circumstances exist, the sum of the conditional uses and their impacts shall also remain consistent with the policies of RCW 90.58.020 and shall not produce a significant adverse effect to the shoreline environment.

STAFF RESPONSE: BMC 22.08.140 B 2 (Dredging and Disposal) requires that the applicant demonstrate consistency with the conditional use criteria in 22.06.050 C 1-7. The applicant has provided this analysis on Exhibit A. PCDD staff concludes that the applicant's demonstration of consistency with the criteria has been met. PCDD staff provide additional analysis below of the specific applicable regulations.

22.08: GENERAL POLICIES AND REGULATIONS

22.08.030: Critical Areas

A. Policies.

1. Critical areas that are within the shoreline jurisdiction are to be protected and managed in such a manner that the result of any use activity or development is no net loss of shoreline ecological function and is in accordance with the standards and requirements within this title.

2. Critical areas within the shoreline jurisdiction should be protected and restored by integrating the full spectrum of planning and regulatory measures, including the comprehensive plan, inter-local watershed plans, local development regulations, and state, tribal, and federal programs.

3. The city should protect critical areas and their existing shoreline ecological functions so that they continue to contribute to existing ecosystem-wide processes.

4. The city and other special interest groups, organizations or nonprofit entities should restore and enhance degraded critical areas as separate restoration projects to improve existing shoreline ecological functions and ecosystem-wide processes, where feasible and appropriate.

B. Regulations

2. Endangered, Threatened, and Sensitive Species.
   a. Whenever activities are proposed within or adjacent to a habitat conservation area with which state or federally endangered, threatened, or sensitive species have a primary association, such area shall be protected through the application of protection measures in accordance with a critical area report prepared by a qualified professional and approved by the city.

22.08.040: Critical Saltwater Habitats.

A. Policies.

1. Development within critical saltwater habitats including, but not limited to, designated habitats of local significance, all kelp beds, eelgrass beds, spawning and holding areas for forage fish, such as herring, smelt and sand lance, subsistence, commercial and recreational shellfish beds, mudflats, intertidal habitats with vascular plants, and areas with which priority species have a primary association, should result in no net loss of ecological function, comply with the applicable requirements in this title and those specific use policies and regulations in Chapter 22.09 BMC.

2. Protection of critical saltwater habitats should incorporate the participation of resource agencies including tribal nations to assure consistency with other legislatively created mandates and programs in addition to local and regional government entities. (Including but not limited to Washington State Department of Fish and Wildlife, Lummi Nation, Nooksack Tribe, Port of Bellingham, Puget Sound Action Team, Department of Ecology.)

3. Permitted uses adjacent to or within critical saltwater habitats should not compromise the ability to restore these features in the future.

B. Regulations.

1. No structures of any kind shall be placed in or constructed over critical saltwater habitats unless they result in no net loss of ecological function, are associated with a water-dependent use, comply

with the applicable requirements within this chapter and Chapter 22.09 BMC and meet all of the following conditions:

a. The project, including any required mitigation, will result in no net loss of ecological functions associated with critical saltwater habitat;

b. Avoidance of impacts to critical saltwater habitats by an alternative alignment or location is not feasible or would result in unreasonable and disproportionate cost to accomplish the same general purpose;

c. The project is consistent with the state's interest in resource protection and species recovery;

d. The public's need for such an action or structure is clearly demonstrated and the proposal is consistent with protection of the public trust, as embodied in RCW 90.58.020;

e. Shorelands that are adjacent to critical saltwater habitats shall be regulated per the requirements within this program.

STAFF RESPONSE: The RA is consistent with the policies and regulations specified above and is expected to result in no net loss of existing shoreline ecological function. Implementation of the RA removes ongoing point source pollution elements (contaminated sediments and creosote treated marine infrastructure) which will improve habitat substrate and water quality in the project area and immediate vicinity. Replacement of marine infrastructure with fewer pilings and grated decking on floats will allow for natural processes to reestablish to a certain degree, i.e., less structure in the water that is not pollution generating and increased light pass-through to aquatic bedlands. Implementation of the RA will result in temporary short-term impacts but overall, will result in long-term benefits to water quality and shoreline natural processes.

