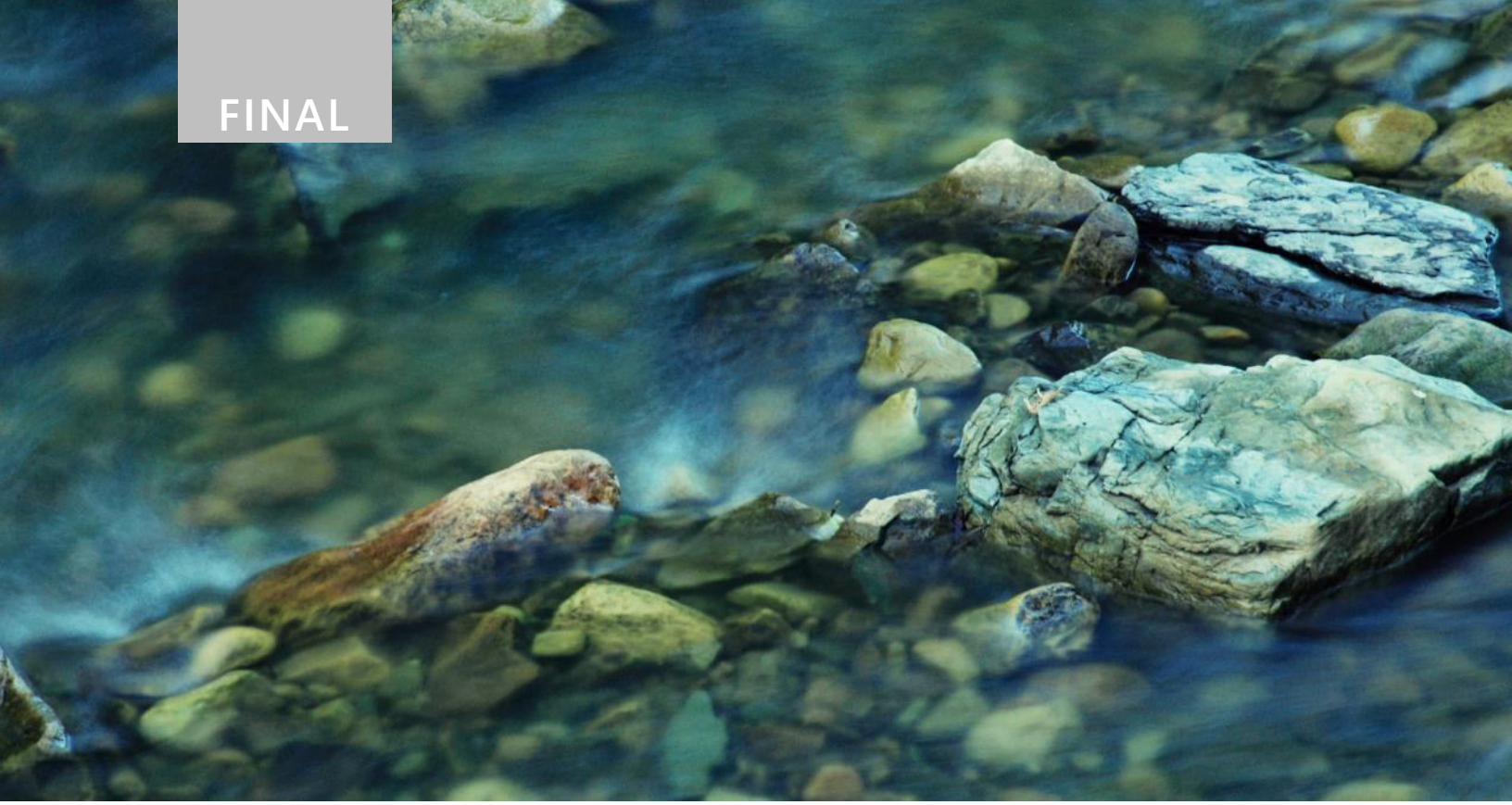
FINAL



July 2026
Port of Tacoma – Tru-Grit Site

ANCHOR QEA

Interim Action Plan

Prepared for the Port of Tacoma

FINAL

July 2026
Port of Tacoma – Tru-Grit Site

Interim Action Plan

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FINAL

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APPENDICES

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ABBREVIATIONS

µg/kg	microgram per kilogram
bml	below mudline
BT	bioaccumulation trigger
CanAm	CanAm Materials
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMCRP	Compliance Monitoring and Contingency Response Plan
CMMP	Comprehensive Maintenance and Mitigation Program
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CQAP	Construction Quality Assurance Plan
CSL	cleanup screening level
cy	cubic yard
CZMA	Coastal Zone Management Act
DAHP	Washington State Department of Archaeology and Historic Preservation
DMMP	Dredged Material Management Program
DMMU	dredged material management unit
DNS	Determination of Nonsignificance
Ecology	Washington State Department of Ecology
ESA	Endangered Species Act
feasibility boundary	FNC boundary identified by USACE in the FS phase
FNC	federal navigation channel
FS	feasibility study
H:V	horizontal to vertical (ratio)
IAP	Interim Action Plan
JARPA	Joint Aquatic Resources Permit Application
Lower Slope	lower slope of the Tru-Grit Site
Martinolich	Martinolich Shipbuilding Corporation
MLLW	mean lower low water
MTCA	Model Toxics Control Act
ng/kg	nanogram per kilogram
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PDS	Planning and Development Services
PIF	project information form
Port	Port of Tacoma
Powers	A.H. Powers
RI	remedial investigation

RMC	residuals management cover
SCO	sediment cleanup objective
SCR	*Sediment Characterization Report, Port of Tacoma – Tru-Grit*
SEPA	State Environmental Protection Act
Site	Tru-Grit Site
SL	screening level
SMS	Sediment Management Standards
SQAPP	Sampling and Quality Assurance Project Plan
TEQ	toxic equivalent quotient
the Services	National Marine Fisheries Service and U.S. Fish and Wildlife Service
Tru-Grit	Tru-Grit Abrasives, Inc.
UCL	upper confidence level
Upper Slope	upper slope of the Tru-Grit Site
USACE	U.S. Army Corps of Engineers
USACE FNC Deepening Project	Project by USACE to deepen the FNC in the Blair Waterway to -57 feet MLLW plus a 2-foot overdredge
USEPA	U.S. Environmental Protection Agency
UTL	upper tolerance limit
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WQC	Water Quality Certification
WQMPP	Water Quality Monitoring and Protection Plan

1 Introduction

1.1 Site Description

This Interim Action Plan (IAP) for the Tru-Grit Abrasives, Inc. (Tru-Grit) Site (Site) was prepared by Anchor QEA on behalf of the Port of Tacoma (Port). The IAP presents the proposed Interim Action for cleanup of the Tru-Grit Site. This report has been revised based on comments received from Washington State Department of Ecology (Ecology) in April and June 2026.

The Site is located on the northeastern side of the Blair Waterway in Tacoma, Washington, with the upland address at 1110 East Alexander Avenue, Tacoma, Washington (Figure 1-1). The Site includes areas of contaminated marine sediment along the shoreline and nearshore of Tru-Grit and Graymont Inc. facility to the east, as well as within a portion of side slopes of the proposed federal navigation channel (FNC) in the Blair Waterway.

The Port plans to implement this Interim Action as an independent remedial action during the 2026/2027 dredging season. The proposed work is an incidental remedial action under the Sediment Management Standards (SMS; Chapter 173-204-540[3][c] Washington Administrative Code [WAC]). The Port is conducting this work with Ecology, the U.S. Army Corps of Engineers (USACE), the U.S. Environmental Protection Agency (USEPA), and the Puyallup Tribe of Indians, as well as other regulatory agencies and project stakeholders.

1.2 Purpose and Scope

The main state law that governs the cleanup of contaminated sites is the Washington State Model Toxics Control Act (MTCA). When contaminated sediment is involved, the cleanup levels and other procedures are also regulated by the SMS (Chapter 173-204 WAC). MTCA regulations specify criteria for the evaluation and conduct of a state cleanup action. SMS regulations dictate the standards for cleanup of sediment. Under both laws, cleanup must protect human health and the environment, meet environmental standards in other laws that apply, and provide for monitoring to confirm compliance with site cleanup standards.

The USACE is currently planning to deepen the FNC in the Blair Waterway to -57 feet mean lower low water (MLLW) plus a 2-foot overdredge (final elevation to -59 feet MLLW; USACE FNC Deepening Project). The sampling described in the *Sampling and Quality Assurance Project Plan* (SQAPP; Anchor QEA 2024) and SQAPP addenda (Anchor QEA 2025a, 2025b) was intended to delineate the extent of Site-associated contaminated sediments that could potentially be impacted (i.e., disturbed by sloughing) by that deepening project.

The Port plans to implement an Interim Action in advance of the USACE FNC Deepening Project. That Interim Action will remove Site-associated contaminated sediments from the lower slope of the

Tru-Grit Site (Lower Slope) that could potentially be destabilized by the USACE FNC Deepening Project. The Interim Action is expected to provide a final cleanup for the Lower Slope area.

Additional actions may be required in the future to address contaminated sediment located in the upper slope of the Tru-Grit Site (Upper Slope). Sediments located in the Upper Slope area are outside the influence of the USACE FNC Deepening Project.

This IAP relies on extensive sediment quality data that has been collected by the Port. Those data are summarized in the *Sediment Characterization Report, Port of Tacoma – Tru-Grit* (SCR; Anchor QEA 2026a); both the SCR and IAP were revised to incorporate the results from the five surface samples that were pending when the draft reports were first submitted in January 2026.

This IAP describes the proposed Interim Action for the Site. Consistent with the requirements of WAC 173-340-380, this document provides the following information:

- Summary of Site background and current conditions (Section 2)
- A description of the proposed Interim Action (Section 3), including the proposed work; a description of the types, levels, and amounts of hazardous substances and/or other deleterious substances that will remain on Site following the Interim Action; the measures that will be used to prevent migration and contact with those substances; compliance monitoring; and potential contingency actions
- A description of how the Interim Action will be implemented (Section 4), including design, permitting, implementation, and schedule

2 Site Background

This section describes background information relevant to the cleanup of the Site. Information presented in this section includes the following:

- **Site History and Background:** Section 2.1 describes the history of the Site and vicinity, including a summary of previous Site activities and current land use.
- **Previous Investigations:** Section 2.2 describes previous investigations and other nearby cleanup sites.
- **Current Site Conditions:** Section 2.3 provides a summary of the environmental information presented in the SQAPP (Anchor QEA 2024) and SCR (Anchor QEA 2026a).
- **Effects of the USACE FNC Deepening Project:** Section 2.4 discusses the USACE FNC Deepening Project and its relationship to the Tru-Grit Site.

Figure 2-1 shows the physical setting of the Tru-Grit Site inclusive of property boundaries and adjacent ownership. The floor of the FNC near the Site is owned by the Port of Tacoma.

2.1 Site History and Background

Table 2-1 provides a summary of Site history, focusing on dates and activities relevant to the Site's physical conditions and the release of Site-associated contaminants.

Prior to the 1950s, the Blair Waterway was known as the Wapato Waterway, and its head was located at 11th Street. The Site was located adjacent to a tidal inlet located south of 11th Street. The Site and adjacent areas were owned by the Tacoma Harbor Lumber Company.

In 1953, the Blair Waterway bridge was constructed at 11th Street. The waterway was then lengthened southward to Lincoln Avenue and renamed the Port Industrial Waterway. The waterway was deepened to approximately 30 feet. The Site remained vacant at that time.

In 1966, the Port received federal funding for lengthening and deepening of the Blair Waterway. The waterway was dredged southward to the turning basin, and the waterway was deepened to a depth of 51 feet. The waterway was subsequently renamed in 1969 after Archie Blair, a Port of Tacoma commissioner.

The Site was first developed for shipyard activity by the Martinolich Shipbuilding Corporation (Martinolich) between 1968 and 1976. The shipyard used a marine railway to launch vessels and a wooden pier structure to service them. Several shipyard buildings were constructed in the uplands. A drydock was acquired by 1973 and moored between the wooden dock and the former Blair 11th Street bridge. The Martinolich shipyard entered bankruptcy in 1976, and the original drydock was removed.

Shipyard activity at the Site resumed in 1976 under a different company, Sextant Marine. Sextant Marine leased a 1,000-ton drydock from the U.S. Navy. It was installed following a dredging event in roughly the same location as the former Martinolich drydock. Sextant Marine then changed its name to Sea-Tac Alaska Shipbuilding. The company continued operations until 1982, when it entered bankruptcy and the drydock was removed.

A.H. Powers (Powers) was a marine contractor incorporated in 1964. By the 1970s, the company was operating at the Site, using a former T-shaped dock located in the vicinity of the current Powers dock as shown in Figure 2-2. In 1978, Powers acquired ownership of the Site.

The Powers dock and the metal sheet-pile bulkhead were constructed in 1978. The dock structure was a portion of a former concrete barge salvaged by the company. The dock structure was installed in its current location following construction of the bulkhead and dredging of waterway sediments from the current dock footprint. The dock was subsequently used to support moorage and maintenance of Powers' barges and marine construction equipment. In 2007, the entire Powers property, including the two dock structures, was acquired by the Port.

Tru-Grit began operations in approximately 1990 as a tenant of Powers. Tru-Grit continued operations at the Site under a lease with the Port after 2007. The parent company of Tru-Grit is CanAm Materials (CanAm).

Between 1990 and 2013, Tru-Grit operations included receiving and offloading grit shipments and processing and packaging grit for resale. The offloading occurred at the Tru-Grit dock using a hopper and conveyor system that has since been removed. The barges being unloaded were moored in the same approximate location as the former shipyard drydocks, which had been removed by this time.

The CanAm/Tru-Grit material consists of a copper-smelting byproduct that undergoes preliminary processing before being shipped to the Site. It was sold to roofing manufacturers and sandblasters under the names Tru-Grit Abrasives and Tru-Grit Roofing Granules. The CanAm grit material was rich in copper and zinc but not arsenic.

The Tru-Grit product differed from many of the grit products manufactured from other metallurgical slags that were commonly used as abrasive blast grit in marine shipyards throughout this period. Locally, many blasting grits were derived from the slag produced at the ASARCO metals smelter in Tacoma (Landau 2021). In contrast to the Tru-Grit products, the ASARCO slag-derived grits contained elevated concentrations of arsenic, antimony, and lead in addition to copper and zinc.

Grit shipments were received by the facility two to three times a year, offloaded from barges using a series of ship-to-shore conveyors, and stored in an outdoor area surrounded by 8-foot-high concrete block walls. Grit was also temporarily stored on the southeastern portion of the upland property between 2005 and 2007, until Tru-Grit expanded their on-Site containment area. After 2013, barge

offloading operations ceased, and Tru-Grit operations only encompassed the upland storage and processing of grit materials. During this period, grit was trucked from a nearby Tru-Grit facility (Landau 2021).

As described in Section 2.2, the extent of the Tru-Grit Site investigated under the Agreed Order (No. DE-8978; Ecology 2012) included only the areas of Tru-Grit's operations. It did not include the area around the Powers dock. As described in the SCR (Anchor QEA 2026a), heavy metals contamination extended from the Tru-Grit area of operations east around the Powers dock. The 2024–2025 investigations confirmed the boundary of the Site as defined for all Site-associated contaminants.

The most recent use of the Tru-Grit and Powers docks was by Orion Marine, a marine contractor and Port tenant. The dock and uplands were used for staging of their barges and marine construction equipment.

As of 2025, the Site and adjacent upland areas of the former Powers property are vacant except for intermittent use for trailer storage by Port tenants.

2.2 Previous Investigations

Previous investigations at the Site have included both upland and in-water areas, as summarized below. Figure 2-2 shows historical features of the Site as well as historical sampling locations.

2.2.1 Blair Waterway Cleanup and Delisting

In 1985, the Commencement Bay Nearshore/Tideflats remedial investigation (RI) collected sediment samples from eight potentially impacted areas in Commencement Bay, including the Blair Waterway. This study detected polycyclic aromatic hydrocarbons (PAHs), metals (i.e., copper and lead), polychlorinated biphenyls (PCBs), phenols, and phthalate esters concentrated around the Lincoln Avenue Drain and reaching the former 11th Street bridge (Landau 2021; Tetra Tech 1985).

Cleanup of the Blair Waterway sediments was conducted in the early 1990s. Contaminated sediments were removed by dredging and were disposed in the Milwaukee Waterway nearshore confined disposal facility. The Blair Waterway was removed from the National Priorities List in 1996 following completion of that cleanup.

2.2.2 Tru-Grit Site Investigations

Investigation of the Site was previously conducted under an Agreed Order (No. DE-8978; Ecology 2012) executed between the Ecology and CanAm. CanAm was identified by Ecology as a potentially liable party under MTCA due to releases of the company's grit material containing elevated concentrations of copper and zinc. Work completed up to 2024 by CanAm includes a RI (Landau 2021) and draft feasibility study (FS; Landau 2019).

Investigations completed by Landau Associates provide an understanding of heavy metals distribution in surface and subsurface sediments near the former Tru-Grit operations. These studies documented the presence and distribution of grit material and associated metals in surface and shallow subsurface sediments. Available chemical data from these investigations are included as Appendix B of the SCR (Anchor QEA 2026a). The Landau investigations did not include testing for contaminants other than heavy metals.

Surface samples collected between 2008 and 2018 had concentrations of arsenic, copper, and zinc exceeding SMS numeric sediment cleanup objective (SCO) values. Exceedances of SMS interpretive criteria were also observed during confirmational bioassays. The highest percentages of grit content encountered were west of the Tru-Grit dock within a relatively flat bathymetric area and coinciding with the Tru-Grit ship-to-shore conveyance system area. Concentrations of heavy metals decreased with distance from the pier. Background locations showed either low or no grit and lower metals concentrations, though some exceedances of screening levels (SLs) did occur in the background samples.

Taken together, the Landau investigation results indicated that the heavy metals associated with Tru-Grit operations (copper and zinc) are spatially concentrated around the Tru-Grit dock area and diminish outward, with vertical distribution generally limited to the upper several feet of sediment where Tru-Grit materials were deposited (Landau 2009, 2019, 2021). Grit and heavy metals contamination containing arsenic from historical operations not associated with Tru-Grit were present generally at deeper sediment intervals.

As discussed in Section 2.2 and in the SCR (Anchor QEA 2026a), the nature and extent of other Site-associated contaminants was determined during later 2024–2025 testing. That testing included the full suite of SMS contaminants. That testing also documented the nature and extent of dioxin/furans within and adjacent to the Site. As discussed in Section 2.3, dioxin/furans are a regional contaminant that is present sporadically throughout portions of the outer, middle, and head of the Blair Waterway.

The 2021 Tru-Grit RI report largely delineated the areas and volumes of copper and zinc contamination that appeared to be associated with past releases of the Tru-Grit products. However, a full delineation of the Site, including other co-located contaminants from past shipyard and marine contractor operations was not conducted.

The 2019 Tru-Grit draft FS considered potential remedial alternatives to address the overlying Tru-Grit product but did not address the cleanup of the entire Site or antidegradation requirements associated with the cleanup of the Tru-Grit materials. The FS also did not fully consider the impacts of potential FNC deepening. These limitations were later addressed by the testing performed on behalf of the Port during 2025 and in the development of this IAP.

2.2.3 2024–2025 Sediment Testing

This IAP was developed following completion of several additional rounds of sediment testing performed on behalf of the Port. This includes both testing throughout the Blair Waterway in support of planned waterway deepening and targeted investigation of the Tru-Grit Site sediments, as follows:

- **2024–2025 Tru-Grit Sediment Testing:** Anchor QEA conducted sediment testing throughout the Tru-Grit Site during 2024 and 2025 on behalf of the Port. The purpose of that work was to characterize the nature and extent of all Site-related contamination to support cleanup planning for the Site and to inform planned deepening of the FNC. The work was conducted in accordance with a SQAPP (Anchor QEA 2024) and SQAPP addenda (Anchor QEA 2025a, 2025b).
  - The results of the 2024 and 2025 testing are presented in the SCR (Anchor QEA 2026a), which is being submitted concurrently with this IAP. The results of follow-up testing of several archived samples were summarized in the revised SCR (Anchor QEA 2026a).
  - Figure 2-3 shows the recent sampling locations from the 2024 and 2025 Tru-Grit investigations, broken out by location in the Upper Slope (area not expected to be impacted by the USACE FNC Deepening Project) and the Lower Slope (area adjacent to the side slopes of the USACE FNC Deepening Project). Adjacent sampling locations within the FNC from the 2025 FNC investigation are also shown in Figure 2-3.
  - Table 2-2 summarizes the chemical parameters analyzed as part of the 2024 and 2025 Site investigations.
- **Testing in Support of Waterway Deepening:** Several rounds of subsurface sediment testing have been performed on behalf of the Port and the USACE in support of planned waterway deepening. For characterization of waterway conditions in the vicinity of the Site and for definition of background waterway sediment quality, this IAP incorporates sediment data collected during 2025 as part of those efforts.
  - Subsurface sediment testing within the Blair Waterway FNC and side slopes was conducted to collect data to support dredge design, dredged material management, and disposal at a Dredged Material Management Program (DMMP) open-water disposal site or for beneficial use. The results of the 2025 samples collected from this investigation are presented in the *Blair Waterway Federal Navigation Channel Sediment Characterization Report* (Anchor QEA 2026b), and relevant results within the vicinity of Tru-Grit are included in the Tru-Grit SCR (Anchor QEA 2026a).
  - Investigation in the vicinity of the Lincoln Avenue Ditch was conducted to refine the extent of upland contaminants associated with the Lincoln Avenue Ditch Site and supplement historical analytical data from previous investigations. This investigation was conducted to support development of a new marine terminal on the Blair Waterway, which is being coordinated between the Port and the Puyallup Tribe of Indians and which will include cutting back the existing shoreline to accommodate berthing areas for

the new terminal. The results of the 2025 samples collected from this investigation are presented in the *Supplemental Investigation Report* (Maul Foster Alongi 2025).

2.3 Current Site Conditions

This section provides a brief overview of the current Site conditions based on the recent sediment testing data and applicable SLs.

2.3.1 Sediment Screening Levels

Table 2-2 lists the SLs for the Site. These SLs consider both SMS and DMMP requirements. The SMS requirements are applicable to the investigation and cleanup of the sediments at the Site. DMMP open-water disposal criteria area (DMMP 2025) were also considered given the planned USACE FNC Deepening Project, as follows:

- **Protection of Benthic Organisms:** The primary environmental receptors applicable to the Site consist of sediment-dwelling organisms. These benthic and epibenthic invertebrates are located near the base of the food chain and are important indicators of overall environmental health.
  - The SMS include two sets of numeric values for the protection of benthic organisms, including the SCO and the cleanup screening level (CSL). For most contaminants, these are provided on a dry weight basis. For non-polar organic compounds, organic carbon normalized SCO and CSL values are also provided.
  - Where the numeric SCO has been exceeded, confirmational bioassay testing can be used under the SMS to confirm or refute the presence of benthic toxicity.
  - The DMMP SLs for most contaminants are the same as the SMS SCO, as most were derived from the same underlying bioassay data set. The SMS SCO for the protection of benthic organisms is also used under the DMMP to evaluate projects for antidegradation; for chemicals without SCO values (e.g., dioxin and tributyltin), the DMMP SLs are used to evaluate antidegradation.
  - The DMMP maximum levels are higher than both the SCO and DMMP SLs and are provided for information purposes and to inform if dredge material removed during a cleanup action is suitable for open-water disposal.
  - SLs associated with benthic protection are typically applied to sediments on a point-by-point basis.
- **Assessing the Impacts of Bioaccumulative Contaminants:** The SLs listed in Table 2-2 also consider the potential impacts of bioaccumulative compounds.
  - Under the SMS, bioaccumulative compounds are assessed for their potential to accumulate in the food web and affect human or environmental receptors. For concentrations exceeding natural background or regional background concentrations, this can involve risk assessment. Table 2-2 incorporates Ecology's natural background concentrations for Puget Sound surface sediments as defined in Ecology guidance.

- SLs associated with bioaccumulative contaminants are typically applied to sediments on an area-wide basis, because average exposures from within a Site tend to drive potential risks.
- The DMMP incorporates bioaccumulation testing in its dredge disposal decisions. Sediments proposed for open-water disposal are required to perform bioaccumulation testing of the respective DMMP bioaccumulation trigger (BT) is exceeded. Current DMMP BT values are included in Table 2-2.

Dioxin/furans are not associated with the contaminant releases that resulted in the Tru-Grit Site, but they are present throughout the Blair Waterway at concentrations above natural background levels. Refer to Section 2.3.3 for further discussion of these compounds.

SMS and DMMP SLs were applied to the Site data. Samples with confirmed exceedances are included Table 2-3a and are discussed further in Section 2.3.2. Section 2.3.2 also discusses detected bioaccumulative compounds. Samples where no exceedances occurred are shown in Table 2-3b.

2.3.2 Nature and Extent of Site-Associated Contaminants

The nature and extent of sediment contamination at the Site was delineated through sediment testing performed in 2024 to 2025, along with the heavy metals data generated during the previous Tru-Grit RI/FS investigations. The 2024 and 2025 testing was more extensive and defined the lateral and vertical distribution of Site-associated contaminants in both the Upper Slope and the Lower Slope areas, including in the areas around the Powers dock that were not investigated during the previous studies.

As described in this section, the Preliminary Site Boundary was initially estimated based on the lateral distribution of heavy metals SCO exceedances at any depth in any of the 2024 and 2025 sediment cores and surface sediment samples. That boundary was then adjusted, as shown in Figure 2-4, to incorporate the following: 1) historical heavy metals sampling data; 2) SLs for bioaccumulative metals (arsenic, cadmium, lead, and mercury); and 3) the distribution of other Site-associated contaminants.

The Preliminary Site Boundary so established, as shown in Figure 2-4, generally follows the principal Site features and surrounds the Tru-Grit dock, the Powers dock, and the former marine railway.

Key findings regarding the nature and extent of Site-associated contaminants are summarized below and in Figures 2-4 through 2-6 and Tables 2-3a, 2-3b, and 2-4:

- **Heavy Metals:**
  - Exceedances of SLs for heavy metals are summarized in Table 2-3a. The primary heavy metals associated with the Site include arsenic, copper, and zinc. These contaminants are present in shipyard-associated wastes (all three metals) and in the Tru-Grit materials (copper and zinc only). Other heavy metals present at the Site above SLs include antimony, chromium, and lead, but at much lower frequencies than arsenic, copper, and zinc.

  - Figure 2-4 shows the distribution of SCO exceedances for all heavy metals detected at any depth in both surface and subsurface sediment data. These Site-associated heavy metals are present in both the Upper Slope and the Lower Slope and in areas surrounding the Tru-Grit dock and the Powers dock. No SCO or DMMP SL exceedances were detected in any of the core locations located within the FNC.
  - The depth of heavy metals contamination detected in the 2024 and 2025 sediment cores varies throughout the Site. The heavy metals exceedances extend to depths of 4 to 5 feet below mudline (bml) near the Tru-Grit dock and to deeper depths of up to 8 feet in the areas offshore of the Powers dock.
  - Outside of the Preliminary Site Boundary shown in Figure 2-4, the average concentrations of the four bioaccumulative metals (arsenic, cadmium, lead, and mercury) are currently below Ecology-estimated natural background concentrations for Puget Sound surface sediments. This analysis was performed conservatively by: 1) calculating the 95% upper confidence level (UCL) around the mean for each contaminant in each of the 2024 and 2025 samples and the adjacent cores from the Blair Waterway investigations as shown in Figure 2-4; and 2) representing each core location by only the maximum detected value of each heavy metal. The 95% UCLs are included in Table 2-4, which were calculated using ProUCL 5.2. The ProUCL output is included in Appendix A-1.

- **PCB Aroclors:**
  - Total PCB Aroclors were detected above the SCO at four sampling stations surrounding the Powers dock and three locations around the Tru-Grit dock, as shown in Figure 2-5a. No SCO or DMMP SL exceedances were detected in surface or subsurface sediments located outside of the Preliminary Site Boundary.
  - Using the same methodology applied for heavy metals, the 95% UCL was calculated for total PCB Aroclors for the 2024 and 2025 sampling locations located just outside of the Preliminary Site Boundary (35 micrograms per kilogram [µg/kg] dry weight). This concentration was less than the current Blair Waterway background concentrations (37 µg/kg dry weight) for shallow subsurface sediments. The Blair Waterway background concentrations for shallow subsurface sediments were estimated by calculating the 90/90 upper tolerance limit (UTL) for total PCB Aroclors throughout the Blair Waterway using all of the available PCB data generated for surface dredged material management units (DMMUs) from the 2025 Blair Waterway sediment characterization activities after excluding samples located within or adjacent to the Tru-Grit Site and after removal of higher-concentration outliers. This methodology is aligned with Ecology's approach for determining surface sediment regional background concentrations in surface sediments. The 90/90 UTL calculations for the Blair Waterway indicate that the distribution of potentially significant Site-associated total PCB Aroclor concentrations is limited to areas within the Preliminary Site Boundary. The 90/90 UTLs

are included in Table 2-4 and were calculated using ProUCL 5.2 and following *Sediment Cleanup User's Manual (SCUM): Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards, Chapter 173-204 WAC* (Ecology 2025) for development of regional background values. The ProUCL output is included in Appendix A-2.

- **Tributyltin:** The tributyltin SL was exceeded only in three surface sediment samples located in the immediate vicinity of the Powers dock and one sample adjacent to the Tru-Grit dock (Figure 2-5b). There were no tributyltin exceedances located outside of the Preliminary Site Boundary.
- **PAH Compounds:**
  - Several PAH compounds were detected in excess of the SCO and the DMMP SL at stations located inside the Preliminary Site Boundary. As shown in Table 2-3a, these include benzo(a)anthracene, chrysene, fluoranthene, and pyrene, as well as the sum of high-molecular-weight PAH compounds.
  - No exceedances of the SCO or the DMMP SL were detected at locations sampled outside of the Preliminary Site Boundary.
- **Total Carcinogenic Polycyclic Aromatic Hydrocarbon (cPAH) Toxic Equivalent Quotient (TEQ):**
  - The concentration of cPAH TEQ was elevated at several locations within the Preliminary Site Boundary, with a maximum detected concentration of 1,230 µg/kg dry weight. Higher concentrations of cPAH TEQ contamination were generally co-located with elevated heavy metals contamination.
  - There are no benthic SCO or DMMP SL values for total cPAH TEQ.
  - Using the same methodology applied for heavy metals and PCBs, the 95% UCL was calculated for cPAH TEQ for the 2024 and 2025 sampling locations located just outside of the Preliminary Site Boundary (57 µg/kg dry weight). This concentration was less than the current Blair Waterway background concentrations (59 µg/kg dry weight) for shallow subsurface sediments. The Blair Waterway background concentrations in shallow subsurface sediments were estimated by calculating the 90/90 UTL for cPAH TEQ throughout the Blair Waterway using all of the available cPAH data generated for surface DMMUs from the 2025 Blair Waterway sediment characterization activities after excluding samples located within or adjacent to the Tru-Grit Site and after removal of high-concentration outliers. These calculations indicate that the distribution of potentially significant Site-associated cPAH TEQ concentrations is limited to areas within the Preliminary Site Boundary.
- **Other Sporadically Detected Contaminants:** Other contaminants were sporadically detected within the Site, including 1,2-dichlorobenzene (three detections, one SCO exceedance), 1,4-dichlorobenzene (six detections, one SCO exceedance), and 4,4'-DDT (five detections, zero DMMP SL exceedances). Exceedances for these contaminants occurred only in the Upper

Slope area near the Tru-Grit dock; no exceedances for these contaminants occurred in the Lower Slope area.

Results of the recent testing and statistical evaluations demonstrate that the distribution of Site-associated contamination is limited to the areas within the Preliminary Site Boundary. Remediation of the areas within the Preliminary Site Boundary would eliminate all detected SCO exceedances and would reduce levels of Site-associated bioaccumulative contaminants to background levels.

2.3.3 Distribution of Regional Contaminants

Dioxin/furan compounds have been detected during previous dredge material characterization events in the outer Blair Waterway (e.g., at the Husky Terminal), within the Middle Blair Waterway (e.g., at the Georgia-Pacific Gypsum berth area and within the Lincoln Avenue ditch areas), and within the head of the Blair Waterway (e.g., at the Pierce County Terminal). These observations suggested that dioxin/furans may be present as a regional contaminant throughout the Blair Waterway.

The presence of dioxin/furans as a regional contaminant were confirmed more recently during the 2025 sediment testing performed in support of the USACE FNC Deepening Project. That testing confirmed that dioxin/furans were sporadically present at elevated concentrations within certain waterway side slope/berth areas and throughout much of the Blair Waterway turning basin. The distribution of dioxin/furan suggests the influence of historical and regional source inputs, with reductions in concentrations associated with past cleanup and navigation dredging efforts.

Figure 2-6 summarizes the distribution of dioxin/furan TEQ concentrations in surface and subsurface sediments near the Site within the middle reach of the Blair Waterway, as follows:

- Dioxin/furan TEQ concentrations were less than 10 nanograms per kilogram (ng/kg) dry weight in all of the 2024–2025 Tru-Grit investigation sediment cores collected within the FNC, except for one sample (TG-SC22) within DMMU D118, which had a concentration of 10.1 ng/kg TEQ in the 0-to-2-foot interval but which had a concentration of 0.498 ng/kg TEQ in the 2-to-4-foot interval, resulting in an average concentration of 5.3 ng/kg TEQ across the 0-to-4-foot interval. That average is similar to the DMMU D118 concentration (3.03 ng/kg from D118CS-A [BW-SC81]) from the Blair Waterway testing. The FNC was historically dredged during the cleanup performed in the early 1990s.
- Dioxin/furan TEQ concentrations were detected at concentrations exceeding 10 ng/kg sporadically in sediments within both the Upper Slope and the Lower Slope areas at the Tru-Grit Site. The detected concentrations in most samples ranged from less than 10 ng/kg to 82 ng/kg. One sample contained a detected concentration of 270 ng/kg. The distribution of dioxin/furan TEQ exceedances did not correlate with concentrations of heavy metals and in some cases were present at deeper depths.

- The range of dioxin/furan TEQ concentrations within the Site were similar to those detected during dredge material characterizations performed in the adjacent Graymont berth areas during 2025 (maximum concentration of 219 ng/kg at DMMU D120; BW-SC94) and in the prior characterization of sediments located within the Georgia-Pacific Gypsum berth areas prior to the 2016 dredging of that area (dioxin/furan TEQ concentration of 110 ng/kg in the shallow DMMU1 composite prior to dredging) and in berth areas across the Blair Waterway from the former Lincoln Avenue ditches (dioxin/furan TEQ concentrations of 61.7 ng/kg and 160 ng/kg in shallow DMMUs D147 [BW-SC142] and D148 [BW-SC143], respectively).
- The recent Site investigations confirm that dioxin/furans are present within the Site as within adjacent waterway berth and slope areas. The presence of these regional compounds will impact dredging and Site remediation decisions and have been considered in development of this IAP.

2.4 Effects of the USACE FNC Deepening Project

The USACE FNC Deepening of the Blair Waterway to -57 feet MLLW plus a 2-foot overdredge (final elevation to -59 feet MLLW) is projected to begin in 2028. This IAP considers the potential impacts of that work on the stability of contaminated sediments located within the Site.

Figure 2-7 shows the USACE FNC Deepening Project's DMMUs located adjacent to the Tru-Grit Site. Those DMMUs were developed conservatively in considering how the deepening of the channel might impact adjacent side slope areas by causing sediment sloughing during or following completion of the work, as follows:

- The potential FNC slough area was calculated using a contingency 10-foot buffer landward of the FNC boundary identified by USACE in the FS phase (feasibility boundary) and a 2H:1V (horizontal to vertical [ratio]) slope.[1] The 10-foot adjustment considers the potential for lateral overdredging that could potentially occur during dredging. A full 2-foot overdredge allowance was also incorporated into the DMMUs, causing them to reach further shoreward within the Blair Waterway side slopes.
- Three of the USACE FNC Deepening Project's DMMUs overlap with the Tru-Grit Preliminary Site Boundary as shown in Figure 2-7. These include portions of DMMUs D117 (BW-SC75), D118 (BW-SC81), and D119 (BW-SC88).

In developing this IAP, the removal of contaminated sediment from the Lower Slope areas of the Site has been prioritized. The planned work for this area to be conducted during the Interim Action is

[1] For remediation planning, the use of the feasibility boundary with a 10-foot offset is conservative and likely over-estimates the area of sediments that may be destabilized (i.e., that may slough) as a result of the FNC deepening. The feasibility boundary assumes a wider navigation channel closer to the Tru-Grit Site, though the preliminary engineering and design evaluations by USACE may result in a narrower FNC boundary that is farther from the Site. The estimated slough area also incorporates a 10-foot offset from the feasibility boundary, a full 2-foot overdredge assumption and a 2H:1V side slope. Actual FNC dredge extents may be less and overdredge depths may be shallower. Also, the final side-slopes may be steeper than the assumed 2H:1V.

described in Section 3. Upper Slope areas of the Site will not be destabilized by the proposed deepening. The need for cleanup of the Upper Slope areas will be addressed through separate future cleanup action planning.

3 Proposed Interim Action

This section describes the proposed Interim Action for the Site. Information summarized in this section includes the following:

- Purpose of the Interim Action (Section 3.1)
- Interim Action description (Section 3.2)
- Basis for selecting the proposed Interim Action (Section 3.3)
- Compliance monitoring and associated contingency measures (Section 3.4)
- Reporting (Section 3.5)
- Estimated costs for the proposed Interim Action (Section 3.6)
- Final cleanup considerations (Section 3.7)

3.1 Purpose of Interim Action

The purpose of the Interim Action is to remove contaminated sediments, consistent with MTCA and SMS requirements, in the Lower Slope area of the Tru-Grit Site prior to the USACE FNC Deepening Project to prevent them from sloughing into the FNC during or after waterway deepening.

The Interim Action is expected to provide a final cleanup action for the Lower Slope area of the Site. This includes remediating all Lower Slope areas containing SCO exceedances. The proposed remediation will also reduce levels of bioaccumulative contaminants in the Lower Slope to appropriate background-based concentrations listed in Table 3-1.

The Interim Action will not remediate the Upper Slope area of the Site. Additional actions may be required in the future to address remaining contaminated sediment in the Upper Slope area of the Tru-Grit Site.

3.2 Interim Action Description

The Interim Action will be completed in advance of the USACE FNC Deepening Project. The proposed Interim Action is shown in plan-view in Figure 3-1 and in cross-section view in Figures 3-2 and 3-3. Performance Standards are listed in Table 3-1.

The Interim Action will remove contaminated sediments from the Lower Slope area of the Site. Planned removal areas are identified as Area A and Area B on Figure 3-1. These include both areas of SCO exceedances and areas with elevated concentrations of potentially bioaccumulative contaminants.

The contaminated sediments will be removed by mechanical dredging and will be disposed of at a permitted upland Subtitle D landfill site. Following confirmation of contaminated sediment removal, clean residuals management cover (RMC) will be placed throughout the dredging area on the post-project surface.

The Interim Action work area includes two sediment removal areas:

- Area A is located offshore of the Tru-Grit dock and overlaps with portions of USACE FNC Deepening Project DMMUs D117 and D118 (also subsurface DMMUs D506 and D507). The depth of sediments exceeding the Table 3-1 Performance Standards is 4 feet bml based on metals and PCB contamination in Tru-Grit cores TG-SC14, TG-SC15, TG-SC-16, TG-SC17, and TG-SC18. D/F contamination is also co-located at this depth. Preliminary estimates of removal volumes are summarized in Table 3-2 and include a conservative 2-foot overdredge allowance and estimated side slope volumes calculated using a 2H:1V side slope assumption. The estimated removal volumes for Area A are between 5,767 cubic yards (cy; no overdredge allowance) and 9,062 cy (full 2-foot overdredge allowance). These volumes do not include contingency re-dredging, which is discussed in Section 3.4.
- Area B is located offshore of the Powers dock and overlaps with portions of USACE FNC Deepening Project DMMU D119 (also subsurface DMMU D507). The depth of sediments exceeding the Table 3-1 Performance Standards is 8 feet bml based on metals contamination in Tru-Grit core TG-SC26. D/F contamination is also co-located at this depth. Preliminary estimates of removal volumes are summarized in Table 3-2 and range between 2,723 cy (no overdredge allowance) and 3,637 cy (full 2-foot overdredge allowance). These volumes do not include contingency re-dredging, which is discussed in Section 3.4.

A preliminary geotechnical analysis was conducted to evaluate whether the proposed dredging of Area A or Area B could adversely impact the stability of the Tru-Grit dock or the Powers dock. That analysis documented that the slope can be dredged safely to the planned 2H:1V dredge prism geometry and that the dredging would not cause destabilization of these structures under static conditions. Following dredging and completion of performance monitoring, the slope cut will be backfilled with clean sandy sediments to a flatter slope of 3H:1V. The material will be derived from a clean quarry source and free of contaminants. The material will be a mix of sand and gravel suitable for use as RMC and slope backfill. This will provide 1) additional buttressing of the slope against potential slumping; and 2) additional protection against sediment erosion from prop wash. This backfill is above and beyond the 6-inch minimum placement of RMC throughout the dredge areas. It represents an interim cover over the edge of the Upper Slope area but may not be permanent depending on the cleanup decisions to be made in the future for the Upper Slope (e.g., it could be removed under a dredging remedy or alternately upgraded with armoring under a capping-based remedy).

The final extent of dredging in small portions of Area A is affected by physical obstructions. These include the navigational tower located near TG-SC14 and subsurface utilities located near the western portion of Area A. The approach for dredging in these areas will be refined during remedial design. Any residual contamination that is impracticable to remove will be covered with RMC.

Transloading of dredged material is planned to occur at the Port's West Hylebos Log Dock facility located on the Hylebos Waterway. This facility has existing stormwater infrastructure. A temporary transload facility will be constructed to support Tru-Grit dredge material management, as well as the USACE FNC Deepening Project. Tru-Grit dredge material will be dewatered and solidified sufficiently for acceptance at a landfill for upland disposal.

Performance monitoring will be performed within the dredge areas to confirm that the Performance Standards (Table 3-1) have been met. If missed inventory (residual contaminated sediment) is identified in that testing, then contingency re-dredging may be required of affected areas. Performance monitoring and contingency re-dredging will be conducted in accordance with the Compliance Monitoring and Contingency Response Plan (CMCRP), discussed further in Section 3.4 and included as Appendix C.

After performance testing and any associated contingency re-dredging, a 6-inch minimum layer of RMC and additional slope backfill materials will be placed over the entire dredged area (both Action Areas A and B). To stay in place, RMC material requires a maximum slope grade of approximately 3H:1V. There, in areas where the post-dredge slope grade is steeper than 3H:1V, the RMC material thickness will need to be increased to reduce the final slope grade to 3H:1V or shallower. As described above, this additional material placement provides additional buttressing of the slope against potential sloughing or instability, and additional protection against sediment erosion.

Based on preliminary design assumptions, the total RMC and slope backfill material placement quantity will be approximately 6,500 tons. The final material placement quantities will be determined during remedial design and permitting.

No armor layers are to be placed over the RMC and slope backfill materials. The design of the Interim Action without armoring layers is appropriate to current conditions at the Tru-Grit berth. The Interim Action area sediments are located in deep subtidal areas below areas of potential vessel wake or wind-driven wave disturbance. Prop wash is not expected to be significant because the berth area is currently inactive and is not subject to significant prop wash forces as part of navigation activities in the adjacent channel:

- **Planned Removal of Tru-Grit and Powers Docks:** Both the Tru-Grit dock and the former Powers dock are in poor condition and have been removed from service by the Port. Programming has been initiated by the Port for their eventual removal. Pending future redevelopment of the Port-owned properties in the vicinity of the Tru-Grit Site, there are no planned navigation uses for the Tru-Grit berth area.
- **Waterway Navigation Patterns:** Though the Tru-Grit Site is located along-side a FNC, the berth-area sediments are not subject to significant prop wash from vessels transiting the waterway, because 1) the larger vessels are depth-restricted and transit the waterway within

the federal channel boundaries; 2) smaller vessels are precluded from traveling through the berth area by the presence of existing navigation control structures (i.e., two pile-supported navigational aids and one pile-supported navigation tower); and 3) the Tru-Grit Site is not located opposite any existing berthing areas for large vessels (e.g., container terminals; large tugs are not expected to be oriented perpendicular to the Site shoreline as can occur in some other areas of the waterway when tugs are helping to dock a large ship at a container terminal).

- **Further Review as Part of Future Upper Slope Cleanup and/or Future Redevelopment:** The potential for prop wash disturbance of the Tru-Grit berth area and the need for additional mitigation measures will be revisited as part of the final cleanup of the Upper Slope area. Similar evaluations will also occur in the event that the Tru-Grit Site and vicinity are redeveloped.

Confirmation monitoring will be performed as described in Section 3.4 and Appendix C following RMC material placement. This monitoring will confirm that the Table 3-1 Performance Standards have been met.

Long-term monitoring will be performed during the 3 years following completion of the Interim Action as described in Section 3.4 and Appendix C. That monitoring will be used to verify that the slope backfill materials remain stable and that recontamination is not occurring within the Interim Action area.

3.3 Basis for Interim Action Selection

The proposed Interim Action was selected following a screening of potential remedial approaches and consideration of the following evaluation criteria:

- Ability of the remedial approach to remove contaminated sediments from those areas of the Lower Slope that could potentially be destabilized by the planned deepening of the FNC
- Ability of the remedial approach to provide a final cleanup for the Lower Slope areas of the Site
- Ability of the remedial approach to comply with the Interim Action Performance Standards listed in Table 3-1, including both SMS SCO values and background-based performance standards for bioaccumulative contaminants
- Use of remedial technologies and methods that have been proven effective during the cleanup of similar contaminated sediment sites
- The use of remedial approaches that are permanent to the maximum extent practicable as defined under MTCA and SMS remedy selection requirements
- Alignment of the remedy with MTCA preferences for cleanup action selection as defined in WAC 173-340-370
- Preference for the use of remedial approaches that can be implemented in a timely manner in advance of the planned deepening of the FNC

The proposed Interim Action includes full removal to the extent practicable for all contaminated sediments (those that exceed the Table 3-1 Performance Standards) in the Lower Slope areas of the Site. Removal and upland disposal of these sediments represents a permanent remedy for these Lower Slope areas under the MTCA and SMS regulations. The work can be implemented prior to planned deepening of the FNC in 2028, removing potential interference with the proposed USACE FNC Deepening Project.

3.4 Compliance Monitoring and Contingency Responses

Compliance monitoring will be performed as part of the Interim Action. The Water Quality Monitoring and Protection Plan (WQMPP) is included as Appendix B, and the CMCRP is included as Appendix C.

- The WQMPP describes the water quality monitoring to be performed during dredging and material placement activities, including any contingency re-dredging or material placement activities. The document describes turbidity monitoring, action levels, and controls to be applied based on the monitoring results.
- The CMCRP describes the performance, confirmation, and long-term monitoring to be performed during and after completion of the Interim Action. For each of the different types of monitoring, Table 3-4 summarizes the applicable objectives, decision points, sampling locations, timing/frequency, and performance criteria. Analytical parameters and associated QA/QC requirements are tabulated in the CMCRP (Appendix C). The CMCRP also includes measurable trigger conditions resulting in contingency re-dredging and/or other contingency actions.

Monitoring activities will be performed during and following completion of the Interim Action. Monitoring will include each of the following:

- **Protection Monitoring:** Protection monitoring will include water quality monitoring to document water quality protection within the Site during dredging. During the Interim Action, various construction controls will be implemented as feasible to ensure water quality protection within the Site and surrounding area. Protection will be verified through a combination of intensive monitoring (e.g., twice daily during dredging) and routine monitoring (e.g., once weekly). Protection monitoring will identify the need for further controls as appropriate. The final WQMPP is included as Appendix B.
- **Performance Monitoring:** Performance monitoring will be performed after dredging to confirm that the sediment removal has met performance criteria. This monitoring will be repeated in the event that contingency re-dredging is triggered. Proposed monitoring and contingency measures include the following:
  - Post-Dredge Bathymetric Survey: Post-dredge bathymetry survey will be used to confirm that sediments have been removed to the target dredging elevations and extents. Contingency re-dredging will be used as necessary if high spots are identified.

  - Post-Dredge Sediment Sampling: Post-dredge performance monitoring will be performed at 20 locations within Areas A and B and associated side slopes as shown in Figure 3-4. These locations are systematically placed throughout the dredge prism and side slopes. This monitoring will be used to confirm: 1) that contaminated sediments have been removed to the extent practicable; and 2) that the quantity of dredging residuals does not exceed design requirements. Contingency re-dredging may be used if areas of missed inventory are identified (i.e., contaminant levels in undisturbed sediment exceed the Table 3-1 Performance Standards) or if the thickness of dredging residuals exceeds design requirements. The extent of such contingency re-dredging may be limited by geotechnical stability considerations in the portions of Area B located closest to the former Powers dock.

- **Confirmation Monitoring:** Confirmation monitoring will be performed after dredging and RMC placement are complete to confirm that RMC and slope backfill materials have been placed consistent with the project design. This monitoring will be repeated in the event that contingency material placement is triggered. Proposed monitoring and contingency measures include the following:
  - Post-Material Placement Bathymetric Survey: Post-material placement survey will be used to confirm that material placement activities achieve required target elevations and slopes as defined in the project design. Contingency measures include placement of additional RMC or slope backfill in affected areas followed by a second round of surveys to verify that target thicknesses and slopes have been achieved.
  - Post-Material Placement Sediment Sampling: Post-material placement confirmation monitoring will include resampling at the 20 sediment monitoring stations (Figure 3-4) used for performance monitoring. Results of confirmation monitoring will be compared to Table 3-1, Performance Standards. Contingency measures may be applied if Performance Standards are not met. The nature of the contingent actions will depend on the nature and extent of the exceedance, including triggering contingent bioassay testing or placement of additional RMC or slope backfill in affected areas.
- **Long-Term Monitoring:** Long-term monitoring will be performed during the 3 years after completion of the Interim Action. The purpose of the long-term monitoring is to document the stability of the placed slope backfill materials. This will include completion and analysis of three annual bathymetric surveys. If areas of sloughing or slope instability are identified, then contingent surface sediment testing will be performed to document surface sediment quality. If triggered, that testing will include resampling surface sediments at each of the 12 sediment sampling stations shown in Figure 3-5. These include the former dredge prism bottom samples and the north side slope samples. Because the other former side slope locations (south, east, and west side slopes) will have been removed from the USACE FNC Deepening Project, no monitoring will be performed in those areas. The results of long-term monitoring will be

documented in a Year 3 Monitoring Report. If long-term monitoring sediment samples fail to meet the Performance Standards (Table 3-1), then additional remediation work on the Lower Slope may be required as part of the final cleanup of the Tru-Grit Site.

3.5 Reporting

An Interim Action Completion Report will be drafted and submitted following completion of the Interim Action. The report will summarize the results of all protection monitoring, performance monitoring, and confirmation monitoring. The report will include as-built drawings summarizing dredging and material placement activities, and tables and figures summarizing results of performance and confirmation monitoring results. Disposal documentation will also be included for all removed sediments. Any deviations from this plan or final design documents will be discussed. The Interim Action Completion Report will be submitted to Ecology, the USEPA, and USACE within 120 days following completion of post-construction monitoring.

Additionally, a Long-Term Monitoring Report will also be submitted in year 3 following completion of construction. That report will include all bathymetric evaluations as well as the results of contingent sediment testing, if performed.

Collected sediment monitoring data will be uploaded to Ecology's Environmental Information Management database at the time the above-listed reports are submitted.

3.6 Estimated Costs

Table 3-5 summarizes the estimated costs for completion of the Interim Action and associated monitoring and reporting activities. These costs exclude completed sediment characterization activities, development of the IAP, and ongoing design and permitting. Cost estimating assumptions are documented in the notes to the table.

Total estimated Interim Action costs range between approximately $8.8 and $12.2 million. This range includes core costs for mobilization/demobilization, environmental controls and water quality monitoring, sediment dredging and disposal, placement of RMC and slope backfill materials, construction management, and monitoring and reporting costs. Allowances have been included to cover contingent re-dredging and material placement activities and contingent monitoring activities, respectively.

Estimated costs for completion of the Interim Action will be refined during final design and permitting and are subject to change.

3.7 Final Cleanup Considerations

The proposed Interim Action is expected to provide a final cleanup for the Lower Slope areas of the Site. With removal of the contaminated sediments from those areas, the USACE FNC Deepening Project can proceed unencumbered. The need for cleanup of remaining contaminated sediments located in the Upper Slope areas of the Site will be addressed through separate future cleanup action planning.

4 Implementation of the Interim Action

This section describes the anticipated schedule for design and implementation of the proposed Interim Action for the Lower Slope areas of the Site.

4.1 Design

Design activities are to be conducted in early 2026. This will include development of the following deliverables:

- Project plans and technical specifications
- Engineer's Cost Estimate
- Definition of proposed best management practices for use in construction
- Construction Quality Assurance Plan (CQAP)
- CMCRP
- WQMPP

Development of the current Interim Action approach included a preliminary geotechnical analysis to evaluate dredging the Lower Slope areas and the effects of dredging on the static stability of the slope. This analysis utilized existing geotechnical data from surrounding sites to inform the stratigraphy and for development of the slope stability model. Results from this model indicate that the current approach for implementation of the Interim Action dredging activities will result in stable static slope conditions. Further analyses should be completed during the design phase to verify these results and to also consider seismic slope stability as that condition was not evaluated as part of this initial effort.

4.2 Permitting

Table 4-1 provides a summary of permits and approvals that are anticipated to be required for the Interim Action. The information in Table 4-1 assumes that the Interim Action will qualify for programmatic permits issued under the Port's Comprehensive Repair and Maintenance Program approvals as a beneficial activity. Individual permits will be attained to demonstrate compliance with Hydraulic Project Approval (Washington Department of Fish and Wildlife [WDFW]) and Shoreline Substantial Development Permit (City of Tacoma Planning and Development Services [PDS] Department) permitting.