The applicant prepared a JARPA dated 4/28/22 which is provided on Exhibit E. A Biological Assessment dated June 2022 has also been prepared and is incorporated herein by reference. Section 9l of the JARPA identifies the listed species that occur in the vicinity of the project area as well as species that may be present in Whatcom County but are not expected to be within the project area. Section 9m specifies that no priority species or habitats are located within the I & J Waterway.

Table 1 in the BA also specifies the listed species and whether or not their critical habitat is located within the action area. Chinook, bull trout, Bocaccio rockfish, yellow-eye rockfish and southern resident killer whale are the listed species that have designated critical habitat area within the action area. Puget sound steelhead are a listed species but do not have critical habitat in the project area. Table 2 of the BA identifies that implementation of the RA is not likely to adversely affect these species. The critical habitats of both rockfish species and killer whale are not likely to be adversely affected. Chinook habitat may be affected but is not likely to be adversely affected. The habitat of bull trout is likely to be adversely affected. Section 3 of the BA provides details on the existing conditions within the action area such as water and sediment quality, aquatic habitat and existing structures.

Section 4 of the BA provides additional details on listed species; listing date, life history and current status, location and migration and presence (or not) within the action area.

Section 5 of the BA details the effects of the RA; construction impacts, water quality and primary productivity. Long-term effects include changes to nearshore habitat, alterations to aquatic habitat area acreages, substrate changes, over-water coverage and effects of water quality. Section 5

concludes that the RA's long-term effects will have an overall result in a higher functioning aquatic habitat.

Section 6 includes details on effects to the critical *habitats* of listed species that may occur within the project area based upon primary constituent elements. Effects on Chinook habitat (marine near-shore) overall, are stated to be inconsequential. Effects on bull trout habitat (migration / food / habitat complexity / water quality) are expected to be beneficial long-term benefits, generally. Effects on rockfish habitat (water quality / nearshore / deepwater) would not be discernible. Effects on resident killer whale habitat (water quality / prey quantity and quality / passage conditions) are expected to be negligible, generally.

Section 7 includes a description of BMPs and conservation measures that will be implemented during the activities associated with the RA. Most notably, in-water work will be limited to established work-windows for protection of migrating salmonids and other in-water species. (Please note that the proposed RA area does not include presence of eelgrass, macro-algae or forage fish spawning areas.) BMPs will also be employed to minimize turbidity and monitoring will occur to maintain acceptable levels of water quality.

Section 8 (Conclusions and Determinations) provides details associated with Tables 1 and 2 referenced above. Table 13 summarizes the impacts of each element of the RA on essential fish habitat of various species. Section 8 concludes that overall, the RA will not result in destruction of adverse modification on a habitat-wide scale. Therefore, staff concludes that appropriate protective measures will be implemented during the RA and is therefore consistent with 22.08.030 B 2, above.

Section 9 concludes that there will be minor short-term impacts and positive long-term benefits resulting from the RA and specifically the placement of the topping layer of clean sand material once the contaminated sediments are removed. Section 9 acknowledges that the net reduction in habitat *acreage* resulting from the placement of the new sheet pile bulkhead may adversely affect essential fish habitat for certain aquatic species. Section 8c of the JARPA specifies that approximately 1,150 square feet of existing aquatic (and contaminated) habitat will be lost by virtue of the new bulkhead to be placed waterward of the existing bulkhead. Please note that the new bulkhead is necessary to isolate the existing creosote timber bulkhead from the marine environment. Additionally, a 1,050 square foot upland area ("the notch") in the existing bulkhead will also be similarly filled in behind the new sheet-pile bulkhead. Please see the STAFF RESPONSE to shoreline modification and stabilization below.