The Port will coordinate with representatives from the Puyallup Tribe of Indians, USACE, USEPA, National Marine Fisheries Service and U.S. Fish and Wildlife Service (the Services), Ecology, the Washington State Department of Archaeology and Historic Preservation (DAHP), WDFW, and the City of Tacoma PDS Department.

Table 4-1
Anticipated Permits for Tru-Grit Interim Action

Approvals	Agency	Trigger	Notes
Clean Water Act Sections 404/10 Permit (under CMMP: NWS-2024-446-WRD)	USACE	Discharge of dredged or fill material into waters of the United States	A JARPA form and JARPA plan set will be prepared and submitted to USACE along with a PIF to confirm coverage under the Port's CMMP.
Section 408 Permit	USACE	Proposed alteration(s) to a federally authorized project	Section 408 permission will be confirmed by USACE via the PIF and additional supporting materials if requested.
CERCLA Coordination	USEPA	Location of project within Commencement Bay Superfund Site	CERCLA coordination with USEPA will be conducted via the PIF and by USACE as part of the USACE permit confirmation process.
Antidegradation Determination	DMMP	Evaluation of leave-surface sediment quality	USACE will coordinate with the Ecology site manager and DMMP as part of the USACE permit confirmation process to document exposed surface sediment quality is protective.
ESA Compliance (under CMMP: WCRO-2024-02448 & FWS/R1/2025-0000930)	The Services	Potential impacts to ESA-listed species and critical habitat	Supplemental information may be requested by the Services to confirm consultation coverage under the CMMP as a beneficial activity. ESA habitat conservation credits/debits will be calculated using the Port calculator.
National Historic Preservation Act Section 106 Compliance	DAHP	Potential impacts to archaeological, cultural, or historic resources	Cultural resources monitoring requirements will be determined based on the Port's programmatic Cultural Resources Plan developed with the Puyallup Tribe.
Clean Water Act Section 401 WQC (under CMMP: 23740)	Ecology	Potential water quality impacts from dredging and material placement	A project-specific WQMPP demonstrating compliance with Washington State Water Quality Standards will be prepared and submitted to Ecology and USACE with the PIF, as required under the CMMP.
CZMA Compliance (under CMMP: 143975)	Ecology	Federally permitted, licensed, or funded projects affecting coastal resources in one or more of Washington's 15 coastal counties	Coverage under the CMMP CZMA will be confirmed by Ecology via the PIF.
Hydraulic Project Approval	WDFW	Activities occurring within waters of the state	Application materials will be submitted online to WDFW.
SEPA Determination	Ecology	Activities requiring environmental review	SEPA Checklist submitted to Ecology on 3/31/2026.
Shoreline Substantial Development Permit	City of Tacoma PDS Department	Dredging	A written narrative will be submitted to the City of Tacoma PDS Department, describing how the project meets each criterion for approval.

4.3 Implementation

Implementation of the proposed Interim Action will occur as follows:

- **Interim Action Construction:** Following design and permitting activities, the Interim Action will be constructed. Timing of most in-water work activities will be limited by permit-specified "fish windows" to appropriate time periods when those activities are least likely to affect migrating juvenile salmonids and other aquatic species. These time limitations will affect the amount of work that can be completed within a given construction season and will particularly affect the overall time required to complete dredging and RMC material placement activities. Other work does not require in-water activity (e.g., upland sediment staging/transport) but is subject to other logistical constraints. Interim Action construction is reasonably expected to be performed in a single construction season.
- **Compliance Monitoring:** Compliance monitoring will occur during and following construction, in accordance with the CQAP, CMCRP, and WQMPP.

4.4 Schedule

Construction of the Interim Action is proposed for implementation during the 2026/2027 fish window (July 15, 2026, to February 15, 2027) in advance of the USACE FNC Deepening Project.

In order to meet this timeline, design permitting and procurement activities will need to be completed between January 2026 and June 2026, with submittal of the JARPA and related permitting materials during mid-2026. Construction is estimated to take 3 months and is targeted to occur between December 2026 and February 2027.

The Interim Action Completion Report will be submitted within 120 days of completion of construction.

5 References

Anchor QEA, 2024. *Sampling and Quality Assurance Project Plan.* Tru-Grit Site Data Gaps Field Investigation. Prepared for the Port of Tacoma. July 2024.

Anchor QEA, 2025a. *Sampling and Quality Assurance Project Plan Addendum.* Tru-Grit Site Data Gaps Field Investigation. Prepared for the Port of Tacoma. March 2025.

Anchor QEA, 2025b. *Sampling and Quality Assurance Project Plan Addendum #2.* Tru-Grit Site Data Gaps Field Investigation. Prepared for the Port of Tacoma. August 2025.

Anchor QEA, 2026a. *Sediment Characterization Report, Port of Tacoma – Tru-Grit.* Prepared for the Port of Tacoma. Revised July 2026.

Anchor QEA, 2026b. *Sediment Characterization Report, Blair Waterway Federal Navigation Channel Deepening Sediment Characterization*. Prepared for the Port of Tacoma. March 2026.

DMMP (Dredged Material Management Program), 2025. *Dredged Material Evaluation and Disposal Procedures User Manual.* Dredged Material Management Program: U.S. Army Corps of Engineers, Seattle District; Environmental Protection Agency, Region 10; Washington State Department of Natural Resources; and Washington State Depart of Ecology. November 2025. Accessed June 30, 2026. https://www.nws.usace.army.mil/Portals/27/docs/civilworks/dredging/User%20Manual/UM_2025%20Final.pdf?ver=B2yCJUN0xVmrx-_sVQ0Ozg%3d%3d.

Ecology (Washington State Department of Ecology), 2012. Agreed Order No. DE-8978. May 2012.

Ecology, 2025. *Sediment Cleanup User's Manual (SCUM): Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards, Chapter 173-204 WAC*. Fourth Revision. Toxics Cleanup Program Publication No. 12-09-057. December 2025.

Landau (Landau Associates, Inc.), 2009. *Tru-Grit Facility Sediment Sampling and Analysis Results, Tacoma, Washington*. July 2009.

Landau, 2019. *Agency Review Draft Feasibility Study, Tru-Grit Facility, Tacoma, Washington*. Prepared for CanAm Minerals, Inc. December 2019.

Landau, 2021. *Remedial Investigation Report, Tru-Grit Abrasives, Inc.* Prepared for CanAm Minerals, Inc. December 2021.

Maul Foster Alongi (Maul Foster Alongi, Inc.), 2025. *Supplemental Investigation Report.* Lincoln Avenue Ditch, Tacoma, Washington. Prepared for Port of Tacoma. December 2025.

Tetra Tech, 1985. *Commencement Bay Near-Shore/Tideflats Remedial Investigation*. Final Report. Prepared for the Washington State Department of Ecology and U.S. Environmental Protection Agency. August 1985.

Tables

Table 2-1
Summary of Site History

Date	Historical Uses
1940s	The site and vicinity are owned by the Tacoma Harbor Lumber Company.
1949	Wapato Waterway terminates at 11th Street with shallow tidal basin in front of site.
1950	The upland property is vacant and undeveloped. Wapato Waterway terminates just south of the 11th Street bridge.
1953	The original 11th Street bridge is constructed across head of Wapato Waterway.
Late 1950s	Wapato Waterway is extended to Lincoln Avenue with a water depth of approximately 30 feet and renamed the Port Industrial Waterway.
1966–1969	Federal funding is approved for the project to extend the Waterway past Lincoln Avenue to the turning basin and deepen it to 51 feet. Port Industrial Waterway is renamed "Blair Waterway" in 1969 after Port Commissioner Archie Blair.
1968–1976	Martinolich Shipbuilding Corp. operates at the site using a dock, marine railway, and a drydock (drydock added by 1973) at the site.
1973	The drydock is present just northwest of the Tru-Grit dock; a T-shaped float system is present in the location of the Powers dock.
1976	Martinolich enters bankruptcy; the original drydock is removed. Sextant Marine Shipbuilding takes over operations; a new 1,000-ton drydock is leased from U.S. Navy; berth dredging is performed by Sextant Marine Shipbuilding to install a new drydock.
1976–1982	Sextant Marine Shipbuilding is renamed "Sea-Tac Alaska Shipbuilding" and continues operations focusing on both federal maintenance work and fishing/crabbing vessel construction.
1978	A.H. Powers salvages a former concrete barge and modifies and installs a portion of that vessel, creating the Powers concrete dock; dredging and bulkhead construction are conducted as part of concrete dock installation.
1979	A.H. Powers acquires ownership of the property; the southeastern portion of the concrete dock is located in easement with Tacoma Lime (predecessor to Graymont).
1982	Sea-Tac Alaska Shipbuilding enters bankruptcy; the U.S. Navy drydock is removed; A.H. Powers uses the site as the home port for A.H. Powers construction company.
1990	Tru-Grit begins operations, offloading abrasive materials containing elevated levels of copper and zinc (but not arsenic).
1993–1995	Blair Waterway remediation is completed by the Port of Tacoma.
1996	Blair Waterway is removed from the CERCLA National Priorities List.
2007	The Port of Tacoma acquires property from A.H. Powers, including the Graymont easement for the concrete dock.
2012	Tru-Grit receives a PLP letter and enters Ecology Agreed Order to develop an RI/FS for cleanup of Tru-Grit abrasives.
2013	Tru-Grit barge offloading activities cease.
2019–2021	The Tru-Grit RI Report is completed. Presence of deeper arsenic-containing grit materials (in addition to Tru-Grit abrasive materials) is identified during testing.
2019	Tru-Grit Draft FS is completed.

Notes:
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act
Ecology: Washington State Department of Ecology
FS: feasibility study
PLP: potentially liable party
RI: remedial investigation

Table 2-2
Testing Parameters and Screening Levels

Sediment Testing Parameter	Method	Benthic Screening Levels					Bioaccumulation Screening Levels		Other
		DMMP	SMS				DMMP	SMS	DMMP
		DMMP SL	SMS SCO	SMS CSL	AET SCO	AET CSL	DMMP BT	SMS Natural Background (or PQL)[a]	DMMP ML
Conventional Parameters (pct)									
Total organic carbon	SW9060AM								
Total solids	D2216								
Total solids	SM2540G								
Total volatile solids	PSEP-TVS								
Metals (mg/kg)									
Antimony	SW6020	150							200
Arsenic	SW6020	57	57	93	57	93	507.1	11	700
Cadmium	SW6020	5.1	5.1	6.7	5.1	6.7		0.8	14
Chromium	SW6020	260	260	270	260	270			
Copper	SW6020	390	390	390	390	390			1300
Lead	SW6020	450	450	530	450	530	975	21	1200
Mercury	SW7471B	0.41	0.41	0.59	0.41	0.59	1.5	0.2	2.3
Selenium	SW6020						3		
Silver	SW6020	6.1	6.1	6.1	6.1	6.1			8.4
Zinc	SW6020	410	410	960	410	960			3800
Organometals (µg/kg)									
Tributyltin (ion)	SW8270ESIM						73		
Semivolatile Organics (mg/kg-OC)									
1,2,4-Trichlorobenzene	SW8270ESIM		0.81	1.8					
1,2-Dichlorobenzene	SW8270ESIM		2.3	2.3					
1,4-Dichlorobenzene	SW8270ESIM		3.1	9					
Bis(2-ethylhexyl)phthalate	SW8270E		47	78					
Butylbenzyl phthalate	SW8270ESIM		4.9	64					
Di-n-butyl phthalate	SW8270E		220	1700					
Di-n-octyl phthalate	SW8270E		58	4500					
Diethyl phthalate	SW8270ESIM		61	110					
Dimethyl phthalate	SW8270ESIM		53	53					
Hexachlorobenzene	SW8270ESIM		0.38	2.3					
Hexachlorobutadiene (Hexachloro-1,3-butadiene)	SW8270ESIM		3.9	6.2					
n-Nitrosodiphenylamine	SW8270ESIM		11	11					
Pentachlorophenol	SW8270ESIM								

Table 2-2
Testing Parameters and Screening Levels

Sediment Testing Parameter	Method	Benthic Screening Levels					Bioaccumulation Screening Levels		Other
		DMMP	SMS				DMMP	SMS	DMMP
		DMMP SL	SMS SCO	SMS CSL	AET SCO	AET CSL	DMMP BT	SMS Natural Background (or PQL)[a]	DMMP ML
Semivolatile Organics (µg/kg)									
1,2,4-Trichlorobenzene	SW8270ESIM	31			31	51			64
1,2-Dichlorobenzene	SW8270ESIM	35			35	50			110
1,4-Dichlorobenzene	SW8270ESIM	110			110	110			120
2,4-Dimethylphenol	SW8270ESIM	29	29	29	29	29			210
2-Methylphenol (o-Cresol)	SW8270ESIM	63	63	63	63	63			77
4-Methylphenol (p-Cresol)	SW8270ESIM	670	670	670	670	670			3600
Benzoic acid	SW8270ESIM	650	650	650	650	650			760
Benzyl alcohol	SW8270ESIM	57	57	73	57	73			870
Bis(2-ethylhexyl)phthalate	SW8270E	1300			1300	1900			8300
Butylbenzyl phthalate	SW8270ESIM	63			63	900			970
Di-n-butyl phthalate	SW8270E	1400			1400	1400			5100
Di-n-octyl phthalate	SW8270E	6200			6200	6200			6200
Diethyl phthalate	SW8270ESIM	200			200	1200			1200
Dimethyl phthalate	SW8270ESIM	71			71	160			1400
Hexachlorobenzene	SW8270ESIM	22			22	70	168		230
Hexachlorobutadiene (Hexachloro-1,3-butadiene)	SW8270ESIM	11			11	120			270
n-Nitrosodiphenylamine	SW8270ESIM	28			28	40			130
Pentachlorophenol	SW8270ESIM	400	360	690	360	690	504		690
Phenol	SW8270ESIM	420	420	1200	420	1200			1200

Table 2-2
Testing Parameters and Screening Levels

Sediment Testing Parameter	Method	Benthic Screening Levels					Bioaccumulation Screening Levels		Other
		DMMP	SMS				DMMP	SMS	DMMP
		DMMP SL	SMS SCO	SMS CSL	AET SCO	AET CSL	DMMP BT	SMS Natural Background (or PQL)[a]	DMMP ML
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)									
2-Methylnaphthalene	SW8270E		38	64					
Acenaphthene	SW8270E		16	57					
Acenaphthylene	SW8270E		66	66					
Anthracene	SW8270E		220	1200					
Benzo(a)anthracene	SW8270E		110	270					
Benzo(a)pyrene	SW8270E		99	210					
Benzo(b,j,k)fluoranthenes	SW8270E								
Benzo(g,h,i)perylene	SW8270E		31	78					
Carbazole	SW8270E								
Chrysene	SW8270E		110	460					
Dibenzo(a,h)anthracene	SW8270ESIM		12	33					
Dibenzofuran	SW8270E		15	58					
Fluoranthene	SW8270E		160	1200					
Fluorene	SW8270E		23	79					
Indeno(1,2,3-c,d)pyrene	SW8270E		34	88					
Naphthalene	SW8270E		99	170					
Phenanthrene	SW8270E		100	480					
Pyrene	SW8270E		1000	1400					
Total Benzofluoranthenes (b,j,k) (U = 0 max limit)	Calculated		230	450					
Total HPAH (SMS) (U = 0 max limit)	Calculated		960	5300					
Total LPAH (SMS) (U = 0 max limit)	Calculated		370	780					

Table 2-2
Testing Parameters and Screening Levels

Sediment Testing Parameter	Method	Benthic Screening Levels					Bioaccumulation Screening Levels		Other
		DMMP	SMS				DMMP	SMS	DMMP
		DMMP SL	SMS SCO	SMS CSL	AET SCO	AET CSL	DMMP BT	SMS Natural Background (or PQL)[a]	DMMP ML
Polycyclic Aromatic Hydrocarbons (µg/kg)									
2-Methylnaphthalene	SW8270E	670			670	670			1900
Acenaphthene	SW8270E	500			500	500			2000
Acenaphthylene	SW8270E	560			1300	1300			1300
Anthracene	SW8270E	960			960	960			13000
Benzo(a)anthracene	SW8270E	1300			1300	1600			5100
Benzo(a)pyrene	SW8270E	1600			1600	1600			3600
Benzo(b,j,k)fluoranthenes	SW8270E								
Benzo(g,h,i)perylene	SW8270E	670			670	720			3200
Carbazole	SW8270E								
Chrysene	SW8270E	1400			1400	2800			21000
Dibenzo(a,h)anthracene	SW8270ESIM	230			230	230			1900
Dibenzofuran	SW8270E	540			540	540			1700
Fluoranthene	SW8270E	1700			1700	2500	4600		30000
Fluorene	SW8270E	540			540	540			3600
Indeno(1,2,3-c,d)pyrene	SW8270E	600			600	690			4400
Naphthalene	SW8270E	2100			2100	2100			2400
Phenanthrene	SW8270E	1500			1500	1500			21000
Pyrene	SW8270E	2600			2600	3300	11980		16000
Total Benzofluoranthenes (b,j,k) (U = 0 max limit)	Calculated	3200			3200	3600			9900
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0 max limit)	Calculated								
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2 max limit)	Calculated							21	
Total HPAH (DMMP) (U = 0 max limit)	Calculated	12000			12000	17000			69000
Total LPAH (DMMP) (U = 0 max limit)	Calculated	5200			5200	5200			29000

Table 2-2
Testing Parameters and Screening Levels

Sediment Testing Parameter	Method	Benthic Screening Levels					Bioaccumulation Screening Levels		Other
		DMMP	SMS				DMMP	SMS	DMMP
		DMMP SL	SMS SCO	SMS CSL	AET SCO	AET CSL	DMMP BT	SMS Natural Background (or PQL)[a]	DMMP ML
Pesticides (mg/kg-OC)									
2,4'-DDD (o,p'-DDD)	SW8081B								
2,4'-DDE (o,p'-DDE)	SW8081B								
2,4'-DDT (o,p'-DDT)	SW8081B								
4,4'-DDD (p,p'-DDD)	SW8081B								
4,4'-DDE (p,p'-DDE)	SW8081B								
4,4'-DDT (p,p'-DDT)	SW8081B								
Aldrin	SW8081B								
Chlordane, alpha- (Chlordane, cis-)	SW8081B								
Chlordane, beta- (Chlordane, trans-)	SW8081B								
Dieldrin	SW8081B								
Endrin ketone	SW8081B								
Heptachlor	SW8081B								
Hexachlorocyclohexane (BHC), beta-	SW8081B								
Nonachlor, cis-	SW8081B								
Nonachlor, trans-	SW8081B								
Oxychlordane	SW8081B								
Total Chlordane (DMMP) (U = 0 max limit)	Calculated								
Pesticides (µg/kg)									
2,4'-DDD (o,p'-DDD)	SW8081B								
2,4'-DDE (o,p'-DDE)	SW8081B								
2,4'-DDT (o,p'-DDT)	SW8081B								
4,4'-DDD (p,p'-DDD)	SW8081B	16							
4,4'-DDE (p,p'-DDE)	SW8081B	9							
4,4'-DDT (p,p'-DDT)	SW8081B	12							
Aldrin	SW8081B	9.5							
Chlordane, alpha- (Chlordane, cis-)	SW8081B								
Chlordane, beta- (Chlordane, trans-)	SW8081B								
Dieldrin	SW8081B	1.9							1700
Endrin ketone	SW8081B								
Heptachlor	SW8081B	1.5							270
Hexachlorocyclohexane (BHC), beta-	SW8081B								
Nonachlor, cis-	SW8081B								
Nonachlor, trans-	SW8081B								
Oxychlordane	SW8081B								
Sum 4,4 DDT, DDE, DDD (U = 0 max limit)	Calculated						50		69
Total Chlordane (DMMP) (U = 0 max limit)	Calculated	2.8					37		
Total DDx (U = 0 max limit)	Calculated								

Table 2-2
Testing Parameters and Screening Levels

Sediment Testing Parameter	Method	Benthic Screening Levels					Bioaccumulation Screening Levels		Other
		DMMP	SMS				DMMP	SMS	DMMP
		DMMP SL	SMS SCO	SMS CSL	AET SCO	AET CSL	DMMP BT	SMS Natural Background (or PQL)[a]	DMMP ML
Dioxin Furans (ng/kg)									
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	E1613B								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	E1613B								
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	E1613B								
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	E1613B								
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	E1613B								
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B								
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B								
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B								
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B								
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B								
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	E1613B								
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	E1613B								
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B								
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B								
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B								
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	E1613B								
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	E1613B								
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 0 max limit)	Calculated								
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2 max limit)	Calculated	4[b]					10	4.0	
Total Heptachlorodibenzo-p-dioxin (HpCDD)	E1613B								
Total Heptachlorodibenzofuran (HpCDF)	E1613B								
Total Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B								
Total Hexachlorodibenzofuran (HxCDF)	E1613B								
Total Pentachlorodibenzo-p-dioxin (PeCDD)	E1613B								
Total Pentachlorodibenzofuran (PeCDF)	E1613B								
Total Tetrachlorodibenzo-p-dioxin (TCDD)	E1613B								
Total Tetrachlorodibenzofuran (TCDF)	E1613B								

Table 2-2
Testing Parameters and Screening Levels

Sediment Testing Parameter	Method	Benthic Screening Levels					Bioaccumulation Screening Levels		Other
		DMMP	SMS				DMMP	SMS	DMMP
		DMMP SL	SMS SCO	SMS CSL	AET SCO	AET CSL	DMMP BT	SMS Natural Background (or PQL)[a]	DMMP ML
PCB Aroclors (mg/kg-OC)									
Aroclor 1016	SW8082A								
Aroclor 1221	SW8082A								
Aroclor 1232	SW8082A								
Aroclor 1242	SW8082A								
Aroclor 1248	SW8082A								
Aroclor 1254	SW8082A								
Aroclor 1260	SW8082A								
Aroclor 1262	SW8082A								
Aroclor 1268	SW8082A								
Total PCB Aroclors (DMMP and SMMS Marine 2019) (U = 0 max limit)	Calculated		12	65			38		
Total PCB Aroclors (DMMP and SMMS Marine 2019) (U = 1/2 max limit)	Calculated								
PCB Aroclors (µg/kg)									
Aroclor 1016	SW8082A								
Aroclor 1221	SW8082A								
Aroclor 1232	SW8082A								
Aroclor 1242	SW8082A								
Aroclor 1248	SW8082A								
Aroclor 1254	SW8082A								
Aroclor 1260	SW8082A								
Aroclor 1262	SW8082A								
Aroclor 1268	SW8082A								
Total PCB Aroclors (DMMP and SMMS Marine 2019) (U = 0 max limit)	Calculated	130			130	1000			3100
Total PCB Aroclors (DMMP and SMMS Marine 2019) (U = 1/2 max limit)	Calculated							12 to 14 PQL[c]	

Notes:

a. SMS natural background values are presented for bioaccumulative compounds only.

b. The value representing the DMMP SL for Total Dioxin/Furan TEQ is the Disposal Site Management Objective.

c. Ecology has not defined a natural background value for PCB Aroclors. SCUM (Ecology 2025) includes a total PCB congener-based natural background value of 3.5 µg/kg. However, PCB congener data are not available for the Site or the Blair Waterway. Appendix D of SCUM does define PQL values for PCB Aroclors, with PQLs of 12 to 14 µg/kg for individual Aroclors. Three different Aroclors (Aroclors 1248, 1254, and 1260) were detected at the Site.

Bold: Detected result
blank cell: not applicable
µg/kg: microgram per kilogram
AET: apparent effects threshold
BT: bioaccumulation trigger
cPAH: carcinogenic polycyclic aromatic hydrocarbon
CSL: cleanup screening level
DMMP: Dredged Material Management Program
HPAH: high-molecular-weight polycyclic aromatic hydrocarbon
LPAH: low-molecular-weight polycyclic aromatic hydrocarbon
mg/kg: milligrams per kilogram
ML: maximum level
ng/kg: nanograms per kilogram
OC: organic carbon
PCB: polychlorinated biphenyl
pct: percent
PQL: practical quantitation limit
SCO: sediment cleanup objective
SCUM: Sediment Cleanup User's Manual
SL: screening level
SMS: Sediment Management Standards
TBT: tributyltin
TEQ: toxic equivalency quotient
U: Compound analyzed for, but not detected above detection limit

Table 2-3a
Summary of Detected DMMP and SMS Exceedances

Chemical	Method	Max Detected Value	DMMP SL	DMMP BT	DMMP ML	SMS Marine SCO	SMS Marine CSL	AET Marine SCO	AET Marine CSL
Metals (mg/kg)									
Antimony	SW6020 / SW6020B	160	150		200				
Arsenic	SW6020 / SW6020B	1620	57	507.1	700			57	93
Chromium	SW6020 / SW6020B	488	260					260	270
Copper	SW6020 / SW6020B	1260	390		1300			390	390
Lead	SW6020 / SW6020B	1290	450	975	1200			450	530
Zinc	SW6020 / SW6020B	2970	410		3800			410	960
Organometals (µg/kg)									
Tributyltin (ion)	SW8270E / SW8270ESIM	243		73					
Semivolatile Organics (mg/kg-OC)									
1,2-Dichlorobenzene	SW8270E / SW8270ESIM	29.1				2.3	2.3		
1,4-Dichlorobenzene	SW8270E / SW8270ESIM	16.5				3.1	9		
Semivolatile Organics (µg/kg)									
1,2-Dichlorobenzene	SW8270E / SW8270ESIM	215	35		110				
1,4-Dichlorobenzene	SW8270E / SW8270ESIM	122	110		120				
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)									
Benzo(a)anthracene	SW8270E / SW8270ESIM	280				110	270		
Chrysene	SW8270E / SW8270ESIM	407				110	460		
Fluoranthene	SW8270E / SW8270ESIM	2070				160	1200		
Pyrene	SW8270E / SW8270ESIM	1210				1000	1400		
Total HPAH (SMS) (U = 0 max limit)		4600				960	5300		
Polycyclic Aromatic Hydrocarbons (µg/kg)									
Benzo(a)anthracene	SW8270E / SW8270ESIM	1540	1300		5100				
Chrysene	SW8270E / SW8270ESIM	2240	1400		21000				
Fluoranthene	SW8270E / SW8270ESIM	11400	1700	4600	30000				
Pyrene	SW8270E / SW8270ESIM	6670	2600	11980	16000				
Total HPAH (DMMP) (U = 0 max limit)		25000	12000		69000				
Dioxin/Furans (ng/kg)									
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 0 max limit)		270	4	10					
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2 max limit)		270	4	10					
PCB Aroclors (mg/kg-OC)									
Total PCB Aroclors (DMMP) (U = 0 max limit)		136		38					
Total PCB Aroclors (SMS Marine 2019) (U = 0 max limit)		61.3				12	65		
PCB Aroclors (µg/kg)									
Total PCB Aroclors (DMMP) (U = 0 max limit)		529	130		3100				
Total PCB Aroclors (SMS Marine 2019) (U = 0 max limit)		529						130	1000

Table 2-3a
Summary of Detected DMMP and SMS Exceedances

Notes:

Detected concentration is greater than any listed screening level

blank cell: not applicable

µg/kg: microgram per kilogram

AET: apparent effects threshold

BT: bioaccumulation trigger

CSL: cleanup screening level

DMMP: Dredged Material Management Program

HPAH: high-molecular-weight polycyclic aromatic hydrocarbon

ID: identification

mg/kg: milligram per kilogram

ML: maximum level

ng/kg: nanogram per kilogram

OC: organic carbon

PCB: polychlorinated biphenyl

SCO: sediment cleanup objective

SL: screening level

SMS: Sediment Management Standards

TEQ: toxic equivalency quotient

U: Compound analyzed for, but not detected above detection limit

Table 2-3b
Contaminants with No Detected Exceedances

Chemical	Method	Max Detected Value	DMMP SL	DMMP BT	DMMP ML	SMS Marine SCO	SMS Marine CSL	AET Marine SCO	AET Marine CSL
Conventional Parameters (pct)									
Total organic carbon	SW9060AM	5.30							
Total solids	D2216	84.06							
Total solids	SM2540G	91.86							
Total volatile solids	PSEP-TVS	13.30							
Metals (mg/kg)									
Cadmium	SW6020 / SW6020B	1.48	5.1		14	5.1	6.7	5.1	6.7
Mercury	SW7471B	0.344	0.41	1.5	2.3	0.41	0.59	0.41	0.59
Selenium	SW6020 / SW6020B	2.26		3					
Silver	SW6020 / SW6020B	0.92	6.1		8.4	6.1	6.1	6.1	6.1
Organometals (mg/kg-OC)									
Tributyltin (ion)	SW8270E / SW8270ESIM	35.7		73					
Semivolatile Organics (mg/kg-OC)									
1,2,4-Trichlorobenzene	SW8270E / SW8270ESIM	--				0.81	1.8		
Bis(2-ethylhexyl)phthalate	SW8270E / SW8270ESIM	72.1				47	78		
Butylbenzyl phthalate[a]	SW8270E / SW8270ESIM	5.99[a]				5.99[a]	64[a]		
Diethyl phthalate	SW8270E / SW8270ESIM	11.2				61	110		
Dimethyl phthalate	SW8270E / SW8270ESIM	7.08				53	53		
Di-n-butyl phthalate	SW8270E / SW8270ESIM	23.4				220	1700		
Di-n-octyl phthalate	SW8270E / SW8270ESIM	98.6				58	4500		
Hexachlorobenzene	SW8270E / SW8270ESIM	--				0.38	2.3		
Hexachlorobutadiene (Hexachloro-1,3-butadiene)	SW8270E / SW8270ESIM	--				3.9	6.2		
n-Nitrosodiphenylamine	SW8270E / SW8270ESIM	--				11	11		
Pentachlorophenol	SW8270E / SW8270ESIM	23.1							

Table 2-3b
Contaminants with No Detected Exceedances

Chemical	Method	Max Detected Value	DMMP SL	DMMP BT	DMMP ML	SMS Marine SCO	SMS Marine CSL	AET Marine SCO	AET Marine CSL
Semivolatile Organics (µg/kg)									
1,2,4-Trichlorobenzene	SW8270E / SW8270ESIM	--	31		64			31	51
2,4-Dimethylphenol	SW8270E / SW8270ESIM	--	29		210	29	29	29	29
2-Methylphenol (o-Cresol)	SW8270E / SW8270ESIM	5.0	63		77	63	63	63	63
4-Methylphenol (p-Cresol)	SW8270E / SW8270ESIM	160	670		3600	670	670	670	670
Benzoic acid	SW8270E / SW8270ESIM	142	650		760	650	650	650	650
Benzyl alcohol	SW8270E / SW8270ESIM	--	57		870	57	73	57	73
Bis(2-ethylhexyl)phthalate	SW8270E / SW8270ESIM	261	1300		8300			1300	1900
Butylbenzyl phthalate[a]	SW8270E / SW8270ESIM	49.1[a]	63		970			63[a]	900[a]
Diethyl phthalate	SW8270E / SW8270ESIM	149	200		1200			200	1200
Dimethyl phthalate	SW8270E / SW8270ESIM	52.4	71		1400			71	160
Di-n-butyl phthalate	SW8270E / SW8270ESIM	187	1400		5100			1400	1400
Di-n-octyl phthalate	SW8270E / SW8270ESIM	365	6200		6200			6200	6200
Hexachlorobenzene	SW8270E / SW8270ESIM	--	22	168	230			22	70
Hexachlorobutadiene (Hexachloro-1,3-butadiene)	SW8270E / SW8270ESIM	--	11		270			11	120
n-Nitrosodiphenylamine	SW8270E / SW8270ESIM	--	28		130			28	40
Pentachlorophenol	SW8270E / SW8270ESIM	63.0	400	504	690	360	690	360	690
Phenol	SW8270E / SW8270ESIM	152	420		1200	420	1200	420	1200
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)									
1-Methylnaphthalene	SW8270E / SW8270ESIM	3.54							
2-Methylnaphthalene	SW8270E / SW8270ESIM	6.44				38	64		
Acenaphthene	SW8270E / SW8270ESIM	26.4				16	57		
Acenaphthylene	SW8270E / SW8270ESIM	12.0				66	66		
Anthracene	SW8270E / SW8270ESIM	42.7				220	1200		
Benzo(a)pyrene[a]	SW8270E / SW8270ESIM	146[a]					99[a]	210[a]	
Benzo(g,h,i)perylene[a]	SW8270E / SW8270ESIM	87.1[a]					31[a]	78[a]	
Benzo(b,j,k)fluoranthenes	SW8270E / SW8270ESIM	391							
Carbazole	SW8270E / SW8270ESIM	20.9							
Dibenzo(a,h)anthracene[a]	SW8270E / SW8270ESIM	15.0[a]				12[a]	33[a]		
Dibenzofuran	SW8270E / SW8270ESIM	6.65				15	58		
Fluorene	SW8270E / SW8270ESIM	8.63				23	79		
Indeno(1,2,3-c,d)pyrene[a]	SW8270E / SW8270ESIM	69.5[a]				34[a]	88[a]		
Naphthalene	SW8270E / SW8270ESIM	8.06				99	170		
Phenanthrene	SW8270E / SW8270ESIM	97				100	480		
Total Benzofluoranthenes (b,j,k) (U = 0 max limit)[a]		391[a]				230[a]	450[a]		
Total HPAH (SMS) (U = 1/2 max limit)		4600							
Total LPAH (SMS) (U = 0 max limit)		140				370	780		
Total LPAH (SMS) (U = 1/2 max limit)		200							

Table 2-3b

Contaminants with No Detected Exceedances

Chemical	Method	Max Detected Value	DMMP SL	DMMP BT	DMMP ML	SMS Marine SCO	SMS Marine CSL	AET Marine SCO	AET Marine CSL
Polycyclic Aromatic Hydrocarbons (µg/kg)									
1-Methylnaphthalene	SW8270E / SW8270ESIM	28.3							
2-Methylnaphthalene	SW8270E / SW8270ESIM	42.8	670		1900			670	670
Acenaphthene	SW8270E / SW8270ESIM	211	500		2000			500	500
Acenaphthylene	SW8270E / SW8270ESIM	69.5	560		1300			1300	1300
Anthracene	SW8270E / SW8270ESIM	235	960		13000			960	960
Benzo(a)pyrene	SW8270E / SW8270ESIM	1060	1600		3600			1600	1600
Benzo(b,j,k)fluoranthenes	SW8270E / SW8270ESIM	2150							
Benzo(g,h,i)perylene	SW8270E / SW8270ESIM	505	670		3200			670	720
Carbazole	SW8270E / SW8270ESIM	121							
Dibenzo(a,h)anthracene	SW8270E / SW8270ESIM	84.0	230		1900			230	230
Dibenzofuran	SW8270E / SW8270ESIM	53.2	540		1700			540	540
Fluorene	SW8270E / SW8270ESIM	69.0	540		3600			540	540
Indeno(1,2,3-c,d)pyrene	SW8270E / SW8270ESIM	403	600		4400			600	690
Naphthalene	SW8270E / SW8270ESIM	64.5	2100		2400			2100	2100
Phenanthrene	SW8270E / SW8270ESIM	653	1500		21000			1500	1500
Total Benzofluoranthenes (b,j,k) (U = 0 max limit)		2150	3200		9900			3200	3600
Total Benzofluoranthenes (b,j,k) (U = 1/2 max limit)		2150							
Total LPAH (DMMP) (U = 0 max limit)		1030	5200		29000				
Total LPAH (DMMP) (U = 1/2 max limit)		1030							
Total LPAH (SMS) (U = 0 max limit)		1030						5200	5200
Total LPAH (SMS) (U = 1/2 max limit)		1030							
Pesticides (mg/kg-OC)									
2,4'-DDD (o,p'-DDD)	SW8081B	0.101							
2,4'-DDE (o,p'-DDE)	SW8081B	0.153							
2,4'-DDT (o,p'-DDT)	SW8081B	0.680							
4,4'-DDD (p,p'-DDD)	SW8081B	0.422							
4,4'-DDE (p,p'-DDE)	SW8081B	0.721							
4,4'-DDT (p,p'-DDT)	SW8081B	3.29							
Aldrin	SW8081B	--							
Chlordane, alpha- (Chlordane, cis-)	SW8081B	0.082							
Chlordane, beta- (Chlordane, trans-)	SW8081B	0.35							
Dieldrin	SW8081B	0.215							
Endrin ketone	SW8081B	0.342							
Heptachlor	SW8081B	--							
Hexachlorocyclohexane (BHC), beta-	SW8081B	0.085							
Nonachlor, cis-	SW8081B	0.12							
Nonachlor, trans-	SW8081B	--							
Oxychlordane	SW8081B	--							
Total Chlordane (DMMP) (U = 1/2 max limit)		0.97							

Table 2-3b
Contaminants with No Detected Exceedances

Chemical	Method	Max Detected Value	DMMP SL	DMMP BT	DMMP ML	SMS Marine SCO	SMS Marine CSL	AET Marine SCO	AET Marine CSL
Pesticides (µg/kg)									
2,4'-DDD (o,p'-DDD)	SW8081B	1.01							
2,4'-DDE (o,p'-DDE)	SW8081B	1.53							
2,4'-DDT (o,p'-DDT)	SW8081B	6.80							
4,4'-DDD (p,p'-DDD)	SW8081B	3.59	16						
4,4'-DDE (p,p'-DDE)	SW8081B	6.07	9						
4,4'-DDT (p,p'-DDT)	SW8081B	3.38	12						
Aldrin	SW8081B	--	9.5						
Chlordane, alpha- (Chlordane, cis-)	SW8081B	0.82							
Chlordane, beta- (Chlordane, trans-)	SW8081B	0.99							
Dieldrin	SW8081B	1.59	1.9		1700				
Endrin ketone	SW8081B	1.81							
Heptachlor	SW8081B	--	1.5		270				
Hexachlorocyclohexane (BHC), beta-	SW8081B	0.33							
Nonachlor, cis-	SW8081B	0.80							
Nonachlor, trans-	SW8081B	--							
Oxychlordane	SW8081B	--							
Sum 4,4 DDT, DDE, DDD (U = 0 max limit)		32.3		50	69				
Sum 4,4 DDT, DDE, DDD (U = 1/2 max limit)		32.3							
Total Chlordane (DMMP) (U = 0 max limit)		0.99	2.8	37					
Total Chlordane (DMMP) (U = 1/2 max limit)		2.7							
Total DDx (U = 0 max limit)		41.6							
Total DDx (U = 1/2 max limit)		41.6							

Notes:

a. Low TOC sample exceeded the SMS SCO on an OC-normalized basis, but did not exceed the dry weight AET. Therefore, this is not considered an exceedance under SMS.

-- : not detected in any sample
blank cell: not applicable
µg/kg: microgram per kilogram
AET: apparent effects threshold
BT: bioaccumulation trigger
CSL: cleanup screening level
DMMP: Dredged Material Management Program
ID: identification
LPAH: low-molecular-weight polycyclic aromatic hydrocarbon
mg/kg: milligram per kilogram
ML: maximum level
ng/kg: nanogram per kilogram
OC: organic carbon
pct: percent
SCO: sediment cleanup objective
SL: screening level
SMS: Sediment Management Standards
TEQ: toxic equivalency quotient
U: Compound analyzed for, but not detected above detection limit

Table 2-4
Detected Bioaccumulative Compounds

Chemical	Max Detected Concentration Within Site (at any depth)[1]	DMMP BT	SMS Natural Background[2]	95% UCL Excluding Sample Locations Within Site[1] (at any depth)	Blair Waterway Background (90/90 UTL)[3]	Max Detect Sample ID
Metals (mg/kg)						
Arsenic	1620	507.1	11	< 11	--[4]	TG-SC15-00-02-241113
Cadmium	1.48	--	0.8	< 0.8	--[4]	TG-SC10-04-5.2-241112
Lead	1290	--	21	< 21	--[4]	TG-SC15-00-02-241113
Mercury	0.344	1.5	0.2	< 0.2	--[4]	TG-SC15RE-02-04-250328
Organometals (µg/kg)						
Tributyltin (ion)	243	73	--[5]	< 73	--	TG-SG12-250826
Polycyclic Aromatic Hydrocarbons (µg/kg)						
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2 max limit)	1230	--	21	57	59	TG-SG06-250826
PCB Aroclors (µg/kg)						
Total PCB Aroclors (U = 0 max limit)	529	--	--[6]	35	37	TG-SC27-04-06-250512

Notes:

Chemical concentrations are listed on a dry weight basis.

1. Calculations for maximum and 95% UCL concentrations include 2024–2025 Tru-Grit surface and subsurface data, along with immediately adjacent 2025 Blair Waterway cores. For 95% UCL calculations, the data from within the Preliminary Site Boundary were excluded, and each core was represented by only the maximum concentration in that core.
2. Natural background values for Puget Sound were taken from Ecology's Sediment Cleanup Users Manual (Ecology 2025).
3. Waterway background concentrations were developed for shallow subsurface waterway sediments using the same methodology as described in Ecology guidance for derivation of regional background concentrations in surface sediments (i.e., calculation of a 90/90 upper tolerance limit after removal of outliers and samples associated with cleanup sites or specific point sources).
4. Waterway background concentrations of these metals were equal to or less than Ecology-defined natural background concentrations for Puget Sound surface sediments.
5. Ecology has not defined a natural background concentration for tributyltin. This compound is typically elevated near shipyards and boat maintenance areas.
6. Ecology defined a natural background concentration for total PCB congeners (3.5 µg/kg dry weight) but not for total PCB Aroclors. The 3.5 µg/kg value is below the practical quantitation limit for PCB Aroclors.

µg/kg: microgram per kilogram
BT: bioaccumulation trigger
cPAH: carcinogenic polycyclic aromatic hydrocarbon
DMMP: Dredged Material Management Program
Ecology: Washington State Department of Ecology
mg/kg: milligrams per kilogram
ng/kg: nanograms per kilogram
OC: organic carbon
PCB: polychlorinated biphenyl
SL: screening level
TEQ: toxic equivalency quotient
U: Compound analyzed for, but not detected above detection limit
UCL: upper confidence level
UTL: upper tolerance limit

Table 3-1
Interim Action Performance Standards

Analyte	Performance Standards for Benthic Protection (Applied on a Point-by-Point Basis)			Protection (Applied on an Area-Wide Basis)		
	Criteria	Unit[1]	Derivation	Criteria	Unit[1]	Derivation
PART 1: SITE-ASSOCIATED HAZARODUS SUBSTANCES						
Metals (mg/kg)						
Antimony	150	mg/kg	DMMP SL	--	--	--
Arsenic	57	mg/kg	SMS SCO / DMMP SL	11	mg/kg	SMS Natural Background
Cadmium	5.1	mg/kg	SMS SCO / DMMP SL	0.8	mg/kg	SMS Natural Background
Chromium	260	mg/kg	SMS SCO / DMMP SL	--	--	--
Copper	390	mg/kg	SMS SCO / DMMP SL	--	--	--
Lead	450	mg/kg	SMS SCO / DMMP SL	21	mg/kg	SMS Natural Background
Mercury	0.41	mg/kg	SMS SCO / DMMP SL	0.2	mg/kg	SMS Natural Background
Zinc	410	mg/kg	SMS SCO / DMMP SL	--	--	--
Organometals (µg/kg)						
Tributyltin (ion)	73	µg/kg	DMMP BT	73	µg/kg	DMMP BT
Semivolatile Organics (µg/kg)						
1,2-Dichlorobenzene	35	µg/kg	SMS AET	--	--	--
1,4-Dichlorobenzene	110	µg/kg	SMS AET	--	--	--
Polycyclic Aromatic Hydrocarbons (µg/kg)						
Benzo(a)anthracene	1,300	µg/kg	SMS SCO / DMMP SL	--	--	--
Chrysene	1,400	µg/kg	SMS SCO / DMMP SL	--	--	--
Fluoranthene	1,700	µg/kg	SMS SCO / DMMP SL	--	--	--
Pyrene	2,600	µg/kg	SMS SCO / DMMP SL	--	--	--
Total HPAH (DMMP) (U = 0 max limit)	12,000	µg/kg	SMS SCO / DMMP SL	--	--	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2 max limit)	--	--	--	59	µg/kg	Blair Waterway 90/90 UTL[2]
PCB Aroclors (µg/kg)						
Total PCB Aroclors (U = 0)	130	µg/kg	SMS SCO / DMMP SL			
Total PCB Aroclors (U = 1/2 max limit)	--	--	--	37	µg/kg	Blair Waterway 90/90 UTL[2]
PART 2: REGIONAL CONTAMINANTS						
Dioxin Furans (ng/kg)						
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2 max limit)	--	--	--	10	ng/kg	DMMP BT[3]

Notes:

1. Performance standards for benthic protection are listed on a dry weight basis, under the assumption that most sediments tested as part of the interim action will contain total organic carbon contents below 0.5%. For non-ionizable organic compounds, the corresponding carbon normalized value may be substituted when total organic carbon is within the range of 0.5% to 3.5%. If confirmational bioassays are performed using applicable SMS bioassay performance standards and interpretive criteria, the results of those bioassays will override the numeric testing
2. The 90/90 UTL was calculated for shallow subsurface sediments using the same methodologies recommended by Ecology in SCUM (Ecology 2025) for calculating a regional background
3. The interim action will remediate dioxin/furans in the Lower Slope sediments to below the DMMP BT value (10 ng/kg TEQ) on a point-by-point basis to avoid potential impacts of residual sediment on the planned deepening of the federal navigation channel.

--: not applicable

µg/kg: microgram per kilogram (dry weight basis)

AET: apparent effects threshold

BT: bioaccumulation trigger

cPAH: carcinogenic polycyclic aromatic hydrocarbon

DMMP: Dredged Material Management Program

Ecology: Washington State Department of Ecology

HPAH: high-molecular-weight polycyclic aromatic hydrocarbon

mg/kg: milligram per kilogram (dry weight basis)

ng/kg: nanogram per kilogram

PCB: polychlorinated biphenyl

SCO: sediment cleanup objective

SCUM: Sediment Cleanup User's Manual

SL: screening level

SMS: Sediment Management Standards

TEQ: toxic equivalent quotient

U: Compound analyzed for, but not detected above detection limit

UTL: upper tolerance limit

Table 3-2
Estimated Sediment Removal Quantities

Dredge Area Name	Design Depth (ft below mudline)	Neatline Volume (cy)	Side Slope Volume (cy)	Total Volume (cy)	Maximum Allowable Overdredge Depth (ft below mudline)	Neatline Volume with Maximum Allowable Overdredge (cy)	Side Slope Volume with Maximum Allowable Overdredge (cy)	Total Volume with Maximum Allowable Overdredge (cy)
Area A	4	4,935	832	5,767	6	7,403	1,659	9,062
Area B	8	1,805	918	2,723	10	2,256	1,381	3,637
Total	n/a	6,740	1,750	8,490	n/a	9,659	3,040	12,699

Notes:

cy: cubic yard

ft: foot

n/a: not applicable

Table 3-3
Estimated RMC Placement Quantities

Dredge Area	Surface Area (sf)	Minimum Estimated RMC[1] Volume (cy)
Area A	44,483	824
Area B	12,347	229
Total	56,830	1,052

Notes:

1. RMC is designed to be 6-inch-thick layer of material. RMC requires an approximately 3H:1V slope to remain in place and prevent sloughing down the slope; therefore, in some areas the RMC layer may be greater than 6 inches thick as shown on Cross Sections A-A' and B-B' in Figures 3-2 and 3-3, respectively. The precise volume of RMC required will be determined at the design stage once the RMC material is selected and the minimum required slope to stay in place is determined.

cy: cubic yard

H:V: horizontal to vertical (ratio)

RMC: residuals management cover

sf: square foot

Table 3-4
Monitoring Framework for the Interim Action

Monitoring Type (Plan)	Monitoring Activity	Objectives and Decision Points	Sampling Locations	Timing and Frequency	Monitoring Parameters	Performance Criteria	Reporting
Protection Monitoring (WQMPP)	Water Quality Monitoring	- Protect water quality during construction. - Determine when to apply additional BMPs or terminate work.	Monitoring Locations Illustrated in Appendix A of the WQMPP - Early Warning Station: 75 Feet - Compliance Station: 150 Feet - Background Station: 300 Feet	Monitoring is to be conducted twice daily for the first 5 days and then after a triggering event (per WQMPP) occurs during dredging and material placement activities. Visual monitoring will take place after 5 days until the end of work, with the exception of a triggering event.	Turbidity (to be monitored at two elevations: 2–3 feet below water surface and 2–3 feet above substrate surface of the water column)	- Turbidity shall remain 1) below 10 NTU over background when background is 50 NTU; or 2) 20% increase over background if background is more than 50 NTU. - In the event of an exceedance, additional BMPs shall be employed (including potential work stoppage) as necessary to restore compliance.	Summary of monitoring to be included in the WQMR
Performance Monitoring (CMCRP)	Post-Dredge Bathymetric Surveys	- Document removal of contaminated sediments and compliance with project plans. - Trigger re-dredging where needed to meet planned dredge elevations.	Multi-beam bathymetric survey to be conducted throughout dredging footprint	- Following completion of dredging and prior to placement of RMC and slope backfill - Monitoring may be conducted in phases (i.e., as each portion of the dredge prism is completed).	Mud-line bathymetry	Mud-line elevations at the base of the dredging prisms shall comply with (be equal to or deeper than) planned neat-line dredge elevations.	Summary of monitoring to be included in the Interim Action Completion Report
	Post-Dredge Sediment Testing	- Verify the lack of 1) excessive dredging residuals; or 2) missed inventory. - Trigger re-dredging where necessary and practicable[1] to 1) remove excessive dredging residuals; or 2) remove areas of missed inventory.	- Stratified grab samples (20–30 cm collection depth) to be collected at the 20 locations shown in Figure 3-4 - Thickness of dredging residuals layer to be measured (+/- 1 cm) - Samples of the 10–20 cm of undisturbed sediment beneath the residuals layer to be collected for chemical analysis	- Following completion of dredging (as verified by bathymetric surveys) and prior to placement of RMC and slope backfill - Monitoring may be conducted in phases (i.e., as each portion of the dredge prism is completed).	1) Thickness of dredging residuals layer 2) Chemical concentrations within the undisturbed sediment beneath the residuals layer (metals, TBT, SVOCs, PAHs, PCBs, and D/F)	- Dredging residuals layer should not exceed 10 cm.[2] - Chemical concentrations in undisturbed sediments should not exceed the Interim Action Performance Standards (Table 3-1[3, 4]) on the dredge prism bottom, south, east and west sides (not applicable to the north side-slope, which is expected to retain contaminated sediments).	
Confirmation Monitoring (CMCRP)	Post-Placement Bathymetric Surveys	- Document placement of RMC and slope backfill in compliance with project plans. - Trigger additional material placement where needed to comply with project plans.	Multi-beam bathymetric survey to be conducted throughout material placement footprint	- Following placement of RMC and slope backfill - Monitoring may be conducted in phases (i.e., as each portion of the backfill is completed).	Mud-line bathymetry	Placement areas and thicknesses shall meet or exceed those in the project plans.	
	Post-Placement Sediment Testing	- Verify compliance of the final sediment surface with the interim action performance standards (Table 3-1[3, 4]) - Trigger follow-up evaluations[5] if performance standards not met	Surface grab samples (0–10 cm collection depth) to be collected at the 20 locations shown in Figure 3-4	- Following completion of RMC and slope backfill placement (as verified by bathymetric surveys) - Monitoring may be conducted in phases (i.e., as each portion of material placement is completed).	Chemical concentrations within the final surface sediments layer after completion of material placement	Concentrations of site-associated hazardous substances in the 20 surface sediment samples shall not exceed the Interim Action Performance Standards (Table 3-1[3, 4]).	

Table 3-4
Monitoring Framework for the Interim Action

Monitoring Type (Plan)	Monitoring Activity	Objectives and Decision Points	Sampling Locations	Timing and Frequency	Monitoring Parameters	Performance Criteria	Reporting
Long-Term Monitoring (CMCRP)	Annual Bathymetric Surveys	- Document the stability of the slope backfill materials. - Trigger contingent surface sediment testing if slumping or instability are observed.	Multi-beam bathymetric survey to be conducted throughout material placement footprint	Annually in years 1, 2, and 3 following completion of construction	Mud-line bathymetry	Sediment sloughing or instability will be identified as areas of slumping or settlement greater than 1 foot in slope backfill area (as identified by isopach analysis in comparison to post-placement survey) after accounting for sediment consolidation.	Summary of monitoring to be included in the Year-3 Monitoring Report
	Conditional Surface Sediment Testing	- Verify compliance of the final sediment surface with the interim action performance standards (Table 3-1[3, 4]). - Trigger follow-up evaluations[5] if performance standards are not met.	Surface grab samples (0–10 cm collection depth) to be collected at the 12 locations shown in Figure 3-5.	- Following completion of 3-year bathymetric survey evaluations in the event that slumping or instability are observed in bathymetric surveys	Chemical concentrations within the final surface sediments layer after completion of material placement and 3 years of bathymetric survey evaluations	Concentrations of site-related contaminants in surface sediments shall not exceed the Interim Action Performance Standards (Table 3-1[3, 4]).	

Notes:
1. The ability to implement re-dredging is limited in the slope areas near the former Powers Dock due to geotechnical considerations.
2. If dredging residuals exceed 10 cm, re-dredging shall be conducted unless follow-up chemical testing of the residuals layer confirms that the planned RMC placement thickness will be effective at meeting the Interim Action Performance Standards in Table 3-1.
3. Contaminant concentrations to be compared to Table 3-1 Interim Action Performance Standards for benthic protection on a point-by-point basis include the following: antimony, arsenic, cadmium, chromium, copper, lead, mercury, zinc, TBT, 1,2-dichlorobenzene, 1,4-dichlorobenzene, individual PAH compounds, total HPAH, total LPAH, and total PCB Aroclors.
4. Contaminant concentrations to be compared to Table 3-1 Interim Action Performance Standards for human health protection on an area-wide basis (as the average of the 20 monitoring locations) include the following: arsenic, cadmium, lead, mercury, TBT, total cPAH TEQ, and total PCB Aroclors. Total D/F TEQ concentrations will be compared to the respective 10-ng/kg performance standard on a point-by-point basis to limit potential interference of residual contaminant concentrations on future dredging within the federal navigation channel.
5. The performance standards for benthic protection also incorporate use of confirmational bioassay testing consistent with the SMS and established Ecology guidance (i.e., passing bioassays can be used to demonstrate compliance with the benthic protection performance standards).