Staff acknowledges that this lost habitat *area* is not replaced elsewhere within Bellingham Bay. BMC 22 does not require a square foot for square foot replacement when aquatic habitat is lost as is done for wetland protection via BMC 16.55, Critical Areas. Rather, the requirement is to achieve "no net loss of shoreline ecological *function,*" which the documentation referenced herein for the RA clearly demonstrates. Finally, loss of aquatic habitat is only allowed for areas where there is adequate navigability to support water-dependent uses and supporting elements such as Bonstein Seafoods. Therefore, and absent from the RA, the new sheet-pile bulkhead would be permitted provided that it could be demonstrated that no net loss of existing shoreline ecological function could be achieved.

Overall, the BA concludes that overall, the RA will result in no net loss of existing shoreline ecological function and therefore is consistent with the applicable policies and regulations pertaining to critical area saltwater habitats.

22.08.120: Shoreline Modifications & Stabilization

Shoreline modifications are generally related to construction of a physical element such as a bulkhead, fill or vegetation removal in conjunction with development of a permitted use. Shoreline stabilization measures are those mechanisms used to prevent erosion and deterioration of shoreline areas as a result of wave, wind, tidal or flooding actions. Shoreline stabilization measures can include but are not limited to examples of shoreline modifications above and vegetation conservation, biotechnical measures, anchor trees or LWD placement, gabion and rip-rapped banks, retaining walls and sheet pilings.

A. Policies.

    2. Replacement of structurally engineered stabilization measures with the same new measures should not occur unless it is associated with a water-dependent use or there is a demonstrated need based on potential loss of a legally permitted use or primary structure or there is a threat to the viability of an existing water-dependent use.

    4. New structural shoreline modifications should only be allowed as an element of a water-dependent use or when it is demonstrated to be necessary to protect an allowed primary structure or a legally existing shoreline use that is in danger of loss or substantial damage.

    5. Structural shoreline modification should be allowed if it is necessary for reconfiguration of the Shoreline for mitigation or restoration purposes.

    6. Enhancement of impaired ecological functions should be planned for where feasible and appropriate while accommodating permitted uses. As shoreline modifications occur, all feasible measures including mitigation sequencing should be incorporated to protect ecological shoreline functions and ecosystem-wide processes.

    8. Surface water should be tight lined to water treatment features that would avoid contamination of the water body from lawns and yard products and would avoid bank erosion and future sloughing.

B. Regulations.

    2. A bioengineered shoreline modification or stabilization measure(s) shall be considered concurrent with the mitigation sequencing in BMC 22.08.020, Mitigation sequencing, and submittal of an approved critical area report that demonstrates the following:

        a. Natural shoreline processes including channel migration will be maintained. The project will not result in increased beach or stream-bank erosion, alteration to, or loss of, shoreline substrate within one-quarter mile of the project area, sediment supply and transport will be maintained, migration corridors and spawning areas will not be impacted and aquatic vegetation where it exists will not be minimized.

        b. Modification or stabilization techniques will not degrade critical areas or their associated buffers, especially fish and wildlife habitat conservation areas.

        c. The modification or stabilization technique does not prohibit or impede the natural processes of the water body including channel migration, floodwater conveyance and storage and beach acquisition/accretion.

d. The cumulative impacts of a singular shoreline modification on that particular water body shall be analyzed prior to granting of said modification technique.

e. The result of the measure would result in no net loss of shoreline ecological function in the riparian and/or near-shore areas.

3. Structural shoreline modification and/or stabilization shall be allowed if it is necessary for reconfiguration of the shoreline for mitigation, restoration or emergency purposes.

4. In all other cases, a structurally engineered shoreline modification or stabilization measure, including a replacement, shall be allowed when all of the following are demonstrated:

a. Said modification or stabilization measure(s) are necessary as an element of a water-dependent use;

b. It can be demonstrated by a geotechnical/hydrologic report that a bioengineered modification or stabilization technique cannot sustain impacts of wave, current and tidal energy and erosion;

c. It is necessary to protect an existing primary structure demonstrated by a geotechnical analysis that concludes that a given structure is in danger of loss or damage from uncharacteristic or a sudden increase in erosional processes or poses a threat to health, safety and welfare of the general public (loss of yard, grass, landscaping and vegetation, pier abutment, accessory buildings or structures does not constitute an allowance for a structurally engineered measure);

e. The requirements in subsections (B)(2)(a) through (e) of this section have been met.

5. Surface water shall be managed in such a manner that it does not create additional pollutant loading to an adjacent water body and/or cause accelerated bank erosion or bank sloughing.

STAFF RESPONSE: The RA is consistent with the policies and regulations specified above and is expected to result in no net loss of existing shoreline ecological function. As specified above, the new sheet pile bulkhead is necessary because it will isolate the existing creosote timber bulkhead from the marine aquatic environment. It also has to be installed prior to the removal of the contaminated material. Removal of sediment without the sheet-pile bulkhead would compromise the integrity of the bulkhead itself and the upland use which utilizes the area directly beyond the bulkhead. The new sheet-pile bulkhead is not anticipated to affect natural processes. In fact, removal of all the other existing marine infrastructure is expected to improve that function. The new bulkhead is consistent with the majority of the southern shoreline of the I & J Waterway abutting Bornstein's and the All-American Marine storage yard. Finally, a bio-engineered stabilization technique would not facilitate the existing use, would result in additional encroachment either into the I & J Waterway or upland areas where the existing use is located. Two existing stormwater conveyance pipes will be extended so that they can continue to outfall directly to Bellingham Bay at an approximate elevation of +6.6 MLLW.

22.08.140: Dredging and Disposal

Dredging is the removal of material from a stream, river, lake, bay or other water body. The purposes for dredging might include navigation, remediation of contaminated materials, or material mining.

Materials generated from navigational and remedial dredging may be suitable for beneficial reuse (e.g., construction of habitat features or construction of uplands) or may require disposal at appropriate disposal facilities.

A. Policies.

1. Dredging that involves remediation of contaminated materials should be consistent with the applicable policies within Chapter 70.105D RCW and the standards within Chapter 173-204 WAC, Sediment Management Standards.

2. Dredging within aquatic areas for the primary purpose of acquisition of fill material should not be allowed.

3. Navigational dredging should be permitted; provided that it minimizes adverse impacts on critical area habitats, shoreline ecological function and water quality.

4. Dredging and beneficial reuse should be consistent with the guidance of the Bellingham Bay Demonstration Pilot Project Comprehensive Strategy and its associated Habitat Restoration Documentation Report, as amended or updated.

7. When dredging occurs within marine waters, sufficient notice should be publicized for those individuals or groups who crab, fish or manage aquaculture activities so that proper adjustments to schedule, timing or practices can be made.

B. Regulations.

1. Dredging that involves remediation of contaminated materials shall be consistent with the policies within Chapter 70.105D RCW and the applicable standards within Chapter 173-204 WAC, Sediment Management Standards, and all other applicable federal, state and local regulations.

2. Dredging requires a shoreline conditional use except for maintenance dredging, dredging to implement a hazardous substance remedial action under RCW 90.58.355 or, for habitat purposes, pursuant to subsection (B)(7) of this section. Dredging of contaminated materials shall be consistent with the conditional use criteria specified in BMC 22.06.050(C)(1) through (7), Conditional uses, and shall be demonstrated by the applicant/owner to be in compliance with said criteria.

3. Dredging, for any purpose, that occurs within the waters of Bellingham Bay or Lake Whatcom shall comply with the applicable requirements in Chapter 22.03 BMC, Jurisdiction, Maps and Environment Designations; Chapter 22.04 BMC, Shorelines of Statewide Significance; and this chapter, General Policies and Regulations.

5. Beneficial reuse of dredged material shall be consistent with the guidance of the Bellingham Bay Comprehensive Strategy and its associated Habitat Restoration Documentation Report, as amended or updated.

STAFF RESPONSE: The RA is consistent with the applicable policies and regulations specified above and is expected to result in no net loss of existing shoreline ecological function. The dredging is being administered via RCW 70.105D and the standards within Chapter 173-204 WAC, Sediment Management Standards under a Consent Decree and Agreed Order. The applicant has provided a demonstration of consistency with the conditional use criteria on Exhibit A. The dredged material is not eligible for beneficial reuse but instead is being transported to off-site locations for dewatering

and disposal. This substantive compliance also demonstrates consistency with the Waterfront District shoreline designation, the criteria under Chapter 22.04 (SSWS) and the general policies and regulations in chapter 22.08.