BMP: best management practice
cm: centimeter
CMCRP: Compliance Monitoring and Contingency Response Plan
cPAH: carcinogenic polycyclic aromatic hydrocarbon
D/F: dioxin/furans
Ecology: Washington State Department of Ecology
HPAH: high-molecular-weight polycyclic aromatic hydrocarbon
LPAH: low-molecular-weight polycyclic aromatic hydrocarbon
ng/kg: nanogram per kilogram
NTU: nephelometric turbidity unit
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
RMC: residuals management cover
SMS: sediment management standards
SVOC: semivolatile organic compound
TBT: tributyltin
TEQ: toxic equivalent quotient
WQMPP: Water Quality Monitoring and Protection Plan (Confluence 2026)
WQMR: Water Quality Monitoring Report

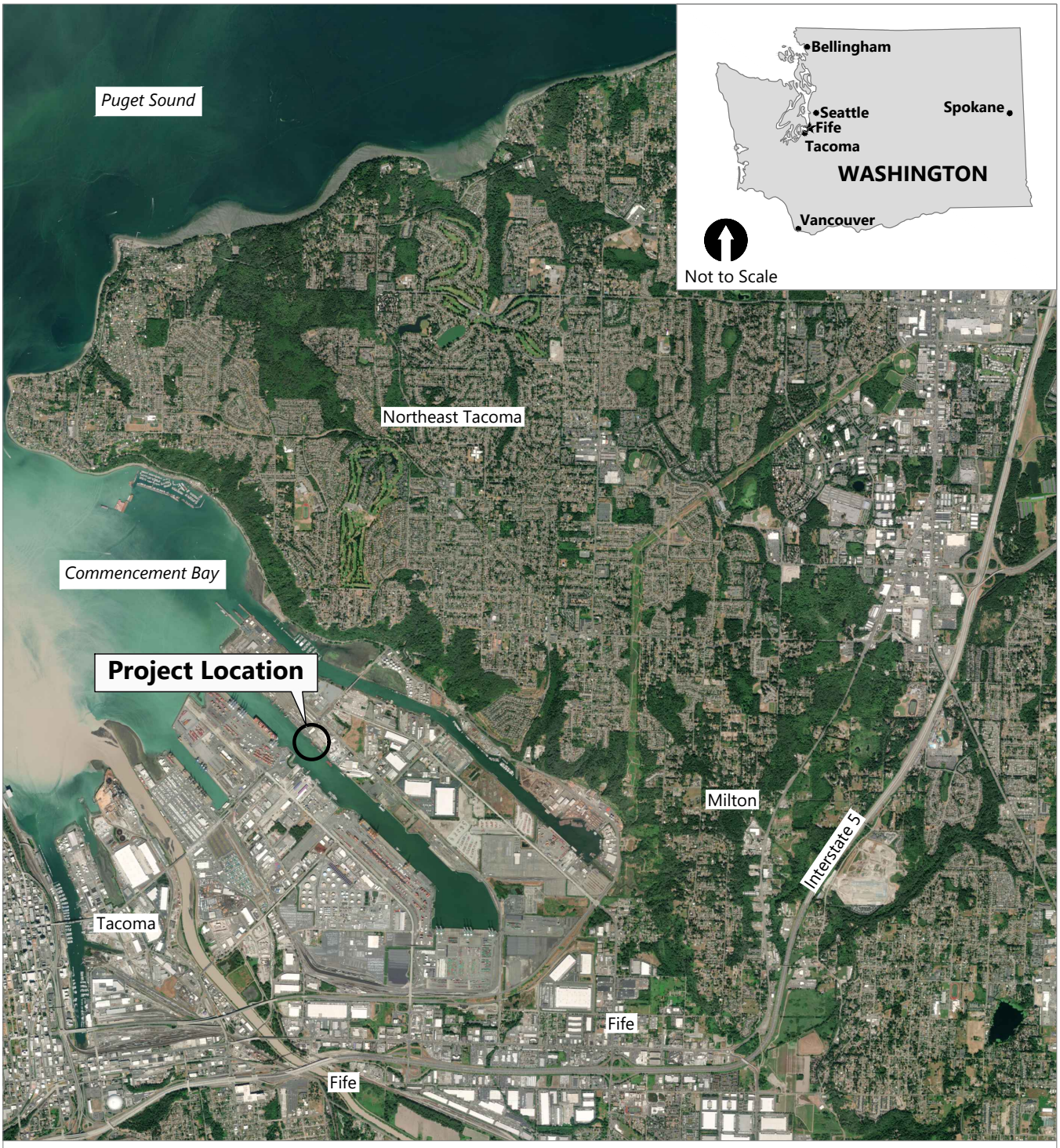
Table 3-5
Estimated Interim Action Costs

Task ID	Task Description	Range of Estimated Costs (x $1 million)	
		Lower Probable Costs	Upper Probable Costs
1	Mobilization/Demobilization and Site Preparation	$ 0.70	$ 0.90
2	Environmental Controls, Water Quality Monitoring and Surveys	$ 0.30	$ 0.50
3	Dredging, Transloading, Dewatering, Transportation & Disposal	$ 3.60	$ 5.00
4	Placement of Residuals Management Cover and Slope Backfill	$ 0.70	$ 0.90
5	Sales Tax (10.4%)	$ 0.55	$ 0.75
	Subtotal Construction Costs	**$ 5.85**	**$ 8.05**
6	Construction Management	$ 0.15	$ 0.25
7	Environmental Testing and Reporting	$ 0.30	$ 0.40
8	Port Engineering & Project Administration	$ 0.20	$ 0.25
9	Long-Term Monitoring and Reporting	$ 0.30	$ 0.40
	Subtotal Indirect Costs	**$ 0.95**	**$ 1.30**
10	Pre-Design Project Contingency (30%)	$ 2.00	$ 2.80
11	**TOTAL PROJECT COSTS**	**$ 8.80**	**$ 12.15**

Notes:

1. This cost estimate is based on the preliminary design and is subject to change during final design and permitting. Costs were developed based on current assumptions for the Interim Action design basis. Unit costs were developed based on estimated project quantities and unit costs from recent comparable projects.
2. Costs are based in current U.S. dollars ($2026).
3. A 30% contingency is included pending finalization of project design and permitting.
4. Dredging costs assume a planned dredging volume of 13,500 in-place cubic yards plus an allowance for contingency re-dredging. Sediments are assumed to be transloaded, dewatered and transported for disposal at an existing Subtitle D landfill.
5. Material placement costs assume a placement volume of 6,500 tons of sandy residuals management cover and slope backfill.
6. Environmental testing and reporting includes post-dredge performance monitoring and post-placement confirmation monitoring. Results of water quality monitoring (performed by the contractor) and performance/confirmation monitoring to be included in the Interim Action Completion Report.
7. Long-term monitoring and reporting includes completion and analysis of three annual bathymetric surveys to document stability of the placed slope backfill materials. If instability is identified, a supplemental sediment sampling effort will be used to evaluate the quality of surface sediments at the 12 compliance monitoring locations.

Figures



SOURCE: Aerial by Global Mapper
HORIZONTAL DATUM: Washington State Plane South Zone, NAD83, U.S. Survey Feet

0 1
Miles

Publish Date: 2026/05/28 11:42 AM | User: dholmer
Filepath: K:\Projects\0092-Port of Tacoma\Dredged Material Characterization for Tru-Grit Sediment Investigation\0092-RP-001 (Vicinity Map-IAP).dwg Figure 1-1 (Interim Action Plan)

ANCHOR QEA

Figure 1-1
Vicinity Map

Interim Action Plan
Port of Tacoma – Tru-Grit Site



LEGEND:

- Feasibility Study Navigation Channel Boundary
- Parcel Boundary
- Easement Boundary For Concrete Dock (Graymont)
- Underwater Communications Crossing
- Underwater Watermain Crossing
- Navigation Tower
- Navigational Aid

NOTES:

1. Aerial imagery: Esri (2025)
2. Horizontal Datum: NAD83 State Plane Washington South, U.S. feet
3. Navigational aids source: Port of Tacoma 2003. Locations of navigational aids are approximate and will be verified during design.

NAD83: North American Datum of 1983

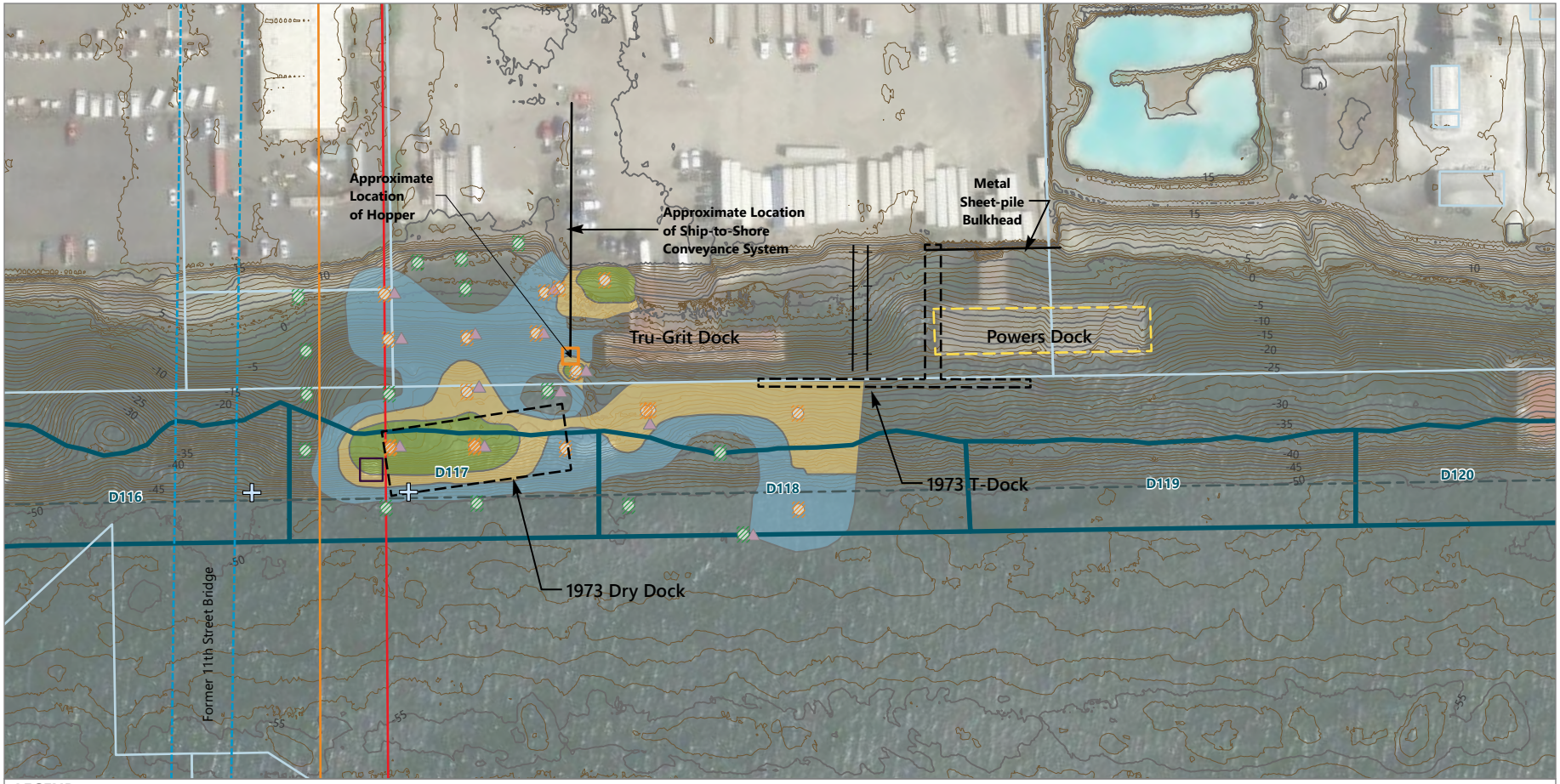
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ANCHOR QEA

Figure 2-1
Site Physical Setting
Interim Action Plan
Port of Tacoma – Tru-Grit Site



LEGEND:

- Feasibility Study Navigation Channel Boundary
- Parcel Boundary
- Upper DMMU Boundary
- Easement Boundary for Concrete Dock (Graymont)
- Former Dry Dock
- Elevation (MLLW, 5-Foot Interval)
- Underwater Communications Crossing
- Underwater Watermain Crossing
- Former Marine Railway
- Former 11th Street Bridge
- Navigation Tower
- Hopper
- Navigational Aid

Grit Content

- < 5%
- 5% - 15%
- > 15%

Previous Sample Location

- Subsurface Sediment
- Surface Sediment
- Grit Present
- No Grit Present

NOTES:

1. Aerial imagery: Esri (2025)
2. Contour Source: Survey by USACE, dated October 27, 2021, and David Evans Associates Inc., dated May 27, 2022, with data gaps filled from survey by USACE dated November 14, 2022
3. Horizontal Datum: NAD83 State Plane Washington South, U.S. feet
4. Vertical Datum: MLLW, feet
5. The later dry dock was located in approximately the same position.
6. Navigational aids source: Port of Tacoma 2003. Locations of navigational aids are approximate and will be verified during design.
7. Grit interpolation from Landau 2021.

DMMU: dredged material management unit
MLLW: mean lower low water
NAD83: North American Datum of 1983
USACE: U.S. Army Corps of Engineers

0 200
Feet

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ANCHOR QEA

Figure 2-2
Historical Features and Previous Sampling Locations
Interim Action Plan
Port of Tacoma – Tru-Grit Site



LEGEND:

- Feasibility Study Navigation Channel Boundary
- Upper DMMU Boundary

Upper Slope Sample Location

- Core (Subsurface Sediment)
- Grab (Surface Sediment)

Lower Slope Sample Location

- Core (Subsurface Sediment)
- Grab (Surface Sediment)

Grit Content

- < 5%
- 5% - 15%
- > 15%

NOTES:

1. Aerial imagery: Esri (2025)
2. Grit interpolation from Landau 2021.

DMMU: dredged material management unit

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ANCHOR QEA

Figure 2-3
2024-2025 Upper Slope and Lower Slope Sampling Locations
Interim Action Plan
Port of Tacoma – Tru-Grit Site



LEGEND:

- Feasibility Study Navigation Channel Boundary
- Preliminary Site Boundary

Upper Slope Sample Location

- Core (Subsurface Sediment)
- Grab

Lower Slope Sample Location

- Core (Subsurface Sediment)
- Grab

SCO Exceedance

- No SCO Exceedance
- SCO Exceedance

NOTES:
1. Aerial imagery: Esri (2025)
2. Site boundary is based on the distribution of SCO exceedances at any depth. See Sections 2 and 3 of the Interim Action Plan for discussion.

SCO: sediment cleanup objective

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Feet

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Filepath: \\GSTFile01\GIS\Jobs\PortofTacoma_0092\Tru-Grit_Site_Project_D\Maps\Interim_Action_Plan\AQ_PoT_TruGrit_InterimActionPlan.aprx | TruGrit_InterimActionPlan_Fig2_4_SCOMetalExceedance

ANCHOR QEA

Figure 2-4
Extent of Site-Associated Heavy Metals Contaminants
Interim Action Plan
Port of Tacoma – Tru-Grit Site



LEGEND:

- Feasibility Study Navigation Channel Boundary
- Preliminary Site Boundary

Upper Slope Sample Location

- Core (Subsurface Sediment)
- Grab

Lower Slope Sample Location

- Core (Subsurface Sediment)
- Grab

Total PCB Exceedance

- No SCO Exceedance
- SCO Exceedance
- Not Analyzed

NOTES:

1. Aerial imagery: Esri (2025)
2. Screening criteria for total PCB Aroclors 130 µg/kg based on the DMMP Screening Level and AET Marine SCO (SCUM).
3. Maximum sample concentration within each core is displayed, regardless of sample depth.
4. Metals SCO Exceedance Boundary was calculated using the five metals analyzed for the Tru-Grit Site and their associated SMS/DMMP screening levels: arsenic (57 mg/kg), chromium (260 mg/kg), copper (390 mg/kg), lead (450 mg/kg), and zinc (410 mg/kg).

µg/kg: microgram per kilogram
AET: apparent effects threshold
DMMP: Dredged Material Management Program
mg/kg: milligram per kilogram
PCB: polychlorinated biphenyl
SCO: sediment cleanup objective
SCUM: Sediment Cleanup User's Manual (WA State Dept. of Ecology 2025)
SMS: Sediment Management Standards

0 200
Feet

Publish Date: 2026/05/27, 11:46 AM | User: thartmann
Filepath: \\GSTFile01\GIS\Jobs\PortofTacoma_0092\Tru-Grit_Site_Project_D\Maps\Interim_Action_Plan\AQ_PoT_TruGrit_InterimActionPlan.aprx | TruGrit_InterimActionPlan_Fig2_5a_tPCB

ANCHOR QEA

Figure 2-5a
Distribution of Other Site-Associated Contaminants: Total PCB Aroclors
Interim Action Plan
Port of Tacoma – Tru-Grit Site



LEGEND:

- Feasibility Study Navigation Channel Boundary
- Preliminary Site Boundary

Upper Slope Sample Location

- Core (Subsurface Sediment)
- Grab

Lower Slope Sample Location

- Core (Subsurface Sediment)
- Grab

Tributyltin Exceedance

- No SCO Exceedance
- SCO Exceedance
- Not Analyzed

NOTES:

1. Aerial imagery: Esri (2025)
2. Screening criteria for tributyltin is 73 µg/kg based on the DMMP Bioaccumulation Trigger.
3. Maximum sample concentration within each core is displayed, regardless of sample depth.
4. Metals SCO Exceedance Boundary was calculated using the five metals analyzed for the Tru-Grit Site and their associated SMS/DMMP screening levels: arsenic (57 mg/kg), chromium (260 mg/kg), copper (390 mg/kg), lead (450 mg/kg), and zinc (410 mg/kg).

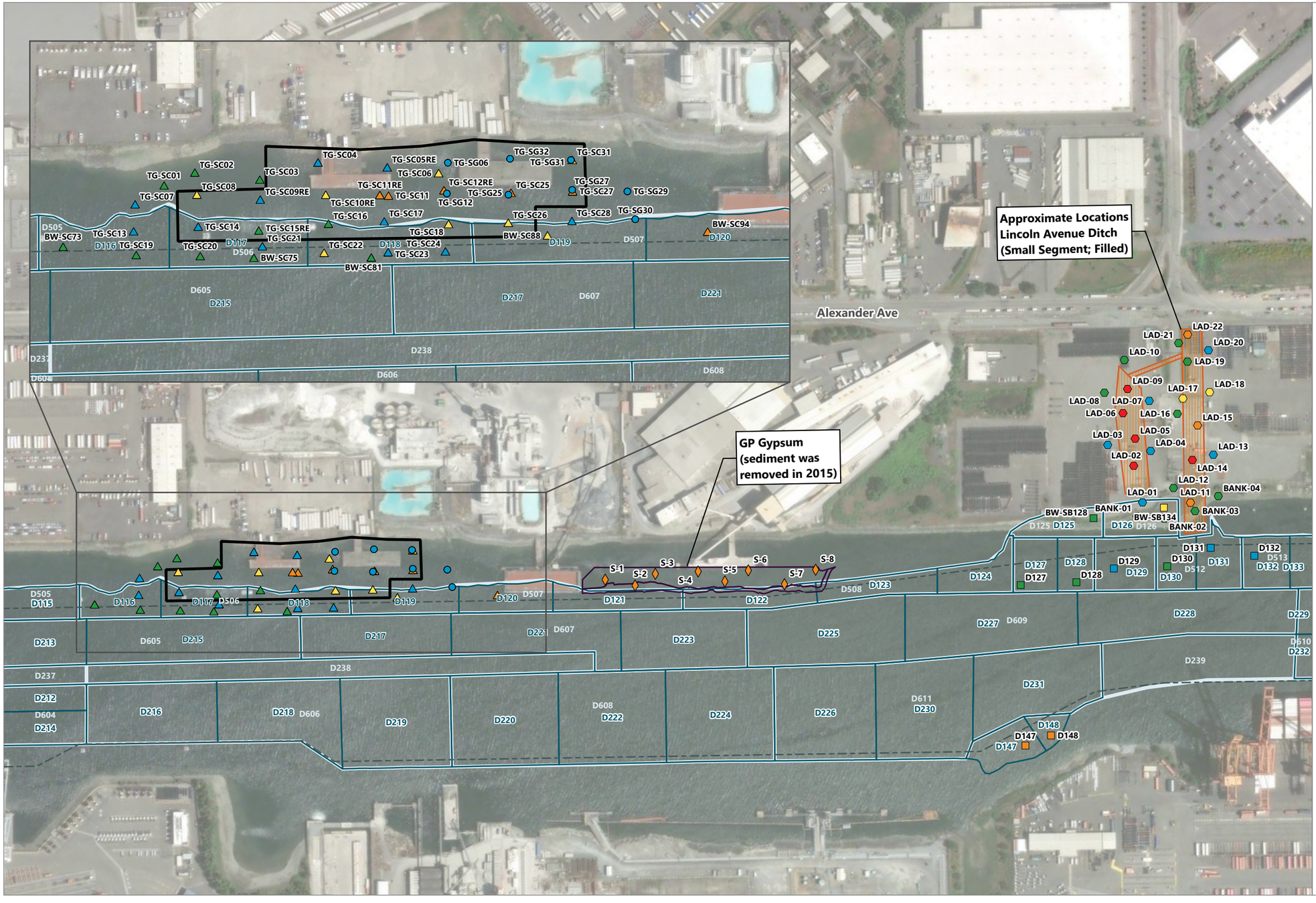
µg/kg: microgram per kilogram
DMMP: Dredged Material Management Program
mg/kg: milligram per kilogram
SCO: sediment cleanup objective
SMS: Sediment Management Standards

0 200
Feet

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ANCHOR QEA

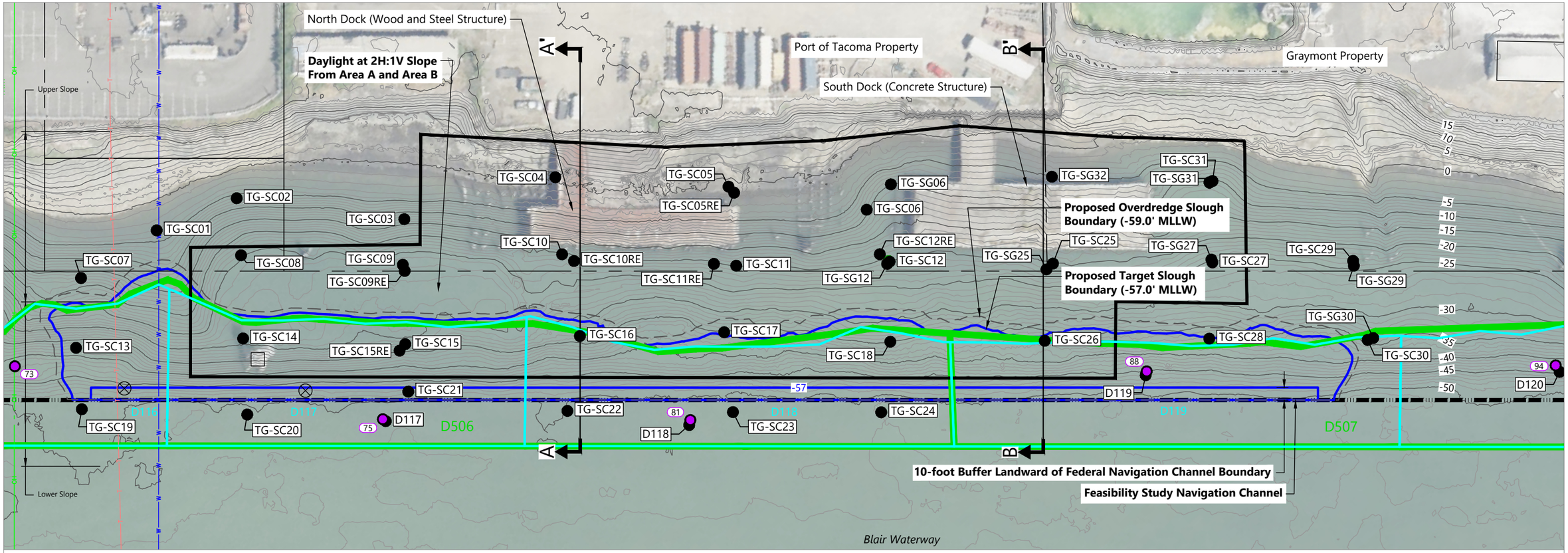
Figure 2-5b
Distribution of Other Site-Associated Contaminants: Tributyltin
Interim Action Plan
Port of Tacoma – Tru-Grit Site



Publish Date: 2026/05/18, 12:50 PM | User: thartmann
Filepath: \\GSTFile01\GIS\Jobs\PortofTacoma_0092\Tru-Grit_Site_Project_D\Maps\Interim_Action_Plan\AQ_PoT_TruGrit_InterimActionPlan.aprx | TruGrit_InterimActionPlan_Fig2_6_RegionalContaminants_DF

ANCHOR QEA

Figure 2-6
Distribution of Regional Contaminant Dioxin/Furan Contamination
Interim Action Plan
Port of Tacoma – Tru-Grit Site



SOURCES: Bathymetric survey by eHydro dated 11/14/22; Aerial image from World Imagery: Esri, Maxar, Earthstar Geographics, and the GIS User community.
HORIZONTAL DATUM: Washington State Plane South Zone, NAD83, U.S. Survey Feet
VERTICAL DATUM: MLLW

NOTE:
FNC deepening project along federal navigation channel boundary, and up to the 10-foot lateral buffer landward of the federal navigation channel boundary, will cause material above it to slough at approximately 2H:1V slope. Slough material will be subsequently dredged.

ABBREVIATIONS:
DMMU: Dredged Material Management Unit
FNC: federal navigation channel
H:V: horizontal to vertical ratio
MLLW: mean lower low water
NAD83: North American Datum of 1983

LEGEND:

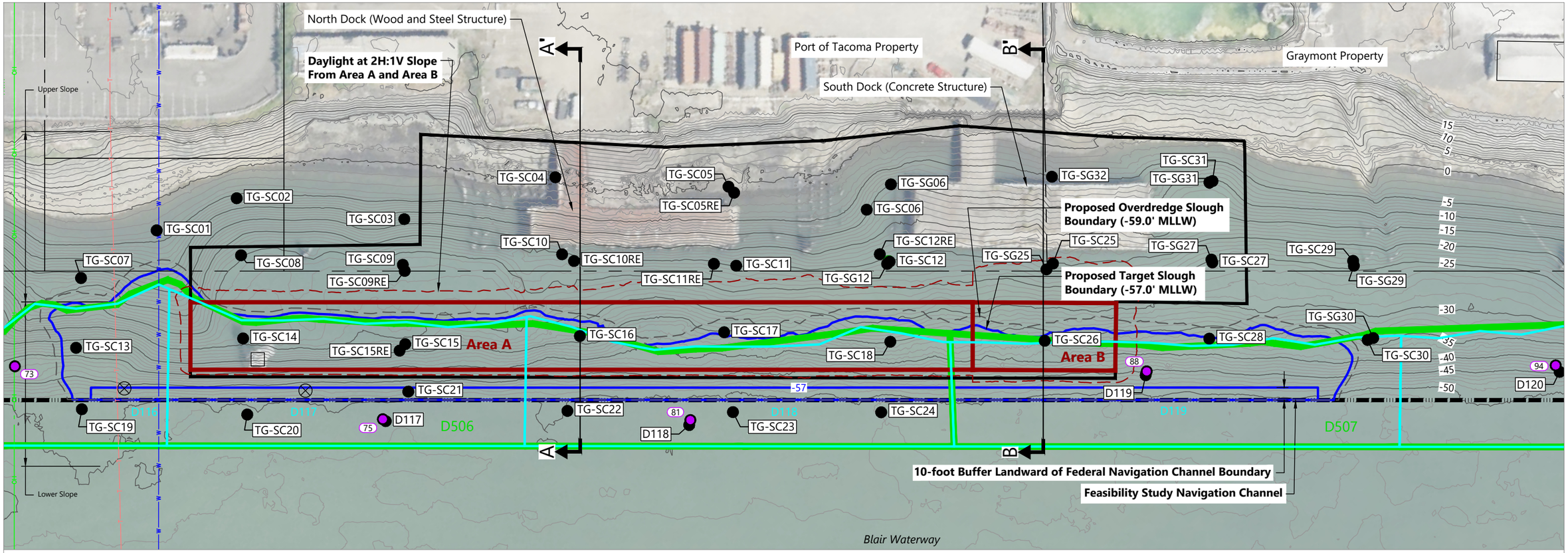
- Existing Contours (USACE 2022, 1' and 5' Interval)
- FNC Deepening Project Design Elevation Slough Boundary in Tru-Grit Area (-57.0' MLLW)
- FNC Deepening Project Allowable Overdredge Slough Boundary in Tru-Grit Area (-59.0' MLLW)
- Feasibility Study Navigation Channel
- Property Line
- Preliminary Site Boundary
- Actual Core Sampling Location
- Channel Deepening Sideslope Vibracore Location
- D506 — Channel Deepening Lower DMMU Boundary
- D118 — Channel Deepening Upper DMMU Boundary
- Navigational Aid
- Navigation Tower
- OH – 115KV — Overhead Power
- T — Underwater Crossing Communication
- W — Underwater Crossing Watermain

0 80
Feet

Publish Date: 2026/06/04 9:05 AM | User: dholmer
Filepath: K:\Projects\0092-Port of Tacoma\Dredged Material Characterization for Tru-Grit Sediment Investigation\0092-RP-002 (Interim Action Plan).dwg Figure 2-7

ANCHOR QEA

Figure 2-7
Potential Waterway Slough Area
Interim Action Plan
Port of Tacoma – Tru-Grit Site



SOURCES: Bathymetric survey by eHydro dated 11/14/22; Aerial image from World Imagery: Esri, Maxar, Earthstar Geographics, and the GIS User community.
HORIZONTAL DATUM: Washington State Plane South Zone, NAD83, U.S. Survey Feet
VERTICAL DATUM: MLLW

NOTE:
FNC deepening project along federal navigation channel boundary, and up to the 10-foot lateral buffer landward of the federal navigation channel boundary, will cause material above it to slough at approximately 2H:1V slope. Slough material will be subsequently dredged.

ABBREVIATIONS:
DMMU: Dredged Material Management Unit
FNC: federal navigation channel
H:V: horizontal to vertical ratio
MLLW: mean lower low water
NAD83: North American Datum of 1983

LEGEND:

- Existing Contours (USACE 2022, 1' and 5' Interval)
- FNC Deepening Project Design Elevation Slough Boundary in Tru-Grit Area (-57.0' MLLW)
- FNC Deepening Project Allowable Overdredge Slough Boundary in Tru-Grit Area (-59.0' MLLW)
- Feasibility Study Navigation Channel
- Property Line
- Preliminary Site Boundary
- Actual Core Sampling Location
- Channel Deepening Sideslope Vibracore Location
- D506 — Channel Deepening Lower DMMU Boundary
- D118 — Channel Deepening Upper DMMU Boundary
- Proposed Dredge Area Daylight Slope
- Area A — Dredge Area A, Lower Slope 4' Dredge Depth + 2' Over-Dredge (Confirmed Contamination within Slough Area)
- Area B — Dredge Area B, Lower Slope 8' Dredge Depth + 2' Over-Dredge (Confirmed Contamination within Slough Area)
- Navigational Aid
- Navigation Tower
- Overhead Power
- Underwater Crossing Communication
- Underwater Crossing Watermain

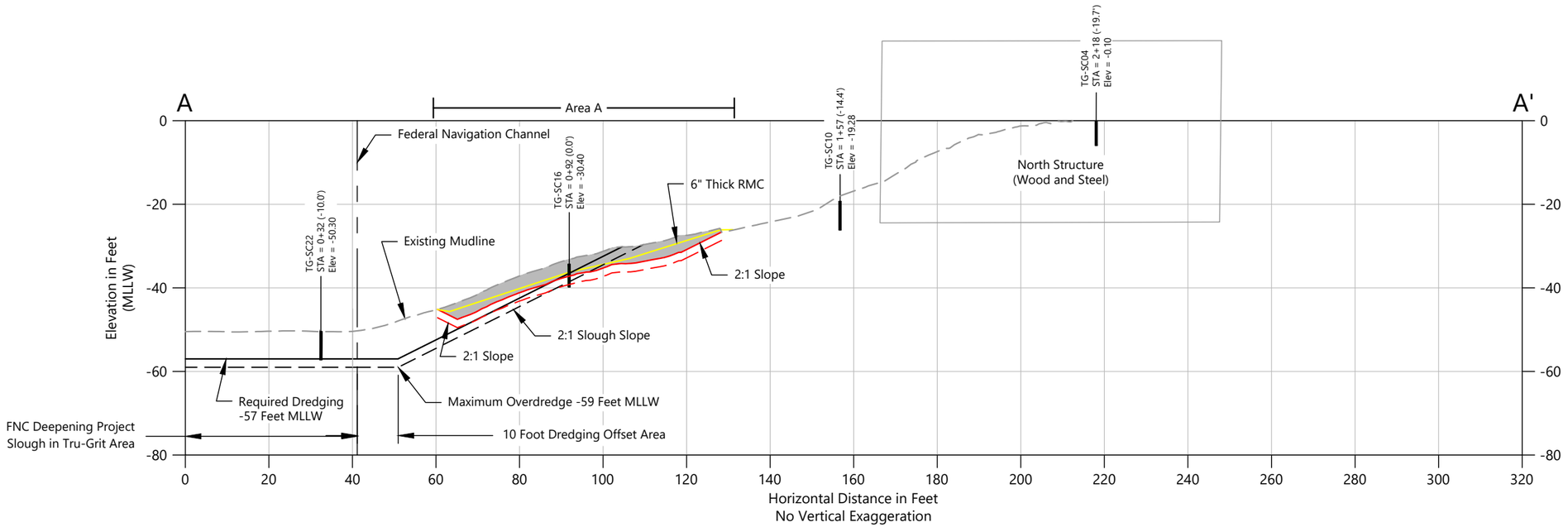
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Filepath: K:\Projects\0092-Port of Tacoma\Dredged Material Characterization for Tru-Grit Sediment Investigation\0092-RP-002 (Interim Action Plan).dwg Figure 3-1

ANCHOR QEA

Figure 3-1
Proposed Interim Action Sediment Removal Area

Interim Action Plan
Port of Tacoma – Tru-Grit Site



NOTE:
FNC deepening project along FNC boundary, and up to the 10-foot lateral buffer landward of the FNC boundary, will cause material above it to slough at approximately 2H:1V slope. Slough material will be subsequently dredged. Proposed dredge areas in the Tru-Grit lower slope (area A and area B) will be dredged prior to FNC deepening project, to mitigate the sloughing of Tru-Grit contaminated material into the FNC project area.

ABBREVIATIONS:
FNC: federal navigation channel
H:V: horizontal to vertical (ratio)
MLLW: mean lower low water
RMC: residuals management cover

LEGEND:

- Required FNC Dredging, -57 Feet MLLW
- Maximum FNC Overdredge, -59 Feet MLLW
- Existing Mudline
- Dredge Area A Design Depth, 4' Depth Cut
- Dredge Area A 2' Allowable Overdredge
- RMC Placement
- Lower Slope Dredge Area

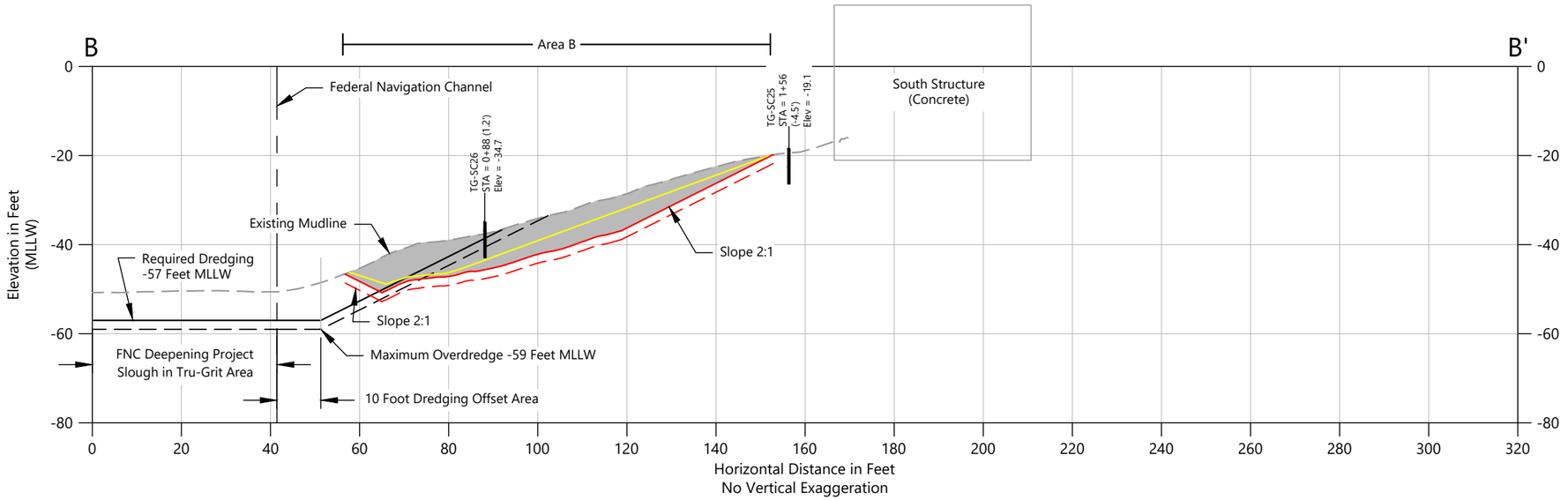
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ANCHOR QEA

Figure 3-2
Cross Section A-A'

Interim Action Plan
Port of Tacoma – Tru-Grit Site



NOTE:
FNC deepening project along FNC boundary, and up to the 10-foot lateral buffer landward of the FNC boundary, will cause material above it to slough at approximately 2H:1V slope. Slough material will be subsequently dredged. Proposed dredge areas in the Tru-Grit lower slope (area A and area B) will be dredged prior to FNC deepening project, to mitigate the sloughing of Tru-Grit contaminated material into the FNC project area.

ABBREVIATIONS:
FNC: federal navigation channel
H:V: horizontal to vertical (ratio)
MLLW: mean lower low water
RMC: residuals management cover

LEGEND:

- Required FNC Dredging, -57 Feet MLLW
- Maximum FNC Overdredge, -59 Feet MLLW
- Existing Mudline
- Dredge Area A Design Depth, 8' Depth Cut
- Dredge Area B 2' Allowable Overdredge
- RMC Placement
- Lower Slope Dredge Area

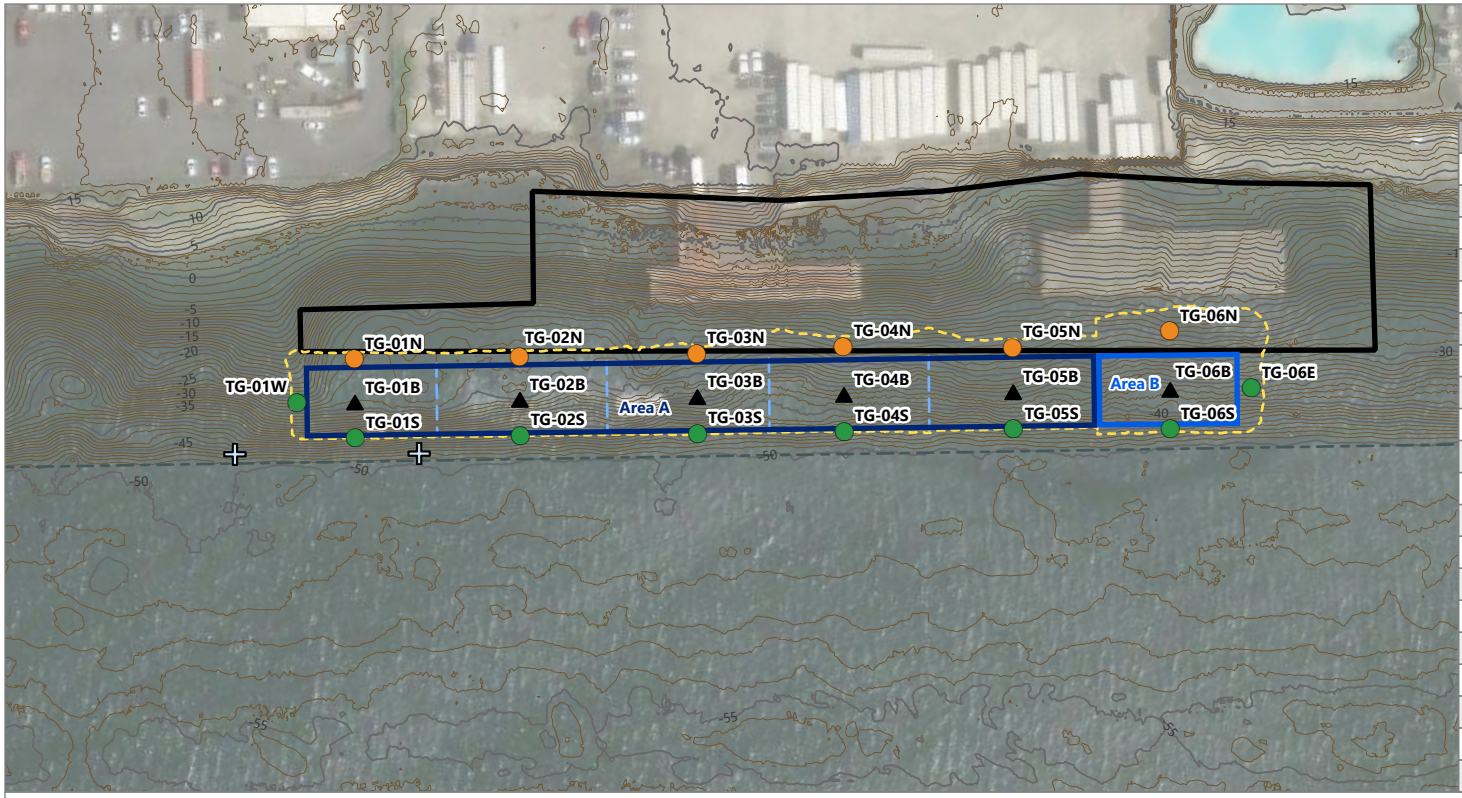
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Filepath: K:\Projects\0092-Port of Tacoma\Dredged Material Characterization for Tru-Grit Sediment Investigation\0092-RP-002 (Interim Action Plan).dwg Figure 3-3

ANCHOR QEA

Figure 3-3
Cross Section B-B'

Interim Action Plan
Port of Tacoma – Tru-Grit Site



Station ID	Easting (feet)	Northing (feet)
TG-01B	1168418	712643
TG-02B	1168511	712553
TG-03B	1168610	712457
TG-04B	1168693	712377
TG-05B	1168788	712285
TG-06B	1168876	712200
TG-06N	1168907	712232
TG-05N	1168811	712310
TG-04N	1168718	712404
TG-03N	1168633	712481
TG-02N	1168534	712577
TG-01N	1168441	712667
TG-01W	1168386	712674
TG-01S	1168398	712623
TG-02S	1168491	712533
TG-03S	1168590	712436
TG-04S	1168672	712356
TG-05S	1168767	712264
TG-06S	1168854	712177
TG-06E	1168921	712155

LEGEND:

- Upper Slope Area
- Feasibility Study Navigation Channel Boundary
- Dredge Area A, Lower Slope 4' Dredge Depth + 2' Over-Dredge (Confirmed Contamination within Slough Area)
- Dredge Area B, Lower Slope 8' Dredge Depth + 2' Over-Dredge (Confirmed Contamination within Slough Area)
- Proposed Dredge Area Daylight Slope
- Elevation (MLLW, 5-Foot Interval)
- Decision Unit Boundary
- Navigational Aid

Proposed Sampling Location

- Dredge Prism Bottom Slope Sample
- Dredge Prism North Slope Sample
- Other Dredge Prism Slope Sample

NOTES:

1. Aerial imagery: Esri (2025)
2. Contour Source: Survey by USACE, dated October 27, 2021, and David Evans Associates, Inc., dated May 27, 2022, with data gaps filled from survey by USACE dated November 14, 2022.
3. Horizontal Datum: NAD83 State Plane Washington South, U.S. feet
4. Vertical Datum: MLLW, feet

MLLW: mean lower low water
NAD83: North American Datum of 1983

0 200
Feet

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ANCHOR QEA

Figure 3-4
Sediment Performance and Confirmation Monitoring Locations
Interim Action Plan
Port of Tacoma – Tru-Grit Site



Station ID	Easting (feet)	Northing (feet)
TG-01B	1168418	712643
TG-02B	1168511	712553
TG-03B	1168610	712457
TG-04B	1168693	712377
TG-05B	1168788	712285
TG-06B	1168876	712200
TG-01N	1168441	712667
TG-02N	1168534	712577
TG-03N	1168633	712481
TG-04N	1168718	712404
TG-05N	1168811	712310
TG-06N	1168907	712232

LEGEND:

- Upper Slope Area
- Feasibility Study Navigation Channel Boundary
- Dredge Area A, Lower Slope 4' Dredge Depth + 2' Over-Dredge (Confirmed Contamination within Slough Area)
- Dredge Area B, Lower Slope 8' Dredge Depth + 2' Over-Dredge (Confirmed Contamination within Slough Area)
- Proposed Dredge Area Daylight Slope
- Elevation (MLLW, 5-Foot Interval)
- Decision Unit Boundary
- Navigational Aid

Proposed Sampling Location

- Dredge Prism Bottom Slope Sample
- Dredge Prism North Slope Sample

NOTES:

1. Aerial imagery: Esri (2025)
2. Contour Source: Survey by USACE, dated October 27, 2021, and David Evans Associates, Inc., dated May 27, 2022, with data gaps filled from survey by USACE dated November 14, 2022.
3. Horizontal Datum: NAD83 State Plane Washington South, U.S. feet
4. Vertical Datum: MLLW, feet

MLLW: mean lower low water
NAD83: North American Datum of 1983

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Feet

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ANCHOR QEA

Figure 3-5
Sediment Long-Term Monitoring Locations
Interim Action Plan
Port of Tacoma – Tru-Grit Site

Appendix A
ProUCL Outputs

Appendix A-1
ProUCL Output – 95% Upper Confidence Levels

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.2 12/15/2025 2:08:30 PM
From File	Data for hilltopping 20251215.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Max_per_loc_avg_dups (arsenic;mg/kg;remaining after removal of sc-08 sc-05 sg-32)

General Statistics

Total Number of Observations	19	Number of Distinct Observations	19
		Number of Missing Observations	0
Minimum	4.21	Mean	7.307
Maximum	14.6	Median	6.56
SD	2.876	Std. Error of Mean	0.66
Coefficient of Variation	0.394	Skewness	1.558

Normal GOF Test

Shapiro Wilk Test Statistic	0.829	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.863	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.212	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.229	Data appear Normal at 1% Significance Level

Data appear Approximate Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	8.451	95% Adjusted-CLT UCL (Chen-1995)	8.644
		95% Modified-t UCL (Johnson-1978)	8.49

Gamma GOF Test

A-D Test Statistic	0.614	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.742	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.159	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.199	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.352	k star (bias corrected MLE)	7.068
Theta hat (MLE)	0.875	Theta star (bias corrected MLE)	1.034
nu hat (MLE)	317.4	nu star (bias corrected)	268.6
MLE Mean (bias corrected)	7.307	MLE Sd (bias corrected)	2.748
		Approximate Chi Square Value (0.05)	231.6
Adjusted Level of Significance	0.0369	Adjusted Chi Square Value	228.6

Assuming Gamma Distribution

95% Approximate Gamma UCL	8.472	95% Adjusted Gamma UCL	8.584

Appendix A-1
ProUCL Output – 95% Upper Confidence Levels

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.934	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.917	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.137	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.18	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.437	Mean of logged Data	1.928
Maximum of Logged Data	2.681	SD of logged Data	0.346

Assuming Lognormal Distribution

95% H-UCL	8.504	90% Chebyshev (MVUE) UCL	9.035
95% Chebyshev (MVUE) UCL	9.833	97.5% Chebyshev (MVUE) UCL	10.94
99% Chebyshev (MVUE) UCL	13.12		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	8.392	95% BCA Bootstrap UCL	8.755
95% Standard Bootstrap UCL	8.392	95% Bootstrap-t UCL	9.186
95% Hall's Bootstrap UCL	10.29	95% Percentile Bootstrap UCL	8.453
90% Chebyshev(Mean, Sd) UCL	9.286	95% Chebyshev(Mean, Sd) UCL	10.18
97.5% Chebyshev(Mean, Sd) UCL	11.43	99% Chebyshev(Mean, Sd) UCL	13.87

Suggested UCL to Use

95% Student's-t UCL	8.451

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Max_per_loc_avg_dups (arsenic;mg/kg;removed with removal of sc-08 sc-05 sg-32)

General Statistics

Total Number of Observations	18	Number of Distinct Observations	18
		Number of Missing Observations	0
Minimum	9.04	Mean	171.8
Maximum	1620	Median	75.7
SD	366.5	Std. Error of Mean	86.38
Coefficient of Variation	2.133	Skewness	4.053

Normal GOF Test

Shapiro Wilk Test Statistic	0.392	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.858	Data Not Normal at 1% Significance Level

Lilliefors Test Statistic	0.391	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.235	Data Not Normal at 1% Significance Level	

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	322.1	95% Adjusted-CLT UCL (Chen-1995)	402.1
		95% Modified-t UCL (Johnson-1978)	335.8

Gamma GOF Test

A-D Test Statistic	1.626	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.777	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.235	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.211	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.773	k star (bias corrected MLE)	0.681
Theta hat (MLE)	222.3	Theta star (bias corrected MLE)	252.2
nu hat (MLE)	27.83	nu star (bias corrected)	24.52
MLE Mean (bias corrected)	171.8	MLE Sd (bias corrected)	208.2
		Approximate Chi Square Value (0.05)	14.25
Adjusted Level of Significance	0.0357	Adjusted Chi Square Value	13.5

Assuming Gamma Distribution

95% Approximate Gamma UCL	295.7	95% Adjusted Gamma UCL	312.1

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.923	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.914	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.144	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.185	Data appear Lognormal at 10% Significance Level	

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.202	Mean of logged Data	4.375
Maximum of Logged Data	7.39	SD of logged Data	1.083

Assuming Lognormal Distribution

95% H-UCL	294.7	90% Chebyshev (MVUE) UCL	253.1
95% Chebyshev (MVUE) UCL	306.1	97.5% Chebyshev (MVUE) UCL	379.7
99% Chebyshev (MVUE) UCL	524.1		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	313.9	95% BCA Bootstrap UCL	440.9
95% Standard Bootstrap UCL	307.4	95% Bootstrap-t UCL	958.5
95% Hall's Bootstrap UCL	840.3	95% Percentile Bootstrap UCL	336.5

90% Chebyshev(Mean, Sd) UCL	430.9	95% Chebyshev(Mean, Sd) UCL	548.3
97.5% Chebyshev(Mean, Sd) UCL	711.3	99% Chebyshev(Mean, Sd) UCL	1031

Suggested UCL to Use

95% H-UCL 294.7

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.
Please verify the data were collected from random locations.
If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Max_per_loc_avg_dups (cadmium;mg/kg;remaining after removal of sc-08 sc-05 sg-32)

General Statistics

Total Number of Observations	19	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	0.1	Mean	0.152
Maximum	0.26	Median	0.14
SD	0.0453	Std. Error of Mean	0.0104
Coefficient of Variation	0.298	Skewness	1.219

Normal GOF Test

Shapiro Wilk Test Statistic	0.872	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.863	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.203	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.229	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.17	95% Adjusted-CLT UCL (Chen-1995)	0.172
		95% Modified-t UCL (Johnson-1978)	0.171

Gamma GOF Test

A-D Test Statistic	0.563	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.741	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.168	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.198	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	13.56	k star (bias corrected MLE)	11.45
Theta hat (MLE)	0.0112	Theta star (bias corrected MLE)	0.0133
nu hat (MLE)	515.1	nu star (bias corrected)	435.1
MLE Mean (bias corrected)	0.152	MLE Sd (bias corrected)	0.0449

		Approximate Chi Square Value (0.05)	387.8
Adjusted Level of Significance	0.0369	Adjusted Chi Square Value	383.9

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.171	95% Adjusted Gamma UCL	0.172

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.917	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.15	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.18	Data appear Lognormal at 10% Significance Level	

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.303	Mean of logged Data	-1.921
Maximum of Logged Data	-1.347	SD of logged Data	0.274

Assuming Lognormal Distribution

95% H-UCL	0.171	90% Chebyshev (MVUE) UCL	0.181
95% Chebyshev (MVUE) UCL	0.194	97.5% Chebyshev (MVUE) UCL	0.212
99% Chebyshev (MVUE) UCL	0.248		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	0.169	95% BCA Bootstrap UCL	0.172
95% Standard Bootstrap UCL	0.169	95% Bootstrap-t UCL	0.177
95% Hall's Bootstrap UCL	0.181	95% Percentile Bootstrap UCL	0.17
90% Chebyshev(Mean, Sd) UCL	0.183	95% Chebyshev(Mean, Sd) UCL	0.197
97.5% Chebyshev(Mean, Sd) UCL	0.217	99% Chebyshev(Mean, Sd) UCL	0.255

Suggested UCL to Use

95% Student's-t UCL	0.17

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Max_per_loc_avg_dups (cadmium;mg/kg;removed with removal of sc-08 sc-05 sg-32)

General Statistics

Total Number of Observations	18	Number of Distinct Observations	14
		Number of Missing Observations	0
Minimum	0.18	Mean	0.466
Maximum	1.48	Median	0.36
SD	0.346	Std. Error of Mean	0.0815
Coefficient of Variation	0.742	Skewness	2.069