22.08.170: Landfill. Landfill is the creation of dry upland area by the placement or deposition of sand, soil, gravel or other sediments into a water body, floodplain, or wetland.

A. Policies.
  1. Landfills should not be permitted within critical areas.

B. Regulations.
  1. Landfills within shorelines shall only be permitted as an element of a water-dependent use and must be demonstrated to be consistent with the substantive requirements in BMC 22.06.050(C)(1) through (6), Conditional uses, and Chapter 22.04 BMC and this chapter where applicable.

  2. Landfills, where permitted, shall include restoration and/or enhancement of ecological function within the shoreline/aquatic area consistent with the restoration objectives within the restoration plan (Appendix B – Table 2) and the specific projects (where applicable) specified in Appendix B – Table 3; and shall provide public access where feasible per BMC 22.08.090, Public access.

  4. Landfills that are part of a hazardous substance remedial action shall be subject to the requirements within BMC 22.05.020(B)(1)(q), Exemptions.

STAFF RESPONSE: The RA is consistent with the policy and regulations specified above. There is a small section of upland area, approximately 2,150 square feet, that qualifies as landfill because it results in a net reduction of aquatic bedland area. This square footage of fill accounts for the area that will be backfilled between the existing and new bulkhead as well as the area necessary to fill in a notched-out area immediately to the east of the Bornstein site. All of this fill is proposed to be behind or, landward of the new sheet-pile bulkhead. The applicant has provided information on Exhibit A relating to the conditional use criteria. The landfill is a required element of a RA and is associated with a water-dependent and water-related use. Public access is not presently available in this location due to the nature of the existing industrial use.

22.08.210: Stormwater Management Facilities.

A. *Policies.*
  1. Stormwater facilities should not be located in areas where there would be an adverse impact to existing shoreline ecological functions.

B. Regulations.
  5. New stormwater conveyance facilities (outfalls) shall not be constructed within required shoreline or critical area buffers unless no other feasible alternative exists.

STAFF RESPONSE: There are two existing stormwater conveyance pipes that currently outfall to the I & J Waterway above the elevation of MLLW at approximately +6.6'. Extension of these pipes through the new sheet-pile bulkhead does not require any additional in-water work or disturbance to aquatic bedlands for a splash pad / energy dissipater.

Sea Level Rise. This subsection of this exemption intends to describe sea level rise generally and clarify the requirements for consideration of same within the Waterfront District. The action area is within the marine trades sub-area of the Waterfront District and is zoned industrial mixed-use. The SMP and the Waterfront District planning documents were adopted in 2013, when the best available science at that time indicated that the Puget Sound – generally – could experience as much as 50 inches of SLR by the year 2100.

Page 23 of Chapter 3 (Environment Chapter) of the 2018 Waterfront District Sub-Area Plan, sea level rise is contemplated. It suggests that SLR could range between 15" and 50" within the next 100 years. The SEPA Planned Action ordinance (BMC 16.30) includes a mitigation measure that requires that construction (buildings, infrastructure, parks, etc.) utilize the "higher end of the range predicted using best available science," i.e., 50-inches.

Sections 1-7 and 3-1 within the planned action ordinance at BMC 16.30, Section II, requires **new** development to be protective against long-term sea level rise. Multiple other shoreline projects within the Waterfront District have accommodated the projected 50" of SLR per these code requirements. All American Marine's new building on Hilton Avenue, Granary and Laurel Avenues, two new buildings on Roeder Avenue between Hilton and Bellwether Way. The Port's new pavilion north of Zuanich Park also performed this analysis even though that project is outside of the Waterfront District. In addition, the RG Haley and Cornwall Avenue landfill clean-up sites (under MTCA) have also been designed to accommodate long-term sea level rise. This was important for these two sites because the City is proposing to develop a variety of park facilities on top of the cleanup sites and will be referred to as "Salish Landing."

However, no new development is proposed, and the existing structures affiliated with Bornstein Seafoods are not going to be altered in any way and therefore, not required to perform additional activities to protect against future sea level rise. (Bornstein Seafoods may pursue this in the future if desired via required permit submittal, analysis and approval processes.

The elements of the overall project that are not specifically related to removing contaminated sediment from the I & J Waterway are the removal and replacement of marine infrastructure. These are not new structural elements and therefore not required to demonstrate protection against sea level rise, i.e., "elevate." Furthermore, the design of the marine infrastructure is inherently adaptive to tidal action and any coastal flooding that currently occurs.

VI. ANALYSIS SUMMARY OF SUBSTANTIVE COPMLIANCE

The RA is consistent with the applicable goals, objectives, policies and regulations in BMC Title 22, Shorelines and therefore meets substantive compliance for a remedial action pursuant to RCW 70A.305D and the shoreline conditional use criteria in 22.06.050. The RA:

- ✓ Is expected to result in no net loss of existing shoreline ecological function;
- ✓ Removes ongoing point source pollution in the I & J Waterway which is expected to improve water quality in the action area and immediate vicinity;
- ✓ Replaces existing dilapidated marine infrastructure with significantly less overall in-water structure and will result in a net reduction in overall water-surface coverage; and
- ✓ Maintains and extends the viability of an existing water-dependent and related use; and,
- ✓ Is consistent with the applicable goals, objectives, policies and regulations BMC Title 22;

VII. DECISION

Based upon the materials provided in the exhibits, the analysis in section V, above, and the materials referenced herein, this shoreline permit exemption #SHR2023-0019 is hereby approved subject to the following conditions:

1. The RA shall adhere to all federal permits and associated conditions and any state authorizations that are necessary to conduct the RA.
2. A no-fee City of Bellingham building permit(s) shall be required for the replacement of marine infrastructure associated with the RA.
3. A no-fee City of Bellingham public works / public facilities construction permit shall be approved and issued for the extension of stormwater mains necessary to maintain conveyance through the new sheet-pile bulkhead.

Prepared and approved by:

____

Steven Sundin, Senior Planner
Planning and Community Development Dept.

VII. APPEAL:

Any party aggrieved by the decision of the Director on this TYPE-I permit may file an appeal within 14 days of the decision on this exemption in accordance with BMC 21.10.250. Any appeal must be filed with the Planning and Community Development Department on the appropriate forms and be accompanied by a filing fee as established by the City Council. An appeal of a TYPE-I permit is heard by the City's Hearing Examiner.

State of Washington
DEPARTMENT OF FISH AND WILDLIFE
Mailing Address: PO Box 43200, Olympia, WA 98504-3200 · 360 902-2200 · TDD 360 902-2207
Main Office Location: Natural Resources Building, 1111 Washington Street, Olympia, WA

June 30th, 2023

Port of Bellingham
ATTENTION: Brian Gouran c/o Larry Lehman
1801 Roeder Avenue
Bellingham, WA 98225

SUBJECT: Bellingham Bay I and J Waterway Sediment Cleanup – Substantive Comments

Dear Mr. Gouran,

The Washington Department of Fish and Wildlife (WDFW) appreciates the opportunity to provide the following Model Toxic Control Act Substantive Comments consistent with Chapter RCW 77.55.021 and Chapter WAC 220-110 of the Washington State Hydraulic Code for the Washington State Department of Ecology's proposed cleanup treatments at the I and J Waterway on Bellingham Bay.

WDFW recognizes and appreciates the substantial effort of the Washington State Department of Ecology and the Port of Bellingham to develop and implement a clean-up plan for the I and J Waterway that effectively removes and/or isolates existing contaminants.

WDFW recognizes and appreciates that the proposed remediation actions at the I and J Waterway will significantly enhance aquatic habitats beneficial to the fish life in Bellingham Bay, and in particular migrating juvenile salmonids. WDFW recognizes the general benefit to fish life resulting from the removal and encapsulation of persistent contaminants.