Appendix A-1
ProUCL Output – 95% Upper Confidence Levels

Normal GOF Test

Shapiro Wilk Test Statistic	0.732	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.858	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.294	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.235	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.608	95% Adjusted-CLT UCL (Chen-1995)	0.643
		95% Modified-t UCL (Johnson-1978)	0.615

Gamma GOF Test

A-D Test Statistic	0.89	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.747	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.209	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.205	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.857	k star (bias corrected MLE)	2.418
Theta hat (MLE)	0.163	Theta star (bias corrected MLE)	0.193
nu hat (MLE)	102.9	nu star (bias corrected)	87.06
MLE Mean (bias corrected)	0.466	MLE Sd (bias corrected)	0.3
		Approximate Chi Square Value (0.05)	66.55
Adjusted Level of Significance	0.0357	Adjusted Chi Square Value	64.83

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.61	95% Adjusted Gamma UCL	0.626

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.92	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.914	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.165	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.185	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.715	Mean of logged Data	-0.948
Maximum of Logged Data	0.392	SD of logged Data	0.585

Assuming Lognormal Distribution

95% H-UCL	0.62	90% Chebyshev (MVUE) UCL	0.651
95% Chebyshev (MVUE) UCL	0.74	97.5% Chebyshev (MVUE) UCL	0.864
99% Chebyshev (MVUE) UCL	1.107		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	0.6	95% BCA Bootstrap UCL	0.651
95% Standard Bootstrap UCL	0.597	95% Bootstrap-t UCL	0.761
95% Hall's Bootstrap UCL	1.209	95% Percentile Bootstrap UCL	0.603
90% Chebyshev(Mean, Sd) UCL	0.711	95% Chebyshev(Mean, Sd) UCL	0.822
97.5% Chebyshev(Mean, Sd) UCL	0.975	99% Chebyshev(Mean, Sd) UCL	1.277

Suggested UCL to Use

95% H-UCL	0.62

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Max_per_loc_avg_dups (lead;mg/kg;remaining after removal of sc-08 sc-05 sg-32)

General Statistics

Total Number of Observations	19	Number of Distinct Observations	19
		Number of Missing Observations	0
Minimum	5.98	Mean	14.29
Maximum	62.5	Median	9.6
SD	13.88	Std. Error of Mean	3.183
Coefficient of Variation	0.971	Skewness	2.866

Normal GOF Test

Shapiro Wilk Test Statistic	0.573	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.863	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.353	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.229	Data Not Normal at 1% Significance Level	

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	19.81	95% Adjusted-CLT UCL (Chen-1995)	21.76
		95% Modified-t UCL (Johnson-1978)	20.16

Gamma GOF Test

A-D Test Statistic	2.112	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.751	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.282	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.201	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.262	k star (bias corrected MLE)	1.94
Theta hat (MLE)	6.317	Theta star (bias corrected MLE)	7.366
nu hat (MLE)	85.95	nu star (bias corrected)	73.72
MLE Mean (bias corrected)	14.29	MLE Sd (bias corrected)	10.26
		Approximate Chi Square Value (0.05)	54.94
Adjusted Level of Significance	0.0369	Adjusted Chi Square Value	53.53

Appendix A-1
ProUCL Output – 95% Upper Confidence Levels

Assuming Gamma Distribution

95% Approximate Gamma UCL	19.17	95% Adjusted Gamma UCL	19.68

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.801	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.917	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.235	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.18	Data Not Lognormal at 10% Significance Level	

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.788	Mean of logged Data	2.422
Maximum of Logged Data	4.135	SD of logged Data	0.608

Assuming Lognormal Distribution

95% H-UCL	18.38	90% Chebyshev (MVUE) UCL	19.31
95% Chebyshev (MVUE) UCL	21.99	97.5% Chebyshev (MVUE) UCL	25.7
99% Chebyshev (MVUE) UCL	32.98		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	19.53	95% BCA Bootstrap UCL	22.98
95% Standard Bootstrap UCL	19.53	95% Bootstrap-t UCL	37.16
95% Hall's Bootstrap UCL	45.87	95% Percentile Bootstrap UCL	20.07
90% Chebyshev(Mean, Sd) UCL	23.84	95% Chebyshev(Mean, Sd) UCL	28.17
97.5% Chebyshev(Mean, Sd) UCL	34.17	99% Chebyshev(Mean, Sd) UCL	45.96

Suggested UCL to Use

95% Student's-t UCL	19.81

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Max_per_loc_avg_dups (lead;mg/kg;removed with removal of sc-08 sc-05 sg-32)

General Statistics

Total Number of Observations	18	Number of Distinct Observations	18
		Number of Missing Observations	0
Minimum	26	Mean	183.7
Maximum	1290	Median	82
SD	292.6	Std. Error of Mean	68.97
Coefficient of Variation	1.593	Skewness	3.542

Normal GOF Test

Shapiro Wilk Test Statistic	0.514	**Shapiro Wilk GOF Test**	

1% Shapiro Wilk Critical Value	0.858	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.321	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.235	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	303.7	95% Adjusted-CLT UCL (Chen-1995)	358.7
		95% Modified-t UCL (Johnson-1978)	313.3

Gamma GOF Test

A-D Test Statistic	1.195	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.766	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.22	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.209	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.017	k star (bias corrected MLE)	0.884
Theta hat (MLE)	180.7	Theta star (bias corrected MLE)	207.8
nu hat (MLE)	36.59	nu star (bias corrected)	31.83
MLE Mean (bias corrected)	183.7	MLE Sd (bias corrected)	195.4
		Approximate Chi Square Value (0.05)	19.94
Adjusted Level of Significance	0.0357	Adjusted Chi Square Value	19.03

Assuming Gamma Distribution

95% Approximate Gamma UCL	293.3	95% Adjusted Gamma UCL	307.2

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.932	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.914	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.134	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.185	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.258	Mean of logged Data	4.647
Maximum of Logged Data	7.162	SD of logged Data	0.96

Assuming Lognormal Distribution

95% H-UCL	301.3	90% Chebyshev (MVUE) UCL	279
95% Chebyshev (MVUE) UCL	333.2	97.5% Chebyshev (MVUE) UCL	408.3
99% Chebyshev (MVUE) UCL	555.8		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	297.2	95% BCA Bootstrap UCL	393
95% Standard Bootstrap UCL	292.9	95% Bootstrap-t UCL	554.7

95% Hall's Bootstrap UCL	678.6	95% Percentile Bootstrap UCL	308.2
90% Chebyshev(Mean, Sd) UCL	390.6	95% Chebyshev(Mean, Sd) UCL	484.3
97.5% Chebyshev(Mean, Sd) UCL	614.4	99% Chebyshev(Mean, Sd) UCL	869.9

Suggested UCL to Use

95% H-UCL	301.3

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.
Please verify the data were collected from random locations.
If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Max_per_loc_avg_dups (mercury;mg/kg;remaining after removal of sc-08 sc-05 sg-32)

General Statistics

Total Number of Observations	19	Number of Distinct Observations	19
Number of Detects	17	Number of Non-Detects	2
Number of Distinct Detects	17	Number of Distinct Non-Detects	2
Minimum Detect	0.00984	Minimum Non-Detect	0.0323
Maximum Detect	0.194	Maximum Non-Detect	0.0335
Variance Detects	0.0019	Percent Non-Detects	10.53%
Mean Detects	0.0515	SD Detects	0.0435
Median Detects	0.0391	CV Detects	0.846
Skewness Detects	2.478	Kurtosis Detects	7.269
Mean of Logged Detects	-3.218	SD of Logged Detects	0.722

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.731	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.851	Detected Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.265	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.241	Detected Data Not Normal at 1% Significance Level	

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0483	KM Standard Error of Mean	0.00974
90KM SD	0.0411	95% KM (BCA) UCL	0.0647
95% KM (t) UCL	0.0652	95% KM (Percentile Bootstrap) UCL	0.0654
95% KM (z) UCL	0.0643	95% KM Bootstrap t UCL	0.0834
90% KM Chebyshev UCL	0.0775	95% KM Chebyshev UCL	0.0908
97.5% KM Chebyshev UCL	0.109	99% KM Chebyshev UCL	0.145

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.465	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.749	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.167	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.212	Detected data appear Gamma Distributed at 5% Significance Level	

Appendix A-1
ProUCL Output – 95% Upper Confidence Levels

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.144	k star (bias corrected MLE)	1.805
Theta hat (MLE)	0.024	Theta star (bias corrected MLE)	0.0285
nu hat (MLE)	72.9	nu star (bias corrected)	61.37
Mean (detects)	0.0515		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.00984	Mean	0.0474
Maximum	0.194	Median	0.0381
SD	0.0428	CV	0.903
k hat (MLE)	1.885	k star (bias corrected MLE)	1.623
Theta hat (MLE)	0.0251	Theta star (bias corrected MLE)	0.0292
nu hat (MLE)	71.63	nu star (bias corrected)	61.66
Adjusted Level of Significance (β)	0.0369		
Approximate Chi Square Value (61.66, α)	44.6	Adjusted Chi Square Value (61.66, β)	43.33
95% Gamma Approximate UCL	0.0655	95% Gamma Adjusted UCL	0.0674

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0483	SD (KM)	0.0411
Variance (KM)	0.00169	SE of Mean (KM)	0.00974
k hat (KM)	1.384	k star (KM)	1.201
nu hat (KM)	52.61	nu star (KM)	45.64
theta hat (KM)	0.0349	theta star (KM)	0.0402
80% gamma percentile (KM)	0.0765	90% gamma percentile (KM)	0.106
95% gamma percentile (KM)	0.136	99% gamma percentile (KM)	0.203

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (45.64, α)	31.14	Adjusted Chi Square Value (45.64, β)	30.09
95% KM Approximate Gamma UCL	0.0708	95% KM Adjusted Gamma UCL	0.0733

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.966	**Shapiro Wilk GOF Test**
10% Shapiro Wilk Critical Value	0.91	Detected Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.139	**Lilliefors GOF Test**
10% Lilliefors Critical Value	0.19	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0481	Mean in Log Scale	-3.293
SD in Original Scale	0.0423	SD in Log Scale	0.717
95% t UCL (assumes normality of ROS data)	0.0649	95% Percentile Bootstrap UCL	0.0651
95% BCA Bootstrap UCL	0.0708	95% Bootstrap t UCL	0.0802
95% H-UCL (Log ROS)	0.0702		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-3.292	KM Geo Mean	0.0372
KM SD (logged)	0.712	95% Critical H Value (KM-Log)	2.235
KM Standard Error of Mean (logged)	0.173	95% H-UCL (KM -Log)	0.0697
KM SD (logged)	0.712	95% Critical H Value (KM-Log)	2.235
KM Standard Error of Mean (logged)	0.173		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0478	Mean in Log Scale	-3.312
SD in Original Scale	0.0425	SD in Log Scale	0.736
95% t UCL (Assumes normality)	0.0647	95% H-Stat UCL	0.0708

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	0.0733	95% GROS Adjusted Gamma UCL	0.0674

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Max_per_loc_avg_dups (mercury;mg/kg;removed with removal of sc-08 sc-05 sg-32)

General Statistics

Total Number of Observations	18	Number of Distinct Observations	18
		Number of Missing Observations	0
Minimum	0.0235	Mean	0.155
Maximum	0.344	Median	0.132
SD	0.106	Std. Error of Mean	0.0249
Coefficient of Variation	0.682	Skewness	0.743

Normal GOF Test

Shapiro Wilk Test Statistic	0.872	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.858	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.159	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.235	Data appear Normal at 1% Significance Level	

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.199	95% Adjusted-CLT UCL (Chen-1995)	0.201
		95% Modified-t UCL (Johnson-1978)	0.199

Gamma GOF Test

A-D Test Statistic	0.422	**Anderson-Darling Gamma GOF Test**

5% A-D Critical Value	0.751	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.144	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.206	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.194	k star (bias corrected MLE)	1.866
Theta hat (MLE)	0.0707	Theta star (bias corrected MLE)	0.0832
nu hat (MLE)	78.99	nu star (bias corrected)	67.16
MLE Mean (bias corrected)	0.155	MLE Sd (bias corrected)	0.114
		Approximate Chi Square Value (0.05)	49.3
Adjusted Level of Significance	0.0357	Adjusted Chi Square Value	47.83

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.211	95% Adjusted Gamma UCL	0.218

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.946	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.914	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.12	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.185	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	-3.751	Mean of logged Data	-2.108
Maximum of Logged Data	-1.067	SD of logged Data	0.756

Assuming Lognormal Distribution

95% H-UCL	0.247	90% Chebyshev (MVUE) UCL	0.249
95% Chebyshev (MVUE) UCL	0.291	97.5% Chebyshev (MVUE) UCL	0.348
99% Chebyshev (MVUE) UCL	0.46		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	0.196	95% BCA Bootstrap UCL	0.204
95% Standard Bootstrap UCL	0.196	95% Bootstrap-t UCL	0.209
95% Hall's Bootstrap UCL	0.201	95% Percentile Bootstrap UCL	0.198
90% Chebyshev(Mean, Sd) UCL	0.23	95% Chebyshev(Mean, Sd) UCL	0.264
97.5% Chebyshev(Mean, Sd) UCL	0.311	99% Chebyshev(Mean, Sd) UCL	0.403

Suggested UCL to Use

95% Student's-t UCL	0.199

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Max_per_loc_avg_dups (total cpah teq (7 minimum caepa 2005) (u = 1/2 max limit);ug/kg;remaining after removal of sc-08 sc-05 sg-32)

Appendix A-1
ProUCL Output – 95% Upper Confidence Levels

General Statistics

Total Number of Observations	19	Number of Distinct Observations	16
Number of Detects	17	Number of Non-Detects	2
Number of Distinct Detects	15	Number of Distinct Non-Detects	1
Minimum Detect	15.3	Minimum Non-Detect	20
Maximum Detect	106	Maximum Non-Detect	20
Variance Detects	889.5	Percent Non-Detects	10.53%
Mean Detects	48.5	SD Detects	29.82
Median Detects	47	CV Detects	0.615
Skewness Detects	0.437	Kurtosis Detects	-0.994
Mean of Logged Detects	3.671	SD of Logged Detects	0.702

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.914	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.851	Detected Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.155	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.241	Detected Data appear Normal at 1% Significance Level

Detected Data appear Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	45.08	KM Standard Error of Mean	6.889
90KM SD	29.13	95% KM (BCA) UCL	56.27
95% KM (t) UCL	57.03	95% KM (Percentile Bootstrap) UCL	56.62
95% KM (z) UCL	56.42	95% KM Bootstrap t UCL	59.47
90% KM Chebyshev UCL	65.75	95% KM Chebyshev UCL	75.11
97.5% KM Chebyshev UCL	88.11	99% KM Chebyshev UCL	113.6

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.566	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.747	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.155	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.211	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.527	k star (bias corrected MLE)	2.121
Theta hat (MLE)	19.19	Theta star (bias corrected MLE)	22.87
nu hat (MLE)	85.93	nu star (bias corrected)	72.1
Mean (detects)	48.5		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	12.28	Mean	45.17
Maximum	106	Median	41.2
SD	29.87	CV	0.661

k hat (MLE)	2.303	k star (bias corrected MLE)	1.974
Theta hat (MLE)	19.62	Theta star (bias corrected MLE)	22.88
nu hat (MLE)	87.5	nu star (bias corrected)	75.02
Adjusted Level of Significance (β)	0.0369		
Approximate Chi Square Value (75.02, α)	56.07	Adjusted Chi Square Value (75.02, β)	54.64
95% Gamma Approximate UCL	60.44	95% Gamma Adjusted UCL	62.02

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	45.08	SD (KM)	29.13
Variance (KM)	848.5	SE of Mean (KM)	6.889
k hat (KM)	2.395	k star (KM)	2.052
nu hat (KM)	91.03	nu star (KM)	77.99
theta hat (KM)	18.82	theta star (KM)	21.97
80% gamma percentile (KM)	67.29	90% gamma percentile (KM)	87.15
95% gamma percentile (KM)	106.1	99% gamma percentile (KM)	148

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (77.99, α)	58.64	Adjusted Chi Square Value (77.99, β)	57.18
95% KM Approximate Gamma UCL	59.95	95% KM Adjusted Gamma UCL	61.49

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.893	**Shapiro Wilk GOF Test**
10% Shapiro Wilk Critical Value	0.91	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.149	**Lilliefors GOF Test**
10% Lilliefors Critical Value	0.19	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	45.29	Mean in Log Scale	3.587
SD in Original Scale	29.74	SD in Log Scale	0.71
95% t UCL (assumes normality of ROS data)	57.12	95% Percentile Bootstrap UCL	56.54
95% BCA Bootstrap UCL	57.12	95% Bootstrap t UCL	58.15
95% H-UCL (Log ROS)	67.56		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.576	KM Geo Mean	35.74
KM SD (logged)	0.701	95% Critical H Value (KM-Log)	2.222
KM Standard Error of Mean (logged)	0.166	95% H-UCL (KM -Log)	65.96
KM SD (logged)	0.701	95% Critical H Value (KM-Log)	2.222
KM Standard Error of Mean (logged)	0.166		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	44.45	Mean in Log Scale	3.527
SD in Original Scale	30.63	SD in Log Scale	0.79
95% t UCL (Assumes normality)	56.63	95% H-Stat UCL	71.69

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 1% Significance Level

Appendix A-1
ProUCL Output – 95% Upper Confidence Levels

Suggested UCL to Use

95% KM (t) UCL	57.03

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Max_per_loc_avg_dups (total cpah teq (7 minimum caepa 2005) (u = 1/2 max limit);ug/kg;removed with removal of sc-08 sc-05 sg-32)

General Statistics

Total Number of Observations	18	Number of Distinct Observations	16
Number of Detects	15	Number of Non-Detects	3
Number of Distinct Detects	14	Number of Distinct Non-Detects	2
Minimum Detect	9.84	Minimum Non-Detect	13.2
Maximum Detect	1230	Maximum Non-Detect	14.2
Variance Detects	171204	Percent Non-Detects	16.67%
Mean Detects	276.5	SD Detects	413.8
Median Detects	82.7	CV Detects	1.496
Skewness Detects	1.66	Kurtosis Detects	1.309
Mean of Logged Detects	4.477	SD of Logged Detects	1.647

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.67	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.835	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.327	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.255	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	232.1	KM Standard Error of Mean	92.27
90KM SD	378.2	95% KM (BCA) UCL	388.7
95% KM (t) UCL	392.6	95% KM (Percentile Bootstrap) UCL	390.2
95% KM (z) UCL	383.9	95% KM Bootstrap t UCL	497.3
90% KM Chebyshev UCL	508.9	95% KM Chebyshev UCL	634.3
97.5% KM Chebyshev UCL	808.3	99% KM Chebyshev UCL	1150

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.792	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.79	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.168	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.233	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.547	k star (bias corrected MLE)	0.482
Theta hat (MLE)	505.7	Theta star (bias corrected MLE)	573.9
nu hat (MLE)	16.4	nu star (bias corrected)	14.46
Mean (detects)	276.5		

Appendix A-1
ProUCL Output – 95% Upper Confidence Levels

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	230.5
Maximum	1230	Median	55.05
SD	390.2	CV	1.693
k hat (MLE)	0.281	k star (bias corrected MLE)	0.271
Theta hat (MLE)	819.2	Theta star (bias corrected MLE)	849
nu hat (MLE)	10.13	nu star (bias corrected)	9.773
Adjusted Level of Significance (β)	0.0357		
Approximate Chi Square Value (9.77, α)	3.8	Adjusted Chi Square Value (9.77, β)	3.45
95% Gamma Approximate UCL	592.7	95% Gamma Adjusted UCL	652.9

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	232.1	SD (KM)	378.2
Variance (KM)	143039	SE of Mean (KM)	92.27
k hat (KM)	0.377	k star (KM)	0.351
nu hat (KM)	13.56	nu star (KM)	12.63
theta hat (KM)	616.3	theta star (KM)	661.5
80% gamma percentile (KM)	367.7	90% gamma percentile (KM)	670
95% gamma percentile (KM)	1008	99% gamma percentile (KM)	1872

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (12.63, α)	5.646	Adjusted Chi Square Value (12.63, β)	5.203
95% KM Approximate Gamma UCL	519.3	95% KM Adjusted Gamma UCL	563.5

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk GOF Test**
10% Shapiro Wilk Critical Value	0.901	Detected Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.187	**Lilliefors GOF Test**
10% Lilliefors Critical Value	0.202	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	231.1	Mean in Log Scale	3.958
SD in Original Scale	389.7	SD in Log Scale	1.918
95% t UCL (assumes normality of ROS data)	391	95% Percentile Bootstrap UCL	384.7
95% BCA Bootstrap UCL	429.1	95% Bootstrap t UCL	482.3
95% H-UCL (Log ROS)	2287		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.112	KM Geo Mean	61.04
KM SD (logged)	1.666	95% Critical H Value (KM-Log)	3.72
KM Standard Error of Mean (logged)	0.407	95% H-UCL (KM -Log)	1100
KM SD (logged)	1.666	95% Critical H Value (KM-Log)	3.72
KM Standard Error of Mean (logged)	0.407		

Appendix A-1
ProUCL Output – 95% Upper Confidence Levels

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	231.6	Mean in Log Scale	4.053
SD in Original Scale	389.5	SD in Log Scale	1.784
95% t UCL (Assumes normality)	391.3	95% H-Stat UCL	1548

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	563.5

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.
Please verify the data were collected from random locations.
If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Max_per_loc_avg_dups (total pcb aroclors (dmmp) (u = 1/2 max limit);ug/kg;remaining after removal of sc-08 sc-05 sg-32)

General Statistics

Total Number of Observations	19	Number of Distinct Observations	14
Number of Detects	8	Number of Non-Detects	11
Number of Distinct Detects	8	Number of Distinct Non-Detects	6
Minimum Detect	20	Minimum Non-Detect	3.5
Maximum Detect	81.9	Maximum Non-Detect	20.5
Variance Detects	488.6	Percent Non-Detects	57.89%
Mean Detects	49.9	SD Detects	22.1
Median Detects	46.5	CV Detects	0.443
Skewness Detects	0.358	Kurtosis Detects	-1.075
Mean of Logged Detects	3.816	SD of Logged Detects	0.477

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.941	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.749	Detected Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.173	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.333	Detected Data appear Normal at 1% Significance Level	

Detected Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	23.12	KM Standard Error of Mean	6.509
90KM SD	26.51	95% KM (BCA) UCL	37.92

95% KM (t) UCL	34.4	95% KM (Percentile Bootstrap) UCL	36.36
95% KM (z) UCL	33.82	95% KM Bootstrap t UCL	34.95
90% KM Chebyshev UCL	42.64	95% KM Chebyshev UCL	51.49
97.5% KM Chebyshev UCL	63.76	99% KM Chebyshev UCL	87.88

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.215	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.719	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.15	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	5.487	k star (bias corrected MLE)	3.513
Theta hat (MLE)	9.094	Theta star (bias corrected MLE)	14.2
nu hat (MLE)	87.8	nu star (bias corrected)	56.21
Mean (detects)	49.9		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	21.92
Maximum	81.9	Median	3.5
SD	28.22	CV	1.287
k hat (MLE)	0.239	k star (bias corrected MLE)	0.236
Theta hat (MLE)	91.75	Theta star (bias corrected MLE)	92.78
nu hat (MLE)	9.08	nu star (bias corrected)	8.979
Adjusted Level of Significance (β)	0.0369		
Approximate Chi Square Value (8.98, α)	3.315	Adjusted Chi Square Value (8.98, β)	3.02
95% Gamma Approximate UCL	59.39	95% Gamma Adjusted UCL	65.19

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	23.12	SD (KM)	26.51
Variance (KM)	703	SE of Mean (KM)	6.509
k hat (KM)	0.76	k star (KM)	0.675
nu hat (KM)	28.88	nu star (KM)	25.66
theta hat (KM)	30.41	theta star (KM)	34.24
80% gamma percentile (KM)	38.04	90% gamma percentile (KM)	58.52
95% gamma percentile (KM)	79.71	99% gamma percentile (KM)	130.5

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (25.66, α)	15.11	Adjusted Chi Square Value (25.66, β)	14.41
95% KM Approximate Gamma UCL	39.24	95% KM Adjusted Gamma UCL	41.16

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.957	**Shapiro Wilk GOF Test**

10% Shapiro Wilk Critical Value	0.851	Detected Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.127	**Lilliefors GOF Test**
10% Lilliefors Critical Value	0.265	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	27.61	Mean in Log Scale	2.991
SD in Original Scale	24.04	SD in Log Scale	0.815
95% t UCL (assumes normality of ROS data)	37.17	95% Percentile Bootstrap UCL	36.6
95% BCA Bootstrap UCL	37.7	95% Bootstrap t UCL	39.65
95% H-UCL (Log ROS)	43.69		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.34	KM Geo Mean	10.39
KM SD (logged)	1.297	95% Critical H Value (KM-Log)	3.058
KM Standard Error of Mean (logged)	0.319	95% H-UCL (KM -Log)	61.33
KM SD (logged)	1.297	95% Critical H Value (KM-Log)	3.058
KM Standard Error of Mean (logged)	0.319		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	25.91	Mean in Log Scale	2.756
SD in Original Scale	25.26	SD in Log Scale	1.103
95% t UCL (Assumes normality)	35.96	95% H-Stat UCL	59.28

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use

95% KM (t) UCL	34.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Max_per_loc_avg_dups (total pcb aroclors (dmmp) (u = 1/2 max limit);ug/kg;removed with removal of sc-08 sc-05 sg-32)

General Statistics

Total Number of Observations	18	Number of Distinct Observations	17
Number of Detects	10	Number of Non-Detects	8
Number of Distinct Detects	10	Number of Distinct Non-Detects	7
Minimum Detect	30.5	Minimum Non-Detect	13
Maximum Detect	536	Maximum Non-Detect	19.9
Variance Detects	28022	Percent Non-Detects	44.44%
Mean Detects	187.4	SD Detects	167.4
Median Detects	128.5	CV Detects	0.893
Skewness Detects	1.449	Kurtosis Detects	1.195
Mean of Logged Detects	4.879	SD of Logged Detects	0.922

Appendix A-1
ProUCL Output – 95% Upper Confidence Levels

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.803	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.781	Detected Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.301	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.304	Detected Data appear Normal at 1% Significance Level

Detected Data appear Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	109.9	KM Standard Error of Mean	36.45
90KM SD	146.7	95% KM (BCA) UCL	171.7
95% KM (t) UCL	173.3	95% KM (Percentile Bootstrap) UCL	172
95% KM (z) UCL	169.9	95% KM Bootstrap t UCL	234.2
90% KM Chebyshev UCL	219.3	95% KM Chebyshev UCL	268.8
97.5% KM Chebyshev UCL	337.5	99% KM Chebyshev UCL	472.6

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.396	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.739	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.195	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.271	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.555	k star (bias corrected MLE)	1.155
Theta hat (MLE)	120.5	Theta star (bias corrected MLE)	162.2
nu hat (MLE)	31.1	nu star (bias corrected)	23.11
Mean (detects)	187.4		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	104.1
Maximum	536	Median	32.75
SD	155	CV	1.488
k hat (MLE)	0.187	k star (bias corrected MLE)	0.193
Theta hat (MLE)	557.5	Theta star (bias corrected MLE)	540.4
nu hat (MLE)	6.724	nu star (bias corrected)	6.937
Adjusted Level of Significance (β)	0.0357		
Approximate Chi Square Value (6.94, α)	2.136	Adjusted Chi Square Value (6.94, β)	1.89
95% Gamma Approximate UCL	338.2	95% Gamma Adjusted UCL	382.3

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	109.9	SD (KM)	146.7
Variance (KM)	21524	SE of Mean (KM)	36.45
k hat (KM)	0.561	k star (KM)	0.505
nu hat (KM)	20.2	nu star (KM)	18.17

theta hat (KM)	195.8	theta star (KM)	217.8
80% gamma percentile (KM)	180.6	90% gamma percentile (KM)	296.8
95% gamma percentile (KM)	420.8	99% gamma percentile (KM)	725.5

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (18.17, α)	9.513	Adjusted Chi Square Value (18.17, β)	8.916
95% KM Approximate Gamma UCL	209.9	95% KM Adjusted Gamma UCL	224

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk GOF Test**
10% Shapiro Wilk Critical Value	0.869	Detected Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.161	**Lilliefors GOF Test**
10% Lilliefors Critical Value	0.241	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Lognormal at 10% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	109.7	Mean in Log Scale	3.822
SD in Original Scale	151.1	SD in Log Scale	1.396
95% t UCL (assumes normality of ROS data)	171.6	95% Percentile Bootstrap UCL	170.3
95% BCA Bootstrap UCL	186	95% Bootstrap t UCL	226.9
95% H-UCL (Log ROS)	364.9		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.85	KM Geo Mean	47.01
KM SD (logged)	1.322	95% Critical H Value (KM-Log)	3.136
KM Standard Error of Mean (logged)	0.328	95% H-UCL (KM -Log)	307.7
KM SD (logged)	1.322	95% Critical H Value (KM-Log)	3.136
KM Standard Error of Mean (logged)	0.328		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	108.1	Mean in Log Scale	3.674
SD in Original Scale	152.2	SD in Log Scale	1.542
95% t UCL (Assumes normality)	170.5	95% H-Stat UCL	480.9

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use

95% KM (t) UCL	173.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Appendix A-2
ProUCL Output – 90/90 Upper Tolerance Limits

Background Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.2 12/15/2025 3:58:11 PM
From File	20251125_Blair_Main_Channel_Flat_File_D100-300_added_chems.xls
Full Precision	OFF
Confidence Coefficient	90%
Coverage	90%
Different or Future K Observations	1
Number of Bootstrap Operations	2000

result_value1 (arsenic)

General Statistics

Total Number of Observations	100	Number of Distinct Observations	90
Minimum	1.18	First Quartile	2.555
Second Largest	12.1	Median	3.55
Maximum	131	Third Quartile	4.793
Mean	5.145	SD	12.85
Coefficient of Variation	2.498	Skewness	9.675
Mean of logged Data	1.275	SD of logged Data	0.609

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.467	d2max (for USL)	3.024

Normal GOF Test

Shapiro Wilk Test Statistic	0.198	**Normal GOF Test**
1% Shapiro Wilk P Value	0	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.396	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.103	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Background Statistics Assuming Normal Distribution

90% UTL with	90% Coverage	23.99	90% Percentile (z)	21.62
	90% UPL (t)	21.81	95% Percentile (z)	26.28
	90% USL	44.01	99% Percentile (z)	35.04

Gamma GOF Test

A-D Test Statistic	7.946	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.77	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.189	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.0911	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.522	k star (bias corrected MLE)	1.483
Theta hat (MLE)	3.38	Theta star (bias corrected MLE)	3.469
nu hat (MLE)	304.4	nu star (bias corrected)	296.6
MLE Mean (bias corrected)	5.145	MLE Sd (bias corrected)	4.225

Background Statistics Assuming Gamma Distribution

90% Wilson Hilferty (WH) Approx. Gamma UPL		9.626	90% Percentile	10.75
90% Hawkins Wixley (HW) Approx. Gamma UPL		8.992	95% Percentile	13.45
90% WH Approx. Gamma UTL with	90% Coverage	10.66	99% Percentile	19.56
90% HW Approx. Gamma UTL with	90% Coverage	9.95		
	90% WH USL	23.74	90% HW USL	22.69

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.884	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk P Value	8.070E-11	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.0813	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.0813	Data appear Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Appendix A-2
ProUCL Output – 90/90 Upper Tolerance Limits

Background Statistics assuming Lognormal Distribution

90% UTL with	90% Coverage	8.748	90% Percentile (z)		7.814
	90% UPL (t)	7.886	95% Percentile (z)		9.751
	90% USL	22.6	99% Percentile (z)		14.77

Nonparametric Distribution Free Background Statistics
Data appear Approximate Lognormal at 10% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, order		95	90% UTL with	90% Coverage	7.43
Approx, f used to compute achieved CC		1.492	Approximate Actual Confidence Coefficient achieved by UTL		0.883
			Approximate Sample Size needed to achieve specified CC		91
90% Percentile Bootstrap UTL with	90% Coverage	7.223	90% BCA Bootstrap UTL with	90% Coverage	7.223
	90% UPL	6.722		90% Percentile	6.578
	90% Chebyshev UPL	43.89		95% Percentile	7.431
	95% Chebyshev UPL	61.44		99% Percentile	13.29
	90% USL	131			

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

result_value1 (cadmium)

General Statistics

Total Number of Observations	100	Number of Missing Observations	0
Number of Distinct Observations	19		
Number of Detects	52	Number of Non-Detects	48
Number of Distinct Detects	18	Number of Distinct Non-Detects	4
Minimum Detect	0.06	Minimum Non-Detect	0.11
Maximum Detect	0.37	Maximum Non-Detect	2
Variance Detected	0.00467	Percent Non-Detects	48%
Mean Detected	0.121	SD Detected	0.0683
Mean of Detected Logged Data	-2.228	SD of Detected Logged Data	0.469

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.467	d2max (for USL)	3.024

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.796	**Normal GOF Test on Detected Observations Only**	
1% Shapiro Wilk P Value	2.9818E-9	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.2	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.141	Data Not Normal at 1% Significance Level	

Data Not Normal at 1% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	0.103	KM SD	0.0549
90% UTL90% Coverage	0.183	90% KM UPL (t)	0.174
90% KM Percentile (z)	0.173	95% KM Percentile (z)	0.193
99% KM Percentile (z)	0.23	90% KM USL	0.269

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	0.13	SD	0.188
90% UTL90% Coverage	0.405	90% UPL (t)	0.373
90% Percentile (z)	0.37	95% Percentile (z)	0.438
99% Percentile (z)	0.566	90% USL	0.697

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

Appendix A-2
ProUCL Output – 90/90 Upper Tolerance Limits

A-D Test Statistic	1.665	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.754	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.167	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.124	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.337	k star (bias corrected MLE)	4.1
Theta hat (MLE)	0.028	Theta star (bias corrected MLE)	0.0296
nu hat (MLE)	451.1	nu star (bias corrected)	426.4
MLE Mean (bias corrected)	0.121		
MLE Sd (bias corrected)	0.06	90% Percentile of Chisquare (2kstar)	13.63

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0198	Mean	0.102
Maximum	0.37	Median	0.0882
SD	0.0576	CV	0.565
k hat (MLE)	4.06	k star (bias corrected MLE)	3.945
Theta hat (MLE)	0.0251	Theta star (bias corrected MLE)	0.0259
nu hat (MLE)	812	nu star (bias corrected)	789
MLE Mean (bias corrected)	0.102	MLE Sd (bias corrected)	0.0514
90% Percentile of Chisquare (2kstar)	13.21	90% Percentile	0.171
95% Percentile	0.199	99% Percentile	0.258

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
90% Approx. Gamma UTL with 90% Coverage	0.183	0.184	90% Approx. Gamma UPL	0.171	0.171
90% Gamma USL	0.326	0.341			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.103	SD (KM)	0.0549
Variance (KM)	0.00302	SE of Mean (KM)	0.00589
k hat (KM)	3.495	k star (KM)	3.397
nu hat (KM)	699	nu star (KM)	679.3
theta hat (KM)	0.0294	theta star (KM)	0.0302
80% gamma percentile (KM)	0.144	90% gamma percentile (KM)	0.177
95% gamma percentile (KM)	0.208	99% gamma percentile (KM)	0.274

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
90% Approx. Gamma UTL with 90% Coverage	0.172	0.17	90% Approx. Gamma UPL	0.161	0.16
90% KM Gamma Percentile	0.16	0.159	90% Gamma USL	0.287	0.291

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.915	**Shapiro Wilk GOF Test**	
10% Shapiro Wilk P Value	0.00106	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.141	**Lilliefors GOF Test**	
10% Lilliefors Critical Value	0.112	Data Not Lognormal at 10% Significance Level	

Data Not Lognormal at 10% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	0.104	Mean in Log Scale	-2.356
SD in Original Scale	0.0547	SD in Log Scale	0.414
90% UTL90% Coverage	0.174	90% BCA UTL90% Coverage	0.19
90% Bootstrap (%) UTL90% Coverage	0.19	90% UPL (t)	0.162
90% Percentile (z)	0.161	95% Percentile (z)	0.187

99% Percentile (z)	0.248	90% USL	0.331

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	-2.371	90% KM UTL (Lognormal)90% Coverage	0.168
KM SD of Logged Data	0.398	90% KM UPL (Lognormal)	0.157
90% KM Percentile Lognormal (z)	0.156	90% KM USL (Lognormal)	0.311

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	0.13	Mean in Log Scale	-2.391
SD in Original Scale	0.188	SD in Log Scale	0.659
90% UTL90% Coverage	0.241	90% UPL (t)	0.215
90% Percentile (z)	0.213	95% Percentile (z)	0.271
99% Percentile (z)	0.424	90% USL	0.672

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics
Data do not follow a Discernible Distribution

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	94	90% UTL with90% Coverage	0.33
Approx, f used to compute achieved CC	1.492	Approximate Actual Confidence Coefficient achieved by UTL	0.883
Approximate Sample Size needed to achieve specified CC	91	90% UPL	0.19
90% USL	2	90% KM Chebyshev UPL	0.268

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

result_value1 (lead)

General Statistics

Total Number of Observations	100	Number of Missing Observations	0
Number of Distinct Observations	95		
Number of Detects	98	Number of Non-Detects	2
Number of Distinct Detects	94	Number of Distinct Non-Detects	2
Minimum Detect	1.15	Minimum Non-Detect	2.15
Maximum Detect	36.4	Maximum Non-Detect	3.39
Variance Detected	29.67	Percent Non-Detects	2%
Mean Detected	5.498	SD Detected	5.447
Mean of Detected Logged Data	1.41	SD of Detected Logged Data	0.711

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.467	d2max (for USL)	3.024

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.678	**Normal GOF Test on Detected Observations Only**	
1% Shapiro Wilk P Value	0	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.225	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.104	Data Not Normal at 1% Significance Level	

Data Not Normal at 1% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	5.43	KM SD	5.386
90% UTL90% Coverage	13.33	90% KM UPL (t)	12.41
90% KM Percentile (z)	12.33	95% KM Percentile (z)	14.29
99% KM Percentile (z)	17.96	90% KM USL	21.72

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	5.416	SD	5.422
90% UTL90% Coverage	13.37	90% UPL (t)	12.45

90% Percentile (z)	12.37	95% Percentile (z)	14.34
99% Percentile (z)	18.03	90% USL	21.81

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	3.578	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.767	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.143	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.0917	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.849	k star (bias corrected MLE)	1.799
Theta hat (MLE)	2.973	Theta star (bias corrected MLE)	3.056
nu hat (MLE)	362.4	nu star (bias corrected)	352.7
MLE Mean (bias corrected)	5.498		
MLE Sd (bias corrected)	4.099	90% Percentile of Chisquare (2kstar)	7.177

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	5.404
Maximum	36.4	Median	3.39
SD	5.433	CV	1.005
k hat (MLE)	1.589	k star (bias corrected MLE)	1.548
Theta hat (MLE)	3.401	Theta star (bias corrected MLE)	3.491
nu hat (MLE)	317.8	nu star (bias corrected)	309.6
MLE Mean (bias corrected)	5.404	MLE Sd (bias corrected)	4.344
90% Percentile of Chisquare (2kstar)	6.402	90% Percentile	11.18
95% Percentile	13.93	99% Percentile	20.14

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
90% Approx. Gamma UTL with 90% Coverage	12.06	12.19	90% Approx. Gamma UPL	10.89	10.92
90% Gamma USL	26.97	29.59			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	5.43	SD (KM)	5.386
Variance (KM)	29.01	SE of Mean (KM)	0.541
k hat (KM)	1.016	k star (KM)	0.992
nu hat (KM)	203.2	nu star (KM)	198.5
theta hat (KM)	5.343	theta star (KM)	5.472
80% gamma percentile (KM)	8.744	90% gamma percentile (KM)	12.53
95% gamma percentile (KM)	16.31	99% gamma percentile (KM)	25.1

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
90% Approx. Gamma UTL with 90% Coverage	11.69	11.57	90% Approx. Gamma UPL	10.59	10.44
90% KM Gamma Percentile	10.5	10.35	90% Gamma USL	25.33	26.68

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.946	**Shapiro Wilk GOF Test**
10% Shapiro Wilk P Value	0.00115	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.104	**Lilliefors GOF Test**
10% Lilliefors Critical Value	0.0821	Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Appendix A-2
ProUCL Output – 90/90 Upper Tolerance Limits

Mean in Original Scale	5.429	Mean in Log Scale	1.396
SD in Original Scale	5.414	SD in Log Scale	0.712
90% UTL90% Coverage	11.47	90% BCA UTL90% Coverage	13.22
90% Bootstrap (%) UTL90% Coverage	13.22	90% UPL (t)	10.16
90% Percentile (z)	10.05	95% Percentile (z)	13.02
99% Percentile (z)	21.15	90% USL	34.75

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	1.396	90% KM UTL (Lognormal)90% Coverage	11.41
KM SD of Logged Data	0.708	90% KM UPL (Lognormal)	10.12
90% KM Percentile Lognormal (z)	10.01	90% KM USL (Lognormal)	34.39

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	5.416	Mean in Log Scale	1.388
SD in Original Scale	5.422	SD in Log Scale	0.721
90% UTL90% Coverage	11.54	90% UPL (t)	10.21
90% Percentile (z)	10.1	95% Percentile (z)	13.13
99% Percentile (z)	21.46	90% USL	35.5

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics
Data do not follow a Discernible Distribution

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	94	90% UTL with90% Coverage	15.3
Approx, f used to compute achieved CC	1.492	Approximate Actual Confidence Coefficient achieved by UTL	0.883
Approximate Sample Size needed to achieve specified CC	91	90% UPL	12.29
90% USL	36.4	90% KM Chebyshev UPL	21.67

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

result_value1 (mercury)

General Statistics

Total Number of Observations	100	Number of Missing Observations	0
Number of Distinct Observations	91		
Number of Detects	94	Number of Non-Detects	6
Number of Distinct Detects	86	Number of Distinct Non-Detects	6
Minimum Detect	0.00716	Minimum Non-Detect	0.0238
Maximum Detect	0.391	Maximum Non-Detect	0.03
Variance Detected	0.00246	Percent Non-Detects	6%
Mean Detected	0.0363	SD Detected	0.0496
Mean of Detected Logged Data	-3.694	SD of Detected Logged Data	0.755

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.467	d2max (for USL)	3.024

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.515	**Normal GOF Test on Detected Observations Only**	
1% Shapiro Wilk P Value	0	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.318	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.106	Data Not Normal at 1% Significance Level	

Data Not Normal at 1% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	0.0351	KM SD	0.0481
90% UTL90% Coverage	0.106	90% KM UPL (t)	0.0974
90% KM Percentile (z)	0.0967	95% KM Percentile (z)	0.114

99% KM Percentile (z)	0.147	90% KM USL	0.18

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	0.0349	SD	0.0484
90% UTL90% Coverage	0.106	90% UPL (t)	0.0976
90% Percentile (z)	0.0969	95% Percentile (z)	0.114
99% Percentile (z)	0.147	90% USL	0.181

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	5.553	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.771	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.197	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.0941	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.471	k star (bias corrected MLE)	1.431
Theta hat (MLE)	0.0247	Theta star (bias corrected MLE)	0.0253
nu hat (MLE)	276.5	nu star (bias corrected)	269
MLE Mean (bias corrected)	0.0363		
MLE Sd (bias corrected)	0.0303	90% Percentile of Chisquare (2kstar)	6.032

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.00716	Mean	0.0347
Maximum	0.391	Median	0.0204
SD	0.0485	CV	1.395
k hat (MLE)	1.445	k star (bias corrected MLE)	1.408
Theta hat (MLE)	0.024	Theta star (bias corrected MLE)	0.0247
nu hat (MLE)	289	nu star (bias corrected)	281.7
MLE Mean (bias corrected)	0.0347	MLE Sd (bias corrected)	0.0293
90% Percentile of Chisquare (2kstar)	5.96	90% Percentile	0.0735
95% Percentile	0.0924	99% Percentile	0.135

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
90% Approx. Gamma UTL with 90% Coverage	0.0783	0.0762	90% Approx. Gamma UPL	0.0703	0.0681
90% Gamma USL	0.182	0.188			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0351	SD (KM)	0.0481
Variance (KM)	0.00231	SE of Mean (KM)	0.00483
k hat (KM)	0.534	k star (KM)	0.524
nu hat (KM)	106.7	nu star (KM)	104.9
theta hat (KM)	0.0658	theta star (KM)	0.067
80% gamma percentile (KM)	0.0578	90% gamma percentile (KM)	0.0941
95% gamma percentile (KM)	0.133	99% gamma percentile (KM)	0.227

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
90% Approx. Gamma UTL with 90% Coverage	0.0781	0.0761	90% Approx. Gamma UPL	0.0703	0.0681
90% KM Gamma Percentile	0.0696	0.0674	90% Gamma USL	0.179	0.185

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.923	**Shapiro Wilk GOF Test**	
10% Shapiro Wilk P Value	8.2261E-6	Data Not Lognormal at 10% Significance Level	

Lilliefors Test Statistic	0.115	**Lilliefors GOF Test**	
10% Lilliefors Critical Value	0.0838	Data Not Lognormal at 10% Significance Level	

Data Not Lognormal at 10% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	0.0351	Mean in Log Scale	-3.715
SD in Original Scale	0.0483	SD in Log Scale	0.737
90% UTL90% Coverage	0.0718	90% BCA UTL90% Coverage	0.0904
90% Bootstrap (%) UTL90% Coverage	0.0904	90% UPL (t)	0.0633
90% Percentile (z)	0.0626	95% Percentile (z)	0.0818
99% Percentile (z)	0.135	90% USL	0.226

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	-3.72	90% KM UTL (Lognormal)90% Coverage	0.0718
KM SD of Logged Data	0.741	90% KM UPL (Lognormal)	0.0633
90% KM Percentile Lognormal (z)	0.0626	90% KM USL (Lognormal)	0.228

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	0.0349	Mean in Log Scale	-3.73
SD in Original Scale	0.0484	SD in Log Scale	0.746
90% UTL90% Coverage	0.0717	90% UPL (t)	0.0631
90% Percentile (z)	0.0624	95% Percentile (z)	0.0819
99% Percentile (z)	0.136	90% USL	0.229

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics
Data do not follow a Discernible Distribution

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	94	90% UTL with90% Coverage	0.105
Approx, f used to compute achieved CC	1.492	Approximate Actual Confidence Coefficient achieved by UTL	0.883
Approximate Sample Size needed to achieve specified CC	91	90% UPL	0.0838
90% USL	0.391	90% KM Chebyshev UPL	0.18

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

result_value1 (total cpah teq (7 minimum caepa 2005) (u = 1/2 max limit))

General Statistics

Total Number of Observations	100	Number of Missing Observations	0
Number of Distinct Observations	65		
Number of Detects	59	Number of Non-Detects	41
Number of Distinct Detects	50	Number of Distinct Non-Detects	19
Minimum Detect	3.7	Minimum Non-Detect	13.7
Maximum Detect	788	Maximum Non-Detect	20
Variance Detected	10291	Percent Non-Detects	41%
Mean Detected	39.37	SD Detected	101.4
Mean of Detected Logged Data	3.11	SD of Detected Logged Data	0.796

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.467	d2max (for USL)	3.024

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.264	**Normal GOF Test on Detected Observations Only**	
1% Shapiro Wilk P Value	0	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.363	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.133	Data Not Normal at 1% Significance Level	

Data Not Normal at 1% Significance Level

Appendix A-2
ProUCL Output – 90/90 Upper Tolerance Limits

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	28.81	KM SD	78.32
90% UTL90% Coverage	143.7	90% KM UPL (t)	130.4
90% KM Percentile (z)	129.2	95% KM Percentile (z)	157.6
99% KM Percentile (z)	211	90% KM USL	265.6

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	27.1	SD	79.05
90% UTL90% Coverage	143	90% UPL (t)	129.6
90% Percentile (z)	128.4	95% Percentile (z)	157.1
99% Percentile (z)	211	90% USL	266.1

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	6.184	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.779	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.244	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.119	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.022	k star (bias corrected MLE)	0.982
Theta hat (MLE)	38.52	Theta star (bias corrected MLE)	40.12
nu hat (MLE)	120.6	nu star (bias corrected)	115.8
MLE Mean (bias corrected)	39.37		
MLE Sd (bias corrected)	39.74	90% Percentile of Chisquare (2kstar)	4.541

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	24.54
Maximum	788	Median	14
SD	79.83	CV	3.253
k hat (MLE)	0.269	k star (bias corrected MLE)	0.268
Theta hat (MLE)	91.12	Theta star (bias corrected MLE)	91.6
nu hat (MLE)	53.87	nu star (bias corrected)	53.59
MLE Mean (bias corrected)	24.54	MLE Sd (bias corrected)	47.41
90% Percentile of Chisquare (2kstar)	1.599	90% Percentile	73.25
95% Percentile	116.3	99% Percentile	229.9

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
90% Approx. Gamma UTL with 90% Coverage	74.31	82.41	90% Approx. Gamma UPL	61.61	65.69
90% Gamma USL	279.1	422.3			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	28.81	SD (KM)	78.32
Variance (KM)	6134	SE of Mean (KM)	7.905
k hat (KM)	0.135	k star (KM)	0.138
nu hat (KM)	27.06	nu star (KM)	27.58
theta hat (KM)	212.9	theta star (KM)	208.9
80% gamma percentile (KM)	29.14	90% gamma percentile (KM)	84.27
95% gamma percentile (KM)	161	99% gamma percentile (KM)	387.7

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
90% Approx. Gamma UTL with 90% Coverage	62.57	58.03	90% Approx. Gamma UPL	55.88	51.8

90% KM Gamma Percentile	55.31	51.28	90% Gamma USL	150.2	144.6

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.873	**Shapiro Wilk GOF Test**	
10% Shapiro Wilk P Value	1.5002E-6	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.166	**Lilliefors GOF Test**	
10% Lilliefors Critical Value	0.105	Data Not Lognormal at 10% Significance Level	

Data Not Lognormal at 10% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	28.81	Mean in Log Scale	2.883
SD in Original Scale	78.74	SD in Log Scale	0.702
90% UTL90% Coverage	50.03	90% BCA UTL90% Coverage	53.6
90% Bootstrap (%) UTL90% Coverage	53.5	90% UPL (t)	44.39
90% Percentile (z)	43.93	95% Percentile (z)	56.69
99% Percentile (z)	91.49	90% USL	149.3

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	2.887	90% KM UTL (Lognormal)90% Coverage	49.83
KM SD of Logged Data	0.697	90% KM UPL (Lognormal)	44.26
90% KM Percentile Lognormal (z)	43.8	90% KM USL (Lognormal)	147.5

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	27.1	Mean in Log Scale	2.753
SD in Original Scale	79.05	SD in Log Scale	0.748
90% UTL90% Coverage	47.02	90% UPL (t)	41.4
90% Percentile (z)	40.94	95% Percentile (z)	53.72
99% Percentile (z)	89.45	90% USL	150.7

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics
Data do not follow a Discernible Distribution

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	94	90% UTL with90% Coverage	59
Approx, f used to compute achieved CC	1.492	Approximate Actual Confidence Coefficient achieved by UTL	0.883
Approximate Sample Size needed to achieve specified CC	91	90% UPL	47.12
90% USL	788	90% KM Chebyshev UPL	264.9

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

result_value1 (total pcb aroclors (sms marine 2019) (u = 1/2 max limit))

General Statistics

Total Number of Observations	100	Number of Missing Observations	0
Number of Distinct Observations	28		
Number of Detects	20	Number of Non-Detects	80
Number of Distinct Detects	19	Number of Distinct Non-Detects	9
Minimum Detect	15	Minimum Non-Detect	2.8
Maximum Detect	330	Maximum Non-Detect	4
Variance Detected	5004	Percent Non-Detects	80%
Mean Detected	55.4	SD Detected	70.74
Mean of Detected Logged Data	3.637	SD of Detected Logged Data	0.778

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.467	d2max (for USL)	3.024

Normal GOF Test on Detects Only

Appendix A-2
ProUCL Output – 90/90 Upper Tolerance Limits

Shapiro Wilk Test Statistic	0.548	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.868	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.335	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.223	Data Not Normal at 1% Significance Level	

Data Not Normal at 1% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	13.32	KM SD	37.33
90% UTL90% Coverage	68.06	90% KM UPL (t)	61.72
90% KM Percentile (z)	61.15	95% KM Percentile (z)	74.72
99% KM Percentile (z)	100.2	90% KM USL	126.2

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	12.61	SD	37.72
90% UTL90% Coverage	67.93	90% UPL (t)	61.52
90% Percentile (z)	60.95	95% Percentile (z)	74.65
99% Percentile (z)	100.4	90% USL	126.7

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.302	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.758	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.219	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.198	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.468	k star (bias corrected MLE)	1.281
Theta hat (MLE)	37.73	Theta star (bias corrected MLE)	43.23
nu hat (MLE)	58.73	nu star (bias corrected)	51.25
MLE Mean (bias corrected)	55.4		
MLE Sd (bias corrected)	48.94	90% Percentile of Chisquare (2kstar)	5.55

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	11.09
Maximum	330	Median	0.01
SD	38.16	CV	3.442
k hat (MLE)	0.144	k star (bias corrected MLE)	0.146
Theta hat (MLE)	76.91	Theta star (bias corrected MLE)	75.68
nu hat (MLE)	28.83	nu star (bias corrected)	29.3
MLE Mean (bias corrected)	11.09	MLE Sd (bias corrected)	28.97
90% Percentile of Chisquare (2kstar)	0.866	90% Percentile	32.76
95% Percentile	61.3	99% Percentile	144.5

The following statistics are computed using Gamma ROS Statistics on Imputed Data

Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
90% Approx. Gamma UTL with 90% Coverage	24.67	19.91	90% Approx. Gamma UPL	19.13	14.62
90% Gamma USL	131.1	158.7			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	13.32	SD (KM)	37.33
Variance (KM)	1393	SE of Mean (KM)	3.83
k hat (KM)	0.127	k star (KM)	0.13
nu hat (KM)	25.46	nu star (KM)	26.03
theta hat (KM)	104.6	theta star (KM)	102.3
80% gamma percentile (KM)	12.74	90% gamma percentile (KM)	38.51
95% gamma percentile (KM)	75.14	99% gamma percentile (KM)	184.8

Appendix A-2
ProUCL Output – 90/90 Upper Tolerance Limits

The following statistics are computed using gamma distribution and KM estimates

Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
90% Approx. Gamma UTL with 90% Coverage	33.24	30.42	90% Approx. Gamma UPL	28.48	25.85
90% KM Gamma Percentile	28.09	25.47	90% Gamma USL	103.3	105.6

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.901	**Shapiro Wilk GOF Test**
10% Shapiro Wilk Critical Value	0.92	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.143	**Lilliefors GOF Test**
10% Lilliefors Critical Value	0.176	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	13.38	Mean in Log Scale	1.105
SD in Original Scale	37.59	SD in Log Scale	1.707
90% UTL90% Coverage	36.91	90% BCA UTL90% Coverage	45.4
90% Bootstrap (%) UTL90% Coverage	45.4	90% UPL (t)	27.61
90% Percentile (z)	26.91	95% Percentile (z)	50.03
99% Percentile (z)	160.1	90% USL	526.8

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	1.551	90% KM UTL (Lognormal)90% Coverage	23.56
KM SD of Logged Data	1.097	90% KM UPL (Lognormal)	19.55
90% KM Percentile Lognormal (z)	19.23	90% KM USL (Lognormal)	129.9

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	12.61	Mean in Log Scale	1.247
SD in Original Scale	37.72	SD in Log Scale	1.25
90% UTL90% Coverage	21.75	90% UPL (t)	17.59
90% Percentile (z)	17.26	95% Percentile (z)	27.18
99% Percentile (z)	63.69	90% USL	152.3

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics

Data appear to follow a Discernible Distribution

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	94	90% UTL with90% Coverage	49
Approx, f used to compute achieved CC	1.492	Approximate Actual Confidence Coefficient achieved by UTL	0.883
Approximate Sample Size needed to achieve specified CC	91	90% UPL	35.31
90% USL	330	90% KM Chebyshev UPL	125.9

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

Appendix B
Water Quality Monitoring and Protection Plan

CONFLUENCE
ENVIRONMENTAL COMPANY

Tru-Grit Sediment Remediation

WATER QUALITY MONITORING AND PROTECTION PLAN

Prepared for:

Port of Tacoma

June 2026

146 N Canal Street, Suite 111 • Seattle, WA 98103 • www.confenv.com

Tru-Grit Sediment Remediation
WATER QUALITY MONITORING AND PROTECTION PLAN

Prepared for:

Port of Tacoma
One Sitcum Plaza
Tacoma, WA 98401

Prepared by:

Confluence Environmental Company

June 2026

This report should be cited as:

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APPENDICES

Appendix A – Example Sampling Map

Appendix B – Example Intensive Monitoring Form (from original WQMPP)

Appendix C – Example Visual Monitoring Form (from original WQMPP)

Appendix D – Multimeter Calibration Worksheet (from original WQMPP)

Appendix E – Daily Log (from original WQMPP)

Appendix F – Daily Safety Briefing (from original WQMPP)

ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
BMPs	best management practices
Corps	U.S. Army Corps of Engineers
CWA	Clean Water Act
cy	cubic yard
CZMP	Washington State Coastal Zone Management Program
DMMU	dredged material management unit
Ecology	Washington State Department of Ecology
ESC	erosion and spill control
FNC	federal navigation channel
GPS	global positioning system
H:V	horizontal to vertical ratio
MHHW	mean higher high water
MTCA	Model Toxics Control Act
NTU	nephelometric turbidity units
PAHs	polycyclic aromatic hydrocarbons
POC	point of compliance
Port	Port of Tacoma
the project	Tru-Grit Sediment Remediation Project
RMC	residuals management cover
SMS	Sediment Management Standards
SPCC	spill prevention, control, and countermeasure
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington State Department of Natural Resources
WQC	Water Quality Certification
WQMP	Water Quality Monitoring Plan
WQMR	Water Quality Monitoring Report

1.0 INTRODUCTION

The Port of Tacoma (Port) requests Washington State Department of Ecology's (Ecology) pre-construction approval in order to perform a beneficial dredging activity under the Comprehensive Mitigated Repair and Maintenance Programmatic (U.S. Army Corps of Engineers [Corps] Reference NWS-2024-446). This Water Quality Monitoring and Protection Plan (WQMPP) has been revised to specifically address monitoring during the Tru-Grit Sediment Remediation Project (the project), and to be consistent with Water Quality Certification (WQC; Section 401 of the Clean Water Act [CWA]) Order No. 23740, the associated certificate of consistency with the Washington State Coastal Zone Management Program (CZMP), and other permit conditions.