WDFW recognizes that the Best Management Practices (BMPs) proposed in your JARPA and Supporting Documentation are substantially consistent with the requirements of the Chapter RCW 77.55.021 and Chapter WAC 220-110 of the Washington State Hydraulic Code for the protection of fish life at the I and J Waterway and that the following substantive comments reiterate these BMPs.

Sincerely,

Elizabeth Tate

Elizabeth Tate
Habitat Biologist

TIMING LIMITATIONS

1. Work may occur at any time, provided: (a) all work is conducted in the dry at low tide only; (b) To protect fish and shellfish habitats at the job site, work below the ordinary high-water line must occur from August 1st to February 15th of any year and must be completed by February 15, 2028.

APPROVED PLANS

2. Work must be accomplished per plans and specifications received by the Washington Department of Fish and Wildlife, entitled “20220520-PmtDrawings-IJ_Waterway_Cleanup.pdf” pages 1-14 of 14, and the JARPA entitled “20220520-JARPA-IJ_Waterway_Cleanup.pdf,” both received June 6th, 2023. You must have a copy of these plans available on site during all phases of the project proposal.

NOTIFICATION REQUIREMENT

3. The Habitat Biologist (HB) listed below shall be notified of the project start date.

STAGING, JOB SITE ACCESS AND EQUIPMENT

4. Establish the staging area (used for activities such as equipment storage, vehicle storage, fueling, servicing and hazardous material storage) in a location and manner that will prevent contaminants like petroleum products, hydraulic fluid, sediments, sediment-laden water, chemicals, or any other toxic or harmful materials from entering waters of the state.

5. Check equipment daily for leaks and complete any required repairs before using the equipment in or near the water.

6. Lubricants composed of biodegradable base oils such as vegetable oils, synthetic esters, and polyalkylene glycols are recommended for use in equipment operated in or near water.

7. Limit the use of equipment below the OHWL to that necessary to gain position for the work.

CONSTRUCTION-RELATED SEDIMENT, EROSION AND POLLUTION CONTAINMENT

8. Do not conduct work activities when the project area is inundated by tidal waters.

9. Erosion control devices such as silt fences and debris booms shall be placed prior to the start of excavation.

LONG TERM UPLAND DISPOSAL

10. Existing concrete, creosote-treated wood components, and other anthropogenic debris shall be removed from the shoreline and disposed of at an approved upland facility.

11. Demolition activities should occur outside of the heron breeding season (April through July).

CONSTRUCTION MATERIALS

12. Do not use native bed material for project construction or fills.

13. Do not use wood treated with oil-type preservative (creosote, pentachlorophenol) in any hydraulic project. Wood treated with waterborne preservative chemicals (ACZA, ACQ) may be used if the Western Wood Preservers Institute has approved the waterborne chemical for use in the aquatic environment. The manufacturer must follow the Western Wood Preservers Institute guidelines and the best management practices to minimize the July 8, 2021 Page 4 preservative migrating from treated wood into aquatic environments. To minimize leaching, wood treated with a preservative by someone other than a manufacturer must follow the field treating guidelines. These guidelines and best management practices are available at www.wwpinstitute.org.

SEDIMENT CAP

14. The scour protection cap and fix mix top layer shall be installed per approved plans.

15. The source of all import material shall be approved by Department of Ecology prior to material being brought to the site.

PILE REMOVAL, DRIVING

16. Remove the existing creosote-treated timber piling and dispose of them in an upland area above extreme high tide waters unless the material is approved by the Washington Department of Fish and Wildlife for reuse in the project.

17. Attach rubbing strips made of ultra-high molecular weight (UHMW) type plastic, or high-density polyethylene (HDPE) type plastic to the replacement fender system. Do not use rubber tires for the fender system.

18. Fit all pilings with devices to prevent perching by fish-eating birds.

19. The use of both a vibratory and/or an impact hammer is authorized for piling installation under this Hydraulic Project Approval, however a vibratory driver is preferred.