The Port proposes to remove contaminated sediments present in the lower slope of the Tru-Grit site in the northeastern side of the Blair Waterway in Tacoma, Washington (Figure 1). Contaminated sediments must be removed before the Corps can deepen the federal navigation channel (FNC) under the Tacoma Harbor Deepening in order to prevent contaminants from sloughing into the FNC. Cleaning up contaminated sediments will enhance aquatic habitat and lower the possibility of contaminant-related health risks for marine life, including Endangered Species Act (ESA)-listed aquatic species present in Commencement Bay and the Blair Waterway, as described in the Project Benefits to ESA-Listed Species Memorandum (see application package). The Port proposes to perform this independent cleanup action as a beneficial activity under the CMMP in accordance with the CMMP requirements for dredge projects.

The proposed cleanup actions are on a Port-owned parcel (2275200292) with an upland address at 1110 East Alexander Avenue. All in-water activities will be done in the marine subtidal zone below -20 feet mean lower water (MLLW). Dredged materials and excess water will be routed to a Port-owned transloading facility (0321362046) with an existing permitted upland conveyance and stormwater treatment system managed under a construction stormwater general permit (CSGP) and Phase 1 Municipal Separate Storm Sewer System (MS4) stormwater permit. Contaminated materials will be disposed of an approved upland landfill.

Under Section 401 of the CWA, state jurisdictions are given the responsibility to enforce water quality standards for projects requiring federal permits. In the State of Washington, Ecology is the agency tasked with permitting actions and ensuring that the established water quality standards are upheld. The Port has a WQC (Order No. 23740) for programmatic maintenance, repair, and scientific sampling in Commencement Bay.

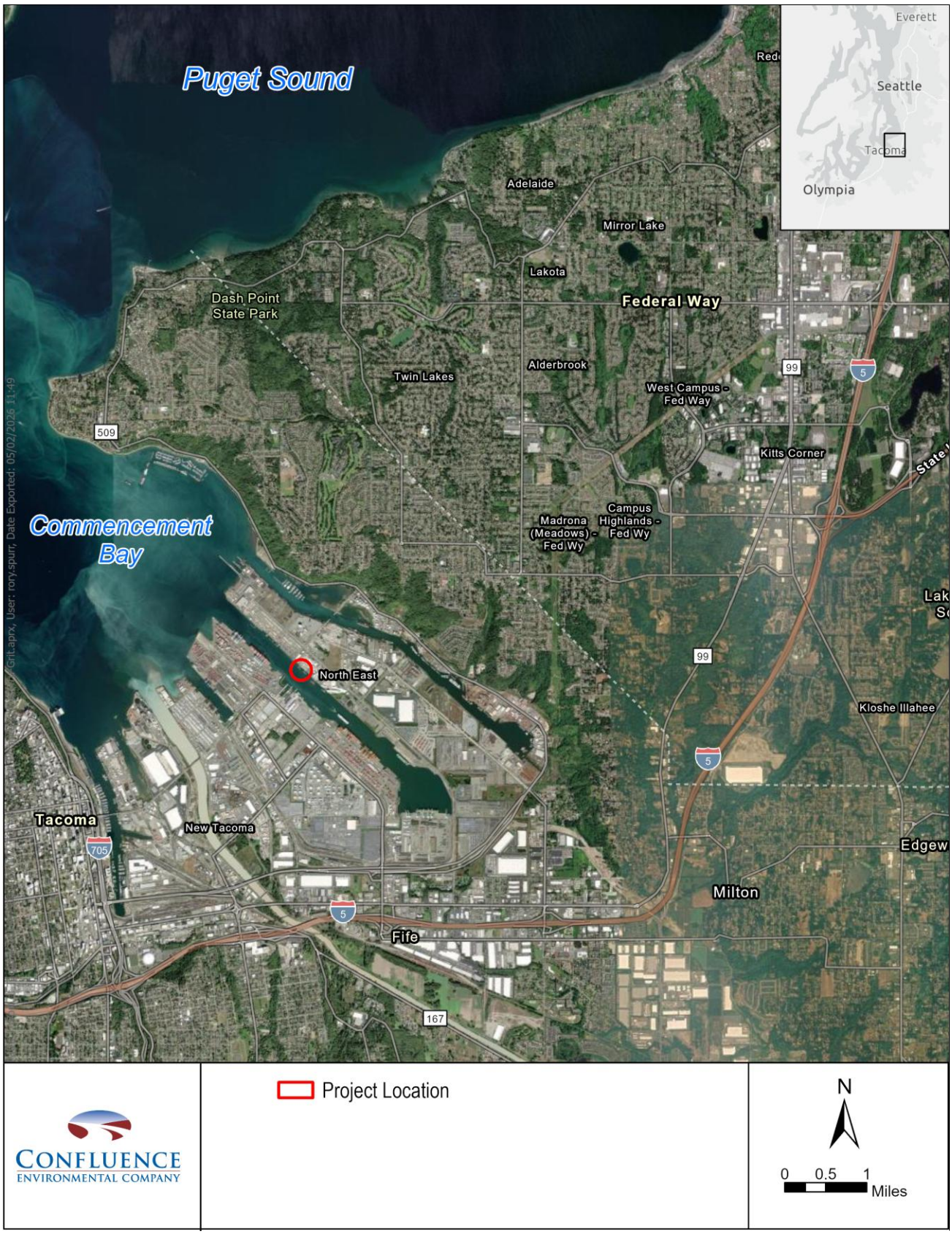


Figure 1. Vicinity Map

The project is covered under this WQC but according to Condition D.6, "The Project Proponent shall revise the Water Quality Monitoring and Protection Plan (WQMPP), identified in Table 1, to be consistent with the conditions of this WQC Order, as described in the WQMPP. The revised WQMPP shall be submitted to Ecology's Federal Permit Manager (per Condition A.2 of this Order) for review at least 90 days prior to beginning any work covered by this WQC Order. The WQMPP may be included in the Port's Project Information Form (identified in Table 1)."

This document provides a revision specific to the project in the Blair Waterway.

1.1 Objectives

This WQMPP will:

- Ensure that water quality conditions are within the prescribed limits required by Ecology's 401 WQC, WAC 173-201A, and described in this plan while conducting in-water activities that temporarily disturb the sediment.
- Allow for appropriate adjustment of construction activities in a manner that ensures protection of the natural environment during construction.
- Document the performance criteria of best management practices (BMPs) and procedures used within waters of Commencement Bay and the Blair Waterway in which the project is working.

The WQMPP includes identification of the appropriate parameters to be monitored, locations, sampling procedures, and frequency. It also contains the BMPs and construction procedures that will be used to reduce impacts to waters of the state.

2.0 PROJECT SUMMARY

Contaminated sediments will be removed by mechanical dredging and will be disposed of at a permitted upland Subtitle D landfill site. Following confirmation of contaminated sediment removal, clean residuals management cover (RMC) will be placed throughout the dredged area. Finally, the contaminated sediments will be removed by mechanical dredging, processed at a Port-owned transloading facility, and disposed of at a permitted upland Subtitle D landfill site. Excess water will be treated using the existing stormwater treatment facility at the transload site.

The project work area includes two sediment removal areas (Figure 2), as identified in the bullets following Figure 2.

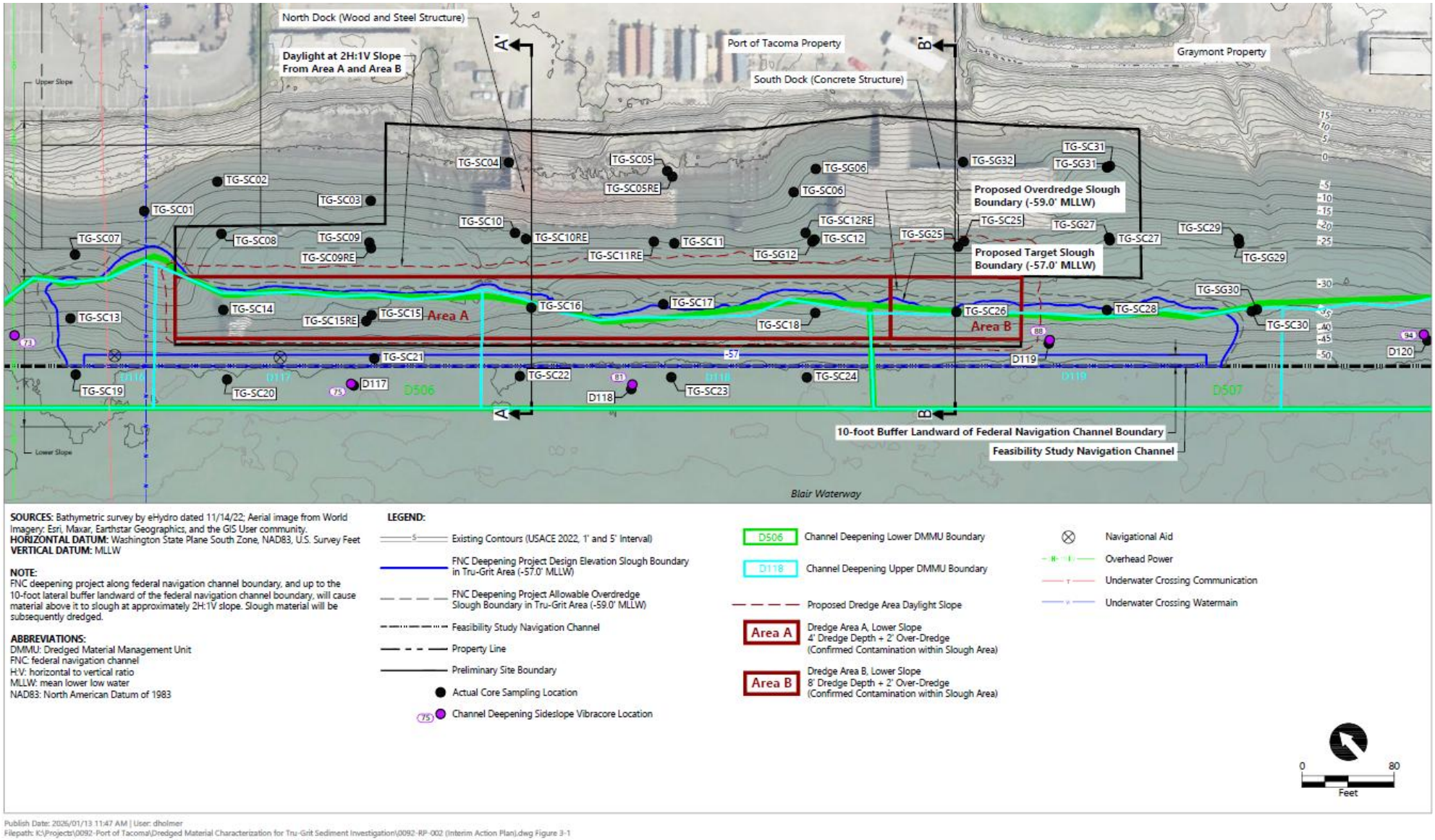


Figure 2. Proposed Sediment Removal Area

Source: Anchor QEA (2026b)

- Area A is located offshore of the Tru-Grit dock and overlaps with portions of the Corps FNC Tacoma Harbor Deepening dredged material management units (DMMUs) D117 and D118 (also subsurface DMMUs D506 and D507). The depth of sediments currently exceeding the performance standards is 4 feet below mudline. Preliminary estimates of removal volumes are summarized in ◎ and include a conservative 2-foot overdredge allowance and estimated side slope volumes calculated using a 2H:1V (horizontal to vertical ratio) side slope assumption. The estimated removal volumes for Area A are between 5,767 cubic yards (cy; no overdredge allowance) and 9,062 cy (full 2-foot overdredge allowance). These volumes do not include contingency re-dredging.
- Area B is located offshore of the Powers dock and overlaps with portions of the Corps FNC Tacoma Harbor Deepening DMMU D119 (also subsurface DMMU D507). The depth of sediments exceeding the performance standards is 8 feet below mudline. Preliminary estimates of removal volumes are summarized in ◎ and range between 2,723 cy (no overdredge allowance) and 3,637 cy (full 2-foot overdredge allowance). These volumes do not include contingency re-dredging.

Table 1. Estimated sediment removal quantities

Dredge Area Name	Design Depth (ft below mudline)	Total Volume (cy)	Maximum Allowable Over Dredge Depth (ft below mudline)	Total Volume with Maximum Allowable Over Dredge (cy)
Area A	4	5,767	6	9,062
Area B	8	2,723	10	3,637
Total	**-**	**8,490**	**-**	**12,699**

cy = cubic yard; ft = foot

Performance monitoring will be performed within the dredge areas to confirm that performance standards have been met. Details on performance standards can be found in Table 3-1 of the Anchor QEA (2026) report. If missed inventory is identified in that monitoring, then contingency re-dredging may be required of affected areas.

After performance testing and any associated contingency re-dredging, a 6-inch minimum layer of RMC material will be placed over the entire dredged area (both Areas A and B). To stay in place, RMC material requires a maximum slope grade of approximately 3H:1V. Therefore, in areas where the post-dredge slope grade is steeper than 3H:1V, the RMC material thickness will need to be increased to reduce the final slope grade to 3H:1V or shallower. Table 2 includes a preliminary minimum volume estimate of 1,052 cy for the RMC placement based on a 6-inch minimum lift. Actual RMC material placement volumes will be higher than those values due to over-placement allowance and the need to provide additional material to stabilize the RMC material on the upper side slopes. The final RMC material placement volumes will be determined during remedial design.

Table 2. Estimated RMC Placement Quantities

Dredge Area Name	Surface Area (sf)	Minimum Estimated RMC Volume (cy)
Area A	44,483	824
Area B	12,347	229
Total	**56,830**	**1,052**
cy = cubic yard; sf = square feet; RMC = residuals management cover		

Compliance monitoring will be performed after RMC material placement to confirm that all performance standards have been met.

2.1 Best Management Practices

BMPs will be employed during dredging to minimize and avoid temporary effects to water quality and the aquatic environment. The contractor will be responsible for selecting and implementing BMPs to comply with the 401 WQC and State water quality criteria at the designated compliance boundary.

2.1.1 Dredging BMPs

- BMPs to minimize sediment loss and turbidity generation during dredging:
  - Removing large debris where practicable prior to dredging in known debris areas
  - Avoiding overfilling of dredge bucket
  - If bucket does not close, move to over barge as soon as possible
  - Eliminating multiple bites while the bucket is on the seafloor
  - No stockpiling of dredged material below mean higher high water (MHHW)
  - No seafloor leveling
  - Placing filter material over the barge scuppers to clear water return
- If water quality monitoring is showing the above BMPs to be ineffective, enhanced BMPs below may be implemented:
  - Slowing the velocity of the ascending loaded clamshell bucket through the water column
  - Pausing the dredge bucket near the bottom while descending and near the water line will ascending

  - A floating silt curtain may be placed around the in-water dredge area to minimize the dispersion of suspended sediment during completion of dredging activities

- Mechanical dredging equipment will be used for dredging and sediment handling activities. Use of any other type of dredging techniques requires preapproval from the Corps, Ecology, and Washington Department of Fish and Wildlife (WDFW).
- Slope dredging will be initiated at the top of the slope and then proceed in the down-slope direction.
- In-water activities will be limited to periods determined appropriate by participating state and federal agencies to avoid potential adverse effects on migratory fish.
- All equipment shall be inspected daily to ensure that it is in proper working condition.
- The contractor shall utilize real-time positioning control when implementing dredging
- The contractor shall develop a Construction Workplan that will be submitted to the Corps and Ecology.

2.1.2 BMPs for Barge Use and Operation

- Barges will be restricted to tide elevations adequate to prevent grounding of the barge.
- Barge anchors will not be placed in contaminated sediments unless specified by Ecology.
- Whenever feasible, the barge location will be fixed through the use of methods that do not disturb sediments (e.g., mooring dolphins, docks, piers, and upland structures).
- Motorized vessel operation will be restricted to tidal elevations adequate to prevent prop scour disturbance to the sediments.
- Minimal propulsion power will be used when maneuvering barges or other vessels to prevent prop scour disturbance to the sediments.
- Barges will be managed such that the dredged sediment load does not exceed the capacity of the barge. The load will be placed in the barge to maintain an even keel and avoid listing. All barges handling dredged materials within the site will have hay bales and/or filter fabric placed over the barge scuppers to help filter suspended sediment from the barge effluent. The contractor will not allow effluent to overflow or bypass these turbidity controls. If sealed barges are used within the site (rather than using the treatment BMPs), no overflow of untreated water or suspended sediment from the sealed barges shall be permitted within the site.

- Haul barges will be loaded evenly to maintain barge stability.
- Haul barges will be filled to less than 90% capacity to reduce the potential for spillage or overflow.
- Once the barge is loaded and stabilized, it will be inspected for sediment adhered to the outside of the barge that could fall off the barge during transport. Contractor personnel will conduct a visual inspection around the entire barge deck area to remove such sediment before moving the barge out of the site.
- Barges must be sealed with no return water in transit to the transloading site.
- Dewatering is not allowed at the transload site.
- No petroleum products or other deleterious materials will enter surface waters.

2.1.3 BMPs for Spill Prevention and Control

- Dredge vessel personnel will be trained in hazardous material handling and spill response and will be equipped with appropriate response tools, including adsorbent oil booms. If a spill occurs, spill cleanup and containment efforts will begin immediately and will take precedence over completion of normal work.
- The dredging contractor will be responsible for the preparation of a Spill Prevention, Control, and Countermeasure (SPCC) Plan to be used for the duration of the Project. The plan will be submitted to the project engineer as a pre-construction submittal prior to the commencement of any construction activities. A copy of the plan with any updates will be maintained at the work site by the contractor.
- The SPCC Plan will identify construction planning elements and recognize potential spill sources at the site. The SPCC Plan will outline responsive actions in the event of a spill or release and will describe notification and reporting procedures. The SPCC Plan will outline contractor management elements, such as personnel responsibilities, project site security, site inspections, and training.
- The SPCC Plan will outline the measures that will be taken by the contractor to prevent the release or spread of hazardous materials, either found on site and encountered during construction but not identified in contract documents or any hazardous materials that the contractor stores, uses, or generates on the construction site during construction activities. These items include, but are not limited to, gasoline, oils, and chemicals.

2.1.4 Additional Conservation Measures

- Spills, sheens, and/or conditions resulting in distressed or dying fish shall be reported immediately to Ecology's Northwest Regional Spill Response Office at (425) 649-7000 (a

24-hour phone number), the Washington Emergency Management Division at (800-258-5990), and the National Response Center at 1-800-424-8802.

- If fish are observed in distress or a fish kill occurs, work will stop immediately. WDFW, Ecology and other necessary agencies will be contacted, and work will not resume until further approval is given.
- Stormwater management will adhere to the requirements set forth in the Phase 1 Municipal Separate Storm Sewer System (MS4) permit administered by Ecology and the Port's internal Maritime Stormwater Management Program.

3.0 WATER QUALITY STANDARDS FOR SURFACE WATERS

Ecology establishes surface water quality standards (Chapter 173-201A WAC) as required by the Environmental Protection Agency. All surface waters of the state have uses designated to them for protection under this chapter. These standards are intended to protect surface waters of the state for beneficial uses. These uses include public health, recreation, and the propagation and protection of fish, shellfish, and wildlife. Surface waters of the state include lakes, rivers, ponds, streams, inland waters, salt water, wetlands, and all other surface waters and water courses within the jurisdiction of the State of Washington.

The aquatic life use designated for marine waters of inner Commencement Bay is listed as "good" quality, per WAC 173-201A-612 (Table 3). The aquatic life use criteria for the good quality designation are detailed in WAC 173-201A-210(1).

Table 3. Aquatic Use Criteria by Waterbody

Waterbody	Parameters	Criteria
Good	Turbidity	Turbidity must not exceed: ▪ 10 NTU over background when the background is 50 NTU or less; or ▪ A 20% increase in turbidity when the background turbidity is more than 50 NTU.
	Fish	No visible sign of distress in the Project Area
	Oil and sheen	No visible sheen anywhere in the Project Area
NTU = nephelometric turbidity units		

According to WAC 173-201A-210(1)(e)(i), the turbidity criteria shall be modified to allow a temporary area of mixing during and immediately after necessary in-water construction activities that result in the disturbance of in-place sediments. The point of compliance (POC) for a temporary area of mixing is a radius of 150 feet from the activity causing the turbidity exceedance.

4.0 MONITORING PLAN

The monitoring plan is separated into the following sections: (1) frequency and schedule, (2) monitoring duration, (3) contingency monitoring/measures, (4) sampling personnel, (5) parameters and sampling equipment, and (6) sampling locations.

4.1 Frequency and Schedule

Water quality will be monitored at the start of dredging and will be reduced if no confirmed exceedances are measured. Intensive monitoring for the first 5 days will use a multi-parameter meter (see Section 4.5 *Parameters and Sampling Equipment*). If no confirmed exceedances are measured, metered water quality will be measured 1 time per week alongside visual monitoring twice daily when metered monitored does not occur. If visual monitoring indicates a potential exceedance in water quality standards, intensive monitoring will resume (Table 4).

Table 4. Monitoring Schedule

Work Area	Work Activity	Monitoring Point Locations*	Frequency**	Parameter	Water Quality Standard
In-water (Blair Waterway)	Dredging	▪ Warning Point (75 feet) ▪ POC (150 feet) ▪ Background (300 feet)	First 5 days, then once a week with visual monitoring 2x daily; and after triggering event	Turbidity	Intensive monitoring for 10 NTU over background when background is 50 NTU; or 20% increase over background when background is more than 50 NTU
				Fish	Sign of distress anywhere in the project area
				Oil Sheen	Visible oil sheen anywhere in the project area

NTU = nephelometric turbidity units; POC = point of compliance
* See Appendix A for example sampling locations.
** Reducing frequency after 5 days is dependent on monitoring results showing compliance with water quality standards and agreement from Ecology.

Intensive monitoring will occur twice daily for the first 5 days of work, with the first sample being taken about 15 minutes to 1 hour after dredging starts and the last sample being about 4 hours after initial monitoring or at least 1 hour prior to stop work for the day. Intensive monitoring will be done from a separate boat and will be conducted at the start of work and each time a triggering event occurs. A triggering event is defined as any significant change in activity or condition. Examples include use of a new piece of construction equipment, a change in construction methods (i.e., adding a turbidity curtain), a storm event, or visible turbidity. If a triggering event occurs, then intensive sampling will occur again for 5 days (i.e., restart the sampling protocols). Specific identification of triggering events will be the responsibility of the contractor-designated water quality monitoring lead (i.e., erosion and spill control [ESC] lead). If monitoring is within the water quality criteria for the first 5 days and no triggering event

occurs, then monitoring will shift to metered monitoring once a week and visual monitoring two times daily (see below for additional information).

Intensive monitoring point locations will include the POC, background station(s), and a point halfway between the POC and work activity as an early warning (see Appendix A for an example). Coordinates during intensive monitoring will be collected for each sample point using a global positioning system (GPS) and recorded on a data form (see Appendix B for an example). If there is an exceedance, data will be collected beyond the POC to confirm the extent of the exceedance. Section 4.3 (*Contingency Monitoring/Measures*) provides additional information if an exceedance is identified at the POC.

Visual monitoring will be done either from the construction barge or a separate boat, depending on site conditions and safety. If there are visible signs of turbidity during dredging, then intensive monitoring will resume. Any signs of fish distress will be monitored, and any visible oil sheen will also be visually monitored. Visual monitoring will occur continuously for the entire duration of the activity. Basic information will be collected during visual monitoring (see Appendix C for an example).

The following steps outline the water quality monitoring process:

- Intensive Monitoring – Background stations:
  - Collect a sample before dredging activities begin; and
  - Collect samples at the top (2-3 feet below water surface), mid depth, and bottom (2-3 feet above substrate surface) of the water column at the same frequency as other monitoring locations.
  - Data for each monitoring depth will be presented separately (i.e., not averaged).
- Intensive Monitoring – Monitoring locations:
  - Collect a sample at the POC at the same monitoring depths noted above; and
  - Collect a sample halfway between the work activity and the POC as an early warning for potential water quality exceedances. If turbidity is elevated at the early warning location, BMPs would be checked and adjusted, as necessary, to prevent an exceedance at the POC.
- Intensive Monitoring – Monitoring frequency:
  - Start sampling 15 minutes to 1 hour after work begins;
  - Collect a sample twice daily for first 5 days;
  - Collect a final sample about 4 hours from the initial sample or at least 1 hour after activities end; and
  - Collect samples for 5 days after dredging activities begin and 1 time per week after first 5 days unless there is a triggering event that will result in continuing intensive monitoring (e.g., visible turbidity).

- Visual Monitoring:
  - Relevant if no confirmed exceedances are measured after 5 days of intensive monitoring;
  - Frequency is twice daily until the end of the work if no visible turbidity or triggering event; and
  - Triggers intensive monitoring if there are visible signs of turbidity (e.g., turbidity plumes).
- Submit a Water Quality Monitoring Report (WQMR) to Ecology weekly throughout the extent of construction activity unless there is an exceedance (see Section 4.3 *Contingency Monitoring/Measures* for steps if there is an exceedance).

4.2 Monitoring Duration

Following approval of the WQMPP by Ecology, intensive monitoring will occur for the first 5 days of dredging activities and 1 time per week thereafter. Visual monitoring will take place after 5 days and occur twice daily until the end of work assuming that no exceedances are measured or visual exceedances are observed. The sampling duration may be extended if visual monitoring triggers intensive monitoring and the water quality measurements demonstrate additional data is necessary.

4.3 Contingency Monitoring/Measures

If water quality standards cannot be met, as specified in Table 4 above, contingency monitoring must be done and contingency measures should be considered.

4.3.1 Contingency Monitoring

If a water quality exceedance is documented at the POC, field personnel will stop work. The source of exceedance or impact will be identified and assessed, the extent of the plume will be evaluated, and corrective actions will be evaluated and implemented. The following contingency monitoring actions must be taken if there is a water quality exceedance:

- Verify the exceedance:
  - Sample at the POC to verify the exceedance;
  - Sample at background station(s) to verify that the exceedance is a result of the project activities; and
  - Sample beyond the POC (e.g., 500 feet) to understand the extent of the violation.
- If exceedance is a result of project activities:
  - Notify the contractor to pause work until water quality meets compliance. Field personnel will implement operations modifications and/or additional/different BMPs to bring water quality back into compliance with the criteria; and

  - Sample again at the POC and background station(s) to see if those changes addressed the problem.
- If exceedance persists:
  - Metered monitoring will occur on the hour to verify until it is confirmed water quality is back into compliance with the criteria;
  - Document the duration and extent of the violation;
  - Monitoring will continue until compliance is met. Work would then restart with more stringent BMPs; and
  - Intensive phase restarts.
- Report to Ecology within 2 hours of this event happening and submit a WQMR within 5 days of the event.

4.3.2 Contingency Measures

The following measures can be considered to control water quality exceedances:

- Turbidity:
  - Slow work to reduce the generation of turbidity;
  - Check functionality of the BMPs (e.g., debris boom); and
  - Add additional BMPs (e.g., change from a debris boom to a turbidity curtain).

- Sheen:
  - Immediately inspect equipment and fuel storage areas;
  - Check functionality of the BMPs (e.g., containment is functioning appropriately); and
  - Deploy booms to contain any sheen and absorbent pads for removal of sheen.

4.4 Sampling Personnel

The contractor-designated water quality monitoring lead (i.e., ESC lead) will be performing or directing the sampling. The Port is the primary Section 401 point of contact and will oversee monitoring to ensure compliance with the WQC. Refer to Section 5.4 (*Contacts*).

4.5 Parameters and Sampling Equipment

Dredging has the potential to result in increases in turbidity (in NTU), which will be monitored during construction, per Table 4. Intensive samples will be collected and analyzed for the appropriate parameters following the equipment and sampling guidelines below. Fish and oil sheens will be monitored visually.

- **Turbidity:** A multi-parameter meter (e.g., YSI ProDSS or comparable water quality meter) will be used in the field. A representative sample should accurately reflect the true condition of the water source from which the sample was taken. The measurements

will be averaged to determine the mean turbidity level. The mean turbidity level will be used to establish background values, the halfway monitoring point, and POC values. Minimum and maximum values will also be recorded to assist in understanding the variability in turbidity naturally and during in-water construction activities.

Field monitoring equipment will be calibrated daily and allowed to equilibrate prior to use. Calibration information will be recorded on the Multimeter Calibration Worksheet (Appendix D). Monitoring equipment will be used according to the manufacturer's recommendations. Unusual or questionable readings will be noted and duplicate readings will be recorded.

- **Fish:** Signs of distress if there is an exceedance of turbidity water quality standards at the POC.
- **Oil and Grease:** Continuous visual for a visible sheen on the water's surface anywhere in the Project area.

4.6 Sample Locations

Sampling locations consist of temporary locations identified prior to construction activities. Appendix A provides examples of the sample locations. Data from these locations will be recorded on the attached monitoring forms (Appendix B, Appendix C), or similar type of form, for the duration of the activity that triggers the monitoring.

Sampling locations will be identified as needed, given unique names, and clearly marked on the plans. Data from these locations will be recorded on the monitoring form.

5.0 DOCUMENTATION AND REPORTING

The contractor-designated water quality monitoring lead (i.e., ESC lead) will be required to prepare weekly WQMRs of the monitoring results to be submitted to the Port and forwarded to Ecology. Weekly WQMRs can be as simple as submitting a daily WQMR bundled together.

5.1 Documents Required

Sampling maps showing named and/or numbered sampling locations are required. Appendix A provides an example of monitoring station(s), but a final map will be generated for the WQMR. All water quality monitoring will be recorded on monitoring forms (see Appendix B and Appendix C for examples). The monitoring form will include the date, time, weather, activity prompting monitoring, location of monitoring, waterbody, monitoring results, and room for comments. These records will be in a form that is accessible by interested individuals upon request, such as Ecology's Federal Project Coordinator.

5.2 Reporting

This section describes reporting protocol for water quality monitoring activities, including communication responsibilities in the event of a confirmed exceedance event and summary reporting.

5.2.1 Daily Reporting

At the end of each monitoring day, a brief summary of water quality monitoring activities, field data sheets, and results of the monitoring will be provided by the ESC lead to the Project Manager. A daily log form is provided in Appendix E for use in recording general activities and observations, and other relevant information such as start and end times, and locations. A daily safety briefing form is provided in Appendix F to be completed at the start of each workday. A detailed description of each water quality standard to be monitored is provided in Table 4 above.

In the event of a water quality criteria confirmed exceedance the Port will report to the Ecology representative listed in the WQC within 2 hours. If there is evidence of a significant oil sheen, the Port will immediately report to Ecology's Northwest Regional 24-hour Spill Response Office at (206) 594-0000.

5.2.2 Weekly Reporting

Weekly water quality monitoring data will be compiled into a summary table with a comparison to water quality compliance criteria. Weekly reports will be provided to Ecology. Weekly reports will summarize any confirmed exceedances, and corrective actions that were employed to achieve compliance with water quality criteria.

5.2.3 Water Quality Monitoring Completion Summary

After the project is completed, water quality monitoring data will be summarized in a WQMR to be submitted to the Ecology Federal Project Coordinator (Laura Inouye). The WQMR will include the following sections:

- Order number
- Applicant name
- Project name
- Project location
- Project contact and contact phone number
- Data tables
- Site background and content
- Field monitoring and sampling methods and actual sample locations
- Method deviations from this WQMPP
- Results of monitoring, including data validation, and water quality measurements

- Summary of confirmed exceedances and description of corrective actions taken
- Color photos from the in-water active construction process

Sampling results and notifications shall be sent to (email preferred):

Laura Inouye
360-515-8213
Or fednotification@ecy.wa.gov and cc to laura.inouye@ecy.wa.gov

and Valerie Chu vchu461@ecy.wa.gov

5.3 Communication Protocol

All communication and correspondence with Ecology will occur with Laura Inouye as the primary point of contact. The contractor will be responsible for providing Ecology with the necessary notifications and results of the water quality monitoring on a weekly basis and at the conclusion of the monitoring period.

5.4 Contacts

Port of Tacoma			
Title	**Name**	**Telephone**	**Email**
Project Manager	Sara Potter	253-888-4789	spotter@portoftacoma.com

Construction Contractor			
Title	**Name**	**Telephone**	**Email**
Project Manager, Compliance Lead	TBD	TBD	TBD
Alternate Compliance Lead	TBD	TBD	TBD
ESC lead	TBD	TBD	TBD

Washington State Department of Ecology			
Title	**Name**	**Telephone**	**Email**
401/CZM Federal Permit Manager	Laura Inouye	360-515-8213	laura.inouye@ecy.wa.gov
Washington Emergency Management Division (spills)	Federal Notification	1-800-258-5990	fednotification@ecy.wa.gov

6.0 REFERENCES

Anchor QEA. 2026. Port of Tacoma - Tru-Grit Site: Interim Action Plan. Prepared for Port of Tacoma, Tacoma, Washington, by Anchor QEA, Tacoma, Washington.

Appendix A
Example Sampling Map



Example Sampling Map

Appendix B

Example Intensive Monitoring Form (from original WQMPP)

Water Quality Monitoring Form

1201 3rd Avenue, Suite 2600
Seattle, Washington 98101
Phone 206.287.9130
www.anchorqea.com

Date:	Monitoring Start Time:	Monitoring Personnel:
Monitored Work Start Time:		Weather Observations:

Station ID	Time	Water Depth (feet)	Coordinates		Turbidity Reading (NTU)			Exceed	Notes
			Northing Latitude	Easting Longitude	Surface	Middle	Bottom	Yes/No*	

Notes:

***Water Quality Standard: Turbidity shall be < 5.0 NTU above BGS when BGS < 50 NTU, and less than 10% over BGS when BGS is > 50 NTU.**
CS = Compliance Station (150 feet from in-water work area [IWA]); **BGS** = Background Station (300 feet from IWA); **NTU** = Nephelometric Turbidity Unit

Tidal Elevations	Elevation	Time	Elevation	Time
High:				
Low:				

Appendix C

Example Visual Monitoring Form (from original WQMPP)

Visual Monitoring Field Form

Staff Initials	**Date/Time**	**Tide Stage** (ebb, flood, slack)	**Sheen, Floating Debris, or Distressed or Dying Fish or Wildlife Observed** (Y/N, brief description)	**BGS Turbidity** (note time of most recent record)	**EWS Turbidity** (note time of most recent record)	**CS Turbidity** (note time of most recent record)	**Plume Chasing** (approximate distance from IWA and GPS coordinates of endpoint of plume)

BGS = Background Station, EWS = Early Warning Station, CS = Compliance Station, IWA = In-Water Work Area

Appendix D

Multimeter Calibration Worksheet (from original WQMPP)

Multimeter Calibration Worksheet

Project Name: _____

Project Number:_____

Date: _____

Reminder: Allow 2 minutes to warm up before calibration or use.

Turbidity Date: Calibration by:				
Initial 0 NTU	Final 0 NTU	Temp. (°C)	Initial ____ NTU	Final ____ NTU

Turbidity Std (_____) Lot # _____ Exp Date: _____

Turbidity Std (_____) Lot # _____ Exp Date: _____

Turbidity Std (_____) Lot # _____ Exp Date: _____

Dissolved Oxygen (DO) Date: Calibration by:			
Temp. (°C)	BP (mm Hg)	Initial DO (mg / L)	Final DO (mg / L)

DO method (circle one) Saturated Air Saturated Water

Source of barometric pressure: _____

pH Date: Calibration by:			
pH reading in 4.0 buffer	pH reading in 7.0 buffer	pH reading in 10.0 buffer	Meter successfully calibrated (Y / N), Notes

Notes:

Appendix E

Daily Log

(from original WQMPP)

Daily Log

PROJECT NAME: _____ **DATE:** _____

SITE ID(s): _____ **PERSONNEL:** _____

WEATHER: **WIND FROM:**

N	NE	E	SE	S	SW	W	NW	LIGHT	MEDIUM	HEAVY

SUNNY	CLOUDY	RAIN	?

TEMPERATURE: ° F . ° C

[Circle appropriate units]

TIME	COMMENTS

Signature: _____

Appendix F

Daily Safety Briefing

(from original WQMPP)

DAILY SAFETY BRIEFING

DATE: _____

PROJECT NAME: _____

PROJECT NO: _____

Meeting Conductor / Company: _____

Health & Safety Officer / Company: _____

Field Lead / Company: _____

TOPICS COVERED:

- ☐ Emergency Procedures and Evacuation Route
- ☐ Directions to Hospital
- ☐ HASP Review and Location
- ☐ Safety Equipment Location
- ☐ Proper Safety Equipment Use
- ☐ Employee Right-to-Know/MSDS Location
- ☐ Fire Extinguisher Location
- ☐ Eye Wash Station Location
- ☐ Buddy System
- ☐ Self and Coworker Monitoring
- ☐ Chain of Command
- ☐ Communication
- ☐ Site Security
- ☐ Vessel Safety Protocols
- ☐ Work Zones
- ☐ Vehicle Safety and Driving/Road Conditions
- ☐ Equipment Safety and Operation
- ☐ Proper Use of PPE
- ☐ Decontamination Procedures
- ☐ Other:
- ☐ Lifting Techniques
- ☐ Slips, Trips, and Falls
- ☐ Hazard Exposure Routes
- ☐ Heat and Cold Stress
- ☐ Overhead and Underfoot Hazards
- ☐ Chemical Hazards
- ☐ Flammable Hazards
- ☐ Biological Hazards
- ☐ Eating/Drinking/Smoking

WEATHER CONDITIONS: _____

DAILY WORK SCOPE: _____

SITE-SPECIFIC HAZARDS: _____

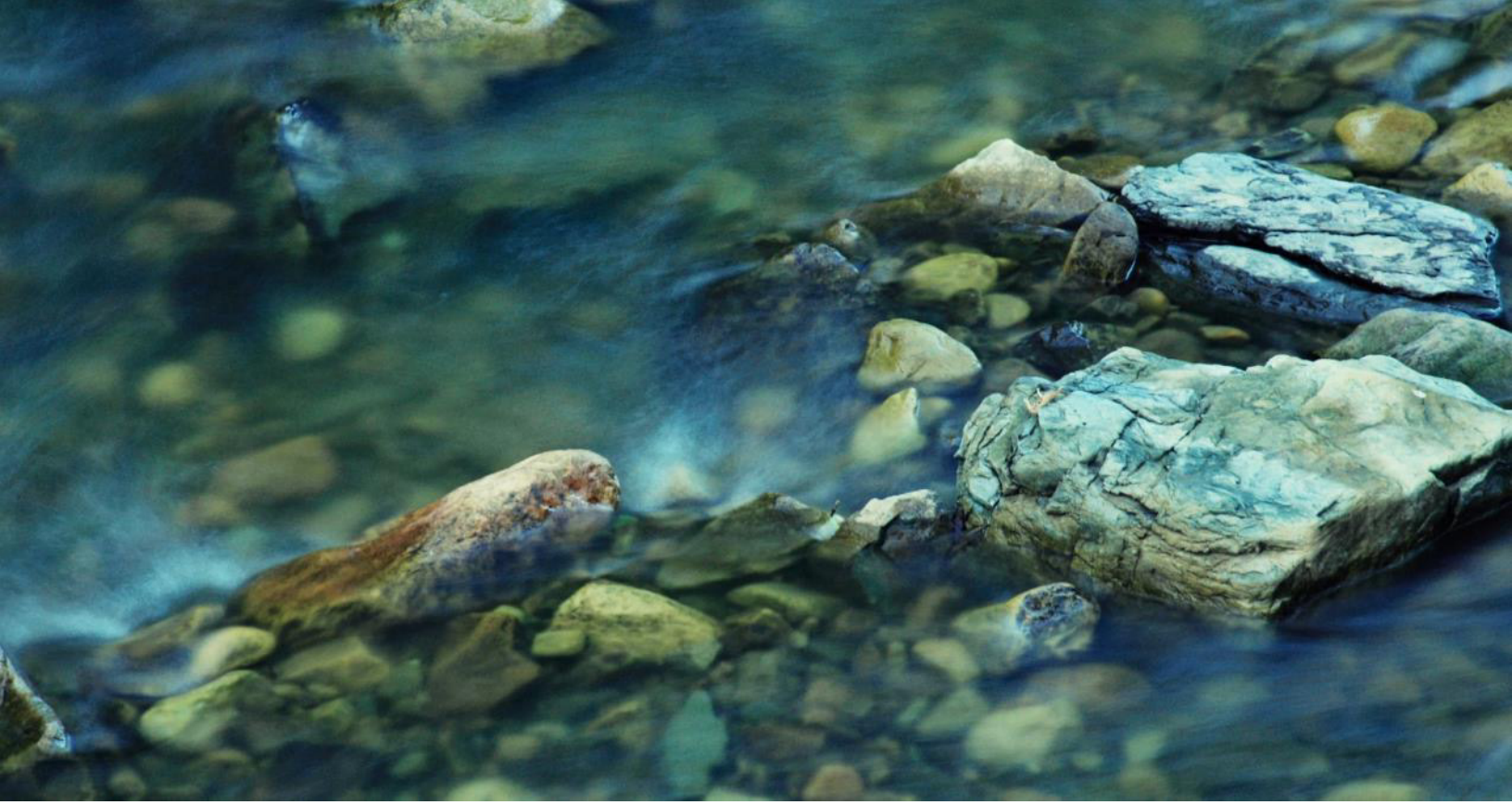
SAFETY COMMENTS: _____

ATTENDEES

PRINTED NAME / COMPANY	SIGNATURE


CONFLUENCE
ENVIRONMENTAL COMPANY

Appendix C
Compliance Monitoring and Contingency Response Plan



July 2026
Port of Tacoma – Tru-Grit Site

ANCHOR QEA

Compliance Monitoring and Contingency Response Plan

Prepared for the Port of Tacoma

July 2026
Port of Tacoma – Tru-Grit Site

Compliance Monitoring and Contingency Response Plan

Prepared for
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APPENDIX

Appendix A Sampling and Quality Assurance Project Plan

ABBREVIATIONS

cm	centimeter
CMCRP	*Compliance Monitoring and Contingency Response Plan*
D/F	dioxin/furans
DMMP	Dredged Material Management Program
DMMU	dredged material management unit
Ecology	Washington State Department of Ecology
FC	Field Coordinator
FNC	federal navigation channel
MTCA	Model Toxics Control Act
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
Port	Port of Tacoma
QA/QC	quality assurance/quality control
RMC	residuals management cover
SCUM	*Sediment Cleanup User's Manual*
Site	Tru-Grit Site
SMS	Sediment Management Standards
SQAPP	*Sampling and Quality Assurance Project Pla*n
SVOC	semivolatile organic compound
TBT	tributyltin
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency

1 Introduction

This *Compliance Monitoring and Contingency Response Plan* (CMCRP) describes the protection, performance, and confirmation monitoring and associated contingency response actions that will be implemented after construction and cleanup within the Lower Slope of the Tru-Grit Site (Site) in Tacoma, Washington.

The Site is located on the northeastern side of the Blair Waterway, with the upland address at 1110 East Alexander Avenue, Tacoma, Washington (Figure 1-1). The Site includes areas of contaminated marine sediment along the shoreline and nearshore of the Tru-Grit and Graymont, Inc. facility to the east, as well as within a portion of side slopes of the proposed federal navigation channel (FNC) in the Blair Waterway.

The Port of Tacoma (Port) plans to implement an Interim Action during the 2026/2027 dredging season. The proposed work is an incidental remedial action under the Sediment Management Standards (SMS; Washington Administrative Code 173-204-540[3][c]). The Port is conducting this work with the Washington State Department of Ecology (Ecology), the U.S. Army Corps of Engineers (USACE), the U.S. Environmental Protection Agency (USEPA), and the Puyallup Tribe of Indians, as well as other regulatory agencies and project stakeholders.

The CMCRP implements the compliance monitoring and contingency response requirements set forth in Section 3.4 of the *Interim Action Plan* (Anchor QEA 2026a). This CMCRP complies with Model Toxics Control Act (MTCA) compliance monitoring requirements as described in Washington Administrative Code 173-340-410. A *Sampling and Quality Assurance Project Plan* (SQAPP) documenting the detailed sampling and analysis methods to be used during implementation of this CMCRP is attached as Appendix A.

2 Background

This section describes background information relevant to the Interim Action of the Lower Slope of the Site. Information presented in this section includes the following:

- **Site Description and History:** Section 2.1 describes the history of the Site and vicinity.
- **Interim Action and Performance Standards:** Section 2.2 provides a summary of the Interim Action and its performance standards.
- **Compliance Monitoring Requirements:** Section 2.3 provides the compliance monitoring requirements.

2.1 Site Description and History

Martinolich Shipbuilding Corporation conducted shipbuilding activities at the Site between 1968 and 1976, which included use of a floating drydock and marine railway. Several shipyard buildings were constructed in the uplands.

Following bankruptcy of Martinolich Shipbuilding Corporation in 1976, shipyard activity resumed under a different company, Sextant Marine. Sextant Marine also operated using a dry dock and marine railway. Sextant Marine then changed its name to Sea-Tac Alaska Shipbuilding. The company continued operations until 1982, when it entered bankruptcy.

In 1978, A.H. Powers, a marine contractor, acquired ownership of the Site and made various modifications, including installation of the current Powers dock, construction of the current bulkhead, and dredging of marine sediments from the current dock footprint.

In 2007, the entire Powers property, including the two dock structures, was acquired by the Port.

Tru-Grit began operations in approximately 1990 as a tenant of Powers. Tru-Grit continued operations at the Site under a lease with the Port after 2007. The parent company of Tru-Grit is CanAm Materials. Between 1990 and 2013, Tru-Grit operations included receiving and offloading grit shipments and processing and packaging grit for resale. The offloading occurred at the Tru-Grit dock using a hopper and conveyor system that has since been removed. The barges being unloaded were moored in the same approximate location as the former shipyard drydocks, which had been removed by this time. After 2013, barge offloading operations ceased, and Tru-Grit operations only encompassed the upland storage and processing of grit materials.

The most recent use of the Tru-Grit and Powers docks was by Orion Marine, a marine contractor and Port tenant. The dock and uplands were used for staging of barges and marine construction equipment. As of 2025, the Site and adjacent upland areas of the former Powers property are vacant except for intermittent use for trailer storage by Port tenants.

Various environmental investigations have occurred at the Site over the past 20 years. Sediment samples taken between 2008 and 2018 indicated that heightened metals concentrations are concentrated around the Tru-Grit dock, which coincides with the Tru-Grit ship-to-shore conveyance system area. A remedial investigation and draft feasibility study were completed by CanAm in 2021 and 2019, respectively, to evaluate potential remedial options for Site cleanup, but these plans did not include a full delineation of the Site or investigation of other Site-associated contaminants, such as dioxin/furans (D/F). The 2024-2025 testing was more extensive and defined the lateral and vertical distribution of Site-associated contaminants in both the Upper Slope and the Lower Slope areas (Figure 2-1). These sediment quality data are summarized in the *Sediment Characterization Report, Port of Tacoma – Tru-Grit* (Anchor QEA 2026b).

2.2 Interim Action and Performance Standards

The Interim Action and performance standards are described in detail in the *Interim Action Plan* (Anchor QEA 2026a). The purpose of the Interim Action is to remove contaminated sediments from the Lower Slope area of the Site, consistent with the MTCA and Washington State SMS requirements. The Lower Slope materials are being removed from the Site prior to the USACE FNC Deepening Project to prevent Site-associated contaminated sediments from sloughing into the FNC during or after waterway deepening.

Activities proposed as part of the Interim Action include mechanical dredging to remove contaminated sediments, placement of contaminated material in a permitted upland Subtitle D landfill site, and placement of clean backfill material to maintain the desired final slope and function as a residuals management cover (RMC). Planned removal areas are identified as Area A and Area B on Figure 2-1.

As described in the *Interim Action Plan*, the Interim Action will remove sediments from the Lower Slope area that contain exceedances of the sediment cleanup objective for benthic protection. It will also reduce levels of bioaccumulative contaminants to the Interim Action Performance Standards defined in the Interim Action Plan (Anchor QEA 2026a). The Interim Action work area includes two sediment removal areas:

- Area A is located offshore of the Tru-Grit dock and overlaps with portions of USACE FNC Deepening Project dredged material management units (DMMUs) D117 and D118 (also subsurface DMMUs D506 and D507). The depth of sediments exceeding the Table 2-1 Performance Standards is 4 feet below mudline based on metals and polychlorinated biphenyl (PCB) contamination. Regional D/F contamination is also co-located at this depth.
- Area B is located offshore of the Powers dock and overlaps with portions of USACE FNC Deepening Project DMMU D119 (also subsurface DMMU D507). The depth of sediments

exceeding the Table 2-1 Performance Standards is 8 feet below mudline based on metals contamination. Regional D/F contamination is also co-located at this depth.

Following completion of dredging, performance monitoring will occur within the dredge areas to confirm that the performance standards (Table 2-1) have been met for Site-associated hazardous substances.