20. Sound attenuation methods are required for the driving or proofing of steel piles with an impact hammer

below the ordinary high-water line. For impact driving of steel piles that exceed the following criteria, a bubble curtain or other Washington Department of Fish and Wildlife approved sound attenuation device must be used.

The specific criteria include sound pressure levels of:

a) Greater than or equal to 206 dB (one micropascal squared per second) peak,
b) Greater than or equal to 187 dB (one micropascal squared per second) accumulated sound exposure level (SEL) for fish greater than or equal to 2 grams, and
c) Greater than or equal to 183 dB (one micropascal squared per second) (SEL) for fish less than 2 grams.
d) Install a bubble curtain around the pile during all driving operations to ensure proper sound attenuation. The bubble curtain must distribute air bubbles around 100 percent of the perimeter of the piling over the full length of the pile in the water column.

21. Piling removal:

a. Vibratory or direct pull extraction is the preferred method of pile removal.
b. Place the piling on a construction barge or other dry storage site after the piling is removed. The piling must not be shaken, hosed off, left hanging to dry or any other action intended to clean or remove adhering material from the piling near waters of the state.
c. If a treated wood piling breaks during extraction, remove the stump from the water column by fully extracting. If the stump cannot be fully extracted, remove the remainder of the stump with a clamshell bucket, chain, or similar means, or cut it off three feet below the mudline. Cap all buried cut stumps and fill holes left by piling extraction with clean sediment that matches the native material.
d. When removing creosote piling, containment booms and absorbent booms (or other oil absorbent fabric) must be placed around the perimeter of the work area to capture wood debris, oil, and other materials released into marine waters as a result of construction activities to remove creosote pilings. All debris on the bed and accumulated in containments structures must be collected and disposed upland at an approved disposal site.

BULKHEAD CONSTRUCTION

22. As shown in the project plans, the length of the new sheet pile bulkhead should not exceed 405 linear feet.

23. Establish the waterward distance of the rock bulkhead from a permanent benchmark(s) (fixed objects) before starting work on the project.

24. As shown in the project plans, locate the waterward face of the new sheet pile bulkhead no further than six feet from the existing creosote bulkhead.

25. Construct the rock scour protection using clean, angular material of a sufficient durability and size to prevent its being broken up or washed away by high water or wave action.

26. Incorporate all upland drainage tight lines into the bulkhead near beach grade to prevent erosion of the bed.

27. Prior to tidal inundation, backfill all trenches, depressions, or holes created during construction waterward of the

ordinary high-water line.

28. For beach nourishment: place clean, round gravel, not crushed or angular rock waterward of the bulkhead at the depth and distance shown on the project plans. The mix must not contain fine silt or clay type soils and should be placed within 72 hours following bulkhead construction.

GENERAL

29. If at any time, as a result of project activities, fish are observed in distress, a fish kill occurs, or water quality problems develop (including equipment leaks or spills), the Washington Military Department's Emergency Management Division shall be immediately contacted at 1-800-258-5990.

30. No petroleum products or other deleterious materials shall enter state waters.

31. Project activities shall not degrade water quality to the detriment of fish life.

DEMOBILIZATION/CLEANUP

32. Alteration or disturbance of the bank and bank vegetation must be limited to that necessary to construct the project. Within seven calendar days of project completion, all disturbed areas must be protected from erosion using vegetation or other means.

33. Remove all trash and unauthorized fill in the project area, including concrete blocks or pieces, bricks, asphalt, metal, treated wood, glass, floating debris, and paper, that is waterward of the ordinary high-water line and deposit upland.

34. Remove any riprap (including quarry spalls) scattered, or abandoned outside the original design footprint, from the bed and deposit it an upland area above the limits of extreme high tidal water.

35. Remove all debris or deleterious material resulting from construction from the beach area or bed and prevent from entering waters of the state.

36. Do not burn wood, trash, waste, or other deleterious materials waterward of the ordinary high-water line.

Thank you for the opportunity to provide these comments. If you have any questions, please contact me at 360-826-2665 or Elizabeth.Tate@dfw.wa.gov