2.3 Compliance Monitoring Requirements

This CMCRP implements the compliance monitoring framework outlined in the *Interim Action Plan*. That framework is described in more detail in Table 2-2 and includes protection monitoring, performance monitoring, confirmation monitoring, and long-term monitoring:

- **Protection Monitoring:** Protection monitoring will include water quality monitoring to document water quality protection within the Site during dredging. During the Interim Action, various construction controls will be implemented as feasible to ensure water quality protection within the Site and surrounding area. Protection will be verified through a combination of intensive monitoring (e.g., twice daily during dredging) and routine monitoring (e.g., once weekly). Protection monitoring will identify the need for further controls as appropriate. Detailed information on water quality protection and monitoring procedures is presented in the *Water Quality Monitoring and Protection Plan* (Confluence 2026).
- **Performance Monitoring:** Performance monitoring will include post-removal bathymetric surveys and surface sediment sampling to confirm compliance with project documentation and performance standards. Additional details related to performance monitoring are presented in Section 4.
- **Confirmation Monitoring:** Confirmation monitoring will include post-material placement bathymetric surveys and surface sediment sampling to confirm compliance with project documentation and performance standards. Additional details related to confirmation monitoring are presented in Section 5.
- **Long-Term Monitoring:** Long-term monitoring will include 3 years of bathymetric surveys to document the stability of the slope backfill materials and potentially trigger conditional surface sediment testing if the final sediment surface indicates slumping or instability. Additional details related to long-term monitoring are presented in Section 6.

3 Project Roles and Responsibilities

The monitoring described in this document will be led by the Port. The Port, or its designated representatives, will be responsible for implementing the monitoring program. The Port will manage the contractor performing the required monitoring activities. Some monitoring activities may also be performed by Port staff, as appropriate.

The monitoring contractor's project manager will provide overall project coordination, including production of all project deliverables and administrative coordination to ensure timely and successful completion of the project.

The Field Coordinator (FC) will supervise field collection of all samples and will also be responsible for positioning for sample collection accurately; recording sample locations, depths, and identification; ensuring conformance to sampling and handling requirements, including field decontamination procedures; physical evaluation and logging of samples; and completing chain of custody forms. The FC will be responsible for compliance with the Ecology-approved SQAPP (Appendix A). The FC will be responsible for the submittal of environmental samples to the designated laboratories for chemical and bioassay analyses.

The Laboratory Project Manager at each laboratory will provide analytical support and will be responsible for providing certified, pre-cleaned sample containers and sample preservatives (as appropriate) and for ensuring that all chemical analyses meet the project data quality objectives and other quality specifications of the SQAPP.

The Port will review all work products prepared by its contractors and consultants and will communicate to the Ecology Project Coordinator any concerns that may arise regarding the implementation of the Interim Action monitoring activities.

4 Performance Monitoring

Performance monitoring will be performed after dredging to confirm that the sediment removal has met performance criteria, and again after material placement to confirm that RMC and slope backfill materials have been placed consistent with the project design. Portions of this monitoring will be repeated in the event that contingency re-dredging or contingency material placement is triggered. Proposed monitoring and contingency measures include the following:

- Post-Dredge Bathymetric Survey: Post-dredge bathymetry survey will be used to confirm that sediments have been removed to the target dredging elevations and extents. Contingency dredging will be used as necessary if high spots are identified.
- Post-Dredge Sediment Sampling: Post-dredge performance monitoring will be performed at 20 locations within Areas A and B, as shown in Figure 4-1. These locations are systematically placed throughout the dredge prism. This monitoring will be used to confirm: 1) that contaminated sediments have been removed to the extent practicable; and 2) that the quantity of dredging residuals does not exceed design requirements. Contingency re-dredging may be used if areas of missed inventory are identified (i.e., contaminant levels in undisturbed sediment exceed the Table 2-1 Performance Standards and Table 2-2 decision criteria) or if the thickness of dredging residuals exceeds design requirements. The extent of such contingency re-dredging may be limited by geotechnical stability considerations in the portions of Area B located closest to the former Powers dock.

4.1 Post-Dredge Bathymetric Survey

4.1.1 Bathymetric Survey Methods

Bathymetric surveying will be conducted across both Areas A and B to verify that dredging activities achieve required target elevations as defined in the project design. The surveys will be performed using multi-beam survey methods, conducted by a licensed surveyor, and will meet or exceed the accuracy standards for a USACE Navigation and Dredging Support Survey as referenced in the *USACE Hydrographic Survey Manual*, November 2013 Revision (USACE 2013).

4.1.2 Contingency Response Actions

In the event that missed inventory is identified (e.g., high spots indicating missed inventory), re-dredging will be initiated expediently to achieve the final removal surface as specified in project design documents.

4.2 Post-Dredge Sediment Sampling

Dredging is intended to achieve removal of contaminated sediments from the bottom and from the south, east, and west side slopes of the dredge prism. The northern side slope will consist of the cut

face of the Upper Slope area and is expected to contain residual Site-associated contaminants. Post-dredge sediment sampling is intended to verify the lack of excessive dredging residuals on the bottom and sides of the dredge prism and to verify the lack of missed inventory on the bottom, south, east, and west sides of the dredge prism. The post-dredge sediment sampling will be used to trigger contingency re-dredging where necessary and practicable to remove excessive dredging residuals or missed inventory prior to material placement.

- Verifying Residuals Thicknesses: Prior to the placement of clean sand cover, surface sediment grab sampling will be performed to verify that the thickness of the dredge residuals layer averages less than 10 centimeters (cm).
- Testing for Missed Inventory: Sampling will also be used to verify the lack of missed inventory on the bottom and on the south, east, and west side slopes of the dredge prism.
- North Side-Slope Samples: Sampling of the north side slope will be used to document the levels of contamination along the cut face between the Upper Slope and the Lower Slope prior to the placement of slope backfill and RMC.

Surface and shallow subsurface sediment will be collected using a hydraulic Van Veen sampling device at the 20 locations within Areas A and B, as shown in Figure 4-1. The overlying residuals layer is expected to consist of poorly consolidated materials. The thickness of this overlying residuals layer will be measured in each grab sample.

The overlying material will then be removed from the Van Veen sampler to expose the underlying sediments. A sample of the underlying sediment will be collected from approximately 10 to 20 cm below the contact with the dredging residuals layer (a minimum of 5 cm of sediment should separate the interface between dredging residuals and underlying sediment to be sampled). The sample will be collected and submitted for sediment chemical analyses described in the following section for verification that dredging has reached the base of chemical contamination. Sufficient volume will be collected for sediment chemical analyses and potential re-analyses.

The methods and quality assurance/quality control (QA/QC) procedures for Van Veen sampling and sampling locations, sample depths, and analyses are defined in the project SQAPP (Appendix A).

4.2.1 Chemical Testing

The post-dredging samples will receive Dredged Material Management Program (DMMP) chemical and conventional parameter testing (total solids, total volatile solids, total organic carbon, ammonia, and sulfide) and will be compared to the performance standards in Table 2-1 for metals (including mercury), tributyltin (TBT), semivolatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), PCBs, and D/F (DMMP 2025; Ecology 2025). Analytical methods, data quality objectives, and performance criteria for these analytes are documented in the project SQAPP (Appendix A).

Concentrations of Site-associated contaminants in the post-dredge sediment samples will be compared to the Interim Action Performance Standards as shown in Table 2-1. Performance standards for benthic protection are applied on a point-by-point basis, and human health criteria are applied on an area-wide basis across the Interim Action area (including the dredge prism bottom and south, east and west side slopes).

4.2.2 Contingency Response Actions

Consistent with the provisions set forth in the *Interim Action Plan* (Anchor QEA 2026a), if the post-dredging sampling indicates that the thickness of the residuals layer is greater than 10 cm or if sediment chemical concentrations on the dredge prism bottom and/or south, east, or west side slopes exceed the performance standards (Table 2-1), contingency response actions will be implemented:

- Contingency actions for excessive dredging residuals may include one or both of the following:
  - If residuals thicknesses are between 10 and 15 cm, the minimum thickness of residuals cover will increase from 6 inches to 12 inches in the corresponding areas.
  - If residuals are thicker than 15 cm, then a dredging cleanup pass will be conducted to remove at least 1 foot of material from the corresponding areas prior to placing RMC and/or slope backfill materials.
- Contingency actions for missed inventory will include contingency re-dredging as follows:
  - If Site-associated contaminants exceed their respective performance standards by up to 2.5 times in the dredge prism bottom samples, a contingency re-dredge to remove 1 additional foot of material will be conducted in corresponding areas. If Site-associated contaminants exceed their respective performance standards by more than 2.5 times, then the contingency re-dredge will remove 2 additional feet of material from the corresponding areas.
  - If Site-associated contaminants exceed their respective performance standards along the south, east, or west side slopes, then contingency re-dredging will be performed.
  - Site-associated contaminants are expected to exceed their respective performance standards along the northern side slope, because that represents the cut face between the Upper Slope and Lower Slope areas of the Site. The post-dredge sampling data collected in that area is for documentation purposes and will not be used to trigger contingency actions.

5 Confirmation Monitoring

Confirmation monitoring will be performed after both dredging and the placement of slope backfill and RMC are complete. Confirmation monitoring activities described in this section include: 1) post-material placement bathymetric surveys, and 2) surface sediment quality monitoring.

5.1 Post-Material Placement Bathymetric Survey

A post-material placement bathymetric survey will be used to document placement of RMC and slope backfill to ensure compliance with project plans. Should post-placement bathymetry discover areas of inadequate placement, additional material placement will be triggered.

5.1.1 Bathymetric Survey Methods

Bathymetric surveying will be conducted across both Areas A and B to verify that material placement activities achieve required target elevations and slopes as defined in the project design. The surveys will be performed using multi-beam survey methods, conducted by a licensed surveyor, and will meet or exceed the accuracy standards for a USACE Navigation and Dredging Support Survey as referenced in the *USACE Hydrographic Survey Manual*, November 2013 Revision (USACE 2013).

In the event that significant sediment consolidation occurs during backfill placement, the bathymetric survey may be supplemented with diver cores and/or sediment probing to document actual placed backfill and RMC thicknesses.

5.1.2 Contingency Response Actions

In the event that target placement thicknesses and slopes (maximum 3H:1V side slope along the north side slope) are not achieved in RMC and slope backfill areas, then contingency response measures will include placement of additional RMC or slope backfill in affected areas followed by a second round of surveys to verify that target thicknesses and slopes have been achieved.

5.2 Surface Sediment Quality Monitoring

Surface sediment quality will be monitored to document the effectiveness of remediation in maintaining performance standards for Site contaminants. Surface sediment will be collected from the biologically active zone (top 10 cm) of sediment at 20 locations within the material removal and RMC placement areas. Locations of the confirmation monitoring surface sampling stations are depicted on Figure 4-1 and specified in the SQAPP (Appendix A).

Confirmation monitoring will take place following completion of RMC and slope backfill placement. Sampling will include collection of archived materials for bioassay testing in the event that Site contaminants are detected in excess of the performance criteria.

5.2.1 Sampling and Analysis Approach

Surface sediment from all locations will be analyzed for conventional parameters, metals (including mercury), TBT, SVOCs, PAHs, PCBs, and D/F. Results will be compared to the performance standards listed in Table 2-1 (DMMP 2025; Ecology 2025).

Surface sediment (0 to 10 cm) will be collected using a hydraulic Van Veen or similar sampling device. The methods and QA/QC procedures for surface sediment sampling and sampling locations, sample depths, and analyses are defined in the project SQAPP (Appendix A). Sufficient volume will be collected for sediment chemical analyses, potential re-analyses, and contingent bioassay tests.

Contingent bioassay tests will be performed at stations where the benthic performance standards listed in Table 2-1 are exceeded. Following the *Sediment Cleanup User's Manual* (SCUM; Ecology 2025), three contingent bioassay tests are planned: 10-day amphipod mortality test, 20-day juvenile polychaete growth test, and the sediment larval development test.

Bioassay testing will be performed in accordance with *Recommended Protocols for Conducting Laboratory Bioassays on Puget Sound Sediments* (PSEP 1995) and SCUM (Ecology 2025), as detailed in the SQAPP (Appendix A).

5.2.2 Contingency Response Actions

If Site sediments fail to meet the performance standards (Table 2-1) following confirmation monitoring, appropriate contingency actions will be conducted. These may include placement of additional RMC or slope backfill in affected areas.

6 Long-Term Monitoring

Long-term monitoring will be performed in years 1, 2, and 3 following completion of construction and will consist of 1) annual bathymetric surveys and 2) conditional surface sediment testing.

6.1 Annual Bathymetric Surveys

Annual bathymetric surveys will be conducted in years 1, 2, and 3 following completion of construction to document the stability of the slope backfill materials. If areas of sloughing or instability are observed, then contingent surface sediment testing will be performed.

6.1.1 Bathymetric Survey Methods

Multi-beam bathymetric surveying will be conducted at least annually for 3 years across both Areas A and B to document changes in mudline elevations and compare current mudline elevations to those of previous surveys. The surveys will be conducted by a licensed surveyor, and will meet or exceed the accuracy standards for a USACE Navigation and Dredging Support Survey as referenced in the *USACE Hydrographic Survey Manual*, November 2013 Revision (USACE 2013).

6.1.2 Contingency Response Actions

An isopach will be developed following each of the three annual surveys to compare the mudline bathymetry survey results to the elevations collected in the post-placement survey. If, after 3 years of monitoring, significant areas of bathymetric anomalies are identified that indicate greater than 1 foot of potential slough or prop wash are observed, contingent surface sediment testing will be performed, as described in Section 6.2.

6.2 Contingent Surface Sediment Testing

If contingent sediment monitoring is triggered, as described in Section 6.1.2, samples will be collected from 12 locations shown on Figure 4-2 to verify compliance of the final sediment surface with the Interim Action Performance Standards (Table 2-1). These include the former dredge prism bottom samples and the north side-slope samples. Because the other former side-slope locations (south, east, and west side slopes) will have been removed by the USACE FNC Deepening Project, no monitoring will be performed in those areas.

6.2.1 Sampling and Analysis Approach

Surface sediment from 12 locations will be analyzed for conventional parameters, metals (including mercury), TBT, SVOCs, PAHs, PCBs, and D/F. The results will be screened against the performance standards, as presented in Table 2-1.

Surface sediment (0 to 10 cm) will be collected using a hydraulic Van Veen or similar sampling device. The methods and QA/QC procedures for surface sediment sampling and sampling locations, sample depths, and analyses are defined in the project SQAPP (Appendix A). Sufficient volume will be collected for sediment chemical analyses, potential re-analyses, and contingent bioassay tests. Contingent bioassay tests will be performed at stations where the performance criteria are exceeded. Sediment chemical concentrations will be compared to the performance standards presented in Table 2-1.

6.2.2 Contingent Bioassay Testing

If surface sediment exceeds the performance criteria, contingent bioassay testing will be initiated for toxicity testing. Following SCUM (Ecology 2025), three contingent bioassay tests will be performed: a 10-day amphipod mortality test, 20-day juvenile polychaete growth test, and the sediment larval development test.

Bioassay testing will be performed in accordance with Puget Sound Estuary Program protocols (PSEP 1995) and SCUM (Ecology 2025) by an Ecology-accredited laboratory and as detailed in the SQAPP (Appendix A).

6.2.3 Contingency Response Actions

Should long-term monitoring sediment samples fail to meet the performance standards (Table 2-1), then additional remediation work on the Lower Slope may be required as part of the final Site cleanup action of the Tru-Grit Site.

7 Reporting

All protection monitoring, performance monitoring, and confirmation monitoring data and outcomes will be summarized in the Interim Action Completion Report to be prepared and submitted to Ecology, USEPA, and USACE following completion of post-construction monitoring.

A *Long-Term Monitoring Report* will be submitted in year 3 following completion of construction. That report will include all bathymetric evaluations as well as the results of contingent sediment testing, if performed.

All analytical data will also be entered into Ecology's Environmental Information Management database.

The *Interim Action Completion Report* and the *Long-Term Monitoring Report* will include copies of final survey data and any validated analytical data and 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 this CMCRP
- Results of monitoring, including data validation, bathymetric survey results, and sediment testing results
- Comparison of monitoring results to Site performance criteria and previous testing results
- Discussion of contingency responses and their implementation, as applicable

8 References

Anchor QEA, 2026a. *Interim Action Plan*. Tru-Grit Site. Prepared for Port of Tacoma. July 2026.

Anchor QEA, 2026b. *Sediment Characterization Report*. Tru-Grit Site. Prepared for Port of Tacoma. July 2026.

Confluence (Confluence Environmental Company), 2026. Water Quality Monitoring and Protection Plan. Tru-Grit Sediment Remediation. Prepared for Port of Tacoma. July 2026.

DMMP (Dredged Material Management Program), 2025. *Dredged Material Evaluation and Disposal Procedures User Manual*. Dredged Material Management Program: U.S. Army Corps of Engineers, Seattle District; Environmental Protection Agency, Region 10; Washington State Department of Natural Resources; and Washington State Department of Ecology. November 2025. Accessed June 29, 2026. https://www.nws.usace.army.mil/Portals/27/docs/civilworks/dredging/User%20Manual/UM_2025%20Final.pdf?ver=B2yCJUN0xVmrx-_sVQ0Ozg%3d%3d.

Ecology (Washington State Department of Ecology), 2025. *Sediment Cleanup User's Manual (SCUM): Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards, Chapter 173–204 WAC*. Fourth Revision. Toxics Cleanup Program Publication No. 12-09-057. December 2025.

PSEP (Puget Sound Estuary Program), 1995. Recommended Guidelines for Conducting Laboratory Bioassays on Puget Sound Sediments. Prepared for the U.S. Environmental Protection Agency, Region 10, Seattle, Washington, and Puget Sound Water Quality Authority, Olympia, Washington, by King County Environmental Lab, Seattle, Washington. 1995.

USACE (U.S. Army Corps of Engineers), 2013. Engineering and Design - Hydrographic Surveying. Publication number: EM 1110-2-1003. CECW-CE and CECW-OD. November 30, 2013. Accessed June 29, 2026. https://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-2-1003.pdf.

Tables

Table 2-1
Interim Action Performance Standards

Analyte	Performance Standards for Benthic Protection (Applied on a Point-by-Point Basis)			Protection (Applied on an Area-Wide Basis)		
	Criteria	Unit [1]	Derivation	Criteria	Unit [1]	Derivation
PART 1: SITE-ASSOCIATED HAZARODUS SUBSTANCES						
Metals (mg/kg)						
Antimony	150	mg/kg	DMMP SL	--	--	--
Arsenic	57	mg/kg	SMS SCO / DMMP SL	11	mg/kg	SMS Natural Background
Cadmium	5.1	mg/kg	SMS SCO / DMMP SL	0.8	mg/kg	SMS Natural Background
Chromium	260	mg/kg	SMS SCO / DMMP SL	--	--	--
Copper	390	mg/kg	SMS SCO / DMMP SL	--	--	--
Lead	450	mg/kg	SMS SCO / DMMP SL	21	mg/kg	SMS Natural Background
Mercury	0.41	mg/kg	SMS SCO / DMMP SL	0.2	mg/kg	SMS Natural Background
Zinc	410	mg/kg	SMS SCO / DMMP SL	--	--	--
Organometals (µg/kg)						
Tributyltin (ion)	73	µg/kg	DMMP BT	73	µg/kg	DMMP BT
Semivolatile Organics (µg/kg)						
1,2-Dichlorobenzene	35	µg/kg	SMS AET	--	--	--
1,4-Dichlorobenzene	110	µg/kg	SMS AET	--	--	--
Polycyclic Aromatic Hydrocarbons (µg/kg)						
Benzo(a)anthracene	1,300	µg/kg	SMS SCO / DMMP SL	--	--	--
Chrysene	1,400	µg/kg	SMS SCO / DMMP SL	--	--	--
Fluoranthene	1,700	µg/kg	SMS SCO / DMMP SL	--	--	--
Pyrene	2,600	µg/kg	SMS SCO / DMMP SL	--	--	--
Total HPAH (DMMP) (U = 0 max limit)	12,000	µg/kg	SMS SCO / DMMP SL	--	--	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2 max limit)	--	--	--	59	µg/kg	Blair Waterway 90/90 UTL [2]
PCB Aroclors (µg/kg)						
Total PCB Aroclors (U = 0)	130	µg/kg	SMS SCO / DMMP SL			
Total PCB Aroclors (U = 1/2 max limit)	--	--	--	37	µg/kg	Blair Waterway 90/90 UTL [2]
PART 2: REGIONAL CONTAMINANTS						
Dioxin Furans (ng/kg)						
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2 max limit)	--	--	--	10	ng/kg	DMMP BT [3]

Notes:

1. Performance standards for benthic protection are listed on a dry weight basis, under the assumption that most sediments tested as part of the interim action will contain total organic carbon contents below 0.5%. For non-ionizable organic compounds, the corresponding carbon normalized value may be substituted when total organic carbon is within the range of 0.5% to 3.5%. If confirmational bioassays are performed using applicable SMS bioassay performance standards and interpretive criteria, the results of those bioassays will override the numeric testing result.
2. The 90/90 UTL was calculated for shallow subsurface sediments using the same methodologies recommended by Ecology in SCUM (Ecology 2025) for calculating a regional background value in
3. The interim action will remediate dioxin/furans in the Lower Slope sediments to below the DMMP BT value (10 ng/kg TEQ) on a point-by-point basis to avoid potential impacts of residual sediment on the planned deepening of the federal navigation channel.

--: not applicable
µg/kg: microgram per kilogram (dry weight basis)
AET: apparent effects threshold
BT: bioaccumulation trigger
cPAH: carcinogenic polycyclic aromatic hydrocarbon
DMMP: Dredged Material Management Program
Ecology: Washington State Department of Ecology
HPAH: high-molecular-weight polycyclic aromatic hydrocarbon
mg/kg: milligram per kilogram (dry weight basis)
ng/kg: nanogram per kilogram
PCB: polychlorinated biphenyl
SCO: sediment cleanup objective
SCUM: Sediment Cleanup User's Manual
SL: screening level
SMS: Sediment Management Standards
TEQ: toxic equivalent quotient
U: Compound analyzed for, but not detected above detection limit
UTL: upper tolerance limit

Table 2-2
Monitoring Framework for the Interim Action

Monitoring Type (Plan)	Monitoring Activity	Objectives and Decision Points	Sampling Locations	Timing and Frequency	Monitoring Parameters	Performance Criteria	Reporting
Protection Monitoring (WQMPP)	Water Quality Monitoring	- Protect water quality during construction - Determine when to apply additional BMPs or terminate work	Monitoring Locations Illustrated in Appendix A of WQMPP - Early Warning Station: 75 Feet - Compliance Station: 150 Feet - Background Station: 300 Feet	Monitoring is to be conducted twice daily for the first 5 days and then after a triggering event (per WQMPP) occurs during dredging and material placement activities. Visual monitoring will take place after 5 days until the end of work, with the exception of a triggering event.	Turbidity (to be monitored at 2 elevations: 2-3 feet below water surface and 2-3 feet above substrate surface of the water column)	- Turbidity shall remain 1) below 10 NTU over background when background is 50 NTU, or 2) 20% increase over background if background is more than 50 NTU. - In the event of an exceedance, additional BMPs shall be employed (including potential work stoppage) as necessary to restore compliance.	Summary of monitoring to be included in the WQMR
Performance Monitoring (CMCRP)	Post-Dredge Bathymetric Surveys	- Document removal of contaminated sediments and compliance with project plans - Trigger redredging where needed to meet planned dredge elevations	Multi-beam bathymetric survey to be conducted throughout dredging footprint	- Following completion of dredging and prior to placement of RMC and slope backfill - Monitoring may be conducted in phases (i.e., as each portion of the dredge prism is completed)	Mud-line bathymetry	Mud-line elevations at the base of the dredging prisms shall comply with (be equal to or deeper than) planned neat-line dredge elevations.	Summary of monitoring to be included in the Interim Action Completion Report
	Post-Dredge Sediment Testing	- Verify the lack of 1) excessive dredging residuals or 2) missed inventory - Trigger re-dredging where necessary and practicable[1] to 1) remove excessive dredging residuals, or 2) remove areas of missed inventory	- Stratified grab samples (20–30 cm collection depth) to be collected at the 20 locations shown in Figure 4-1 - Thickness of dredging residuals layer to be measured (+/- 1 cm) - Samples of the 10-20 cm of undisturbed sediment beneath the residuals layer to be collected for chemical analysis	- Following completion of dredging (as verified by bathymetric surveys) and prior to placement of RMC and slope backfill - Monitoring may be conducted in phases (i.e., as each portion of the dredge prism is completed)	1) Thickness of dredging residuals layer 2) Chemical concentrations within the undisturbed sediment beneath the residuals layer (metals, TBT, SVOCs, PAHs, PCBs, and D/F)	- Dredging residuals layer should not exceed 10 cm [2] - Chemical concentrations in undisturbed sediments should not exceed the Interim Action Performance Standards (Table 2-1[3, 4]) on the dredge prism bottom, south, east and west sides (not applicable to the north side-slope, which is expected to retain contaminated sediments)	
Confirmation Monitoring (CMCRP)	Post-Placement Bathymetric Surveys	- Document placement of RMC and slope backfill in compliance with project plans - Trigger additional material placement where needed to comply with project plans	Multi-beam bathymetric survey to be conducted throughout material placement footprint	- Following placement of RMC and slope backfill - Monitoring may be conducted in phases (i.e., as each portion of the backfill is completed)	Mud-line bathymetry	Placement areas and thicknesses shall meet or exceed those in the project plans.	
	Post-Placement Sediment Testing	- Verify compliance of the final sediment surface with the interim action performance standards (Table 2-1[3, 4]) - Trigger follow-up evaluations[5] if performance standards not met	Surface grab samples (0–10 cm collection depth) to be collected at the 20 locations shown in Figure 4-1	- Following completion of RMC and slope backfill placement (as verified by bathymetric surveys) - Monitoring may be conducted in phases (i.e., as each portion of material placement is completed)	Chemical concentrations within the final surface sediments layer after completion of material placement	Concentrations of site-associated hazardous substances in the 20 surface sediment samples shall not exceed the Interim Action Performance Standards (Table 2-1[3, 4])	

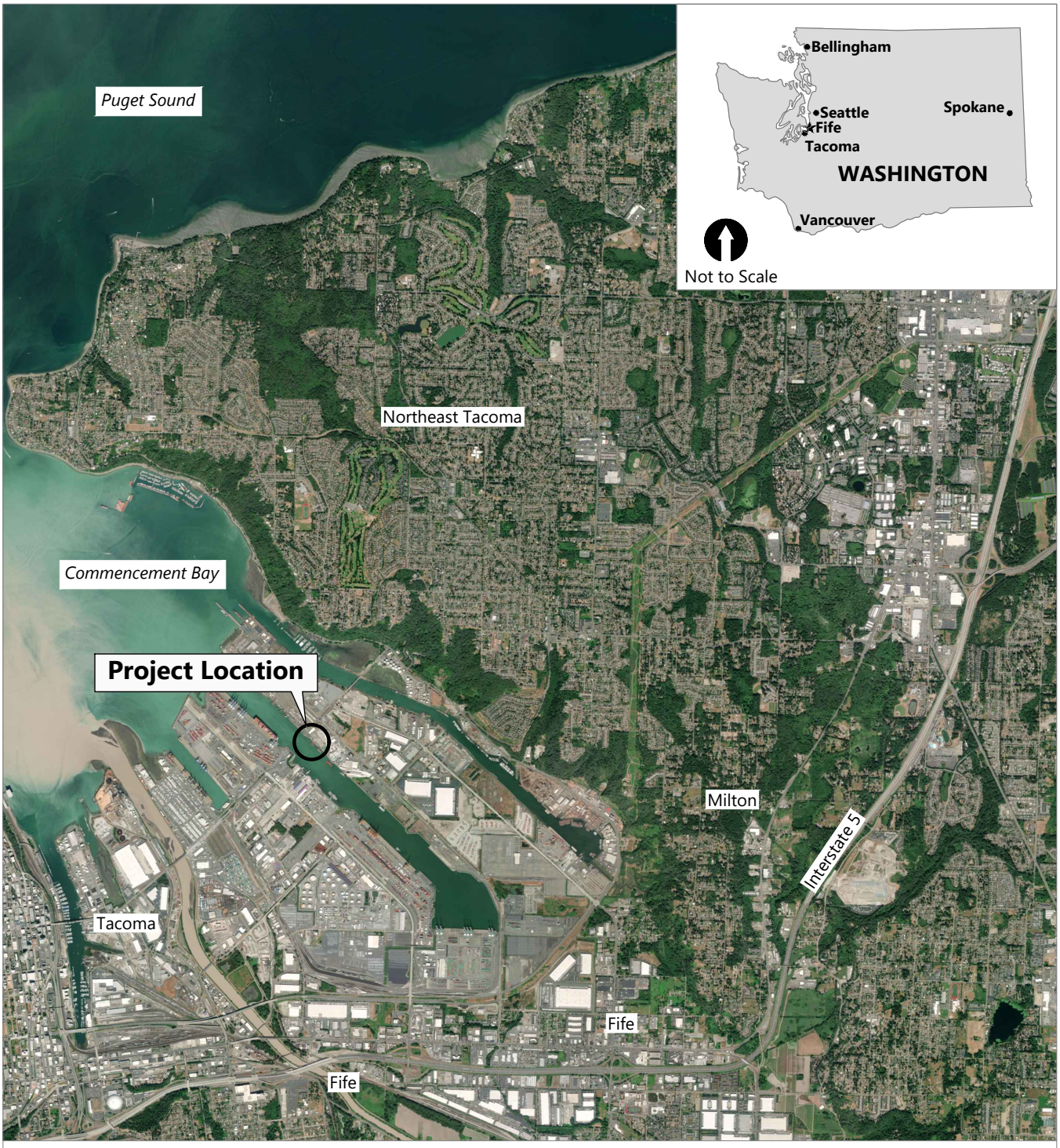
Table 2-2
Monitoring Framework for the Interim Action

Monitoring Type (Plan)	Monitoring Activity	Objectives and Decision Points	Sampling Locations	Timing and Frequency	Monitoring Parameters	Performance Criteria	Reporting
Long-Term Monitoring (CMCRP)	Annual Bathymetric Surveys	- Document the stability of the slope backfill materials - Trigger contingent surface sediment testing if slumping or instability are observed	Multi-beam bathymetric survey to be conducted throughout material placement footprint	Annually in years 1, 2, and 3 following completion of construction	Mud-line bathymetry	Sediment sloughing or instability will be identified as areas of slumping or settlement greater than 1 foot in slope backfill area (as identified by isopach analysis in comparison to post-placement survey) after accounting for sediment consolidation	Summary of monitoring to be included in the Year-3 Monitoring Report
	Conditional Surface Sediment Testing	- Verify compliance of the final sediment surface with the interim action performance standards (Table 2-1[3, 4]) - Trigger follow-up evaluations[5] if performance standards are not met	Surface grab samples (0–10 cm collection depth) to be collected at the 12 locations shown in Figure 4-2	- Following completion of 3-year bathymetric survey evaluations in the event that slumping or instability are observed in bathymetric surveys	Chemical concentrations within the final surface sediments layer after completion of material placement and 3 years of bathymetric survey evaluations	Concentrations of Site-related contaminants in surface sediments shall not exceed the Interim Action Performance Standards (Table 2-1[3, 4])	

Notes:
1. The ability to implement re-dredging is limited in the slope areas near the former Powers Dock due to geotechnical considerations.
2. If dredging residuals exceed 10 cm, re-dredging shall be conducted unless follow-up chemical testing of the residuals layer confirms that the planned RMC placement thickness will be effective at meeting the Interim Action Performance Standards in Table 2-1.
3. Contaminant concentrations to be compared to Table 2-1 Interim Action Performance Standards for benthic protection on a point-by-point basis include the following: antimony, arsenic, cadmium, chromium, copper, lead, mercury, zinc, TBT, 1,2-dichlorobenzene, 1,4-dichlorobenzene, individual PAH compounds, Total HPAH, Total LPAH, and Total PCB Aroclors.
4. Contaminant concentrations to be compared to Table 2-1 Interim Action Performance Standards for human health protection on an area-wide basis (as the average of the 20 monitoring locations) include the following: arsenic, cadmium, lead, mercury, TBT, Total cPAH TEQ, and Total PCB Aroclors. Total D/F TEQ concentrations will be compared to the respective 10 ng/kg performance standard on a point-by-point basis to limit potential interference of residual contaminant concentrations on future dredging within the federal navigation channel.
5. The performance standards for benthic protection also incorporate use of confirmational bioassay testing consistent with the SMS and established Ecology guidance (i.e., passing bioassays can be used to demonstrate compliance with the benthic protection performance standards).

BMP: best management practice
cm: centimeter
CMCRP: Compliance Monitoring and Contingency Response Plan
cPAH: carcinogenic polycyclic aromatic hydrocarbon
D/F: dioxin/furans
HPAH: high-molecular-weight polycyclic aromatic hydrocarbon
LPAH: low-molecular-weight polycyclic aromatic hydrocarbon
ng/kg: nanogram per kilogram
NTU: nephelometric turbidity unit
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
RMC: residuals management cover
SMS: sediment management standards
SVOC: semivolatile organic compound
TBT: tributyltin
TEQ: toxic equivalent quotient
WQMPP: Water Quality Monitoring and Protection Plan (Confluence 2026)
WQMR: Water Quality Monitoring Report

Figures

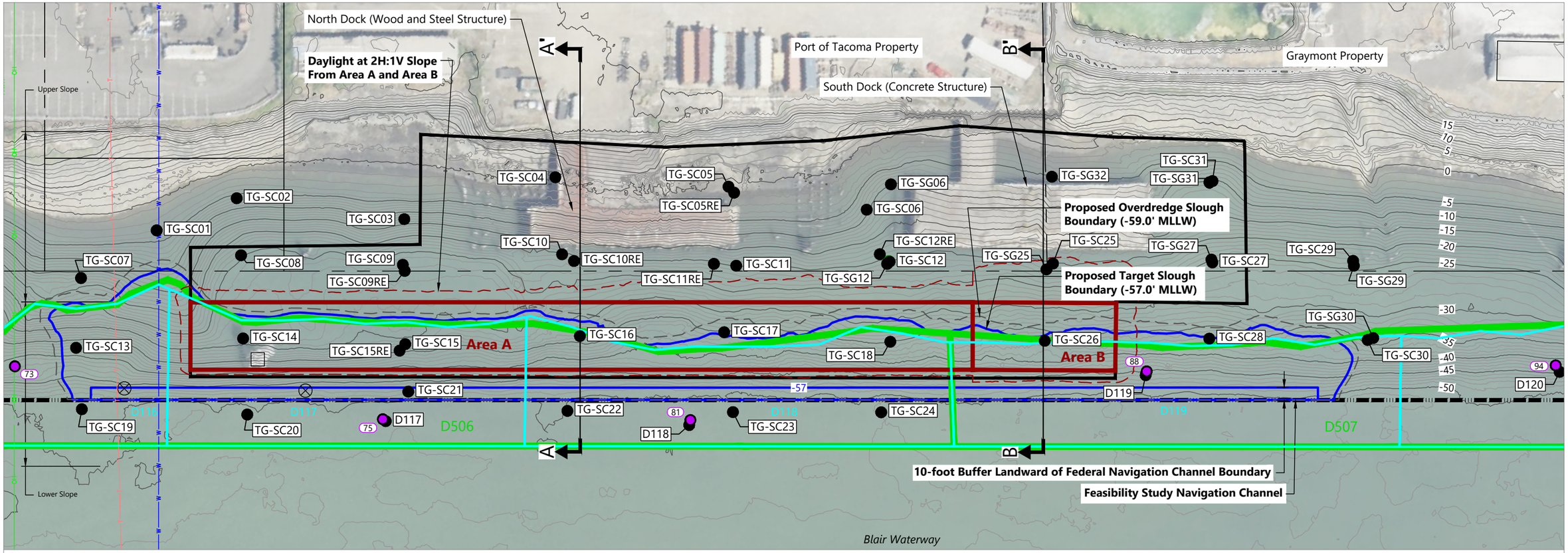


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Filepath: K:\Projects\0092-Port of Tacoma\Dredged Material Characterization for Tru-Grit Sediment Investigation\0092-RP-001 (Vicinity Map-IAP).dwg Figure 1-1 (Interim Action Plan)

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Figure 1-1
Vicinity Map

Compliance Monitoring and Contingency Response Plan
Port of Tacoma – Tru-Grit Site



SOURCES: Bathymetric survey by eHydro dated 11/14/22; Aerial image from World Imagery: Esri, Maxar, Earthstar Geographics, and the GIS User community.
HORIZONTAL DATUM: Washington State Plane South Zone, NAD83, U.S. Survey Feet
VERTICAL DATUM: MLLW

NOTE:
FNC deepening project along federal navigation channel boundary, and up to the 10-foot lateral buffer landward of the federal navigation channel boundary, will cause material above it to slough at approximately 2H:1V slope. Slough material will be subsequently dredged.

ABBREVIATIONS:
DMMU: Dredged Material Management Unit
FNC: federal navigation channel
H:V: horizontal to vertical ratio
MLLW: mean lower low water
NAD83: North American Datum of 1983

LEGEND:

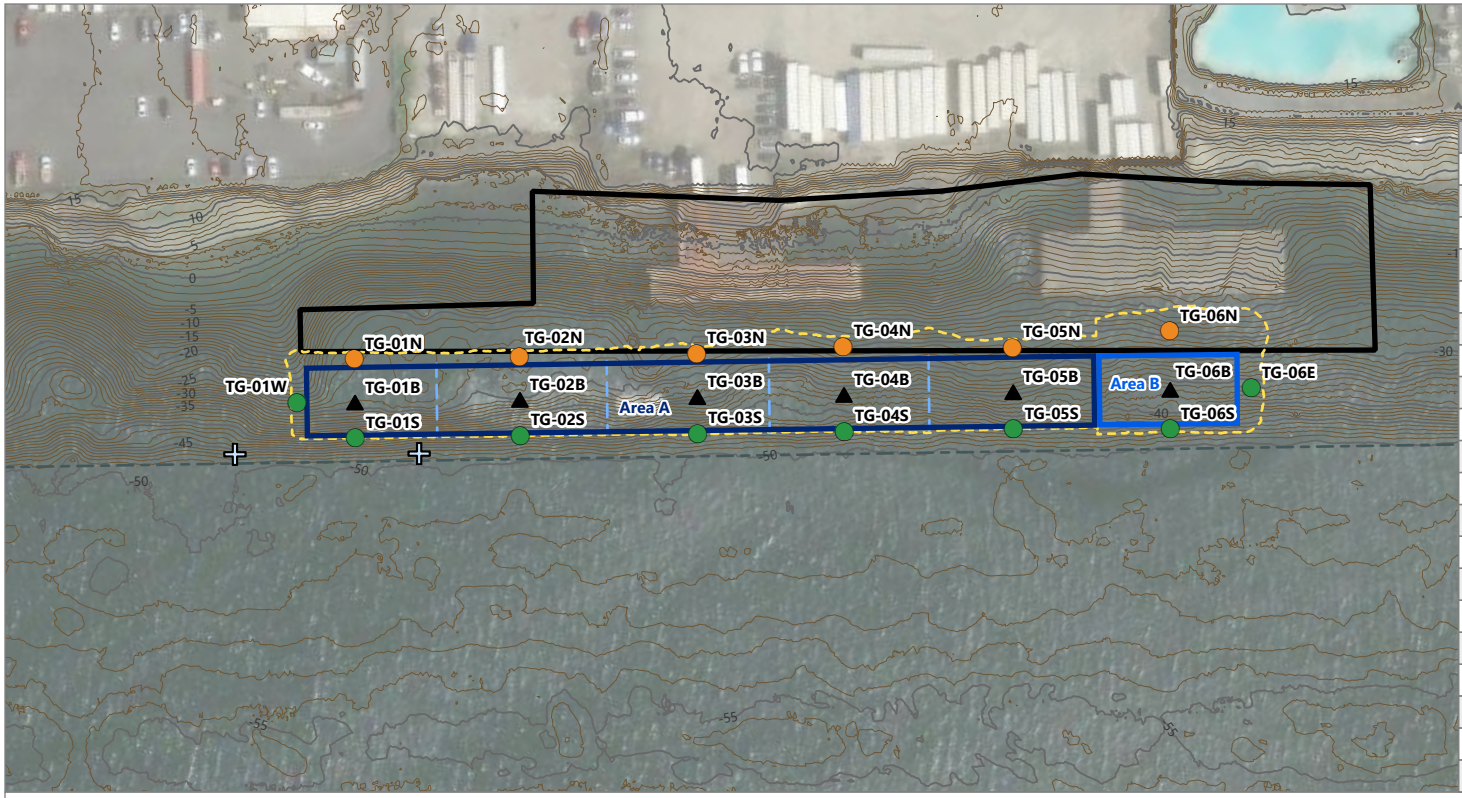
- Existing Contours (USACE 2022, 1' and 5' Interval)
- FNC Deepening Project Design Elevation Slough Boundary in Tru-Grit Area (-57.0' MLLW)
- FNC Deepening Project Allowable Overdredge Slough Boundary in Tru-Grit Area (-59.0' MLLW)
- Feasibility Study Navigation Channel
- Property Line
- Preliminary Site Boundary
- Actual Core Sampling Location
- Channel Deepening Sideslope Vibracore Location
- Channel Deepening Lower DMMU Boundary
- Channel Deepening Upper DMMU Boundary
- Proposed Dredge Area Daylight Slope
- **Area A** — Dredge Area A, Lower Slope 4' Dredge Depth + 2' Over-Dredge (Confirmed Contamination within Slough Area)
- **Area B** — Dredge Area B, Lower Slope 8' Dredge Depth + 2' Over-Dredge (Confirmed Contamination within Slough Area)
- Navigational Aid
- Navigation Tower
- Overhead Power
- Underwater Crossing Communication
- Underwater Crossing Watermain

0 80
Feet

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Filepath: K:\Projects\0092-Port of Tacoma\Dredged Material Characterization for Tru-Grit Sediment Investigation\0092-RP-002 (Interim Action Plan).dwg Figure 2-1

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Figure 2-1
Proposed Interim Action Sediment Removal Areas
Compliance Monitoring and Contingency Response Plan
Port of Tacoma – Tru-Grit Site



Station ID	Easting (feet)	Northing (feet)
TG-01B	1168418	712643
TG-02B	1168511	712553
TG-03B	1168610	712457
TG-04B	1168693	712377
TG-05B	1168788	712285
TG-06B	1168876	712200
TG-01N	1168441	712667
TG-02N	1168534	712577
TG-03N	1168633	712481
TG-04N	1168718	712404
TG-05N	1168811	712310
TG-06N	1168907	712232
TG-01W	1168386	712674
TG-01S	1168398	712623
TG-02S	1168491	712533
TG-03S	1168590	712436
TG-04S	1168672	712356
TG-05S	1168767	712264
TG-06S	1168854	712177
TG-06E	1168921	712155

LEGEND:

- Upper Slope Area
- Feasibility Study Navigation Channel Boundary
- Dredge Area A, Lower Slope 4' Dredge Depth + 2' Over-Dredge (Confirmed Contamination within Slough Area)
- Dredge Area B, Lower Slope 8' Dredge Depth + 2' Over-Dredge (Confirmed Contamination within Slough Area)
- Proposed Dredge Area Daylight Slope
- Elevation (MLLW, 5-Foot Interval)
- Decision Unit Boundary
- Navigational Aid

Proposed Sampling Location

- Dredge Prism Bottom Slope Sample
- Dredge Prism North Slope Sample
- Other Dredge Prism Slope Sample

NOTES:

1. Aerial imagery: Esri (2025)
2. Contour Source: Survey by USACE, dated October 27, 2021, and David Evans Associates, Inc., dated May 27, 2022, with data gaps filled from survey by USACE dated November 14, 2022.
3. Horizontal Datum: NAD83 State Plane Washington South, U.S. feet
4. Vertical Datum: MLLW, feet

MLLW: mean lower low water
NAD83: North American Datum of 1983

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Feet

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Figure 4-1
Sediment Performance and Confirmation Monitoring Locations
Compliance Monitoring and Contingency Response Plan
Port of Tacoma – Tru-Grit Site



Station ID	Easting (feet)	Northing (feet)
TG-01B	1168418	712643
TG-02B	1168511	712553
TG-03B	1168610	712457
TG-04B	1168693	712377
TG-05B	1168788	712285
TG-06B	1168876	712200
TG-01N	1168441	712667
TG-02N	1168534	712577
TG-03N	1168633	712481
TG-04N	1168718	712404
TG-05N	1168811	712310
TG-06N	1168907	712232

LEGEND:

- Upper Slope Area
- Feasibility Study Navigation Channel Boundary
- Dredge Area A, Lower Slope 4' Dredge Depth + 2' Over-Dredge (Confirmed Contamination within Slough Area)
- Dredge Area B, Lower Slope 8' Dredge Depth + 2' Over-Dredge (Confirmed Contamination within Slough Area)
- Proposed Dredge Area Daylight Slope
- Elevation (MLLW, 5-Foot Interval)
- Decision Unit Boundary
- Navigational Aid

Proposed Sampling Location

- Dredge Prism Bottom Slope Sample
- Dredge Prism North Slope Sample

NOTES:

1. Aerial imagery: Esri (2025)
2. Contour Source: Survey by USACE, dated October 27, 2021, and David Evans Associates, Inc., dated May 27, 2022, with data gaps filled from survey by USACE dated November 14, 2022.
3. Horizontal Datum: NAD83 State Plane Washington South, U.S. feet
4. Vertical Datum: MLLW, feet

MLLW: mean lower low water
NAD83: North American Datum of 1983

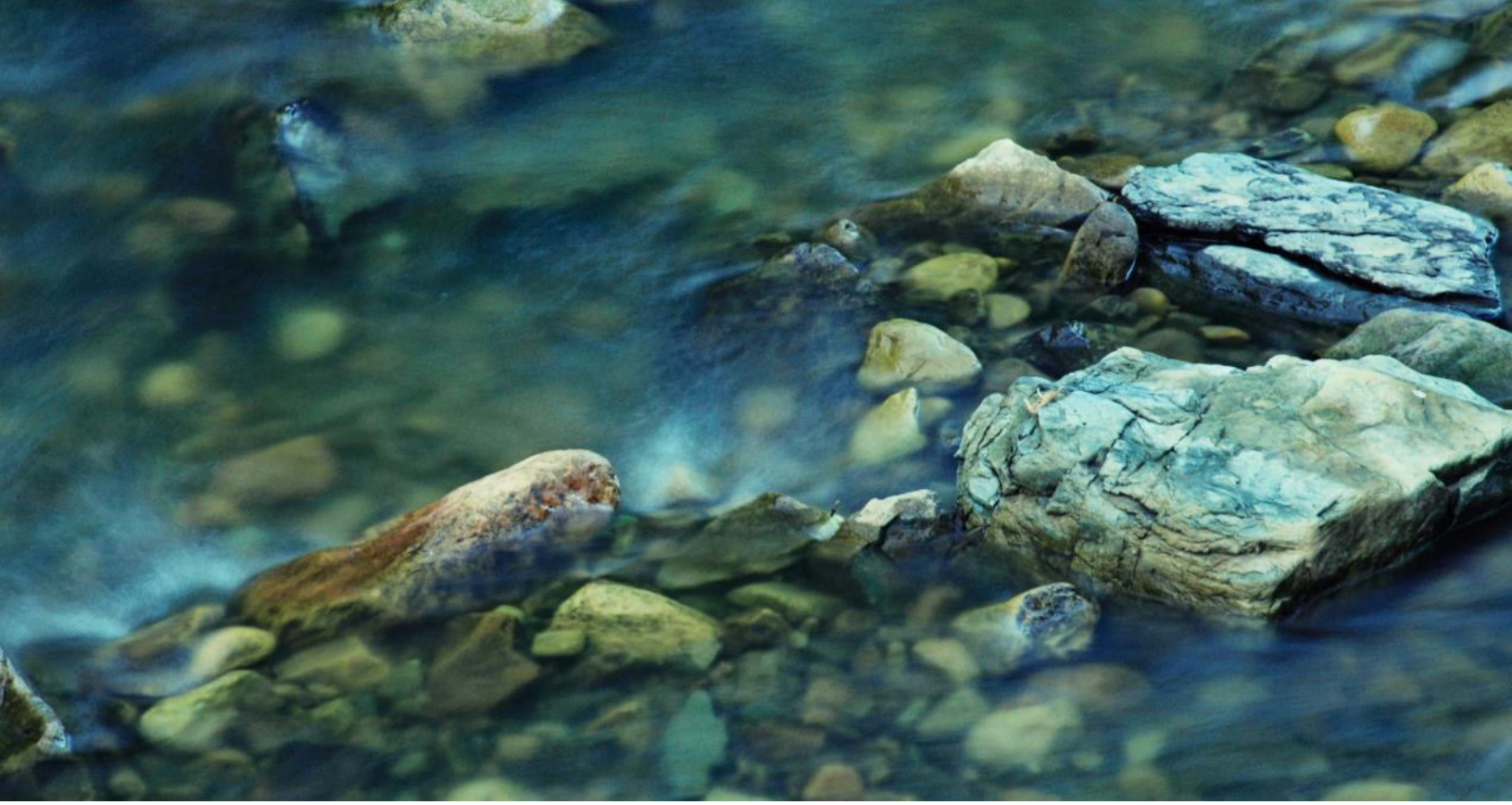
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Figure 4-2
Sediment Long-Term Monitoring Locations
Compliance Monitoring and Contingency Response Plan
Port of Tacoma – Tru-Grit Site

Appendix A
Sampling and Quality Assurance Project Plan



July 2026
Port of Tacoma – Tru-Grit Site

ANCHOR QEA

Sampling and Quality Assurance Project Plan

Prepared for the Port of Tacoma

July 2026
Port of Tacoma – Tru-Grit Site

Sampling and Quality Assurance Project Plan

Prepared for
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Tacoma, Washington 98401

Prepared by
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Tacoma, Washington 98402

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FIGURES

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Figure A-2 Sediment Performance and Confirmation Monitoring Locations

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ATTACHMENT

Attachment A Field Forms

ABBREVIATIONS

ARL	Analytical Resources, LLC
ASTM	ASTM International
CCV	continuation calibration verification
CM	centimeter
CMCRP	*Compliance Monitoring and Contingency Response Plan*
D/F	dioxin/furans
DGPS	differential global positioning system
DMMP	Dredge Material Management Program
DQO	Data Quality Objective
Ecology	Washington State Department of Ecology
EDL	estimated detection limit
EPA	U.S. Environmental Protection Agency
EQuIS	Environmental Quality Information System
FC	field coordinator
FNC	federal navigation channel
GC	gas chromatography
IDW	investigation-derived waste
MD	matrix duplicate
MDL	method detection limit
MIDP	*Archaeological Monitoring and Inadvertent Discovery Plan*
MLLW	mean lower low water
MS	matrix spike
MSD	matrix spike duplicate
NAD83	North American Datum 1983
NAVD88	North American Vertical Datum of 1988
NIST	National Institute of Standards and Technology
OSHA	Occupational Safety and Health Act
PCB	polychlorinated biphenyl
PM	project manager
Port	Port of Tacoma
PSEP	Puget Sound Estuary Program
QA/QC	quality assurance/quality control
RMC	residuals management cover
RL	reporting limit
RPD	relative percent difference
SCUM	Sediment Cleanup User's Manual

Site	Tru-Grit Site
SMS	Sediment Management Standards
SOP	standard operating procedure
SQAPP	Sampling and Quality Assurance Project Plan
Tru-Grit	Tru-Grit Abrasives, Inc.
USACE	U.S. Army Corps of Engineers

1 Introduction

On behalf of the Port of Tacoma (Port), Anchor QEA has prepared this Sampling and Quality Assurance Project Plan (SQAPP) that details sample collection methods and analytical protocols for sediment sample collection activities in the Tru-Grit Abrasives, Inc. (Tru-Grit), site (Site) located at 1110 East Alexander Avenue, Tacoma, Washington (Figure A-1).

The Port plans to implement an Interim Action as an independent remedial action during the 2026/2027 dredging season. The purpose of the Interim Action is to remove contaminated sediments, consistent with the Model Toxics Control Act and Washington State Sediment Management Standards (SMS) requirements, in the Lower Slope area of the Tru-Grit Site prior to the U.S. Army Corps of Engineers (USACE) federal navigation channel (FNC) Deepening Project to prevent them from sloughing into the FNC during or after waterway deepening.

This SQAPP was prepared to outline sampling procedures associated with compliance monitoring, including performance monitoring, confirmation monitoring, and long-term monitoring that will occur during and after implementation of the Interim Action, as outlined in the *Compliance Monitoring and Contingency Response Plan* (CMCRP; Anchor QEA 2026a).

1.1 Site History

The Site has been used for shipyard activities since its development in the 1960s and has passed through multiple owners since that time, including Martinolich Shipbuilding Corporation, Sea-Tac Alaska Shipbuilding (formerly Sextant Marine), A.H. Powers, and the Port. Tru-Grit operated a grit receiving and offloading facility (including a dock, hopper, and conveyor system to offload grit from barges) from 1990 to 2013 at the Site. Site sediment contamination is associated with these operations and is documented in a remedial investigation and draft feasibility study performed by Tru-Grit's parent company, CanAm Materials, in 2021 and 2019, respectively. Other Site contamination (primarily polychlorinated biphenyls [PCBs] and dioxin/furans [D/F]) have been detected in Site sediments and upland soils during a 2024 to 2025 sampling effort by Anchor QEA. Additional site history and a summary of investigations are presented in the *Sediment Characterization Report* (Anchor QEA 2026b).

1.2 Document Organization

This SQAPP was prepared in accordance with Washington State Department of Ecology (Ecology) guidance, as described in the Sediment Cleanup User's Manual (SCUM; Ecology 2025). This SQAPP is organized into the following sections:

- Section 2 – Project Management
- Section 3 – Sample Collection and Processing
- Section 4 – Quality Assurance/Quality Control

- Section 5 – Contingent Biological Testing
- Section 6 – Assessments and Response Actions
- Section 7 – Data Validation, Usability, and Reporting
- Section 8 – References

2 Project Management

This section discusses the proposed project team and team member responsibilities for conducting the field investigation, lists training and certification requirements for sampling personnel, and describes documentation and recordkeeping procedures.

2.1 Project/Task Organization

Responsibilities of the team members, as well as of the laboratory project managers, are described in this section.

Project Manager (PM). The PM will be responsible for directing the project team for the implementation of all activities described in this SQAPP. The PM will also be responsible for production of work plans, producing all project deliverables, and performing the administrative tasks needed to ensure timely and successful completion of these studies. The PM will provide the overall programmatic guidance to support staff and will ensure that all documents, procedures, and project activities meet the objectives contained within this SQAPP. The PM will also be responsible for resolving project concerns or conflicts related to technical matters.

Field Coordinator (FC). The FC will be responsible for coordination of field sampling activities. The FC will ensure that appropriate protocols for sample collection, preservation, and holding times are observed and will oversee submission of environmental samples to the designated laboratory for chemical and physical analyses.

Quality Assurance/Quality Control (QA/QC) Manager. The QA/QC Manager will provide QA/QC oversight for both the field sampling and laboratory programs, ensure that samples are collected and documented appropriately, coordinate with the analytical laboratories, ensure data quality, oversee data validation, and supervise project QA coordination and data validation.

2.2 Special Training Requirements/Certifications

For sample preparation tasks, it is important that field crews are trained in standardized data collection requirements so that the data collected are consistent among the field crews. Field crews will comprise individuals who are fully trained in sediment core collection and processing, decontamination protocols, field documentation, and chain-of-custody procedures.

In addition, the 29 *Code of Federal Regulations* 1910.120 Occupational Safety and Health Act (OSHA) regulations require training to provide employees with the knowledge and skills enabling them to perform their jobs safely and with minimum risk to their personal health. All field personnel will have completed the 40-hour Hazardous Waste Operations and Emergency Response training course and 8-hour refresher courses, as necessary, to meet the OSHA regulations.

2.3 Documentation and Records

This project will require central project files to be maintained. Project records will be stored and maintained in a secure manner. Each project team member is responsible for filing all necessary project information or providing it to the person responsible for the filing system. Individual team members may maintain files for individual tasks but must file documents in the central project files upon completion of each task. Hard copy documents will be scanned and saved to the central files. Electronic data will be maintained in the database, and database exports will be stored in a designated directory.

2.3.1 Field Records

All documents generated during the field effort are controlled documents that become part of the project file. Field team members will keep a daily record of significant events, observations, and measurements on field forms specific to the collection activity. Field documentation will consist of a daily field log and surface sediment collection and processing forms (Attachment A). Field forms will be maintained by the FC. The sampling documentation will contain information on each sample collected and will include, at a minimum, the following information:

- Project name
- Field personnel on site
- Site visitors
- Weather conditions
- Field observations
- Sample collection dates and times
- Sample collection methods and description of activities
- Identification or serial numbers of instruments or equipment used
- Deviations from this SQAPP
- Meetings associated with field sampling activities

Entries for each day will begin on a new form. The person recording information must enter the date and time. In general, sufficient information will be recorded during sample collection and processing activities so that reconstruction of the event can occur without relying on the memory of the field personnel.

The field forms may be electronic or handwritten. If handwritten, they will be on water-resistant, durable paper. Notes will be made in indelible, waterproof blue or black ink. Errors will be corrected by crossing out with a single line and initialing the change. Each form will list the project name, number, and date. The field forms will be scanned or saved into the project file directory as convenient during the sampling event or upon completion of each sampling event.

2.3.2 Analytical Records

The laboratory will retain analytical data records. Additionally, the project team will retain copies of PDF analytical data in the central project files. Data reporting requirements will include those items necessary to complete data validation, including copies of raw data. Elements to be reported in the laboratory data packages are listed in Section 4.4.6.

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

2.3.3 Data Reduction

Data reduction is the process by which original data (analytical measurements) are converted or reduced to a specified format or unit to facilitate analysis of the data. Data reduction requires that all aspects of sample preparation that could affect test results, such as sample mass or volume analyzed, sample moisture content, or dilutions required, be taken into account in the final result. The laboratory analyst is responsible to reduce the data, which are subject to further review by the laboratory manager, the PM, the QA/QC Manager, and independent reviewers. Data reduction may be performed manually or electronically.

3 Sample Collection and Processing

The rationale for the sampling design and design assumptions for locating and selecting samples, as well as methods and procedures for the collection of field samples, are provided in this section. Sampling will be conducted following standard procedures documented in this SQAPP. In general, all sampling procedures will also comply with previously approved sample collection standards established for the study area.

3.1 Sampling Design

Surface sediment samples will be collected during compliance monitoring to verify that sediment quality meets the performance standards outlined in the CMCRP (Anchor QEA 2026a). The following subsections detail surface sediment sampling and processing procedures. Table A-1 summarizes the sample locations, coordinates, sample intervals, and planned analyses. Figure A-2 shows target sample locations for performance monitoring and confirmation monitoring. Figure A-3 shows target sample locations for long-term monitoring.

3.1.1 Performance Monitoring Sediment Sampling

Performance monitoring sediment sampling will follow the sampling procedures outlined in Section 3.2. Dredging is intended to achieve removal of contaminated sediments from the bottom and from the south, east, and west side slopes of the dredge prism. The northern side slope will consist of the cut face of the Upper Slope area and is expected to contain residual Site-associated contaminants. Post-dredge sediment sampling is intended to verify the lack of excessive dredging residuals on the bottom and sides of the dredge prism and to verify the lack of missed inventory on the bottom, south, east, and west sides of the dredge prism. The post-dredge sediment sampling will be used to trigger contingency re-dredging where necessary and practicable to remove excessive dredging residuals or missed inventory prior to material placement. Performance monitoring will include the following:

- **Verifying residuals thicknesses:** Prior to the placement of clean sand cover, surface sediment grab sampling will be performed to verify that the thickness of the dredge residuals layer averages less than 10 centimeters (cm).
- **Testing for missed inventory:** Sampling will also be used to verify the lack of missed inventory on the bottom and on the south, east, and west side slopes of the dredge prism. Locations of the performance monitoring surface sampling stations are depicted in Figure A-2. Samples will be analyzed for parameters identified in Table A-2.
- **North side slope samples:** Sampling of the north side slope will be used to document the levels of contamination along the cut face between the Upper Slope and the Lower Slope prior to the placement of slope backfill and residuals management cover (RMC).

Surface and shallow subsurface sediment will be collected using a hydraulic Van Veen sampling device at the 20 locations within Areas A and B, as shown in Figure A-2. Samples will be analyzed for parameters identified in Table A-2. The overlying residuals layer is expected to consist of poorly consolidated materials. Performance monitoring sediment sampling may occur in phases as is deemed practicable to reduce contractor downtime in the field between dredging and RMC placement.

3.1.2 Confirmation Monitoring Sediment Sampling

Confirmation monitoring sediment sampling will follow the sampling methods described in Section 3.2. Surface sediment quality will be monitored to document the effectiveness of remediation in maintaining performance standards for Site contaminants. Surface sediment will be collected from the biologically active zone (top 10 cm) of sediment at 20 locations within the material removal and RMC placement areas. Locations of the confirmation monitoring surface sampling stations are depicted in Figure A-2. Samples will be analyzed for parameters identified in Table A-2.

Confirmation monitoring sediment sampling will take place following completion of RMC and slope backfill placement. Sampling will include collection of archived materials for bioassay testing in the event that Site contaminants are detected in excess of the performance criteria.

3.1.3 Long-Term Monitoring Sediment Sampling

Long-term monitoring sediment sampling will follow the sampling methods described in Section 3.2. If contingent sediment monitoring is triggered based on 3-year bathymetric survey evaluations as described in the CMCRP (Anchor QEA 2026a), samples will be collected from 12 locations shown in Figure A-3 to verify compliance of the final sediment surface with the interim action performance standards. These include the former dredge prism bottom samples and the north side slope samples. Samples will be analyzed for parameters identified in Table A-2.

Long-term monitoring sediment sampling will take place after completion of the 3-year bathymetric survey evaluation. Surface sediment will be collected from the biologically active zone (0 to 10 cm) of sediment at 12 locations within the material removal and RMC placement areas as shown in Figure A-3.

3.2 Sediment Monitoring Sampling Methods

This section describes sampling methods and includes sample identification, station positioning, and surface sediment collection and processing.

3.2.1 Sample Identification

Each sediment sample will be assigned a unique alphanumeric identifier according to the following method:

- Each sample ID will be identified by the overall Site ("TG") and location within the Site as well as the sample collection method.
  - The monitoring method will be identified by "PM" for performance monitoring, "CM" for confirmation monitoring, and "LT" for long-term monitoring sampling events.
  - The sample collection method will be identified by "SG" for surface grab samples.
  - Station numbers will be added after the collection method identifier and are listed in Table A-1 and shown in Figures A-2 and A-3.
  - The location of the sample station will be added after the station number, with "N" as a dredge prism north slope sample, "B" as a dredge prism bottom slope sample, "S" as a dredge prism south slope sample, "E" as a dredge prism east slope sample, and "W" as a dredge prism west slope sample, as shown in Table A-1 and shown in Figures A-2 and A-3.
  - The date in YYMMDD format will be appended to the end of the sample ID.
  - An example sample identification nomenclature is TG-PM-SG03B-270122, which designates a surface sediment sample collected for performance monitoring from location SG03 at the dredge prism bottom slope on January 22, 2027.
- A field duplicate will be identified by the addition of 100 to the sample station number. A duplicate sample collected from the above example would be TG-PM-SG103B-270122 collected on January 22, 2027.
- Rinsate blank samples will use the overall Site identifier and collection method followed by "RB" and the date. The resulting nomenclature of a rinsate blank of the decontaminated surface sediment sample processing equipment collected on January 22, 2027, would be TG-PM-SG-RB-270122.

3.2.2 Station Positioning

Station locations are listed in Table A-1 and shown in Figures A-2 and A-3. Horizontal positioning will be determined in the field by differential global positioning system (DGPS) based on target coordinates. Target coordinates are provided in Table A-1, and surface grabs will be collected as close to target locations as reasonably feasible. The horizontal datum will be the North American Datum 1983 (NAD83), Washington State Plane, South Zone, U.S. feet. Measured geographical coordinates for station positions will be recorded and reported to the nearest 0.01 second. In addition, state plane coordinates will be reported to the nearest foot. The DGPS accuracy is less than 1 meter and generally less than 30 cm, depending on the satellite coverage and the number of data points collected.

The vertical elevation of each sediment station will be measured using a fathometer or lead line and converted to mean lower low water (MLLW) elevation. Tidal elevations will be determined based on published tide predictions from Tides and Currents software and confirmed using measured data from the National Oceanic and Atmospheric Administration's automated tide gauge station number 9446484, located in Commencement Bay in Tacoma, Washington. Vertical elevations of sampling stations will be converted to elevations in North American Vertical Datum of 1988 (NAVD88), and a conversion table will be presented in the data report.

3.2.3 Surface Sediment Sample Collection Procedures

Surface sediment grab samples will be collected at 20 locations in Areas A and B for performance monitoring and confirmation monitoring activities (Figure A-2) and at 12 locations for long-term monitoring activities (Figure A-3). For performance monitoring post-dredge sampling, each surface grab sample will be collected from approximately 10 to 20 cm below the dredging residuals layer (a minimum of 5 cm of sediment should separate the interface between dredging residuals and underlying sediment to be sampled) for chemical analysis using a Van Veen sampler or similar device from the boat. For confirmation monitoring post-placement sampling and long-term monitoring conditional sediment testing, a one- to two-point composite surface grab sample will be collected from the biologically active zone (top 10 cm) of sediment for chemical analysis and contingent bioassay testing using a Van Veen sampler or similar device from the boat. The target locations are shown in Figures A-2 and A-3, and locations and coordinates are listed in Table A-1. Samples will be collected in the following manner:

- The sampler will be decontaminated prior to use and between each sampling location. The sampler is washing with a cleaning detergent (e.g., Alconox), and rinsed with Site water. Within a specific sample location, the sampler will simply be rinsed with Site water between individual grab samples.
- Once the boat is in the general proximity of the planned sampling location, the sampler is lowered vertically through the water column until just above the sediment surface. For the first sample attempt, the boat is positioned within ± 3 feet of the designated target coordinates for the specific station, and the sampler is set on the sediment surface.
- Once the jaws of the sampler are closed, at that time, the station name, latitude/longitude, time of collection, and water depth-to-mudline will be noted in the field log. The water depth-to-mudline will be taken with a lead line or depth sounder.
- Retrieval of the grab should initially occur no faster than 1-foot per second.
- At the water surface, the winch should then be throttle down to slowly bring the grab into the boat with minimal swinging.
- The sediment sample will be retrieved aboard the vessel and evaluated against the acceptability criteria as stated in Section 3.2.3.2.

Prior to sampling, field personnel will take color photographs and record field conditions and collection notes on a standard surface sediment field log (Attachment A). Logs will include the following information:

- Grab sample recovery depth
- Water depth-to-mudline at each station using lead line or depth sounder at the point of the sampling station
- Coordinates of each station as determined by DGPS
- Date and time of collection of each sediment grab sample
- Names of field personnel collecting and handling the samples
- Observations made during sample collection, including weather conditions, complications, ship traffic, and other details associated with the grab sampling effort:
  - Jaws closed properly
  - Good seal observed
  - Evidence of winnowing, if present
  - Overlying water present
  - Surface of sample remained intact
- Sample station ID
- Grab sample recovery depth
- Physical soil description in accordance with ASTM International (ASTM) procedures (ASTM D 2488 and ASTM D 2487 – Unified Soil Classification System) including soil type, density/consistency of soil, and color
- Odor (e.g., hydrogen sulfide and petroleum)
- Visual stratification, structure, and texture
- Vegetation and debris (e.g., wood chips or fibers, concrete and metal debris, paint chips, sand blast grit, slag, and creosote)
- Biological activity (e.g., detritus, shells, tubes, bioturbation, and live or dead organisms)
- Presence of oily sheen or non-aqueous phase liquids
- For performance monitoring sediment sample processing, the thickness of the apparent dredge residuals layer (expected to be sandy, unconsolidated sediment) will be measured and then subsequently removed from atop undredged (native) sediments.
- Any deviation from the approved SQAPP

Additionally, due to volume requirements for the proposed confirmation and long-term monitoring testing programs, multiple grab attempts with the grab sampler may be required. See Section 3.2.3.1 for further information on the surface sediment composite procedures.

3.2.3.1 Sample Composite Procedures

Due to volume requirements for the proposed confirmation and long-term monitoring testing programs, each surface sediment sample location may be composed of a one- to two-point composite surface sediment grab sample to obtain sufficient volume of 14 liters for bulk chemistry, as well as for contingent bioassay analyses.

For the initial discrete sample collected at each sampling station, the sampling field team will navigate to the target coordinates presented in Table A-1. After collecting an accepted grab, the recovery volume will be approximated to determine if a second sample is required. If more volume is necessary, a second discrete sample for the two-point composite sample will be taken with a separation distance less than 10 feet (3 meters) from the original target location.

If sampling locations are restricted due to obstructions (e.g., debris and/or riprap) or other conditions that make sampling unsafe or inaccessible, modifications to the sample compositing and/or positioning approach for two-point composite surface sediment samples will be discussed with the PM.

3.2.3.2 Sample Acceptance Criteria

After the grab sampler has been secured, the upper access doors of the sampler should be opened, and the sediment sample should be inspected carefully before being accepted. The following acceptability criteria should be satisfied:

- The jaws of the sampler will be fully closed—no protruding rock, branches, or other debris that may prevent a clean and complete closure.
- The grab sampler is not overfilled (i.e., the sediment surface is not against the top of the sampler).
- The sediment surface is relatively flat, indicating minimal disturbance or winnowing during retrieval.
- Overlying water is present, indicating minimal leakage.
- Overlying water has low turbidity, indicating minimal sample disturbance.
- A penetration depth greater than 20 to 30 cm is achieved to provide an undisturbed layer of the sample interval below the dredging residuals layer.

3.2.3.3 Surface Sediment Sample Processing Procedures

Surface sediment grab processing will be conducted aboard the sampling vessel. All working surfaces and instruments will be thoroughly cleaned, decontaminated, and covered with aluminum foil when not in use to minimize potential contamination between sampling stations. Disposable gloves will be discarded after processing each sample and replaced prior to handling decontaminated instruments or work surfaces. Discrete surface grab samples that meet project acceptance criteria will be processed as follows:

- Overlying water will be siphoned off.

- Prior to sampling, color photographs will be taken, and a description of each grab sample will be recorded on a sediment sampling form (Attachment A).
- If sampling for performance monitoring (post-dredge) is being performed:
  - The sample will be visually inspected, and the thickness of the identified residuals layer (expected to be sandy, unconsolidated sediment atop a firmer native sand) will be measured ±1 cm.
  - Once measurement is complete, the overlying residual material will be removed from the sample and handled according to investigation-derived waste (IDW) procedures.
  - Sediment will then be collected from at least 5 cm below the interface with dredge residuals to the bottom of the sampler (a depth of approximately 20 to 30 cm below the surface of the grab, assuming 10 cm of overburden residuals) using a clean, stainless-steel spoon and placed into a clean, stainless-steel bowl or pot.
- If sampling for confirmation monitoring or long-term monitoring is being performed:
  - Sediment will be collected from the top 10 cm (0.3 foot) and placed into a clean, stainless-steel bowl.
- Equal amounts of material from each discrete grab sample will be combined and homogenized in a separate bowl to represent the composite sample.
- To avoid cross-contamination, only sediment that has not contacted the sides or bottom of the grab sampler will be removed and processed.
- The sample will be homogenized until a uniform color and consistency are achieved.
- Samples will be spooned in to the appropriate, laboratory-supplied sample containers, as identified in Table A-3, and submitted to the laboratories identified in Table A-3 for analyses or archival. The sample jars should be pre-labeled (with sample ID, date/time, and analysis) prior to filling.
- The screw cap will be placed on the sample containers, and the lids will be tightened.
- All sample containers will be double-checked for proper identification and secure lid closure.
- Each container will be packed carefully to prevent breakage and placed inside a cooler with ice for proper storage (at 4°C ± 2°C).
- For the performance monitoring testing program, a total of approximately 2 liters is required for chemical analysis. Sampling handling requirements are presented in Table A-3.
- For the confirmation and long-term monitoring testing programs, a total of 14 liters is required; approximately 2 liters will be required for chemical analysis, and 12 liters are required for bioassays. Sample handling requirements are presented in Table A-3.
- Unused surface sediment will be returned to the water; because it was collected from the mudline, it does not need to be considered IDW.
- If performing confirmation monitoring of contingent long-term sediment sampling, overburden residuals are not expected to be encountered. In these cases, sediment will be

sampled from the top 10 cm of the grab. All samples will be homogenized until uniform in color and texture.

An additional 0.25-liter sample container (approximately 8 ounces) will be collected and archived from each sample for additional testing, if required. Sample handling requirements are presented in Table A-3. Samples for chemical analyses will be securely packed and delivered to the selected laboratory. Archived sample aliquots will be held at the laboratory in frozen storage for potential future chemical analyses.

3.2.4 Archaeological Observations

Archaeological monitoring is not anticipated to be required, given that the proposed sampling locations are all below the -10 feet MLLW threshold for archaeological monitoring established in the *Archaeological Monitoring and Inadvertent Discovery Plan* (MIDP; Jenkins and Cooper 2024). If monitoring locations are adjusted above -10 feet MLLW, the MIDP should be followed.

3.3 Sample Handling Requirements

This section addresses the sampling program requirements for field decontamination, IDW management, sample custody, and sample shipping requirements.

3.3.1 Field Decontamination Procedures

Sample containers, instruments, working surfaces, and other items that may come into contact with sediment sample material must meet high standards of cleanliness. All equipment and instruments used that are in direct contact with sediment collected for analyses must be made of glass, stainless steel, high-density polyethylene, or polytetrafluoroethylene. These items will be cleaned prior to each day's use and between sampling or compositing events. Decontamination of all items will follow Puget Sound Estuary Program (PSEP) protocols (PSEP 1997). The decontamination procedure is as follows:

1. Scrub until free of visible sediment in tap water or Site water.
2. Wash with a solution of tap water and phosphate-free soap (e.g., Alconox) and scrub brush.
3. Rinse with tap water.
4. Rinse three times with distilled water.
5. Cover (no contact) all decontaminated items with aluminum foil.
6. Store in a clean, closed container. Bowls may be stored inverted on a clean, foil-covered surface for next use.

3.3.2 Sample Custody and Shipping Requirements

Samples are considered to be in one's custody if they are in the custodian's possession or view, in a secured location (under lock) with restricted access, or in a container that is secured with official seals such that the sample cannot be reached without breaking the seals.

Chain-of-custody procedures will be followed for all samples throughout the collection, handling, and analytical processes. The principal document used to track possession and transfer of samples is the chain-of-custody form. Each sample ID will be listed on an electronic or handwritten chain-of-custody form the day it is collected. All handwritten data entries will be made using an indelible ink pen. Corrections will be made by drawing a single line through the error, writing in the correct information, and then initialing the change. Blank lines and spaces on chain-of-custody forms will be lined-out, dated, and initialed by the individual maintaining custody.

A chain-of-custody form will accompany each shipment of samples to the analytical laboratory. Each person who has custody of the samples will ensure that the samples are not left unattended unless properly secured. Copies of all chain-of-custody forms will be retained in the project files.

All samples will be shipped or hand-delivered to the analytical laboratory no later than the day after collection. Samples collected on Friday may be held until the following Monday for shipment, provided this does not jeopardize any holding time requirements. Specific sample shipping procedures are as follows:

- Each cooler or container with samples will be hand-delivered, couriered, or shipped via overnight delivery to the appropriate analytical laboratory. If Saturday delivery is required, the FC or designee will contact the analytical laboratory before 3 p.m. on Friday to ensure the laboratory is accepting sample deliveries and is aware of the number of containers shipped. The airbill tracking numbers for those containers will be provided to the laboratory.
- Ice will be sealed in separate plastic bags and placed in shipping containers. Ice may be kept in the bags provided and placed in the cooler if the samples will be couriered or hand-delivered.
- Individual samples will be placed in sealable plastic bags, packed to prevent breakage, and transported in a sealed cooler or other suitable container.
- Glass jars will be separated in the shipping container by shock absorbent material (e.g., bubble wrap) to prevent breakage.
- If samples are transferred using a commercial shipping company, the following procedures will be followed:
  - The shipping containers will be clearly labeled with sufficient information (name of project, laboratory name and shipping address, and consultant's name and return address) to enable positive identification.
  - Chain-of-custody forms will be enclosed in a plastic bag and placed inside the cooler.
  - A minimum of two signed and dated chain-of-custody seals will be placed on adjacent sides of each cooler prior to shipping.
  - Each cooler will be secured with packing tape.

Upon transfer of sample possession to the analytical laboratory, the persons transferring custody of the sample container will sign the chain-of-custody form. Upon receipt of samples at the laboratory, the person receiving the cooler will sign the chain-of-custody forms. The shipping container seals will be broken (if applicable), and the receiver will record the condition of the samples on a sample receipt form. Chain-of-custody forms will be used internally in the laboratory to track sample handling and final disposition.

3.4 Laboratory Methods

This section summarizes the target physical and chemical analyses that will be conducted on the samples collected. All sample analyses will be conducted in accordance with U.S. Environmental Protection Agency (EPA)-approved methods or other commonly acceptable methods and this SQAPP. Prior to analyses, all samples will be maintained according to the appropriate holding times and temperatures for each analysis (Table A-3). Analytes, analytical methods, and target detection limits for chemical and physical testing are presented in Table A-2. The analytical laboratory will prepare a detailed report in accordance with this SQAPP.

Prior to sample analyses, the laboratory will calculate method detection limits (MDLs) and establish reporting limits (RLs) for each analyte of interest, where applicable. RLs will be at or below the values specified in Table A-2, if technically feasible.

Chemical testing will be conducted at Analytical Resources, LLC (ARL), in Tukwila, Washington. ARL is accredited under the National Environmental Laboratories Accreditation Program. All chemical and physical testing will adhere to the most recent EPA QA/QC procedures outlined in the approved analytical methods and in this SQAPP. The laboratory may use more current analytical methods if available.

In completing chemical analyses for this project, the contract laboratories are expected to meet the following minimum requirements:

- Adhere to the methods outlined in this SQAPP, including methods referenced for each analytical procedure (Table A-2).
- Deliver electronic data as specified.
- Meet reporting requirements for deliverables.
- Meet agreed-upon turnaround times for deliverables.
- Implement QA/QC procedures discussed in this SQAPP, including following Data Quality Objectives (DQOs), laboratory QC requirements, and performance evaluation testing requirements.
- Notify the project QA/QC Manager of any SQAPP QA/QC problems when they are identified to allow for quick resolution.
- Allow laboratory and data audits to be performed, if deemed necessary.

4 Quality Assurance/Quality Control

Field and laboratory activities will be conducted in such a manner that the results meet specified quality objectives and are fully defensible. Guidance for QA/QC is derived from the protocols developed for EPA SW-846 (1986), the EPA Contract Laboratory Program (EPA 2020a, 2020b, 2020c), and the cited methods.

4.1 Field Quality Control

Field personnel will identify and label samples in a consistent manner to ensure that field samples are traceable. Labels should be used in conjunction with the chain-of-custody and this SQAPP to provide all information necessary for the laboratory to conduct required analyses properly. QA samples will be collected in the field to ensure project DQOs are met. Samples will be placed in appropriate containers and preserved for shipment to the laboratory in accordance with the requirements presented in Table A-3.

4.2 Field Quality Assurance and Quality Control Sampling

Field QA/QC procedures will consist of following procedures for acceptable practices for sample collection and handling. This also includes periodic and routine equipment inspection.

Field QA/QC samples will be collected along with the environmental samples. Field QA/QC samples are useful in identifying possible problems resulting from sample collection or sample processing in the field. The collection of field QA/QC samples includes equipment rinsate blanks and field duplicates as specified in Table A-4. Rinsate blanks will be collected at a frequency of one per event and evaluated during data validation. Field duplicates will be collected at a frequency of 1 per 20 samples collected, provided sufficient sample mass can be collected. Field duplicates will be collected by collecting extra material from the surface grab, homogenizing until uniform in color and texture, and dividing the sample between two sets of jars to create two discrete samples.

Field QA/QC samples will also include the collection of additional sample mass as required to ensure that the laboratory has sufficient sample mass or volume to run the matrix-specified analytical QA/QC (matrix duplicate [MD]/matrix spike [MS]/MS duplicate [MSD]) samples for analyses as specified in Table A-4. Additional sample mass to meet this requirement will be collected at a frequency of 1 per 20 samples collected. The samples designated for MD/MS/MSD analyses should be clearly marked on the chain-of-custody forms.

All field QA/QC samples will be documented on the field forms and verified by the QA/QC Manager or designee.

4.2.1 Sample Containers

Sample containers and preservatives will be provided by the laboratory. The laboratory will maintain documentation certifying the cleanliness of bottles and the purity of preservatives provided. Container requirements are listed in Table A-3.

4.2.2 Sample Identification and Labels

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

- Company name
- Project name
- Sample identification
- Date and time of sample collection
- Preservative type (if applicable)
- Analysis to be performed

4.3 Data Quality Objectives and Criteria

The DQOs for this project will ensure that data collected are of known and acceptable quality so that the project objectives described in this SQAPP are achieved. The quality of the laboratory data is assessed by precision, accuracy, representativeness, comparability, and completeness (the "PARCC" parameters). Definitions of these parameters and the applicable QC procedures are provided in the following subsections. Applicable quantitative goals for these data quality parameters are listed or referenced in Table A-5.

4.3.1 Precision

Precision is the ability of an analytical method or instrument to reproduce its own measurement. It is a measure of the variability, or random error, in sample collection, sample handling, and laboratory analyses. ASTM recognizes two levels of precision (ASTM 2002):

- **Repeatability**: the random error associated with measurements made by a single test operator on identical aliquots of test material in a given laboratory with the same apparatus under constant operating conditions
- **Reproducibility**: the random error associated with measurements made by different test operators in different laboratories using the same method but different equipment to analyze identical samples of test material

In the laboratory, "within-batch" precision is measured using duplicate sample or QC analyses and is expressed as the relative percent difference (RPD) between the measurements. The "batch-to-batch"

precision is determined from the variance observed in the analyses of standard solutions or laboratory control samples from multiple analytical batches.

Field precision will be evaluated by the collection of field duplicates for chemistry samples at a frequency of 1 in 20 samples. Field chemistry duplicate precision will be screened against an RPD of 50%, as listed in Table A-5. Laboratory precision control limits are also listed in Table A-5 for each analysis. Equation 1 shows the RPD equation used to express precision:

Equation 1

$$RPD = \frac{(C_1 - C_2)x\ 100\%}{(C_1 + C_2)/2}$$

where:

RPD	=	relative percent difference
C_1	=	larger of the two observed values
C_2	=	smaller of the two observed values

Precision measurements can be affected by the nearness of a chemical concentration to the MDL, where the percent error (expressed as RPD) increases. Parent and field duplicate results that are less than five times reporting limits will be evaluated by using the difference between results using a control limit of ± 2x RL.

4.3.2 Accuracy

Accuracy is a measure of the closeness of an individual measurement (or an average of multiple measurements) to the true or expected value. Accuracy is determined by calculating the value of results from analyses of laboratory control samples, standard reference materials, and standard solutions. In addition, matrix-spiked samples are also measured, which indicate the accuracy or bias in the actual sample matrix. Accuracy is expressed as percent recovery of the measured value, relative to the true or expected value. If a measurement process produces results that are not the true or expected values, the process is said to be biased. Bias is the systematic error either inherent in a method of analysis (e.g., extraction efficiencies) or caused by an artifact of the measurement system (e.g., contamination). Analytical laboratories use several QC measures to eliminate analytical bias, including systematic analysis of method blanks, laboratory control samples, and independent calibration verification standards. Because bias can be positive or negative, and because several types of bias can occur simultaneously, only the net, or total, bias can be evaluated in a measurement.

Laboratory accuracy will be evaluated using quantitative laboratory control sample, MS, surrogate spike, and calibration standard recoveries compared with criteria listed in Table A-5 or the method-specified performance criteria. Accuracy can be expressed as a concentration compared to the true or reference value, or as a percent recovery in those analyses where reference materials are not available and spiked samples are analyzed. Equation 2 shows the equation used to express accuracy:

Equation 2

$$\%R = 100\% \; x \; (S - U)/Csa$$

where:

$\%R$	=	percent recovery
S	=	measured concentration in the spiked aliquot
U	=	measured concentration in the unspiked aliquot
Csa	=	actual concentration of spike added

Field accuracy will be controlled by adherence to sample collection procedures outlined in this SQAPP.

4.3.3 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent an environmental condition.

4.3.4 Comparability

Comparability expresses the confidence with which one dataset can be evaluated in relation to another dataset. For this program, comparability of data will be established through the use of standard analytical methodologies and reporting formats and through common traceable calibration standards and reference materials.

4.3.5 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 using Equation 3:

Equation 3

$$C = \frac{(Number\ of\ acceptable\ data\ points)x\ 100}{Total\ number\ of\ data\ points}$$

The DQO for completeness for all components of this project is 95%. 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 rejected will not be considered valid for the purpose of assessing completeness.

4.3.6 Sensitivity

Sensitivity is a measure of analytical detection and RLs. In general, the lowest technologically achievable MDLs and RLs will be targeted for this project, and high-resolution method data will be reported to estimated detection limits (EDLs).

The MDL is defined as the minimum concentration at which a given target analyte can be measured and reported with 99% confidence that the analyte concentration is greater than zero. Laboratory RLs are defined as the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. EDLs are defined as the minimum concentration required to produce a signal with a peak height or area at least 2.5 times the background or noise level. EDLs are sample- and analyte-specific and calculated at the time of analysis, so they cannot be determined ahead of time. Laboratory MDLs, RLs, and EDLs will be used to evaluate the method sensitivity and applicability prior to the acceptance of a method for this program. Method blanks will be analyzed to ensure target analytes are not introduced during sample preparation or analysis that would affect analytical sensitivities.

The sample-specific MDLs, RLs, and EDLs will be reported by the laboratory and will take into account any factors relating to the sample analysis that might decrease or increase these limits (e.g., dilution factor, percent moisture, and analytical mass). If MDLs, RLs, or EDLs are elevated due to matrix interferences and subsequent dilutions or reductions in sample aliquots, the data will be evaluated by the QA/QC Manager and the laboratory to determine whether an alternative course of action is required or possible. The sample-specific MDLs, RLs, and EDLs will be the values stored in the project database.

4.4 Laboratory Quality Control

Laboratory QC procedures, where applicable, include instrument performance checks, initial and continuing instrument calibrations, standard reference materials, laboratory control samples, surrogate spikes (for organic analyses), labeled compound spikes (for high-resolution analyses), and method blanks. Sample-specific matrix laboratory control analyses include matrix replicates and MSs. Laboratory quantitative DQOs are listed in Table A-5. QA/QC sample analytical frequencies are provided in Table A-4.

The analyst will review the results of the QC samples from each sample group immediately after a sample group has been analyzed. The QC sample results will be evaluated to determine whether

control limits have been exceeded. Samples will be reprepared and re-analyzed to correct or confirm exceedances. If non-matrix QC control limits are exceeded after they have been confirmed, the QA manager will be contacted, and corrective action (e.g., method modifications followed by reprocessing the affected samples) will be discussed and implemented as determined to be necessary.

4.4.1 Laboratory Instrument Calibration and Frequency

An initial calibration will be performed on each laboratory instrument to be used prior to the start of the project, after each major interruption to the analytical instrument, and when ongoing calibration does not meet method control criteria. An initial calibration verification will be analyzed following each initial calibration and will meet method criteria prior to analyses of samples. Continuing calibration verifications (CCV) will be analyzed at method-required frequencies to track instrument performance. The frequency of CCVs varies with methods. For gas chromatography (GC)/mass spectrometer methods, one will be analyzed every 12 hours. For GC, metals, and inorganic methods, one will be analyzed for every 10 field samples analyzed and at the end of each run, or as specified in the method. If a continuing calibration is out of control, the source of the control failure will be investigated and eliminated or reduced to meet control specifications, which may include analyzing a new initial calibration. Any project samples analyzed while the instrument calibration was out of control will be re-analyzed.

Instrument blanks or continuing calibration blanks provide information on the stability of the baseline established. Continuing calibration blanks will be analyzed immediately prior to or immediately following CCVs at the instrument for each type of applicable analysis.

4.4.2 Laboratory Duplicates/Replicates

Analytical duplicates provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Analytical duplicates and replicates are subsamples of the original sample that are prepared and analyzed as a separate sample.

4.4.3 Matrix Spikes and Matrix Spike Duplicates

Analyses of MS samples provide information on the extraction efficiency of the method on the sample matrix as well as any interferences introduced by the sample matrix. By analyzing MS samples in duplicate, precision data are also provided.

4.4.4 Method Blanks

Method blanks are prepared and analyzed in the same manner as project samples to assess possible laboratory contamination at all stages of sample preparation and analyses. The method blank for all analyses must be less than the method RL of any single target analyte. If a laboratory method blank exceeds this criterion for any analyte, and the concentration of the analyte in any of the samples is

less than five times the concentration found in the blank (10 times for common contaminants), analyses must stop, and the source of contamination must be eliminated or reduced. Affected samples should be reprepared and re-analyzed, if possible.

4.4.5 Laboratory Control Samples

Laboratory control samples are analyzed to assess possible laboratory bias at all stages of sample preparation and analysis. The laboratory control sample is a matrix-dependent spiked sample prepared at the time of sample preparation along with the preparation of the sample, MD, MS, and method blank. The laboratory control sample will provide information on the accuracy of the analytical process and, when analyzed in duplicate, will also provide precision data.

4.4.6 Laboratory Deliverables

Data packages will be checked for completeness immediately upon receipt from the laboratory to ensure that data and QA/QC information requested are present. The analytical laboratory will be required, where applicable, to report the following:

- **Project narrative**. This summary will include a discussion of any problems encountered during analyses. This summary should include (but not be limited to) QA/QC, sample receipt, sample storage, and analytical difficulties. Any problems encountered and their resolutions will be documented in as much detail as appropriate.
- **Chain-of-custody records**. Legible copies of the chain-of-custody forms will be provided as part of the data packages. This documentation will include the time of receipt and condition of the samples received by the laboratory. Additional internal tracking of sample custody by the laboratory will also be documented on a sample receipt form. The form must include sample shipping container temperatures measured at the time of sample receipt.
- **Sample results**. Data packages will provide results for each sample analyzed. The summary will include the following information when applicable:
  - Field sample identification code and the corresponding laboratory identification code
  - Sample matrix
  - Date of sample preparation/extraction
  - Date and time of analysis
  - Mass or volume used for preparation and analysis
  - Final dilution or concentration factors
  - Identification of the instrument used for analysis
  - MDLs, RLs, and/or EDLs accounting for sample-specific factors (e.g., dilution and total solids)
  - Analytical results with reporting units
  - Data qualifiers and their definitions

- **QA/QC summaries**. This section will contain the results of the laboratory QA/QC procedures. Each QA/QC sample analysis will be documented with the same information required for the sample results. No recovery or blank corrections will be made by the laboratory. The required summaries are as follows (additional information may be requested):
  - **Instrument performance checks**. Injection times, ion abundances, and mass resolution checks will be reported and compared to method criteria. Associated samples and analysis times will also be reported.
  - **Calibration data summary**. These summaries will report the concentrations of the initial calibration and continuing calibration standards and the date and time of analyses. The response factor, percent relative standard deviation, percent drift/difference, percent recovery, and retention time for each analyte will be listed, as appropriate. Calibration results for standards will be documented to indicate instrument sensitivity.
  - **Internal standard area summary**. Internal standard areas will be reported and evaluated against method criteria.
  - **Method blank analysis**. The method blank analysis associated with each sample and the concentration of all target analytes identified in these blanks will be reported.
  - **Surrogate and labeled compound spike recoveries**. All surrogate spike recoveries for organic analyses will be reported. The name and concentration of all compounds added, percent recoveries, and range of acceptable recoveries will be provided.
  - **MS recovery**. MS recovery data for all applicable analyses will be reported. The names and concentrations of analytes added, percent recoveries, and range of acceptable recoveries will be listed. The percent recoveries and RPD values for MSD analyses will be reported.
  - **Matrix duplicates**. The RPD values for MD analyses will be reported.
  - **Laboratory control sample**. Laboratory control sample recovery data will be reported. The names and concentrations of analytes added, percent recoveries, and range of acceptable recoveries will be included. The percent recoveries and RPD values for laboratory control sample duplicate analyses will be included.
- **Original data**. Legible copies of the original data generated by the laboratory will include the following information:
  - Sample extraction, preparation, and cleanup logs, including methods used
  - Instrument analysis logs for all instruments used on days of calibration and sample analyses
  - Calculation worksheets as applicable
  - Ion chromatograms for all samples, standards, blanks, calibrations, spikes, replicates, and reference materials, as applicable
  - Copies of full scan chromatograms and quantitation reports for GC/mass spectrometer analyses of samples, standards, blanks, calibrations, spikes, replicates, and reference materials

  - Enhanced spectra of detected compounds with associated best-match spectra for each sample
- **Electronic data deliverable**. An electronic data deliverable will be provided in the Environmental Quality Information System (EQuIS) format specified in advance.

4.5 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

This section describes procedures for testing, inspection, and maintenance of field and laboratory equipment.

4.5.1 Field Instruments/Equipment

In accordance with the QA program, the field team shall maintain an inventory of field instruments and equipment. The frequency and types of maintenance will be based on the manufacturer's recommendations and previous experience with the equipment.

The FC will be responsible for the preparation, documentation, and implementation of the preventative maintenance program. The equipment maintenance information will be documented in the instrument's calibration log. The frequency of maintenance is dependent on the type and stability of the equipment, the methods used, the intended use of the equipment, and the recommendations of the manufacturer. Detailed information regarding the calibration and frequency of equipment calibration is provided in each specific manufacturer's instruction manuals.

All maintenance records will be verified prior to each sampling event. The FC will be responsible for verifying that required maintenance has been performed prior to using the equipment in the field. For this project, maintenance inspections will include the following activities:

- The subcontractor responsible for navigation will confirm proper operation of the navigation equipment daily. This verification may consist of internal diagnostics or visiting a location with known coordinates to confirm the coordinates indicated by the navigation system.
- The winch line and grab sampler will be inspected daily for fraying, misalignment, loose connections, and any other applicable mechanical problems.

Any problems will be noted in the field logbook and corrected prior to continuing sampling operations.

4.5.2 Laboratory Instruments/Equipment

In accordance with the QA program, the laboratory shall maintain an inventory of instruments and equipment, and the frequency of maintenance will be based on the manufacturer's recommendations and previous experience with the equipment.

The laboratory preventative maintenance program, as detailed in the laboratory QA Plan, is organized to maintain proper instrument and equipment performance and to prevent instrument and equipment failure during use. The program considers instrumentation, equipment, and parts that are subject to wear, deterioration, or other changes in operational characteristics, the availability of spare parts, and the frequency at which maintenance is required. Any equipment that has been overloaded, mishandled, gives suspect results, or has been determined to be defective will be taken out of service, tagged with the discrepancy noted, and stored in a designated area until the equipment has been repaired. After repair, the equipment will be tested to ensure that it is in proper operational condition. The client will be promptly notified in writing if defective equipment casts doubt on the validity of analytical data. The client will also be notified immediately regarding any delays due to instrument malfunctions that could impact holding times or turnaround times.

Laboratories will be responsible for the preparation, documentation, and implementation of the preventative maintenance program. Maintenance records will be checked according to the schedule on an annual basis and recorded by laboratory personnel. The laboratory QA/QC manager or designee shall be responsible for verifying compliance.

4.5.2.1 Laboratory Instrument/Equipment Calibration

As part of their QC program, laboratories perform two types of calibrations. A periodic calibration is performed at prescribed intervals (e.g., balances, drying ovens, refrigerators, and thermometers), and operational calibrations are performed daily at a specified frequency or prior to analysis (i.e., initial calibrations) according to method requirements. Calibration procedures and frequency are discussed in the laboratory QA Plan. Calibrations are discussed in the laboratory standard operating procedures (SOPs) for analyses.

The laboratory QA/QC manager will be responsible for ensuring that the laboratory instrumentation is calibrated in accordance with specifications. Implementation of the calibration program will be the responsibility of the respective laboratory Group Supervisors. Recognized procedures (EPA, ASTM, or manufacturer's instructions) will be used when available.

Physical standards (i.e., weights or certified thermometers) will be traceable to nationally recognized standards such as the National Institute of Standards and Technology (NIST). Chemical reference standards will be NIST standard reference materials or vendor-certified materials traceable to these standards.

The calibration requirements for each method and respective corrective actions will be accessible either in the laboratory SOPs or in the laboratory's QA Plan for each instrument or analytical method in use. All calibrations will be preserved on electronic media.

4.6 Inspection/Acceptance of Supplies and Consumables

Inspection and acceptance of field supplies, including laboratory-supplied sampling bottles, will be performed by the FC. All primary chemical standards and standard solutions used for this project, either in the field or laboratory, will be traceable to documented, reliable commercial sources. Standards will be validated to determine their accuracy by comparison with an independent standard. Any impurities found in the standard will be documented.

4.7 Data Management

Field data sheets will be checked for completeness and accuracy by the FC prior to delivery to the data manager. Data generated in the field will be documented on electronic or hard copy and provided to the data manager, who is responsible for the data entry into the database. All manually entered data will be verified by a second party. Field documentation will be filed in the main project folder after data entry and verification are complete.

Laboratory data will be provided to the data manager in the EQuIS electronic format. Laboratory data that are electronically provided and loaded into the database will undergo a check against laboratory hard copy data. Data will be validated or reviewed manually, and qualifiers, if assigned, will be entered manually. The accuracy of all manually entered data will be verified. Data tables and reports will be exported from EQuIS to Microsoft Excel tables.

5 Contingent Biological Testing

Bioassay samples will be collected from surface sediment grab locations during the confirmation monitoring and long-term monitoring programs and may be triggered for toxicity testing if sediment chemical concentrations exceed the SMS SCOs. Bioassay testing will be performed by Spheros Environmental, in Port Gamble, Washington. Following the SCUM (Ecology 2025), three contingent bioassays are planned: the 10-day amphipod mortality test, 20-day juvenile polychaete growth test, and the sediment larval development test.

Bioassay testing will be performed in accordance with *Recommended Protocols for Conducting Laboratory Bioassays on Puget Sound Sediments* (PSEP 1995) and the SCUM (Ecology 2025). Modifications from the Seattle District Dredge Material Management Program (DMMP) may also be incorporated as appropriate, including protocols from the *Dredged Material Evaluation and Disposal Procedures User Manual* (DMMP 2025) and white papers published on the USACE Seattle District website. All bioassay analyses, including retests, are required to commence within 56 days after collection to meet holding times.

Twelve liters of sediment for each sample will be collected for contingent bioassay testing. This volume allows for side-by-side unpurged and purged bioassays should they be needed based on pre-test porewater ammonia and sulfide concentrations as further discussed in Sections 5.1.1 to 5.1.3. Bioassay testing volume will be stored in a laboratory-approved plastic bag at approximately 4°C±2°C until analysis, if required. Temperatures will be monitored, and chain-of-custody procedures will be followed throughout sample handling by the laboratory.

Bioassay testing requires that test sediments be matched and conducted simultaneously with reference sediment to factor out sediment grain size effects on bioassay organisms. The selection of the reference sediment will be based on the percent fines determined from wet sieve analyses conducted during sample processing procedures. According to Section 5.4.5.1 of the SCUM, the fines content of reference sediments should ideally fall within 20% of the fines content in the test sediments (Ecology 2025). Multiple reference sediments will be used to match sample fines if needed.

This section describes bioassay testing procedures, QA/QC, test result interpretative criteria, and reporting.

5.1 Bioassay Testing Procedures

Specific procedures for each sediment bioassay are summarized in the following subsections. As indicated above, the bioassay methodologies will follow those described in PSEP 1995, as modified by DMMP. Bioassay performance standards and evaluation guidelines for the following procedures are presented in Table A-6.

5.1.1 Amphipod Bioassay

The acute amphipod survival bioassay will be performed using the amphipod *Eohaustorius estuarius*, *Rhepoxynius abronius*, or *Ampelisca abdita*. The cultured amphipod *Leptocheirus plumulosus* may also be considered when the other species are not available for field collection or not in a healthy condition suitable for testing (Hester et al. 2024). Appropriate negative control sediment must be used for the test species selected. Species selection will be determined based upon grain size, salinity, and collection season prior to test initiation. Amphipods will be exposed to test, control, and reference sediments for a 10-day period. After 10 days, organisms will be sieved from the sediment and survivorship will be recorded. Test acceptability will be evaluated by mortality in the control, which should be less than or equal to 10%. Additionally, mean mortality for the reference sediment should be less than 25%. If the test does not meet control and reference acceptability criteria, it should be repeated. Ammonia and sulfide concentrations in the exposure medium will be measured on project sediments prior to testing and at test termination. If pre-test ammonia and sulfide concentrations exceed purging triggers identified in the DMMP User Manual (DMMP 2025), Spheros will contact the QA/QC Manager prior to setting up the tests to discuss the need for purging. If purging is recommended, bioassays using purged sediment to remove or decrease sulfide and/or ammonia concentrations should be done side-by-side with non-purged sediment bioassays so results can be compared (Ecology 2025).

5.1.2 Larval Bioassay

The acute larval survival and development bioassay will be conducted with the bivalve species *Mytilus galloprovincialis*, echinoderm species *Dendraster excentricus*, or an alternative species such as the bivalve *Crassostrea gigas* based on availability. For the bioassay, adult test organisms will be allowed to spawn, and the resulting embryos will be exposed to a seawater control, along with test and reference sediments, until formation into the larval stage occurs in 90% of the control organisms (typically 48 to 60 hours). At the end of the test, larvae from each test sediment exposure are examined to quantify abnormality and mortality. Test acceptability will be evaluated by normal development in the control, which should be at least 70%. Additionally, the reference sediment should have at least 65% of normal individuals as compared to the control. If the test does not meet control and reference acceptability criteria, it should be repeated. Ammonia and sulfide concentrations in the exposure medium will be measured in the overlying water prior to testing and at test termination. If pre-test ammonia and sulfide concentrations exceed purging triggers identified in the DMMP User Manual (DMMP 2025), Spheros will contact the QA/QC Manager prior to setting up the tests to discuss the need for purging. If purging is recommended, bioassays using purged sediment to remove or decrease sulfide and/or ammonia concentrations should be done side-by-side with non-purged sediment bioassays so results can be compared (Ecology 2025). Test chambers will be aerated during testing. The recommended pH range for the bioassay test is 7.5 to 9. Low pH

may be a confounding factor to interpret larval bioassay test results. If pH drops below 7.5 at any point during the test, results may be rejected.

The resuspension protocol (DMMP 2013) may be used in place of the standard PSEP protocol if dredged material encountered has high concentrations of fines, wood waste, or other flocculent material. The standard protocol may result in false positives from normally developing larvae being entrained in the flocculent material. The decision to use the resuspension protocol will be made in coordination with the QA/QC Manager for approval before use.

5.1.3 Juvenile Polychaete Bioassay

The chronic juvenile polychaete growth bioassay will be conducted with the worm species *Neanthes arenaceodentata*. Polychaetes will be exposed to test, control, and reference sediments for a 20-day period. After 20 days, organisms will be sieved and survivorship will be recorded. The ash-free dry weight of the test organisms, along with the ash-free dry weight of time zero organisms, will be used to calculate the growth rate. Test acceptability will be evaluated by mortality in the control, which should be less than 10%, as well as a growth rate greater than 0.38 milligram per individual per day (dry weight). Additionally, the mean reference growth rate should be greater than or equal to 80% of the mean negative control growth rate. If the test does not meet control and reference acceptability criteria, it should be repeated. Ammonia and sulfide concentrations in the exposure medium will be measured on project sediments prior to testing and at test termination. If pre-test ammonia and sulfide concentrations exceed purging triggers identified in the DMMP User Manual (DMMP 2025), Spheros will contact the QA/QC Manager prior to setting up the tests to discuss the need for purging. If purging is recommended, bioassays using purged sediment to remove or decrease sulfide and/or ammonia concentrations should be done side-by-side with non-purged sediment bioassays so results can be compared (Ecology 2025).

5.2 Test Quality Assurance/Quality Control

Sediment toxicity tests will incorporate standard QA/QC procedures to ensure that the test results are valid. Standard QA/QC procedures include the use of negative controls, positive controls, reference sediment samples, replicates, and measurements of water quality during testing.

5.2.1 Negative Controls

A negative control will be run for each bioassay to estimate the general health of test organisms during the test exposure period. For the amphipod and juvenile polychaete bioassays, the negative control will be sediment from the amphipod collection site and seawater. The negative control for the larval bioassay will be a seawater control. Negative control performance standards for this bioassay program are presented in Tables 4 and 8-2 of the SCUM (Ecology 2025).

5.2.2 Positive Controls

A positive control will be run for each bioassay to establish the relative sensitivity of the test organisms by exposing the organisms to a reference toxicant. The positive control for sediment tests is typically conducted with diluent freshwater and without sediment. The LC_{50} or the EC_{50} must be within the 95% confidence interval of responses (calculated using a minimum of the most recent 12 monthly positive control tests) expected for the toxicant used.[1] Reference toxicants are typically metals, such as cadmium chloride.

5.2.3 Reference Sediment

Reference sediment will also be included with each bioassay, tested concurrently with test sediments to provide data that can be used to separate toxicant effects from unrelated effects, such as those of sediment grain size. Reference sediment samples should be collected from an area documented to be free from chemical contamination and should represent the range of important natural, physical, and chemical characteristics of the test sediments (e.g., total organic carbon). For this study, reference sediment samples will be collected from Carr Inlet in Puget Sound, Washington. Reference sediment performance standards for this bioassay program are presented in Tables 4 and 8-2 of the SCUM (Ecology 2025). Failure to meet these standards may result in the requirement to retest.

5.2.4 Replicates

Five replicate chambers for each test sediment, reference sediment, and negative controls treatment will be run for each bioassay. A water quality replicate will also be run for each treatment.

5.2.5 Water Quality Monitoring

Water quality monitoring will be conducted for the amphipod, larval, and juvenile polychaete bioassays and reference toxicant tests. This monitoring consists of daily measurements in the water quality replicate of salinity, temperature, pH, and dissolved oxygen for the amphipod and larval tests. These measurements will be made at a minimum of every 3 days for the juvenile polychaete bioassay, with the exception of dissolved oxygen, which will be measured daily. Ammonia and sulfides in the overlying water and sediment porewater from a separate beaker will be determined at test initiation and termination for all three tests. Monitoring will be conducted for all test and reference sediments and negative controls (including seawater controls).

5.3 Interpretation

Test interpretation consists of endpoint comparisons of test sediments to the measurements observed in the controls and in reference sediments on an absolute percentage basis, as well as

[1] LC_{50} is the lethal concentration of toxicant killing 50% of exposed organisms. EC_{50} is the concentration of test substance in dilution water that is calculated to affect 50% of a test population during continuous exposure over a specified time period.

statistical comparison between the test and reference endpoints, where appropriate. Test interpretation will follow the guidelines established through the SMS review process, which are identified in Tables 4 and 8-2 of the SCUM (Ecology 2025).

5.4 Bioassay Retest

If there are issues (e.g., positive or negative control failure) with the bioassay QA/QC tests described previously that result in erroneous findings or failure to meet data QC objectives provided in Table A-6, then the bioassay samples will be retested.

5.5 Data Deliverables

The laboratory conducting the bioassay tests will be responsible for internal checks on data reporting and will correct errors identified during the QA review. The bioassay laboratory for this study will be required to provide a biological testing report that includes all information recommended by PSEP protocols for QA review, as follows:

- A description of any deviations from the methodology or problems with the process and procedures of analyses
- Test methods used for bioassay testing and statistical analyses
- Results for survival, growth, abnormalities, water quality parameters, reference toxicant, and statistical analyses
- Original data sheets for water quality, survival, growth, abnormalities, reference toxicant, and statistical analyses
- Chain-of-custody records

Close contact with the laboratory will be maintained to resolve any QA/QC problems in a timely manner.

6 Assessments and Response Actions

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

6.1 Compliance Assessments

Laboratory and field performance audits consist of on-site reviews of QA systems and equipment for sampling, calibration, and measurement. Laboratory audits will not be conducted as part of this study. However, all laboratory audit reports will be made available to the project QA/QC Manager upon request. The laboratory is required to have written procedures addressing internal QA/QC. These procedures have been submitted, and the project QA/QC Manager will review them to ensure compliance with this SQAPP. The laboratory must ensure that personnel engaged in analytical tasks have appropriate and sufficient training. The laboratory will provide written details of any method modifications planned prior to project commencement.

6.2 Response and Corrective Actions

The following subsections identify the responsibilities of key project team members and actions to be taken in the event of an error, problem, or non-conformance of protocols identified in this document.

6.2.1 Field Activities

The FC will be responsible for correcting equipment malfunctions during the field sampling effort. The project QA/QC Manager will be responsible for resolving situations identified by the FC that may result in non-compliance with this SQAPP. All corrective measures will be immediately documented in the field logbook.

6.2.2 Laboratory

The laboratory is required to comply with its SOPs. The laboratory PM will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this SQAPP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data.

The laboratory PM will be notified if any QC sample exceeds the project-specified control limits and corrective action does not improve results. The analyst will identify and correct the anomaly before continuing with sample analyses. If the laboratory internal corrective action does not resolve the non-conformance, the laboratory PM will notify the QA/QC Manager. A narrative describing the anomaly, the steps taken to identify and correct the anomaly, and the treatment of the relevant

sample batch (i.e., recalculation, re-analysis, and repreparation) will be submitted with the data package in the form of a cover letter.

6.3 Reports to Management

QA reports to management include verbal status reports, data validation reports, and final project reports. These reports shall be the responsibility of the QA/QC Manager.

7 Data Validation, Usability, and Reporting

This section describes the processes that will be used to review project data quality.

7.1 Data Review, Validation, and Verification

During the validation process, analytical data will be evaluated for project, method, and laboratory QC compliance, and their validity and applicability for program purposes will be determined. Based on the findings of the validation process, data validation qualifiers may be assigned. The validated project data, including qualifiers, will be entered into the project database, and all exports generated will include validation qualifiers.

7.2 Validation and Verification Methods

Data validation includes signed entries by the field and laboratory technicians on field data sheets and laboratory data sheets, respectively; review for completeness and accuracy by the FC and laboratory manager; review by the QA manager for outliers and omissions; and the use of QC criteria to accept or reject specific data. All data will be entered into the EQuIS database and verified manually and electronically. A second data manager or designee will perform a cursory verification of the database raw data file. If errors are found, further verification will be performed to ensure that all data are accurate. Any errors found will be corrected in the database, and the laboratory will be notified of the errors.

All laboratory data will be reviewed and verified to determine whether DQOs have been met and that appropriate corrective actions have been taken when necessary. The project QA/QC Manager or designee will be responsible for the final review of data generated from analyses of samples.

The first level of review will take place in the laboratory as the data are generated. The laboratory department manager or designee will be responsible for ensuring that the data generated meet minimum QA/QC requirements and that the instruments were operating under acceptable conditions during generation of data. DQOs will also be assessed at this point by comparing the results of QC measurements with pre-established criteria as a measure of data acceptability.

The analysts or laboratory department manager will prepare a preliminary QC checklist for each parameter and for each sample delivery group as soon as analysis of a sample batch has been completed. Any deviations from the DQOs listed on the checklist will be brought to the attention of the laboratory PM to determine whether corrective action is needed and to determine the impact on the reporting schedule.

Data packages will be checked for completeness upon receipt from the laboratory to ensure that data and QA/QC information requested are present. Stage 2B validations (EPA 2009) will be conducted on all data packages. Data validation will be conducted by a reviewer using current

National Functional Guidelines for Data Review (EPA 2020a, 2020b, 2020c), the analytical methods, this SQAPP, and best professional judgment by considering the following information, as applicable:

- Chain-of-custody documentation and sample receipt condition
- Holding times
- Instrument performance checks
- Initial calibrations
- Continuing calibrations
- Method blanks
- Surrogate recoveries
- Internal standard area counts
- Labeled compound recoveries
- Detection limits
- RLs
- Laboratory control samples
- MS/MSD samples
- Field and laboratory duplicates
- Rinsate blanks
- Standard reference material results

The data will be validated in accordance with the project-specific DQOs described previously and listed in Table A-5, analytical method criteria, and the laboratory's internal performance standards based on their SOPs.

7.3 Reconciliation with User Requirements

The QA/QC Manager will review data after each event to determine whether DQOs have been met. If data do not meet the project's specifications, the QA/QC Manager will review the errors and determine whether the problem is due to calibration, maintenance, sampling techniques, or other factors and will suggest corrective action. Retraining, revision of techniques, or replacement of supplies/equipment should correct the problem; if not, the DQOs will be reviewed for feasibility. If specific DQOs are not achievable, the QA/QC Manager will recommend appropriate modifications.

7.4 Data Summary Report

Following performance and confirmation monitoring, an Interim Action Completion Report will be developed that includes the following:

- Site background and context for the current report
- Monitoring objective(s) and methods
- Method deviations in sampling and/or analysis from this SQAPP

- Results of monitoring, including data validation, bathymetric survey results (as detailed in the CMCRP), and sediment testing results
- Comparison of monitoring results to site performance criteria and previous testing results
- Discussion of contingency responses and their implementation, as applicable

A Long-Term Monitoring Report will be submitted in year 3 following completion of construction. That report will include all bathymetric evaluations (as detailed in the CMCRP) as well as the results of contingent sediment testing, if performed.

All analytical data will also be entered into Ecology's Environmental Information Management database.

8 References

Anchor QEA, 2026a. *Compliance Monitoring and Contingency Response Plan.* Tru-Grit Site. Prepared for Port of Tacoma. Draft. July 2026.

Anchor QEA, 2026b. *Sediment Characterization Report.* Tru-Grit Site. Prepared for Port of Tacoma. July 2026.

ASTM (ASTM International), 2002. *Standard Practices for Use of the Term Precision and Bias in ASTM Test Methods*. Version 177-90a.

DMMP (Dredged Material Management Program), 2013. *DMMP/SMS Clarification Paper: Bioassay Endpoint Refinements: Bivalve Larval And Neanthes Growth Bioassays*. Prepared by David Kendall (U.S. Army Corps of Engineers) and Russ McMillan (Washington State Department of Ecology) for the DMMP agencies and SMS Program, and Bill Gardiner, Brian Hester, and Jack D. Word (NewFields, LLC). Accessed July 1, 2026. https://usace.contentdm.oclc.org/utils/getfile/collection/p266001coll1/id/9152.

DMMP, 2025. *Dredged Material Evaluation and Disposal Procedures User Manual*. Prepared by the Dredged Material Management Program: Office, U.S. Army Corps of Engineers, Seattle District; Environmental Protection Agency, Region 10; Washington State Department of Natural Resources; and Washington State Department of Ecology. November 2025. Accessed June 29, 2026. https://www.nws.usace.army.mil/Portals/27/docs/civilworks/dredging/User%20Manual/UM_2025%20Final.pdf?ver=B2yCJUN0xVmrx-_sVQ0Ozg%3d%3d.

Ecology (Washington State Department of Ecology), 2025. *Sediment Cleanup User's Manual (SCUM): Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards, Chapter 173–204 WAC*. Fourth Revision. Toxics Cleanup Program Publication No. 12-09-057. December 2025.

EPA (U.S. Environmental Protection Agency), 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*. U.S. Environmental Protection Agency Office of Solid Waste and Emergency Response. USEPA 540-R-08-005. January 2009.

EPA, 2020a. *National Functional Guidelines for Organic Superfund Methods Data Review*. Office of Superfund Remediation and Technology Innovation. U.S. Environmental Protection Agency. EPA-540-R-20-005. November 2020.

EPA, 2020b. *National Functional Guidelines for Inorganic Superfund Methods Data Review*. Office of Superfund Remediation and Technology Innovation. U.S. Environmental Protection Agency. EPA-542-R-20-006. November 2020.

EPA, 2020c. *National Functional Guidelines for High Resolution Superfund Methods Data Review*. Office of Superfund Remediation and Technology Innovation. U.S. Environmental Protection Agency. EPA-542-R-20-007. November 2020.

Hester, B., P. Adolphson, and M. Knowlen, 2024. *Adapting to Supply Challenges and Species Substitution for the 10-Day Amphipod Bioassay*. Joint DMMP-Ecology Toxics Cleanup Program Issue Paper. August 2024.

Jenkins, Austin, and Jordan Cooper (Anchor QEA), 2024. *Archaeological Monitoring and Inadvertent Discovery Plan.* Blair Waterway Tacoma Harbor Deepening Program [Berths and Tru-Grit] Sediment Sampling. Prepared for Port of Tacoma. October 2024.

PSEP (Puget Sound Estuary Program), 1995. *Recommended Protocols for Conducting Laboratory Bioassays in Puget Sound*. Prepared for the Puget Sound Estuary Program, EPA Region 10, Office of Puget Sound, Seattle, Washington. July 1995.

PSEP, 1997. *Recommended Guidelines for Measuring Organic Compounds in Puget Sound Water, Sediment, and Tissue Samples*. Final Report. Prepared for the U.S. Environmental Protection Agency.

Tables

Table A-1
Sample Locations, Coordinates, Intervals, and Analyses Summary

Location ID	Station Coordinates (Washington SP NAD83)		Performance Monitoring Sample Interval (bml)	Confirmation Monitoring Sampling Interval (bml)	Contingent Long-Term Monitoring Sampling Interval (bml)	Performance Monitoring Sample ID	Confirmation Monitoring Sample ID	Long-Term Monitoring Sample ID	Analyses
	Easting (feet)	Northing (feet)							
TG-01B	1168418	712643	20-30 cm	0-10 cm	0-10 cm	TG-PM-SG01B-YYMMDD	TG-CM-SG01B-YYMMDD	TG-LT-SG01B-YYMMDD	TS, TVS, TOC, Ammonia, Sulfide, metals, TBT, SVOCs, PAHs, PCBs, D/F, bioassays[2]
TG-02B	1168511	712553	20-30 cm	0-10 cm	0-10 cm	TG-PM-SG02B-YYMMDD	TG-CM-SG02B-YYMMDD	TG-LT-SG02B-YYMMDD	
TG-03B	1168610	712457	20-30 cm	0-10 cm	0-10 cm	TG-PM-SG03B-YYMMDD	TG-CM-SG03B-YYMMDD	TG-LT-SG03B-YYMMDD	
TG-04B	1168693	712377	20-30 cm	0-10 cm	0-10 cm	TG-PM-SG04B-YYMMDD	TG-CM-SG04B-YYMMDD	TG-LT-SG04B-YYMMDD	
TG-05B	1168788	712285	20-30 cm	0-10 cm	0-10 cm	TG-PM-SG05B-YYMMDD	TG-CM-SG05B-YYMMDD	TG-LT-SG05B-YYMMDD	
TG-06B	1168876	712200	20-30 cm	0-10 cm	0-10 cm	TG-PM-SG06B-YYMMDD	TG-CM-SG06B-YYMMDD	TG-LT-SG06B-YYMMDD	
TG-01N	1168441	712667	20-30 cm	0-10 cm	0-10 cm	TG-PM-SG01N-YYMMDD	TG-CM-SG01N-YYMMDD	TG-LT-SG01N-YYMMDD	
TG-02N	1168534	712577	20-30 cm	0-10 cm	0-10 cm	TG-PM-SG02N-YYMMDD	TG-CM-SG02N-YYMMDD	TG-LT-SG02N-YYMMDD	
TG-03N	1168633	712481	20-30 cm	0-10 cm	0-10 cm	TG-PM-SG03N-YYMMDD	TG-CM-SG03N-YYMMDD	TG-LT-SG03N-YYMMDD	
TG-04N	1168718	712404	20-30 cm	0-10 cm	0-10 cm	TG-PM-SG04N-YYMMDD	TG-CM-SG04N-YYMMDD	TG-LT-SG04N-YYMMDD	
TG-05N	1168811	712310	20-30 cm	0-10 cm	0-10 cm	TG-PM-SG05N-YYMMDD	TG-CM-SG05N-YYMMDD	TG-LT-SG05N-YYMMDD	
TG-06N	1168907	712232	20-30 cm	0-10 cm	0-10 cm	TG-PM-SG06N-YYMMDD	TG-CM-SG06N-YYMMDD	TG-LT-SG06N-YYMMDD	
TG-01W	1168386	712674	20-30 cm	0-10 cm	N/A[1]	TG-PM-SG01W-YYMMDD	TG-CM-SG01W-YYMMDD	N/A[1]	
TG-01S	1168398	712623	20-30 cm	0-10 cm	N/A[1]	TG-PM-SG01S-YYMMDD	TG-CM-SG01S-YYMMDD	N/A[1]	
TG-02S	1168491	712533	20-30 cm	0-10 cm	N/A[1]	TG-PM-SG02S-YYMMDD	TG-CM-SG02S-YYMMDD	N/A[1]	
TG-03S	1168590	712436	20-30 cm	0-10 cm	N/A[1]	TG-PM-SG03S-YYMMDD	TG-CM-SG03S-YYMMDD	N/A[1]	
TG-04S	1168672	712356	20-30 cm	0-10 cm	N/A[1]	TG-PM-SG04S-YYMMDD	TG-CM-SG04S-YYMMDD	N/A[1]	
TG-05S	1168767	712264	20-30 cm	0-10 cm	N/A[1]	TG-PM-SG05S-YYMMDD	TG-CM-SG05S-YYMMDD	N/A[1]	
TG-06S	1168854	712177	20-30 cm	0-10 cm	N/A[1]	TG-PM-SG06S-YYMMDD	TG-CM-SG06S-YYMMDD	N/A[1]	
TG-06E	1168921	712155	20-30 cm	0-10 cm	N/A[1]	TG-PMSG06E-YYMMDD	TG-CM-SG06E-YYMMDD	N/A[1]	

Notes:

1. Because the west, south, and east side slope sampling locations will have been removed by the USACE FNC Deepening Project, long-term monitoring is not proposed at those locations.

2. Bioassay samples will be collected from surface sediment grab locations collected during confirmation monitoring and conditional surface sediment testing (if triggered under long-term monitoring) and may be triggered for toxicity testing if sediment chemical concentrations exceed the SMS SCOs.

bml: below mudline
cm: centimeter
D/F: dioxin/furans
FNC: federal navigation channel
ID: identification
N/A: not applicable
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
SCO: sediment cleanup objective
SMS: Sediment Management Standards
SVOC: semivolatile organic compound
TBT: tributyltin
TOC: total organic carbon
TS: total solids
TVS: total volatile solids
USACE: U.S. Army Corps of Engineers
Washington SP NAD83: Washington State Plane North American Datum of 1983
YYMMDD: year, month, day

Table A-2
Parameters for Analysis, Methods, Screening Levels, and Target Quantitation Limits

Parameter	Analytical Method	Method Detection Limit	Reporting Limit	Marine DMMP Guidelines			SMS Marine Sediment		Marine SMS AET	
				Screening Level	Bioaccumulation Trigger	Maximum Level	Sediment Cleanup Objective	Cleanup Screening Level	Sediment Cleanup Objective	Cleanup Screening Level
Conventional Parameters (%)										
Total solids	SM 2540G/PSEP	--	0.1	--	--	--	--	--	--	--
Total volatile solids	SM 2540G/PSEP	--	0.1	--	--	--	--	--	--	--
Total organic carbon	EPA 9060A Mod	--	0.1	--	--	--	--	--	--	--
Conventional Parameters (mg/kg)										
Ammonia	SM 4500-NH3	0.400	0.400	--	--	--	--	--	--	--
Sulfide	SM 4500-S2	1.00	1.00	--	--	--	--	--	--	--
Metals (mg/kg dry weight)										
Antimony	EPA 6020B	0.10	0.20	150	--	200	--	--	--	--
Arsenic	EPA 6020B	0.038	0.20	57	507.1	700	57	93	57	93
Cadmium	EPA 6020B	0.040	0.10	5.1	--	14	5.1	6.7	5.1	6.7
Chromium	EPA 6020B	0.26	0.50	260	--	--	260	270	260	270
Copper	EPA 6020B	0.35	0.50	390	--	1,300	390	390	390	390
Lead	EPA 6020B	0.052	0.10	450	975	1,200	450	530	450	530
Mercury	EPA 7471B	0.0053	0.025	0.41	1.5	2.3	0.41	0.59	0.41	0.59
Selenium[a]	EPA 6020B	0.18	0.50	--	3	--	--	--	--	--
Silver	EPA 6020B	0.022	0.20	6.1		8.4	6.1	6.1	6.1	6.1
Zinc	EPA 6020B	2.9	6.0	410	--	3,800	410	960	410	960
Organometals (µg/kg dry weight)										
Tributyltin (ion)	Krone/8270E-SIM	0.5	3.9	--	73	--	--	--	--	--

Table A-2
Parameters for Analysis, Methods, Screening Levels, and Target Quantitation Limits

Parameter	Analytical Method	Method Detection Limit	Reporting Limit	Marine DMMP Guidelines			SMS Marine Sediment		Marine SMS AET	
				Screening Level	Bioaccumulation Trigger	Maximum Level	Sediment Cleanup Objective	Cleanup Screening Level	Sediment Cleanup Objective	Cleanup Screening Level
Semivolatile Organic Compounds (µg/kg dry weight)										
Polycyclic Aromatic Hydrocarbons (µg/kg dry weight)							**mg/kg OC**		**µg/kg dry weight**	
1-Methylnaphthalene	EPA 8270E	10.0	20	--	--	--	--	--	--	--
2-Methylnaphthalene	EPA 8270E	4.5	20	670	--	1,900	38	64	670	670
Acenaphthene	EPA 8270E	5.2	20	500	--	2,000	16	57	500	500
Acenaphthylene	EPA 8270E	6.2	20	560	--	1,300	66	66	1,300	1,300
Anthracene	EPA 8270E	7.2	20	960	--	13,000	220	1,200	960	960
Benzo(a)anthracene	EPA 8270E	6.0	20	1,300	--	5,100	110	270	1,300	1,600
Benzo(a)pyrene	EPA 8270E	4.2	20	1,600	--	3,600	99	210	1,600	1,600
Benzo(b,j,k)fluoranthenes	EPA 8270E	10	40	3,200	--	9,900	230	450	3,200	3,600
Benzo(g,h,i)perylene	EPA 8270E	14	20	670	--	3,200	31	78	670	720
Chrysene	EPA 8270E	6.1	20	1,400	--	21,000	110	460	1,400	2,800
Dibenz(a,h)anthracene	EPA 8270E-SIM	0.91	5.0	230	--	1,900	12	33	230	230
Fluoranthene	EPA 8270E	6.1	20	1,700	4,600	30,000	160	1,200	1,700	2,500
Fluorene	EPA 8270E	15	20	540	--	3,600	23	79	540	540
Indeno(1,2,3-cd)pyrene	EPA 8270E	15	20	600	--	4,400	34	88	600	690
Naphthalene	EPA 8270E	4.2	20	2,100	--	2,400	99	170	2,100	2,100
Phenanthrene	EPA 8270E	8.7	20	1,500	--	21,000	100	480	1,500	1,500
Pyrene	EPA 8270E	5.7	20	2,600	11,980	16,000	1,000	1,400	2,600	3,300
Total LPAH (U = 0)[b]	EPA 8270E	--	--	5,200	--	29,000	370	780	5,200	5,200
Total HPAHs (U = 0)[c]	EPA 8270E	--	--	12,000	--	69,000	960	5,300	12,000	17,000
Total PAHs (U = 0)[d]	Calculated	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	EPA 8270E-SIM	0.7	5.0	35	--	110	2.3	2.3	35	50
1,4-Dichlorobenzene	EPA 8270E-SIM	0.6	5.0	110	--	120	3.1	9	110	110
1,2,4-Trichlorobenzene	EPA 8270E-SIM	2.7	5.0	31	--	64	0.81	1.8	31	51
Hexachlorobenzene	EPA 8270E-SIM	0.7	5.0	22	168	230	0.38	2.3	22	70
Phthalates							**mg/kg OC**		**µg/kg dry weight**	
Dimethyl phthalate	EPA 8270E-SIM	1.0	5.0	71	--	1,400	53	53	71	160
Diethyl phthalate	EPA 8270E-SIM	4.8	20	200	--	1,200	61	110	200	>1,200
Di-n-butyl phthalate	EPA 8270E	5.6	20	1,400	--	5,100	220	1,700	1,400	1,400
Butyl benzyl phthalate	EPA 8270E-SIM	0.68	5.0	63	--	970	4.9	64	63	900
Bis(2-ethylhexyl) phthalate	EPA 8270E	5.5	50	1,300	--	8,300	47	78	1,300	1,900
Di-n-octyl phthalate	EPA 8270E	4.4	20	6,200	--	6,200	58	4,500	6,200	6,200
Phenols (µg/kg dry weight)							**µg/kg dry weight**		**µg/kg dry weight**	
Phenol	EPA 8270E-SIM	2.2	5.0	420	--	1,200	420	1,200	420	1,200
2-Methylphenol	EPA 8270E-SIM	1.1	5.0	63	--	77	63	63	63	63
4-Methylphenol	EPA 8270E-SIM	0.9	5.0	670	--	3,600	670	670	670	670
2,4-Dimethylphenol	EPA 8270E-SIM	2.2	20	29	--	210	29	29	29	29
Pentachlorophenol	EPA 8270E-SIM	2.1	20	400	504	690	360	690	360	690

Table A-2
Parameters for Analysis, Methods, Screening Levels, and Target Quantitation Limits

Parameter	Analytical Method	Method Detection Limit	Reporting Limit	Marine DMMP Guidelines			SMS Marine Sediment		Marine SMS AET	
				Screening Level	Bioaccumulation Trigger	Maximum Level	Sediment Cleanup Objective	Cleanup Screening Level	Sediment Cleanup Objective	Cleanup Screening Level
Miscellaneous Extractables (µg/kg dry weight)							**mg/kg OC (unless noted)**		**µg/kg dry weight**	
Benzyl Alcohol	EPA 8270E-SIM	2.5	20	57	--	870	57 dry weight	73 dry weight	57	73
Benzoic Acid	EPA 8270E-SIM	13	100	650	--	760	650 dry weight	650 dry weight	650	650
Dibenzofuran	EPA 8270E	14	20	540	--	1,700	15	58	540	540
Hexachlorobutadiene	EPA 8270E-SIM	0.72	5.0	11	--	270	3.9	6.2	11	120
N-Nitrosodiphenylamine	EPA 8270E-SIM	1.3	5.0	28	--	--	11	11	28	40
PCBs (µg/kg dry weight)							**mg/kg OC**		**µg/kg dry weight**	
Aroclor 1016	EPA 8082A	8.0	20	--	--	--	--	--	--	--
Aroclor 1221	EPA 8082A	8.0	20	--	--	--	--	--	--	--
Aroclor 1232	EPA 8082A	8.0	20	--	--	--	--	--	--	--
Aroclor 1242	EPA 8082A	8.0	20	--	--	--	--	--	--	--
Aroclor 1248	EPA 8082A	8.0	20	--	--	--	--	--	--	--
Aroclor 1254	EPA 8082A	8.0	20	--	--	--	--	--	--	--
Aroclor 1260	EPA 8082A	9.3	20	--	--	--	--	--	--	--
Total Aroclor PCBs (U = 0)[e]	EPA 8082A	9.3	20	130	38 mg/kg OC	3,100	12	65	130	1,000
Dioxin/Furans (ng/kg dry weight)[f]										
Dioxins										
2,3,7,8-TCDD	EPA 1613B	0.229	0.500	--	--	--	--	--	--	--
1,2,3,7,8-PeCDD	EPA 1613B	0.576	2.50	--	--	--	--	--	--	--
1,2,3,4,7,8-HxCDD	EPA 1613B	0.667	2.50	--	--	--	--	--	--	--
1,2,3,6,7,8-HxCDD	EPA 1613B	0.596	2.50	--	--	--	--	--	--	--
1,2,3,7,8,9-HxCDD	EPA 1613B	0.672	2.50	--	--	--	--	--	--	--
1,2,3,4,6,7,8-HpCDD	EPA 1613B	0.579	2.50	--	--	--	--	--	--	--
OCDD	EPA 1613B	3.96	5.00	--	--	--	--	--	--	--
Furans										
2,3,7,8-TCDF	EPA 1613B	0.164	0.500	--	--	--	--	--	--	--
1,2,3,7,8-PeCDF	EPA 1613B	0.694	2.50	--	--	--	--	--	--	--
2,3,4,7,8-PeCDF	EPA 1613B	0.713	2.50	--	--	--	--	--	--	--
1,2,3,4,7,8-HxCDF	EPA 1613B	0.702	2.50	--	--	--	--	--	--	--
1,2,3,6,7,8-HxCDF	EPA 1613B	0.692	2.50	--	--	--	--	--	--	--
1,2,3,7,8,9-HxCDF	EPA 1613B	0.703	2.50	--	--	--	--	--	--	--
2,3,4,6,7,8-HxCDF	EPA 1613B	0.746	2.50	--	--	--	--	--	--	--
1,2,3,4,6,7,8-HpCDF	EPA 1613B	0.749	2.50	--	--	--	--	--	--	--
1,2,3,4,7,8,9-HpCDF	EPA 1613B	0.787	2.50	--	--	--	--	--	--	--
OCDF	EPA 1613B	1.41	5.00	--	--	--	--	--	--	--
Total TEQ (U = 1/2 EDL)	--	--	--	4.0	--	--	--	--	--	--
Bioassay[g]										
10-day Amphipod Mortality	PSEP	--	--	--	--	--	--	--	--	--
Larval Development	PSEP	--	--	--	--	--	--	--	--	--
20-day *Neanthes* Growth	PSEP	--	--	--	--	--	--	--	--	--

Table A-2
Parameters for Analysis, Methods, Screening Levels, and Target Quantitation Limits

Notes:

a. Because no screening level value exists for toxicity testing, selenium will only be evaluated for its bioaccumulation potential.

b. Total LPAH consists of the sum of naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene.

c. Total HPAH consists of the sum of fluoranthene, pyrene, benz(a)anthracene, chrysene, benzo(b,j,k)fluoranthenes, benzo(a)pyrene, indeno(1,2,3,-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

d. Total PAHs consist of the sum of all PAHs listed.

e. Total PCBs include the sum of the following Aroclors: 1016, 1221, 1232, 1242, 1248, 1254, and 1260. If present, Aroclors 1262 and 1268 should be reported but not included in the total PCB summation.

f. Dioxin/furan results will be reported to sample- and analysis-specific estimated detection limits.

g. If performance monitoring or conditional surface sediment testing indicate sediment concentrations above relevant performance criteria, bioassay testing may be triggered.

--: not applicable
µg/kg: microgram per kilogram
AET: Apparent Effects Threshold
DMMP: Dredged Material Management Program
EDL: estimated detection limit
EPA: U.S. Environmental Protection Agency
HPAH: high-molecular-weight PAH
LPAH: low-molecular-weight PAH
mg/kg: milligram per kilogram
ng/kg: nanogram per kilogram
OC: organic carbon-normalized
OCDD: octachlorodibenzodioxin
OCDF: octachlorodibenzofuran
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
PSEP: Puget Sound Estuary Program
SM: Standard Method
SMS: Sediment Management Standards
TEQ: toxic equivalency
U: undetected

Table A-3
Sample Handling and Storage Guidelines

Parameter	Sample Size	Container Size and Type[a]	Holding Time	Preservative	Laboratory[b]
Total solids/total volatile solids/ total organic carbon	250 g	16-oz glass	14 days	4°C ± 2°C	ARL
			6 months	-18°C ± 10°C	
Ammonia	25 g		7 days	4°C ± 2°C	
Metals	50 g		6 months; 28 days for mercury	4°C ± 2°C	
			2 years; 1 year for mercury	-18°C ± 2°C	
SVOCs, PAHs, PCBs, organometals	200 g		14 days until extraction	4°C ± 2°C	
			1 year until extraction	-18°C ± 2°C	
			40 days after extraction	4°C ± 2°C	
Sulfide	50 g	2-oz glass; no headspace	7 days	ZnAc/NaOH to pH>9; 4°C ± 2°C	
Dioxin/furans	10 g	4-oz amber glass	1 year until extraction	-18°C ± 2°C	Onterris
			1 year after extraction		
Chemistry archive	250 g	8-oz glass	Varies	-18°C ± 2°C	ARL
Bioassay archive	12 L[c]	Plastic bag, no headspace	8 weeks	4°C ± 2°C	Spheros

Notes:

a. Sample containers may vary based on availability at the time of sample collection.

b. A pre-approved backup laboratory may be used if necessary.

c. 12-L bioassay volume is being collected to allow for side-by-side purged and unpurged testing if needed.

ARL: Analytical Resources, LLC
g: gram
L: liter
NaOH: sodium hydroxide
Onterris: Onterris Environmental - El Dorado Hills
oz: ounce
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
Spheros: Spheros Environmental
SVOC: semivolatile organic compound
Zn:Ac: zinc acetate

Table A-4
Field and Laboratory Quality Assurance/Quality Control Requirements

	Field Quality Control Elements		Laboratory Quality Control Elements								
Parameter	Field Duplicates	Equipment Rinsate Blanks	Initial Calibration	Continuing Calibration	Duplicates	Triplicates	Laboratory Control Sample	Matrix Spikes	Matrix Spike Duplicates	Method Blanks	Surrogates/Labeled Compounds
Total solids/total volatile solids	NA	NA	Each batch[a]	NA	NA	Per batch	NA	NA	NA	NA	NA
Total organic carbon	NA	NA	Daily or each batch	1 per 10 samples	NA	Per batch	1 per 20 samples	NA	NA	1 per 20 samples	NA
Metals	1 per 20 samples	1 per sampling event	Daily	1 per 10 samples	Per batch	NA	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	NA
Ammonia	NA	NA	Daily or each batch	1 per 10 samples	NA	Per batch	1 per 20 samples	NA	NA	1 per 20 samples	NA
Sulfide	NA	NA	Daily or each batch	1 per 10 samples	NA	Per batch	1 per 20 samples	NA	NA	1 per 20 samples	NA
Butyltins	NA	1 per sampling event	As needed[b]	Every 12 hours[c]	NA	NA	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
SVOCs/PAHs	NA	1 per sampling event	As needed[b]	Every 12 hours	NA	NA	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
PCBs	NA	1 per sampling event	As needed[b]	1 per 10 samples[c]	NA	NA	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
Dioxin/furans	1 per 20 samples	1 per sampling event	As needed[b]	Every 12 hours	1 per 20 samples	NA	1 per 20 samples	NA	NA	1 per 20 samples	Every sample[d]

Notes:
a. Calibration and certification of drying ovens and weighing scales are conducted bi-annually.
b. Initial calibrations are considered valid until the continuing calibration no longer meets method specifications. At that point, a new initial calibration is performed.
c. Continuing calibrations at the beginning and end of each batch and every 10 samples.
d. Isotope dilution with labeled compounds required in every sample
NA: not applicable
PAH: polycyclic aromatic hydrocarbon
PCB: polychlorinated biphenyl
SVOC: semivolatile organic compound

Table A-5
Field and Laboratory Data Quality Objectives

Parameter	Field Duplicate Precision[1]	Laboratory Duplicate Precision[1,2]	Accuracy	Surrogates/Labeled Compounds	Completeness
Total solids/total volatile solids	± 50% RPD	± 20% RSD	NA	NA	95%
Total organic carbon	± 50% RPD	± 20% RSD	75%–125% R	NA	95%
Ammonia	± 50% RPD	± 20% RSD	75%–125% R	NA	95%
Sulfide	± 50% RPD	± 20% RSD	75%–125% R	NA	95%
Total metals	± 50% RPD	± 20% RPD	75%–125% R	NA	95%
Butyltins	± 50% RPD	± 35% RPD	50%–150% R	Laboratory limits	95%
SVOCs/PAHs	± 50% RPD	± 35% RPD	50%–150% R	Laboratory limits	95%
PCBs	± 50% RPD	± 35% RPD	50%–150% R	Laboratory limits	95%
Dioxin/furans	± 50% RPD	± 30% RPD	50%–150% R	Method limits	95%

Notes:

1. Parent and/or duplicate results that are less than five times reporting limits will be evaluated by using the difference between results using a control limit of ±2x RL.
2. Laboratory duplicate precision control limits apply to laboratory duplicates, LCS/LCSD, and MS/MSD precision results.

LCS: laboratory control sample

LCSD: laboratory control sample duplicate

MS: matrix spike

MSD: matrix spike duplicate

NA: not applicable

PAH: polycyclic aromatic hydrocarbon

PCB: polychlorinated biphenyl

R: recovery

RL: reporting limit

RPD: relative percent difference

RSD: relative standard deviation

SVOC: semivolatile organic compound

Table A-6

Bioassay Performance Standards and Evaluation Guidelines

Bioassay	Negative Control Performance Standard	Reference Sediment Performance Standard	SCO/SQS[a]	CSL[a]
Amphipod Mortality	$M_C \leq 10\%$	$M_R \leq 25\%$	$M_T > 25\%$ Absolute and M_T vs. M_R SD ($p < 0.05$)	$M_T - M_R \geq 30\%$ and M_T vs. M_R SD ($p < 0.05$)
Larval Development	$N_C / I \geq 0.70$	$N_R / N_C \geq 0.65$	$N_T / N_R < 0.85$ and N_T vs. N_R SD ($p < 0.10$)	$N_T / N_R < 0.70$ and N_T vs. N_R SD ($p < 0.10$)
Neanthes Growth	$M_C \leq 10\%$ and $MIG_C \geq 0.38$	$MIG_R / MIG_C \geq 0.80$	$MIG_T / MIG_R < 0.70$ and MIG_T vs. MIG_R SD ($p < 0.05$)	$MIG_T / MIG_R < 0.50$ and MIG_T vs. MIG_R SD ($p < 0.05$)

Notes:

a. Marine biological criteria (SCO and CSL and performance standards) for each biological test. Adverse effects are defined when any of the biological tests show the results in the table

C: negative control

CSL: cleanup screening level

I: initial count

M: mortality

MIG: mean individual growth rate (milligrams/individual/day)

N: normal larvae

R: reference sediment

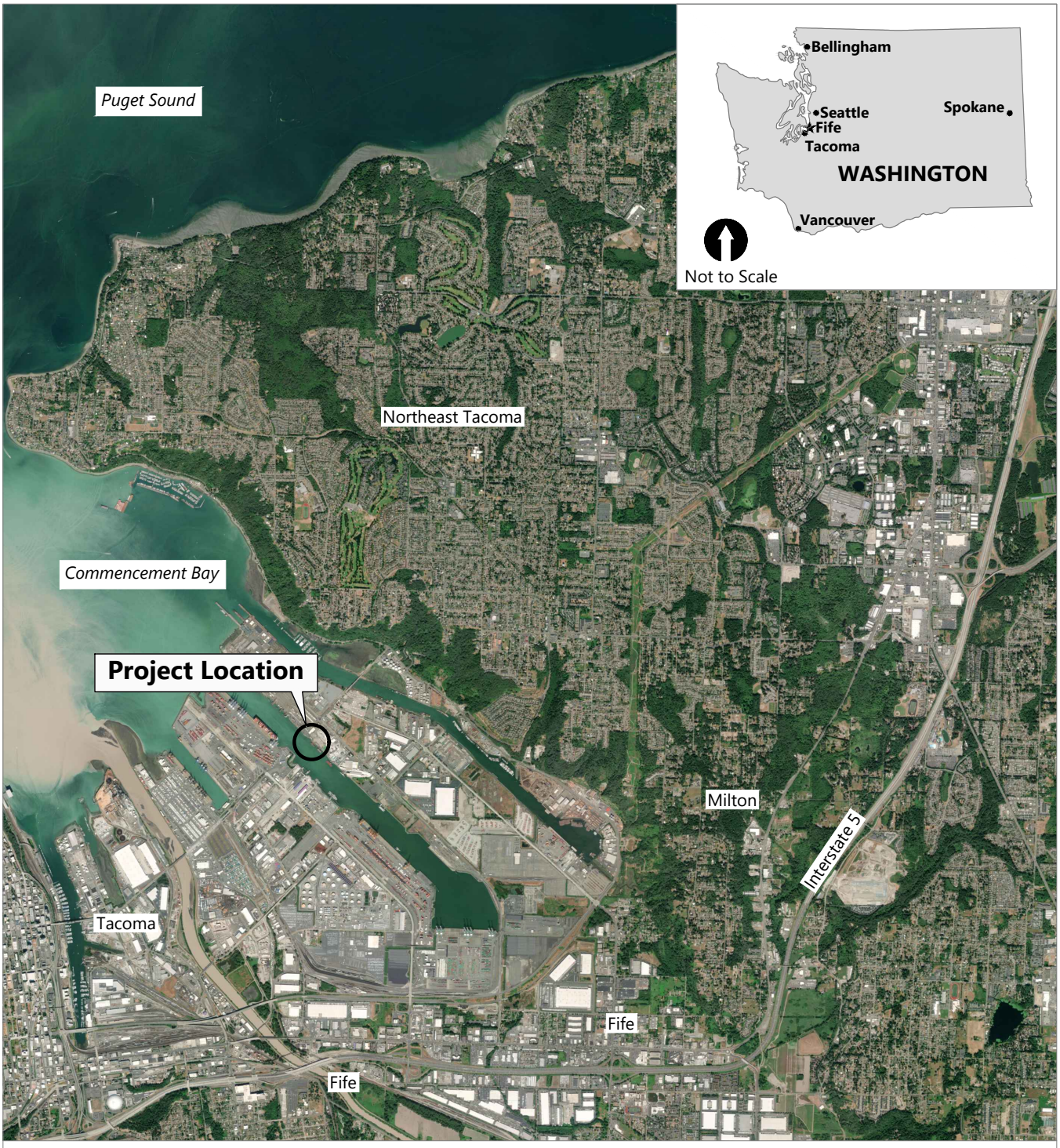
SCO: sediment cleanup objective

SD: statistically significant difference

SQS: Sediment Quality Standard

T: test sediment

Figures



SOURCE: Aerial by Global Mapper
HORIZONTAL DATUM: Washington State Plane South Zone, NAD83, U.S. Survey Feet

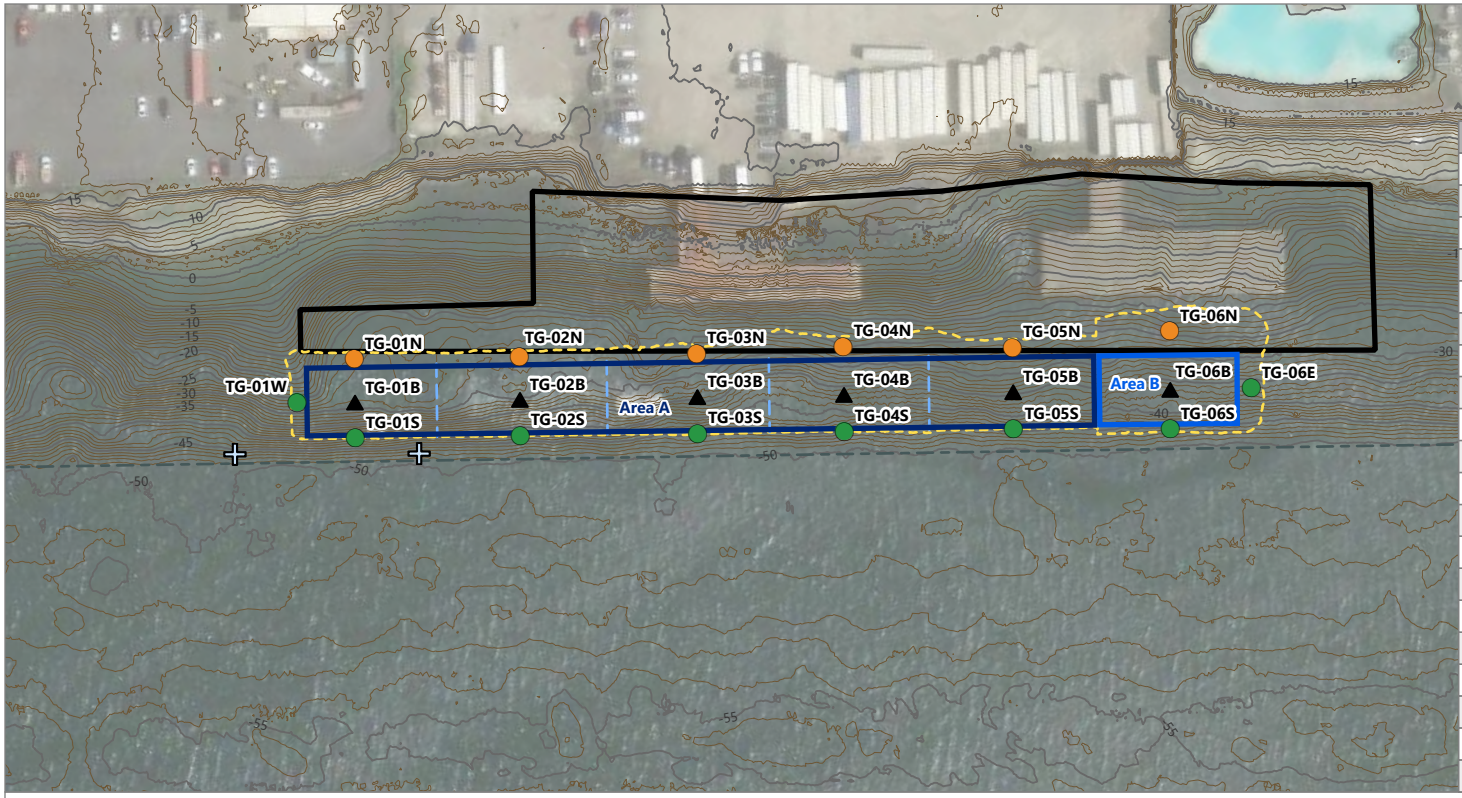
0 1
Miles

Publish Date: 2026/07/01 9:08 AM | User: dholmer
Filepath: K:\Projects\0092-Port of Tacoma\Dredged Material Characterization for Tru-Grit Sediment Investigation\0092-RP-001 (Vicinity Map-IAP).dwg Figure A-1 (SQAPP)

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Figure A-1
Vicinity Map

Sampling and Quality Assurance Project Plan
Port of Tacoma – Tru-Grit Site



Station ID	Easting (feet)	Northing (feet)
TG-01B	1168418	712643
TG-02B	1168511	712553
TG-03B	1168610	712457
TG-04B	1168693	712377
TG-05B	1168788	712285
TG-06B	1168876	712200
TG-01N	1168441	712667
TG-02N	1168534	712577
TG-03N	1168633	712481
TG-04N	1168718	712404
TG-05N	1168811	712310
TG-06N	1168907	712232
TG-01W	1168386	712674
TG-01S	1168398	712623
TG-02S	1168491	712533
TG-03S	1168590	712436
TG-04S	1168672	712356
TG-05S	1168767	712264
TG-06S	1168854	712177
TG-06E	1168921	712155

LEGEND:

- Upper Slope Area
- Feasibility Study Navigation Channel Boundary
- Dredge Area A, Lower Slope 4' Dredge Depth + 2' Over-Dredge (Confirmed Contamination within Slough Area)
- Dredge Area B, Lower Slope 8' Dredge Depth + 2' Over-Dredge (Confirmed Contamination within Slough Area)
- Proposed Dredge Area Daylight Slope
- Elevation (MLLW, 5-Foot Interval)
- Decision Unit Boundary
- Navigational Aid

Proposed Sampling Location

- Dredge Prism Bottom Slope Sample
- Dredge Prism North Slope Sample
- Other Dredge Prism Slope Sample

NOTES:

1. Aerial imagery: Esri (2025)
2. Contour Source: Survey by USACE, dated October 27, 2021, and David Evans Associates, Inc., dated May 27, 2022, with data gaps filled from survey by USACE dated November 14, 2022.
3. Horizontal Datum: NAD83 State Plane Washington South, U.S. feet
4. Vertical Datum: MLLW, feet

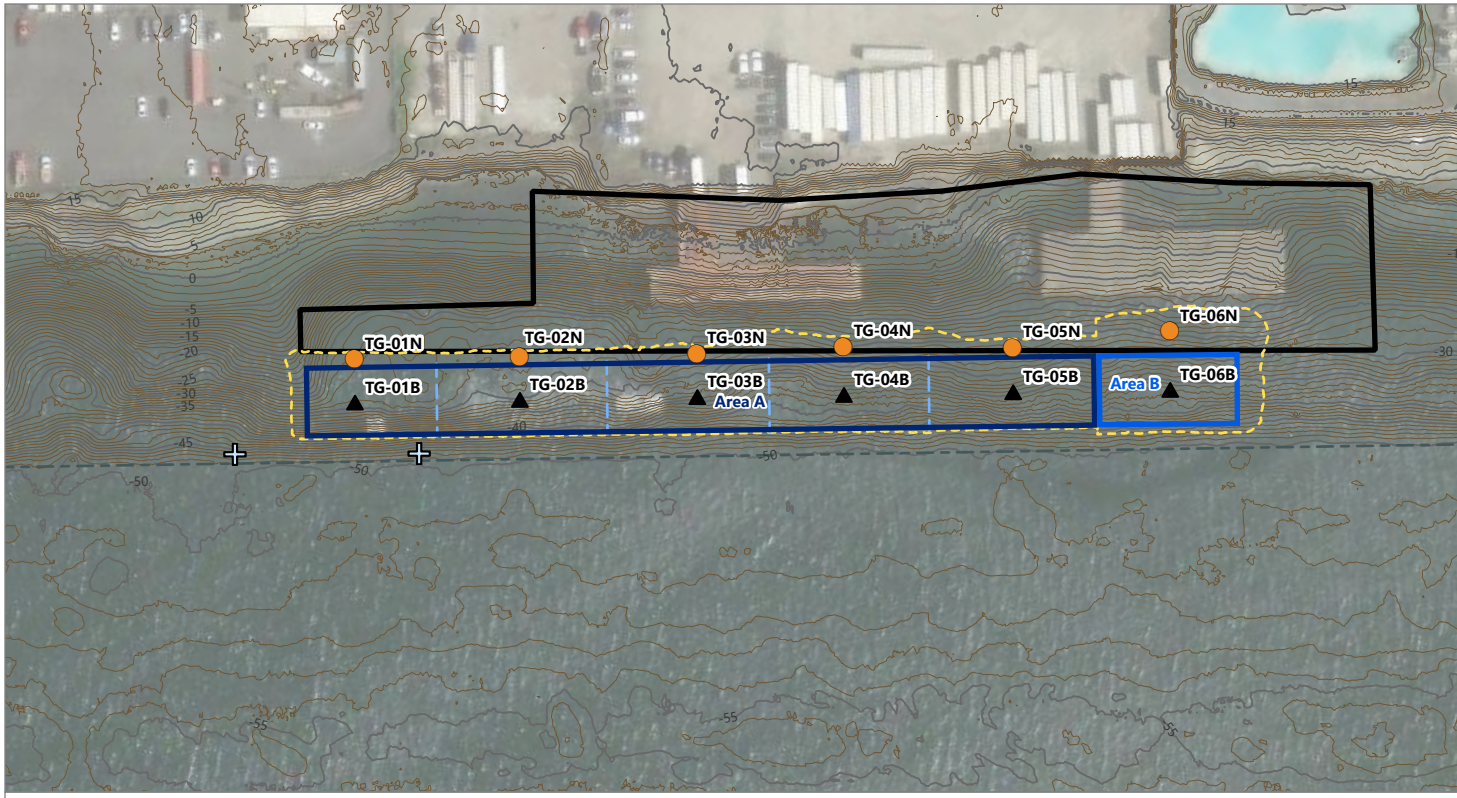
MLLW: mean lower low water
NAD83: North American Datum of 1983

0 200
Feet

Publish Date: 2026/07/01, 2:49 PM | User: thartmann
Filepath: \\GSTFile01\GIS\Jobs\PortofTacoma_0092\Tru-Grit_Site_Project_D\Maps\ComplianceMonitoring_CRP\PoT_TruGrit_ComplianceMonitoring_CRP.aprx | TruGrit_CMCRP_SQAPP_FigA_2_MonitoringSampling

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Figure A-2
Sediment Performance and Confirmation Monitoring Locations
Sampling and Quality Assurance Project Plan
Port of Tacoma – Tru-Grit Site



Station ID	Easting (feet)	Northing (feet)
TG-01B	1168418	712643
TG-02B	1168511	712553
TG-03B	1168610	712457
TG-04B	1168693	712377
TG-05B	1168788	712285
TG-06B	1168876	712200
TG-01N	1168441	712667
TG-02N	1168534	712577
TG-03N	1168633	712481
TG-04N	1168718	712404
TG-05N	1168811	712310
TG-06N	1168907	712232

LEGEND:

- Upper Slope Area
- Feasibility Study Navigation Channel Boundary
- Dredge Area A, Lower Slope 4' Dredge Depth + 2' Over-Dredge (Confirmed Contamination within Slough Area)
- Dredge Area B, Lower Slope 8' Dredge Depth + 2' Over-Dredge (Confirmed Contamination within Slough Area)
- Proposed Dredge Area Daylight Slope
- Elevation (MLLW, 5-Foot Interval)
- Decision Unit Boundary
- Navigational Aid

Proposed Sampling Location

- Dredge Prism Bottom Slope Sample
- Dredge Prism North Slope Sample

NOTES:

1. Aerial imagery: Esri (2025)
2. Contour Source: Survey by USACE, dated October 27, 2021, and David Evans Associates, Inc., dated May 27, 2022, with data gaps filled from survey by USACE dated November 14, 2022.
3. Horizontal Datum: NAD83 State Plane Washington South, U.S. feet
4. Vertical Datum: MLLW, feet

MLLW: mean lower low water
NAD83: North American Datum of 1983

0 200
Feet

Publish Date: 2026/07/01, 2:52 PM | User: thartmann
Filepath: \\GSTFile01\GIS\Jobs\PortofTacoma_0092\Tru-Grit_Site_Project_D\Maps\ComplianceMonitoring_CRP\PoT_TruGrit_ComplianceMonitoring_CRP.aprx | TruGrit_CMCRP_SQAPP_FigA_3_LongTermMonitoringSampling

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Figure A-3
Sediment Long-Term Monitoring Locations
Sampling and Quality Assurance Project Plan
Port of Tacoma – Tru-Grit Site

Attachment A
Field Forms

Daily Log

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PROJECT NAME: **DATE:**

SITE ADDRESS: **PERSONNEL:**

WEATHER: **WIND FROM:**

N	NE	E	SE	S	SW	W	NW	LIGHT	MEDIUM	HEAVY

SUNNY	CLOUDY	RAIN	?

TEMPERATURE: ° F . ° C

[Circle appropriate units]

TIME	COMMENTS

Signature: _____

ANCHOR QEA

Field Deviation Form

Form No. _

Deviation subject:

-

Project name:

-

Standard procedure for field activity:

-

Reason for deviation:

-

Description of deviation:

-

Special equipment, materials, or personnel required:

-

Initiator's name:	Date:
Project Manager:	Date:

Surface Sediment Collection Log

Job: Station:

Job No: Date:

Field Staff: Sample Method:

Contractor: Proposed Coordinates: Lat.

Long.

Water Height

DTM Depth Sounder: _____

DTM Lead Line: _____

Mudline Elevation (datum): calculated after sampling

Tide Measurements

Time: _____

Height: _____

Sample Acceptability Criteria:

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

Notes: _____

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

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

Sample Depth:

Field Measurements: temperature: °C; pH: std units; electrical conductivity (salinity): dS/m

Sample Containers:

Analyses:

Daily Safety Briefing Form

Date: _____

Project No: _____

Project Name: _____

Person Conducting Meeting: _____ **Health & Safety Officer:** _____ **Project Manager:** _____

TOPICS COVERED:

- ☐ Emergency Procedures and Evacuation Route
- ☐ Directions to Hospital
- ☐ HASP Review and Location
- ☐ Safety Equipment Location
- ☐ Proper Safety Equipment Use
- ☐ Employee Right-to-Know/ SDS Location
- ☐ Fire Extinguisher Location
- ☐ Eye Wash Station Location
- ☐ Buddy System
- ☐ Self and Coworker Monitoring
- ☐ Lines of Authority
- ☐ Communication
- ☐ Site Security
- ☐ Vessel Safety Protocols
- ☐ Work Zones
- ☐ Vehicle Safety and Driving/ Road Conditions
- ☐ Equipment Safety and Operation
- ☐ Proper Use of PPE
- ☐ Decontamination Procedures
- ☐ Near Miss Reporting Procedures
- ☐ Lifting Techniques
- ☐ Slips, Trips, and Falls
- ☐ Hazard Exposure Routes
- ☐ Heat and Cold Stress
- ☐ Overhead and Underfoot Hazards
- ☐ Chemical Hazards
- ☐ Flammable Hazards
- ☐ Biological Hazards
- ☐ Eating/Drinking/Smoking
- ☐ Reviewed Prior Lessons Learned
- ☐ Field Team Medical Conditions for Emergency Purposes (Confidential): _____
- ☐ Other: _____

Weather Conditions: _____

Daily Work Scope: _____

Site-specific Hazards: _____

Safety Comments: _____

Attendees		**End of Day Wellness Check Initials**
Printed Name	**Signature**	

PLAYING IT SAFE

Chain of Custody Record & Laboratory Analysis Request

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

Line	Field Sample ID	Collection Date/Time	Matrix	No. of Containers	Test Parameters: Mercury	Total Solids	Grain Size	Total Organic Carbon	Dioxin/Furans	Archive													Comments/Preservation
1																							
2																							
3																							
4																							
5																							
6																							
7																							
8																							
9																							
10																							
11																							
12																							
13																							
14																							
15																							
16																							
17																							
18																							

Notes: _____

Relinquished By:	Company: Anchor QEA, Inc.
Signature/Printed Name	Date/Time

Received By:	Company: _____
Signature/Printed Name	Date/Time

Relinquished By:	Company: _____
Signature/Printed Name	Date/Time

Received By:	Company: _____
Signature/Printed Name	Date/Time

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